

WeTHINKCODE\_

WEB II

PROJECT II

---

# Darkly:

There is something wrong...

---

*Developer*  
Sibonelo Nkosi  
Username: SINKOSI

*Assessor*  
Mufaro SIMBISAYI

October 2020



## CONTENTS

<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Getting Started</b>	<b>3</b>
<b>2.1</b>	<b>Windows</b>	<b>3</b>
<b>2.1.1</b>	Create Virtual Machine	3
<b>2.1.2</b>	Name & Operating System	3
<b>2.1.3</b>	Memory Size	4
<b>2.1.4</b>	Storage Type	5
<b>2.1.5</b>	Hard Disk File Type	5
<b>2.1.6</b>	File Location & Size	5
<b>2.1.7</b>	Mount Disk Image	6
<b>2.1.8</b>	Set Network Bridge	8
<b>2.1.9</b>	Run Disk Image	8
<b>2.1.10</b>	Don't Panic! Loading Screen	9
<b>2.1.11</b>	More Loading Screens	9
<b>2.1.12</b>	Up & Running	9
<b>2.1.13</b>	BornToSec	10
<b>2.2</b>	<b>Linux</b>	<b>12</b>
<b>2.2.1</b>	Create Virtual Machine	12
<b>2.2.2</b>	Name & Operating System	12
<b>2.2.3</b>	Memory Size	13
<b>2.2.4</b>	Hard Disk File Type	13
<b>2.2.5</b>	Storage Type	13
<b>2.2.6</b>	File Location & Size	14
<b>2.2.7</b>	Mount Disk Image	16
<b>2.2.8</b>	Run Disk Image	16
<b>2.2.9</b>	Running but Incomplete	16
<b>2.2.10</b>	Set Network Bridge	17
<b>2.2.11</b>	Don't Panic! Loading Screen	17
<b>2.2.12</b>	More Loading Screens	17
<b>2.2.13</b>	Up & Running	18
<b>2.2.14</b>	BornToSec	19
<b>2.3</b>	<b>MacOS</b>	<b>19</b>
<b>3</b>	<b>Cookies &amp; Sessions</b>	<b>20</b>
<b>3.1</b>	<b>Flag #01</b>	<b>20</b>
<b>3.1.1</b>	Vulnerability	20
<b>3.1.2</b>	Location	20
<b>3.1.3</b>	Method	20
<b>3.1.4</b>	Tools	21
<b>3.1.5</b>	Remedy	21
<b>3.2</b>	<b>Flag #02</b>	<b>22</b>
<b>3.2.1</b>	Vulnerability	22
<b>3.2.2</b>	Location	22
<b>3.2.3</b>	Method	22

3.2.4	Tools . . . . .	22
3.2.5	Remedy . . . . .	22
4	Directories	23
5	JavaScript	24
6	Databases & SQL	25
6.1	Flag # . . . . .	25
6.1.1	Vulnerability . . . . .	25
6.1.2	Location . . . . .	25
6.1.3	Method . . . . .	25
6.1.4	Tools . . . . .	25
6.1.5	Remedy . . . . .	25
7	Bibliography	26
8	Student Honesty Declaration	26

## 1 INTRODUCTION

The aim of this project is to introduce you to computer security in the web domain. You will be able to discover OWASP, which is, no more and no less, the biggest web security project to date. You will also understand what a lot of frameworks do in an automatic and completely transparent way for you.

You will need to use a virtual machine (i386) to validate this project. Once your machine is started with the ISO supplied with the subject. Requirements:

- Virtual Box
- darkly.iso ([download here](#))
- Patience
- The Ability to keep your wits about you
- Other stuff (probably)

## 2 GETTING STARTED

### 2.1 Windows

Windows Installation\*: Ensure that you have the latest version[[1](#)] of VirtualBox for Windows or download it from the [VirtualBox Website](#) or Windows Store.

#### *2.1.1 Create Virtual Machine*

Begin by Creating a new Virtual Machine. To do this click on the blue icon labelled new as shown in Figure [1 on the following page](#).

#### *2.1.2 Name & Operating System*

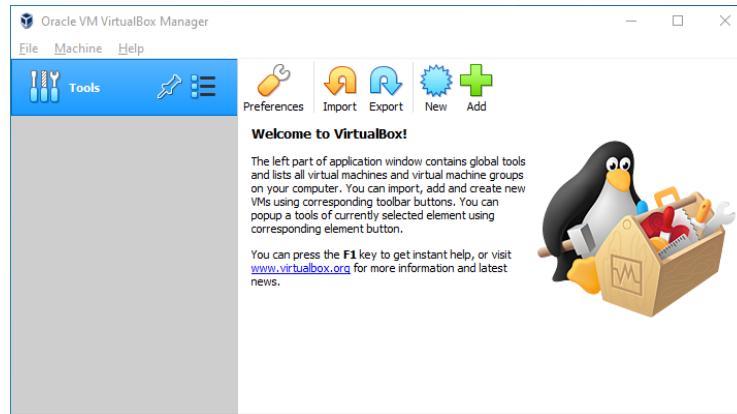
You have to give your Virtual Machine a new name, I have chosen 'Darkly'. Make sure to pick a folder for storage of the Virtual Machine or leave it to the default provided by Virtual Box.

You will have to choose the 'type' of machine you are creating. At this point you must select 'Linux' as this is what the Darkly.iso is based from. You will be given options or 'flavours' to choose from. Pick 'Other 64-bit'. This is best shown in Figure [2 on the next page](#).

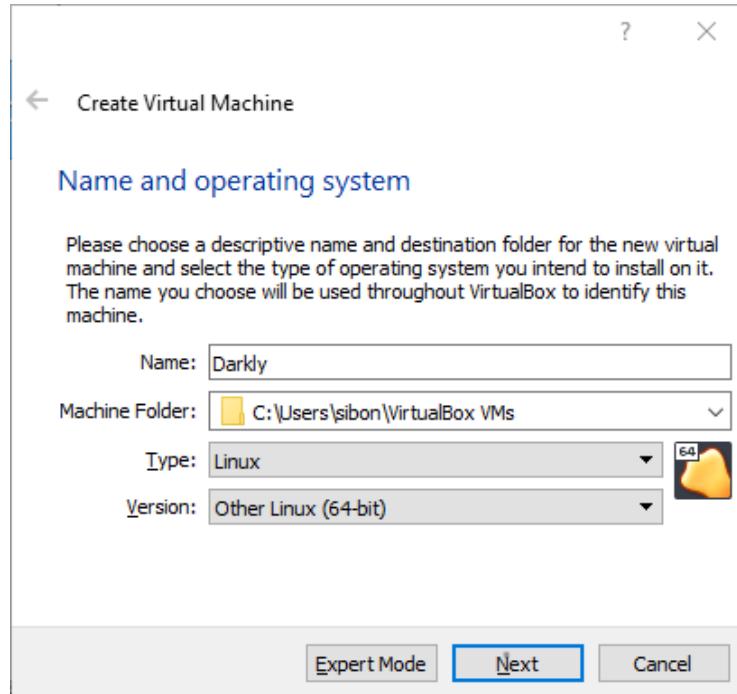
Please do take note that the Darkly VM will not work if it is not 64-bit.

