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Internet of Things Security Penetration Testing Environment Setup

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Introduction

Here I will be explaining how to set up my attack environment so that others can replicate my implementation in a similar way if they wish to conduct their own experiment on an IoT product. I think this is important as I want my project to be repeatable and available for any students who may want to learn how to conduct a simple penetration attack. I will be talking about how to set up a Kali Linux with VirtualBox as its virtual machine and how to set up a USB Wireless Adapter with these applications.

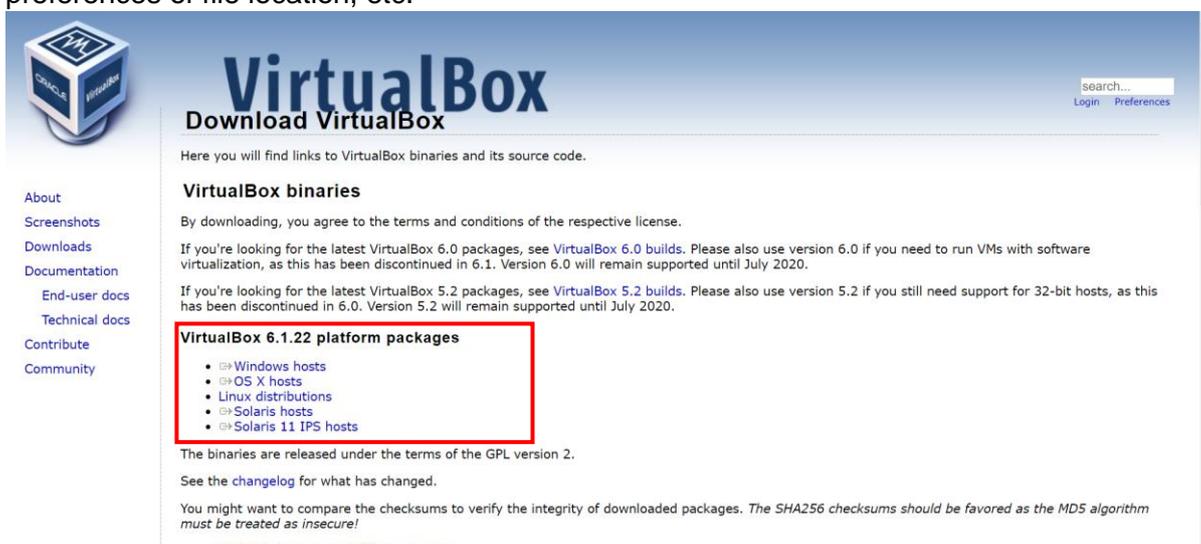
Environment Setup

As explained in the final report, Kali Linux is an environment where you can access a series of tools designed for security and penetration testing. Here I will be explaining how to download this environment.

VirtualBox and Kali Linux Download

Steps:

1. Go to Kali Linux's webpage (<https://www.kali.org/downloads/>) and click download.
2. Scroll down to "Download Kali Virtual Machines" and click the button that says, "Offensive Security VM Download Page".
3. You will be taken to the Offensive Security webpage (<https://www.offensive-security.com/kali-linux-vm-vmware-virtualbox-image-download/#1572305786534-030ce714-cc3b>) where you are able to download Kali Linux custom images. Click on "Kali Linux VirtualBox Images and download "Kali Linux VirtualBox 64-Bit (OVA)". This is a large download so do not worry if it takes a while. Your download should be an OVA file.
4. Next you will need to download VirtualBox on their download webpage (<https://www.virtualbox.org/wiki/Downloads>). At the time of this project the latest version was the "6.1.22" version platform package which is available for download using Windows, Linux or OS X platforms. Go through the download setup with your preferences of file location, etc.