---

\* Information provided is correct for current users configuration i.e Windows Home 10:2004, results may differ for other configurations



**Figure 1:** New Virtual Machine Setup



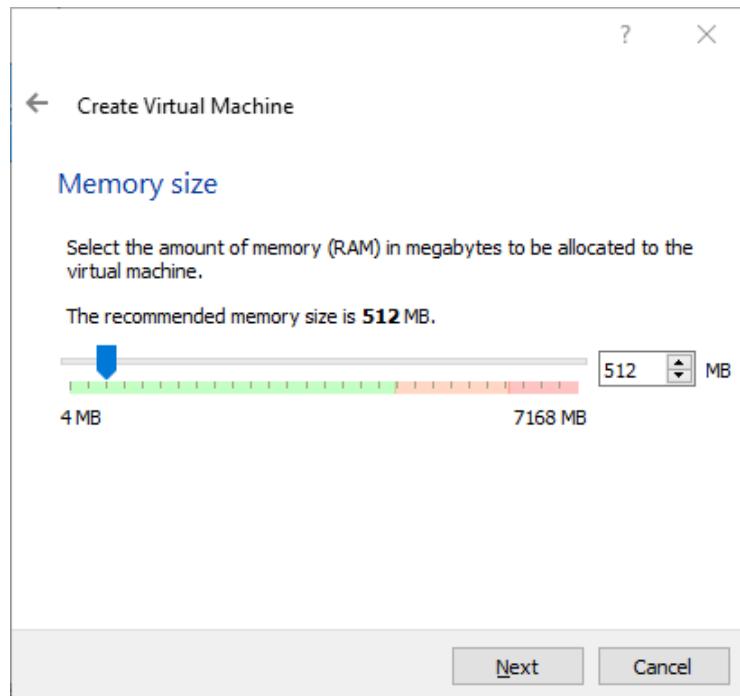
**Figure 2:** Setup Of Operating System Type and Name

### 2.1.3 *Memory Size*

Selecting a memory size is the next step. Darkly will not be actively running as another Virtual Machine would. Therefore only a limited amount of RAM is required. The recommended size is 512MB.

To set the memory size, a slide is used, as shown in Figure 3 on the following page.

You can also set it using manually by typing in the value.



**Figure 3:** Virtual Box Memory Size Settings

#### 2.1.4 Storage Type

Ensure that you have the size Dynamically allocated as shown in [Figure 4 on the next page](#). If you would like a fixed size, it is okay, but this entails your Hard Disk being allocated upfront.

Please note, you have not selected your Hard Disk size so it is key to ensure you are aware of how much space you have free before allocating a fixed space size.

#### 2.1.5 Hard Disk File Type

Select VirtualBox Disk Image as shown in [Figure 5 on page 7](#). This is the best decision because the Machine will not be migrated to other Virtual Machine Players like VMWare etc. The use is short-term.

#### 2.1.6 File Location & Size

This is where you can set up the location for your Virtual Box Machine to store its data. Remember that the machine can be stored in one location but the simulation of its Hard Disk can be stored on a Flash Drive or External Drive if you wish.

I have decided to retain the local drive as the storage location. This is the default VirtualBox directory. You can select any size you wish, I have selected 1,99GB to keep my box small as shown in [Figure 6 on page 7](#). I can amend this later if I need to.

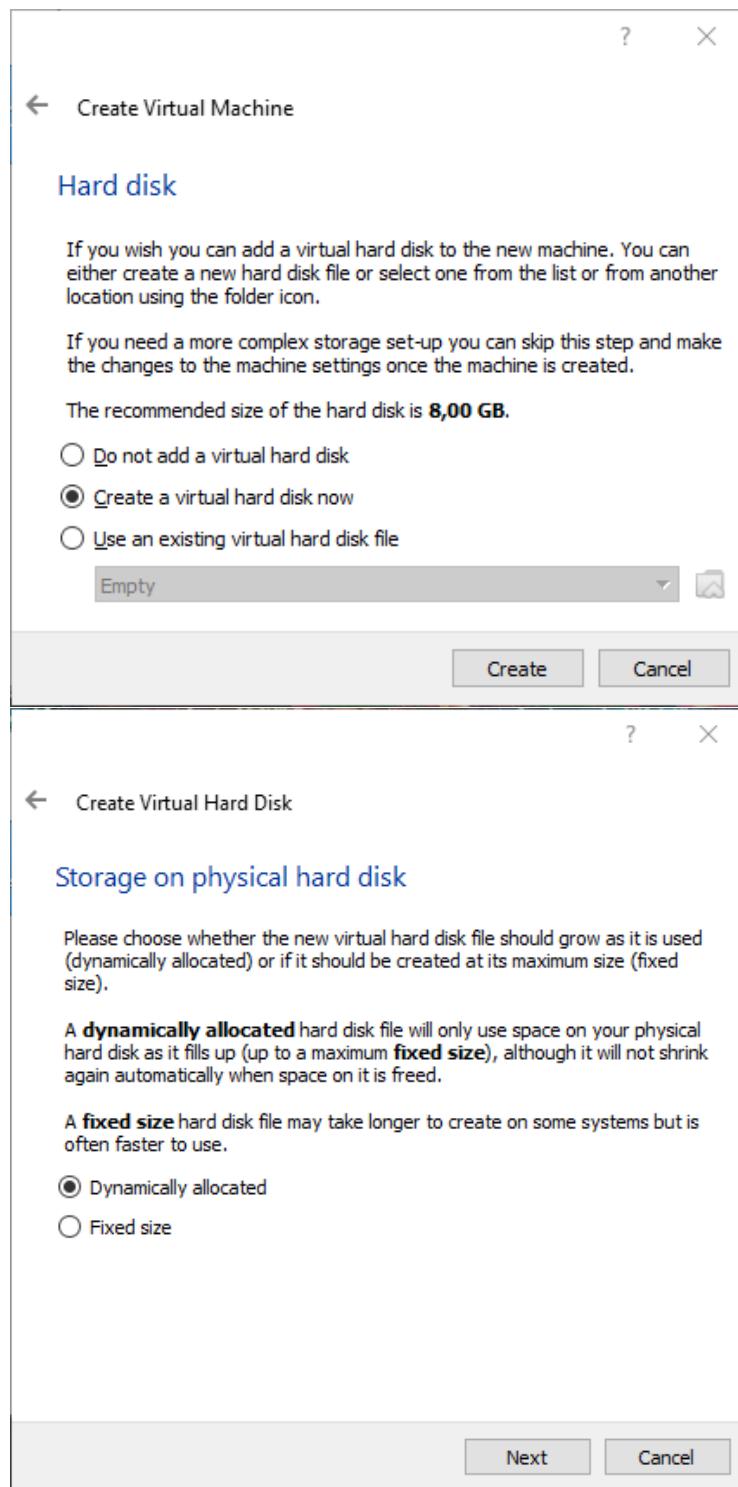


Figure 4: Virtual Box Storage Type

### 2.1.7 Mount Disk Image

The next step is to mount the Darkly.iso disk as a form of storage. Click on your image 'Darkly' or whatever you may have named it, on the lefthand navigation panel as shown in Figure 7 on page 8.

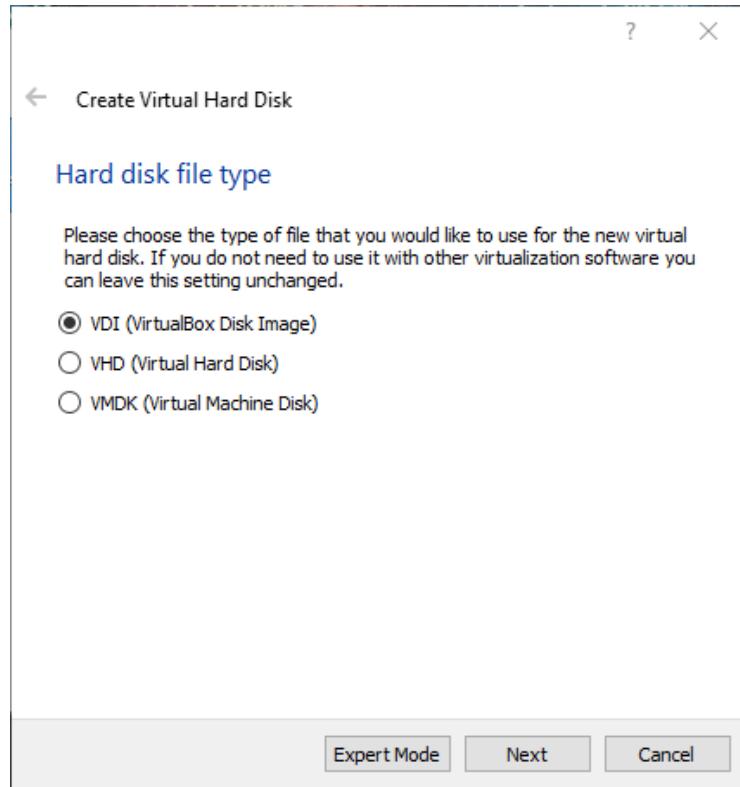


Figure 5: Virtual Box Disk Type

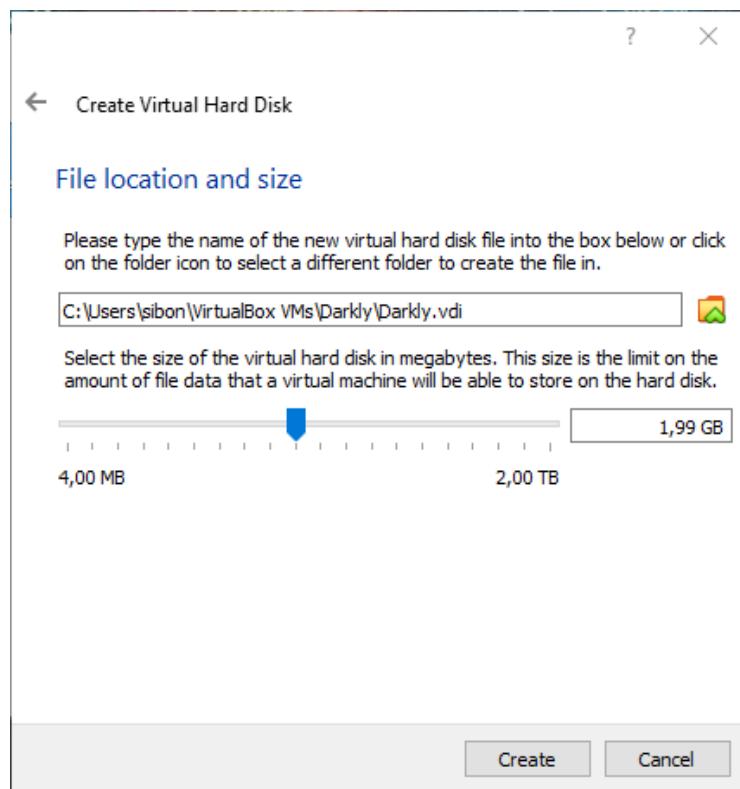
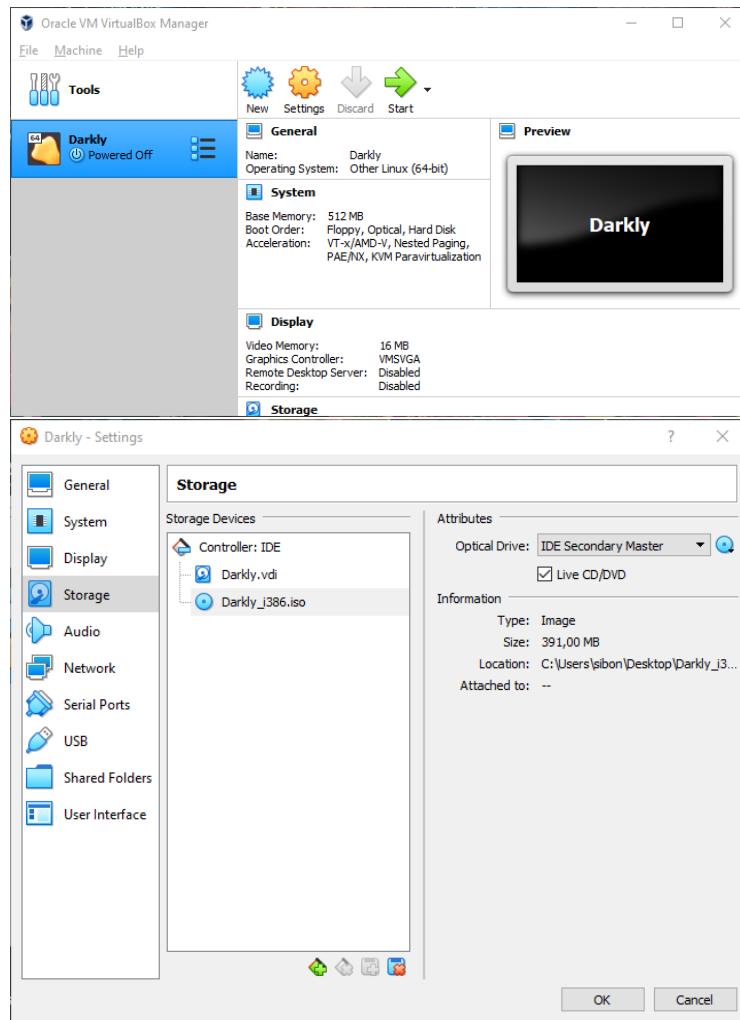


Figure 6: Virtual Box Hard Disk Location and Size



**Figure 7:** Virtual Box Setup of Disk Drive Mount Darkly.iso Image

Next click on Settings -> Storage -> IDE Secondary Master. After this, navigate to the folder where the ISO is located. Mount it and you will see it listed as shown in Figure 7.

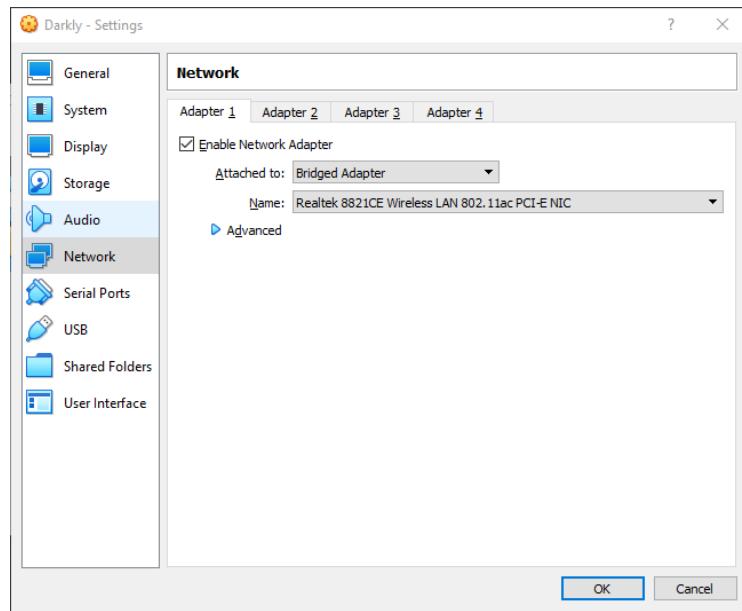
Click Start (Green arrow pointing right) to commence running the image.

#### 2.1.8 Set Network Bridge

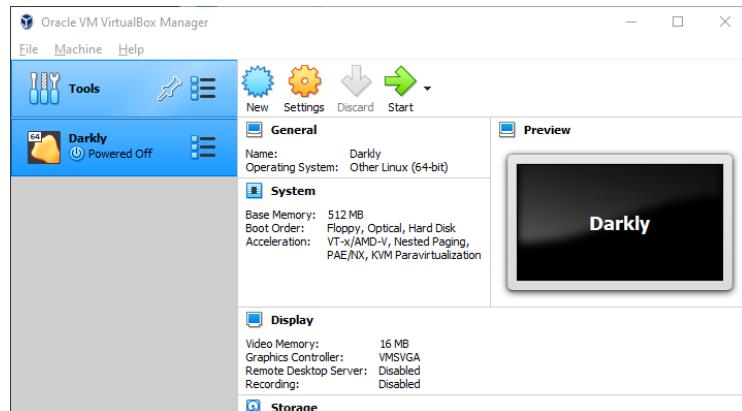
On the lefthand navigation-bar, Select Network -> Adaptor 1. Change the settings from a NAT Adaptor as would be the default, and set it to a 'Bridge' connection. as shown in Figure 8 on the following page.

#### 2.1.9 Run Disk Image

As shown in Figure 9 on the next page, you are expected to select 'Darkly\_i386.iso' as the start-up disk. This will then complete the Installation process.



**Figure 8:** Virtual Box Landing, on Ubuntu



**Figure 9:** Virtual Box Start-up Disk Selector

### 2.1.10 Don't Panic! Loading Screen

**Don't Panic, it's just a loading screen**

### 2.1.11 More Loading Screens

If you are seeing the figure shown in Figure 11 on the following page you are making good progress and must hang in there.

### 2.1.12 Up & Running

The new IP Address should look different to the first one and should be similar to your own IP address after running 'ifconfig'. You should see a similar figure to that shown in Figure 12 on page 11.

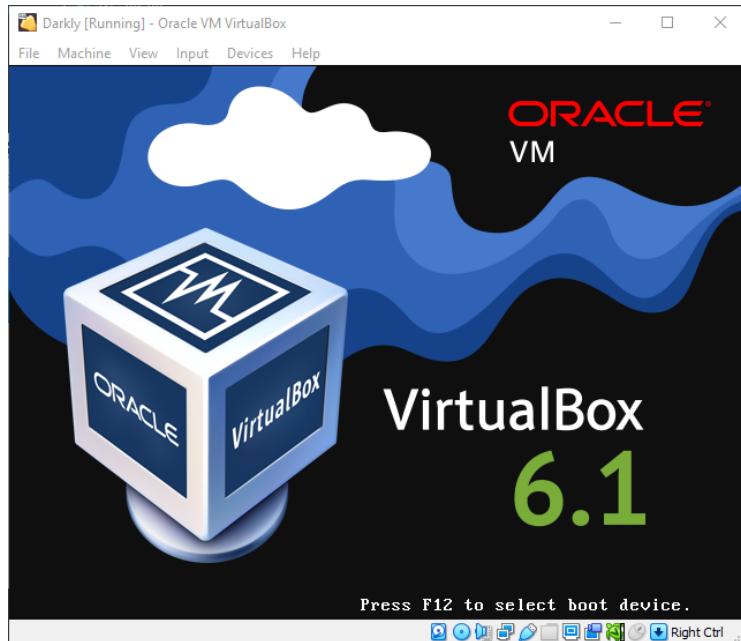


Figure 10: Virtual Box Loading Screen Splash Purple

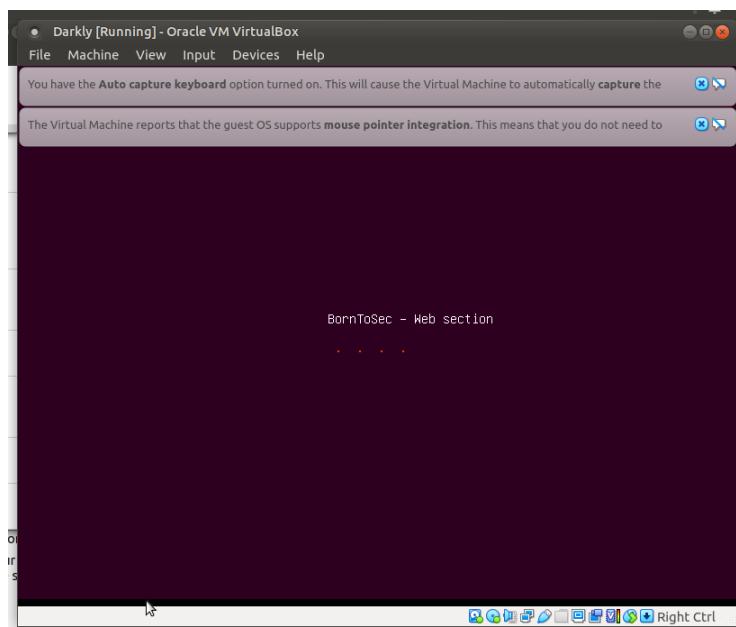


Figure 11: More Virtual Box Loading Screens

#### 2.1.13 BornToSec

If you see the same figure on your screen as the one shown on Figure 13 on the following page, then you have successfully setup your Virtual Machine.

**TIME TO DO THE FUN STUFF!**

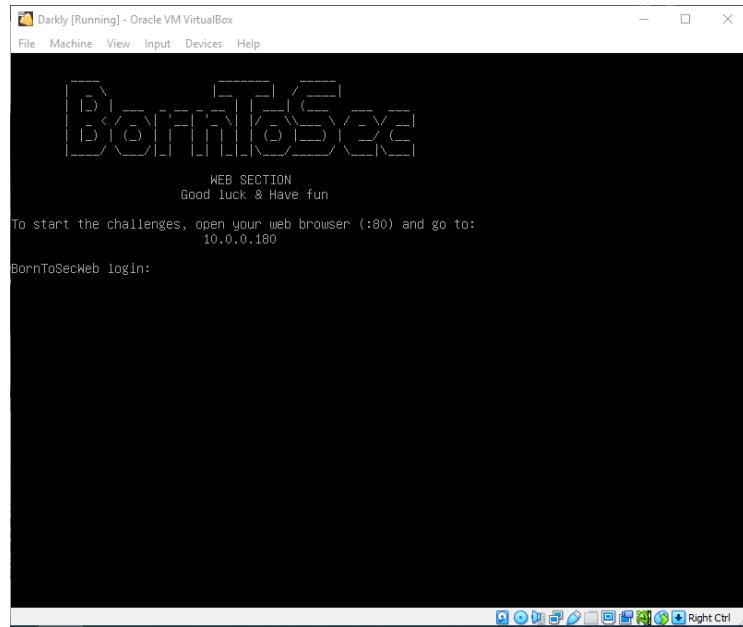


Figure 12: Virtual Box Fully Loaded Screen with IP Address & Prompt

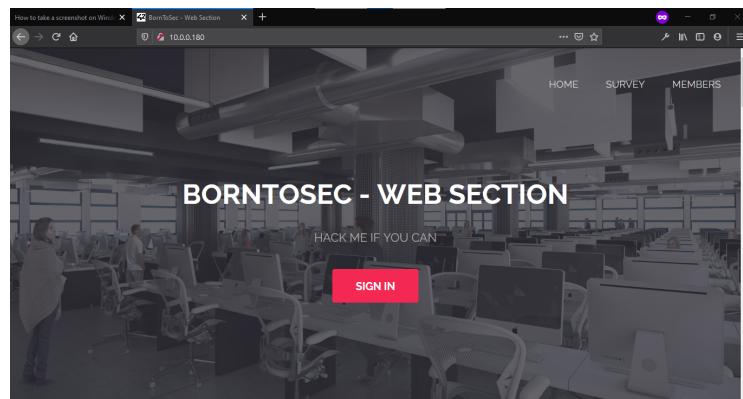


Figure 13: BornToSec Homepage

**FUN NOTES:** If you look at one of the tabs on Figure 13 you will notice that there is one for "How to take a screenshot on Windows". I will be honest, for as long as I have used windows, I have never needed to take a screenshot. It has always seemed cumbersome because it wasn't just a hotkey like Linux.

I highly recommend the Snipping Tool

## 2.2 Linux

Linux Installation<sup>\*\*</sup>: Begin by ensuring that you have Virtual Box installed on your system[2], if not type:

```
$ sudo apt-get install virtualbox
```

### 2.2.1 Create Virtual Machine

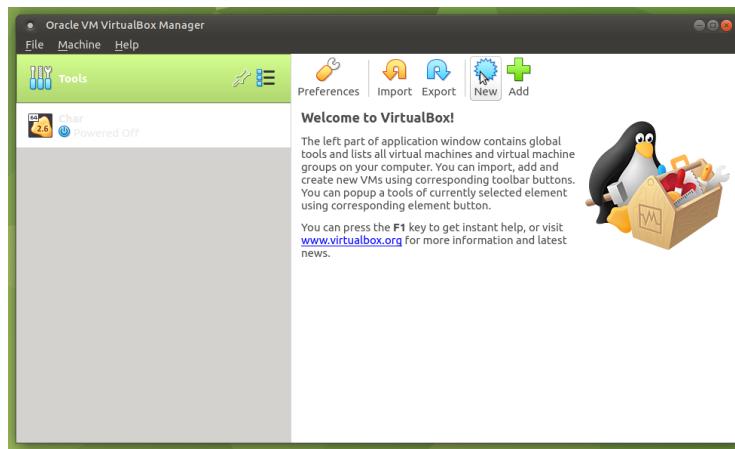


Figure 14: New Virtual Machine Setup

Begin by Creating a new Virtual Machine. To do this click on the blue icon labelled new as shown in Figure 14.

### 2.2.2 Name & Operating System



Figure 15: Setup Of Operating System Type and Name

You have to give your Virtual Machine a new name, I have chosen 'Darkly'. Make sure to pick a folder for storage of the Virtual Machine or leave it to the default provided by Virtual Box.

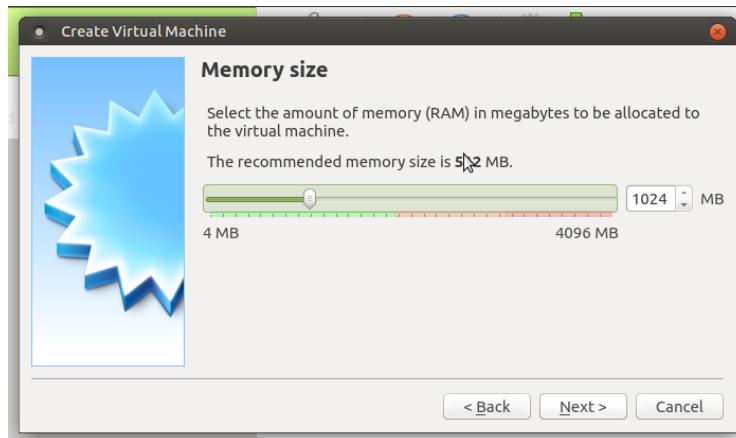
---

<sup>\*\*</sup> Snap install is not available for all Linux Distros, this is expected to work on Ubuntu and Debian flavours

You will have to choose the 'type' of machine you are creating. At this point you must select 'Linux' as this is what the Darkly.iso is based from. You will be given options or 'flavours' to choose from. Pick 'Other 64-bit'. This is best shown in [Figure 15 on the previous page](#).

Please do take note that the Darkly VM will not work if it is not 64-bit.

### **2.2.3 Memory Size**



**Figure 16:** Virtual Box Memory Size Settings

Selecting a memory size is the next step. Darkly will not be actively running as another Virtual Machine would. Therefore only a limited amount of RAM is required. The recommended size is 512MB but in my opinion I believe 1024MB is the best.

To set the memory size, a slide is used, as shown in [Figure 16](#).

You can also set it using manually by typing in the value.

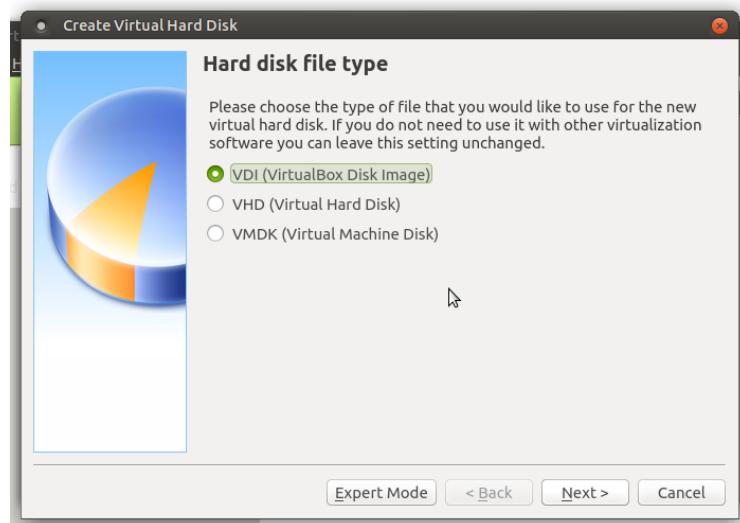
### **2.2.4 Hard Disk File Type**

Select VirtualBox Disk Image as shown in [Figure 17 on the next page](#). This is the best decision because the Machine will not be migrated to other Virtual Machine Players like VMWare etc. The use is short-term.

### **2.2.5 Storage Type**

Ensure that you have the size Dynamically allocated as shown in [Figure 18 on the following page](#). If you would like a fixed size, it is okay, but this entails your Hard Disk being allocated upfront.

Please note, you have not selected your Hard Disk size so it is key to ensure you are aware of how much space you have free before allocating a fixed space size.



**Figure 17:** Virtual Box Disk Type

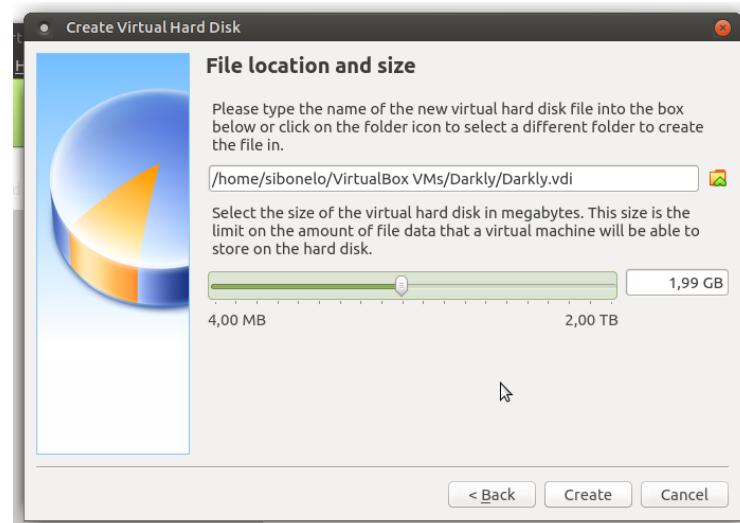


**Figure 18:** Virtual Box Storage Type

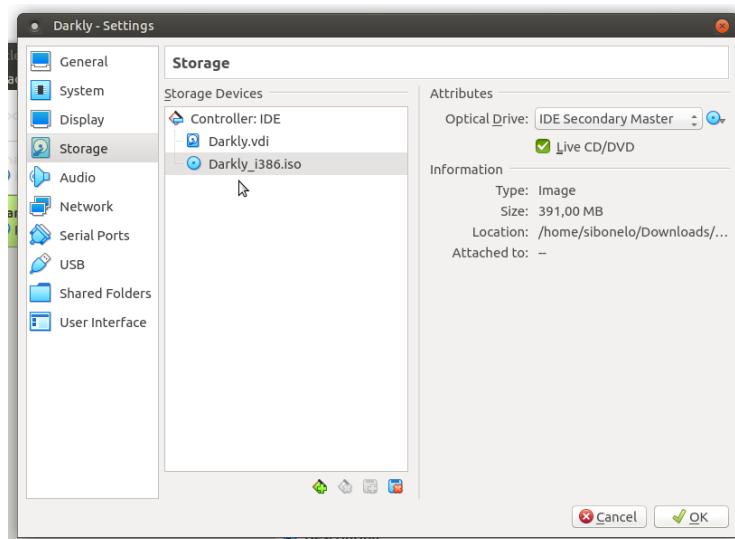
#### 2.2.6 File Location & Size

This is where you can set up the location for your Virtual Box Machine to store its data. Remember that the machine can be stored in one location but the simulation of its Hard Disk can be stored on a Flash Drive or External Drive if you wish.

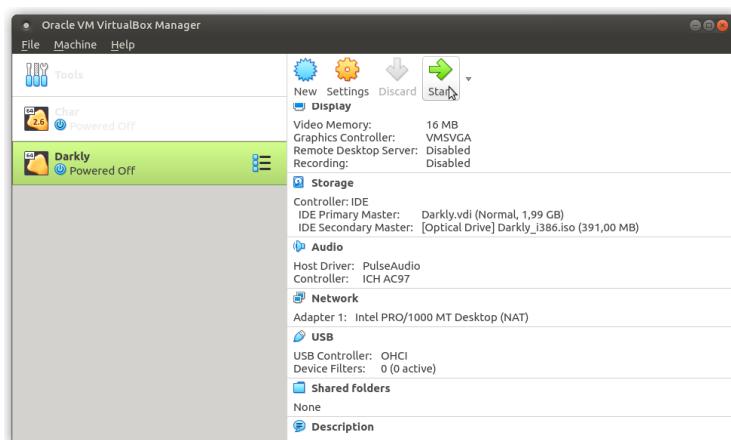
I have decided to retain the local drive as the storage location. This is the default VirtualBox directory. You can select any size you wish, I have selected 1,99GB to keep my box small as shown in Figure 19 on the next page. I can amend this later if I need to.



**Figure 19:** Virtual Box Hard Disk Location and Size



**Figure 20:** Virtual Box Settings Navigation



**Figure 21:** Virtual Box Setup of Disk Drive Mount Darkly.iso Image

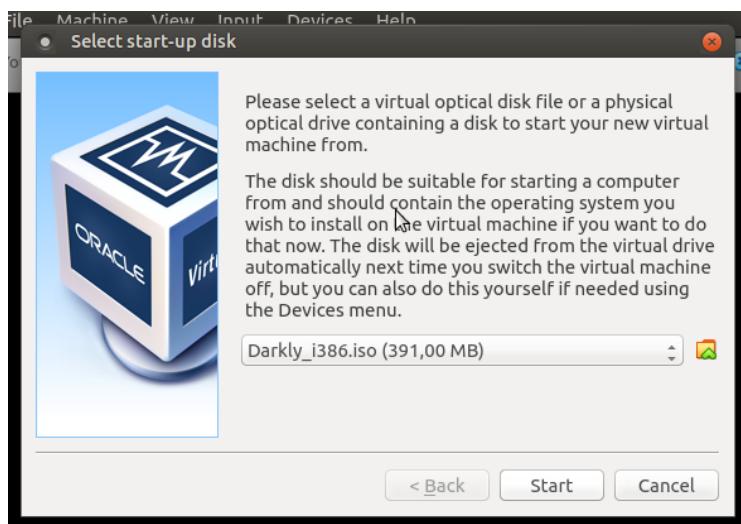
### ***2.2.7 Mount Disk Image***

The next step is to mount the Darkly.iso disk as a form of storage. Click on your image 'Darkly' or whatever you may have named it, on the lefthand navigation panel as shown in [Figure 20 on the preceding page](#).

Next click on Settings -> Storage -> IDE Secondary Master. After this, navigate to the folder where the ISO is located. Mount it and you will see it listed as shown in [Figure 21 on the previous page](#).

Click Start (Green arrow pointing right) to commence running the image.

### ***2.2.8 Run Disk Image***



**Figure 22:** Virtual Box Start-up Disk Selector

As shown in [Figure 22](#), you are expected to select 'Darkly\_i386.iso' as the start-up disk. This will then complete the Installation process.

### ***2.2.9 Running but Incomplete***

You have successfully installed the VM and it is running. The IP address is printed on the screen. ...I bet that the IP address does not really work...

This needs you to go to settings as shown in [Figure 24 on the next page](#)

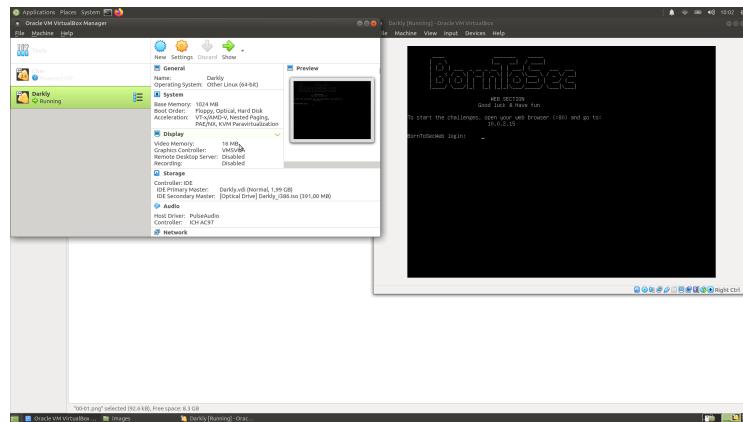


Figure 23: Darkly ISO running on Ubuntu

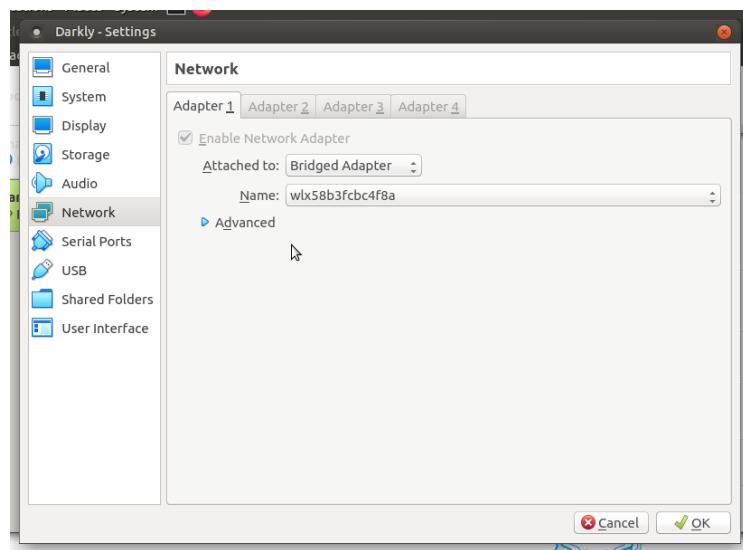


Figure 24: Set the Network to Bridge not NAT

### **2.2.10 Set Network Bridge**

On the lefthand navigation-bar, Select Network -> Adaptor 1. Change the settings from a NAT Adaptor as would be the default, and set it to a 'Bridge' connection. as shown in Figure 24.

### **2.2.11 Don't Panic! Loading Screen**

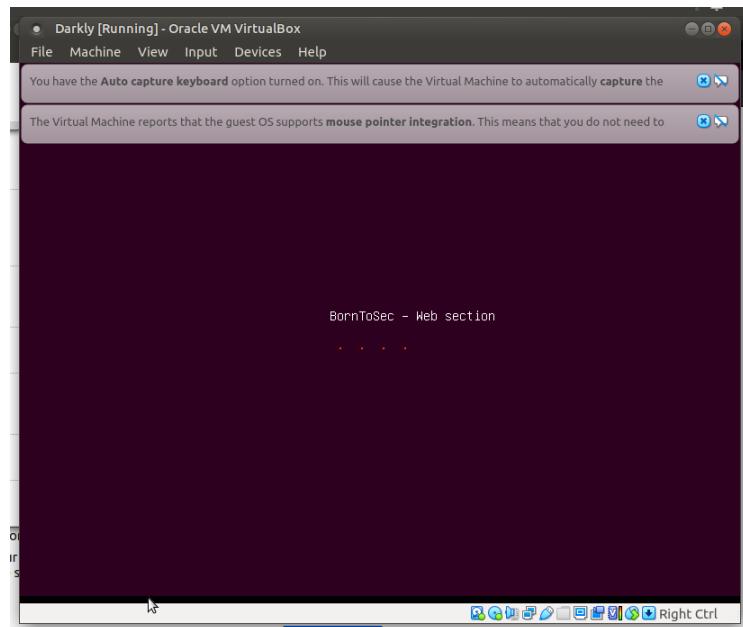
**Don't Panic, it's just a loading screen**

### **2.2.12 More Loading Screens**

If you are seeing the figure shown in Figure 26 on the next page you are making good progress and must hang in there.



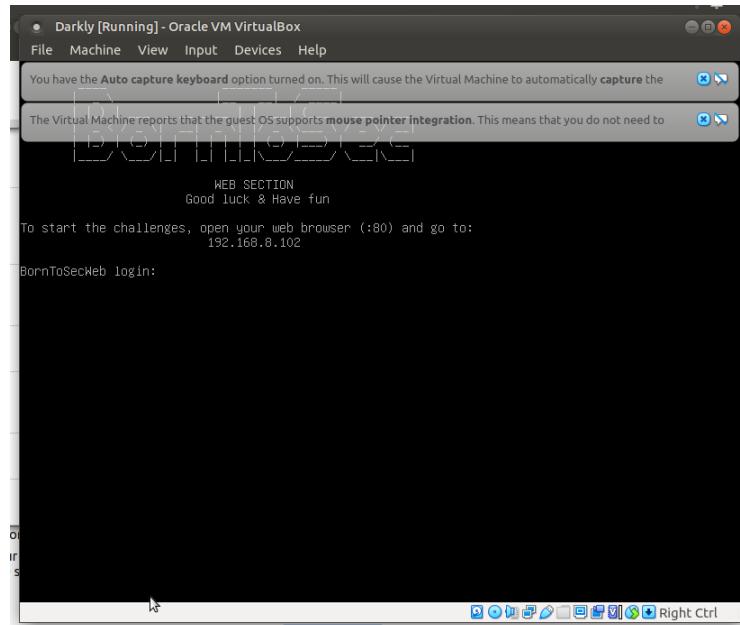
**Figure 25:** Virtual Box Loading Screen Splash with Hitchhiker's Guide Robot



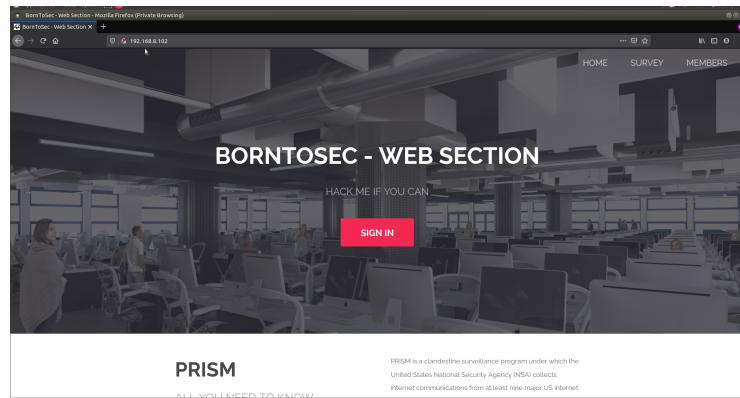
**Figure 26:** More Virtual Box Loading Screens

### 2.2.13 Up & Running

The new IP Address should look different to the first one and should be similar to your own IP address after running 'ifconfig'. You should see a similar figure to that shown in Figure 27 on the following page.



**Figure 27:** Virtual Box Fully Loaded Screen with IP Address & Prompt



**Figure 28:** BornToSec Homepage

### 2.2.14 BornToSec

If you see the same figure on your screen as the one shown on Figure 28, then you have successfully setup your Virtual Machine.

**TIME TO DO THE FUN STUFF!**

## 2.3 MacOS

At the time of typing this document a Mac was not available to conduct testing but the documentation[3] does have instructions.

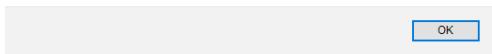
### 3 COOKIES & SESSIONS

It's possible for an attacker to steal and reuse session identifiers or other sensitive cookie values when they are stored or transmitted insecurely[4].

#### 3.1 Flag #01

**DF2EB4BA34ED059A1E3E89FF4DFC13445F104A1A52295214DEF1C4FB1693A5C3**

Good job! Flag : df2eb4ba34ed059a1e3e89ff4dfc13445f104a1a52295214def1c4fb1693a5c3



##### 3.1.1 Vulnerability

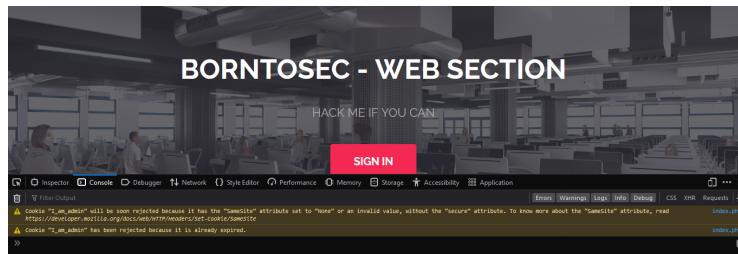


Figure 29: Firefox refusing to set cookie 'I\_am\_admin'

A cookie Vulnerability which is identified by OWASP as a method to 'session-jack'[4].

##### 3.1.2 Location

<ip-address>:80/index.php but also throughout the Web Application.

##### 3.1.3 Method

I was immediately alerted by my console, for inspecting elements on a webpage that there was something wrong with the cookie.

I proceeded to check the contents of the cookie and it was an arbitrary string '68934a3e9455fa72420237eb05902327' (Figure 30a on the following page). The cookie in question had:

SameSite - None

HttpOnly - false

Secure - false

It becomes clear what was to happen next which is determine if the string has any meaning. After working out that the hash translated to 'false', I decided to hash my own string equal to the string 'true'. After refreshing the browser, the flag was returned.

The string 'true' = b326b5062b2foe69046810717534cb09

### 3.1.4 Tools

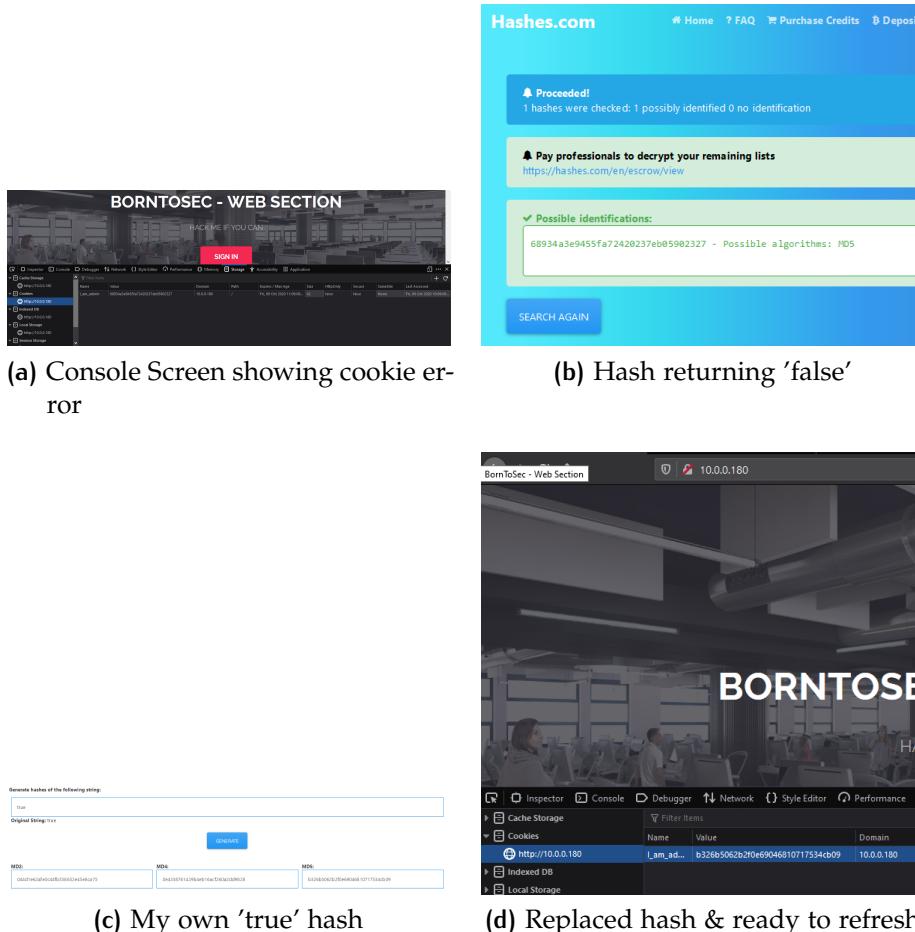


Figure 30: Process to Capture the Cookie Flag

The tools that I used were the console output of the 'Inspection Tool' and the website [hashes.com](https://hashes.com) in order to work with the hashes.

### 3.1.5 Remedy

According to OWASP[4] these are the steps one can take:

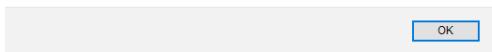
- Make sure that all session identifiers are transmitted over an encrypted protocol.
- Terminate/regenerate the session if the session token is transmitted insecurely (either in clear text or as part of the URL), or signal to the application to do so.

- Enforce the Secure and HttpOnly flags on sensitive cookies using a Web Application Firewall.
- Ensure that session identifiers are transmitted only using the SSL session where they originated. Track sessions across SSL renegotiations and integrate with framework solutions to support common SSL termination/re-encryption architectures.

## 3.2 Flag #02

---

Good job! Flag : df2eb4ba34ed059a1e3e89ff4dfc13445f104a1a52295214def1c4fb1693a5c3



### 3.2.1 Vulnerability

### 3.2.2 Location

### 3.2.3 Method

### 3.2.4 Tools

### 3.2.5 Remedy

## 4 DIRECTORIES

### Directories

## 5 JAVASCRIPT

JS

## 6 DATABASES & SQL

### SQL

#### 6.1 Flag #

6.1.1 *Vulnerability*

6.1.2 *Location*

6.1.3 *Method*

6.1.4 *Tools*

6.1.5 *Remedy*

## 7 BIBLIOGRAPHY

### REFERENCES

- [1] Oracle: VirtualBox. Virtualbox manual: Installation on windows host. [https://www.virtualbox.org/manual/ch02.html#installation\\_windows](https://www.virtualbox.org/manual/ch02.html#installation_windows), 2020.
- [2] Oracle: VirtualBox. Virtualbox manual: Installation on linux host. <https://www.virtualbox.org/manual/ch02.html#install-linux-host>, 2020.
- [3] Oracle: VirtualBox. Virtualbox manual: Installation on mac hosts. <https://www.virtualbox.org/manual/ch02.html#installation-mac>, 2020.
- [4] OWASP. Owasp periodic table of vulnerabilities - cookie theft/session hijacking. [https://wiki.owasp.org/index.php/OWASP\\_Periodic\\_Table\\_of\\_Vulnerabilities\\_-\\_Cookie\\_Theft\\_Session\\_Hijacking](https://wiki.owasp.org/index.php/OWASP_Periodic_Table_of_Vulnerabilities_-_Cookie_Theft_Session_Hijacking), 2013.

## 8 STUDENT HONESTY DECLARATION

Engaging in any cheating or dishonesty in any form of assessment, assignment, test or examination or other WeThinkCode\_ prescribed work is considered cheating and is grounds for disciplinary action. Plagiarism, which is to present work (or a portion of work) as your own when it is not, is considered cheating and is not accepted at WeThinkCode\_.

An evaluator can flag one or more of the following grounds :

- The evaluator (marker) identifies that the student does not understand all or part of the work they have submitted.
- If all or part of the work presented is plagiarised ,i.e. copied from another source without reference.

### Cheating in group projects

The main purpose for a group project is to give students the experience of working in a team, by coming up with a solution to a problem together.

- Each member must be able to show which portion of the project they worked on.

- Failure to do so will result in the student being flagged for cheating which will be grounds for disciplinary action.
- This is to avoid single members doing the majority of the group project at the benefit of a member who is not contributing.
- In this way we are able to ensure fair assessment of each WTC\_ student's competence.

Group projects can be approached in two ways.

1. Divide and conquer: This is usually preferred and advised when working on big projects. The project is divided into segments, in which each member of the group can accomplish. Once completed, the group will then integrate the segments to complete the project
2. One for all: This method is usually preferred and advised when a group is working on a small project. The group will work on the solution together from the start of the project until the end. This will require the members to move at a pace in which everyone in the team can keep up with.

NOTE: At the end of each group project, each member should have a general and basic understanding of the project and the solution found. This will include running, testing and explaining the solutions of the project.

## DECLARATION

I hereby declare that the work submitted by me and/or my group members is:

- Original (not plagiarised)
- References listed
- Honest & in Good Faith
- Subject to WeThinkCode\_policies

---

Sibonelo Nkosi  
Username: SINKOSI  
*Developer*