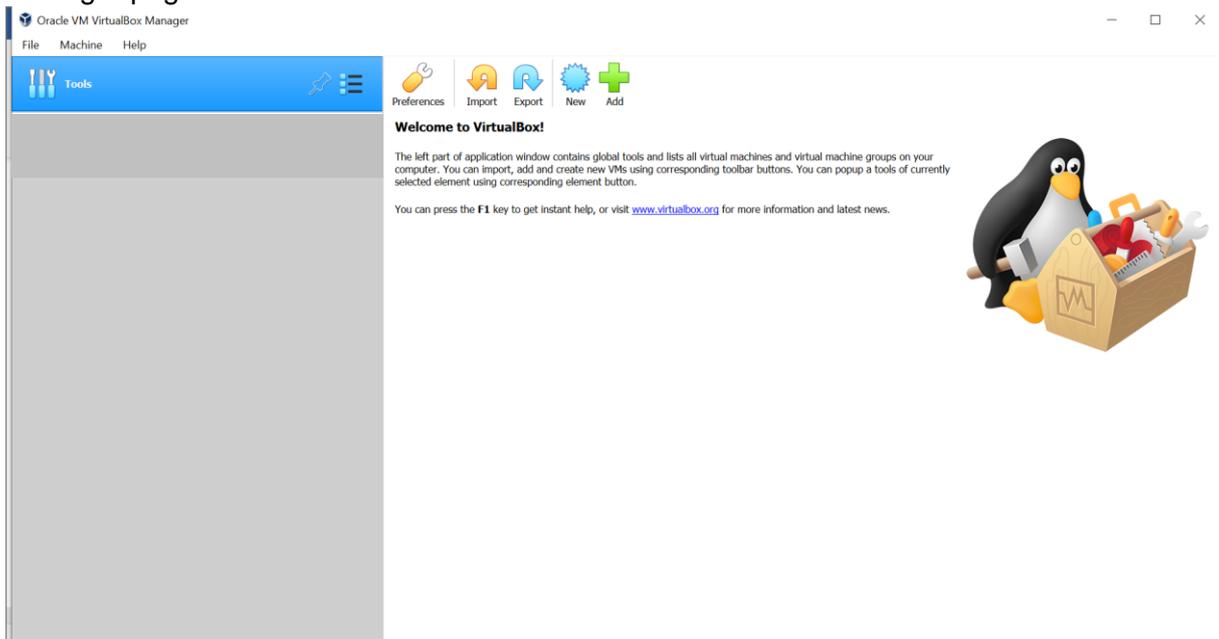


The screenshot shows the VirtualBox website's download page. The main heading is "VirtualBox Download VirtualBox". Below this, there is a section titled "VirtualBox binaries" which includes a list of platform packages for version 6.1.22. The list is highlighted with a red box and includes: Windows hosts, OS X hosts, Linux distributions, Solaris hosts, and Solaris 11 IPS hosts. The page also contains navigation links on the left, a search bar, and a footer with legal notices.

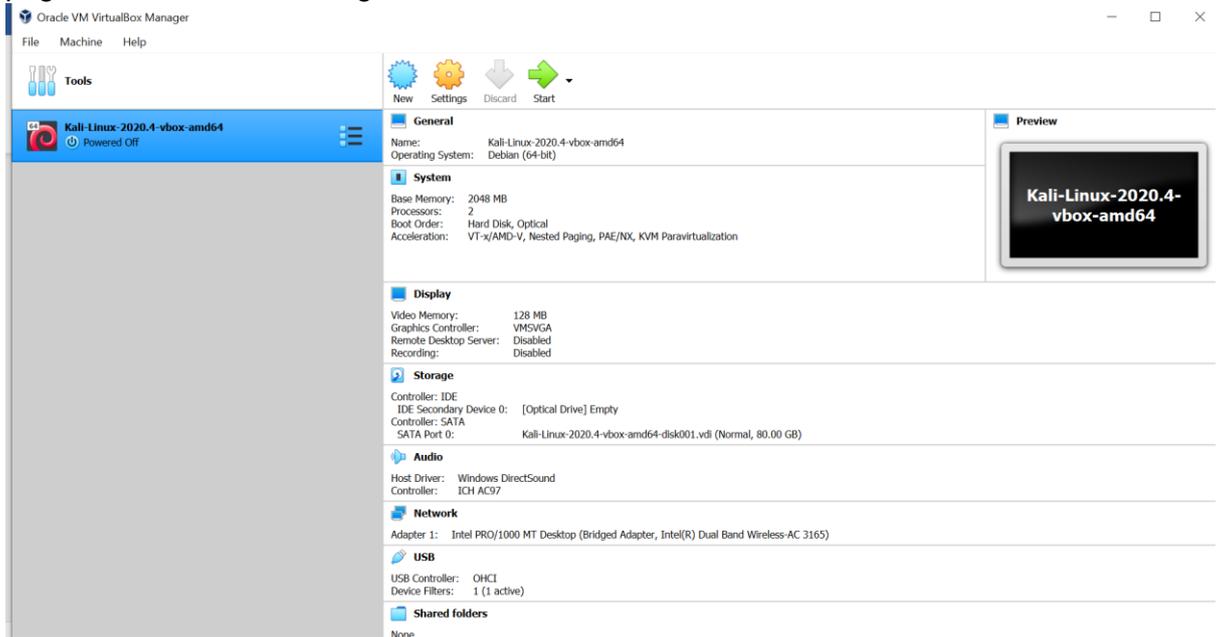
VirtualBox 6.1.22 platform packages

- Windows hosts
- OS X hosts
- Linux distributions
- Solaris hosts
- Solaris 11 IPS hosts

- When VirtualBox has downloaded you will be presented with the following VirtualBox Manager page:



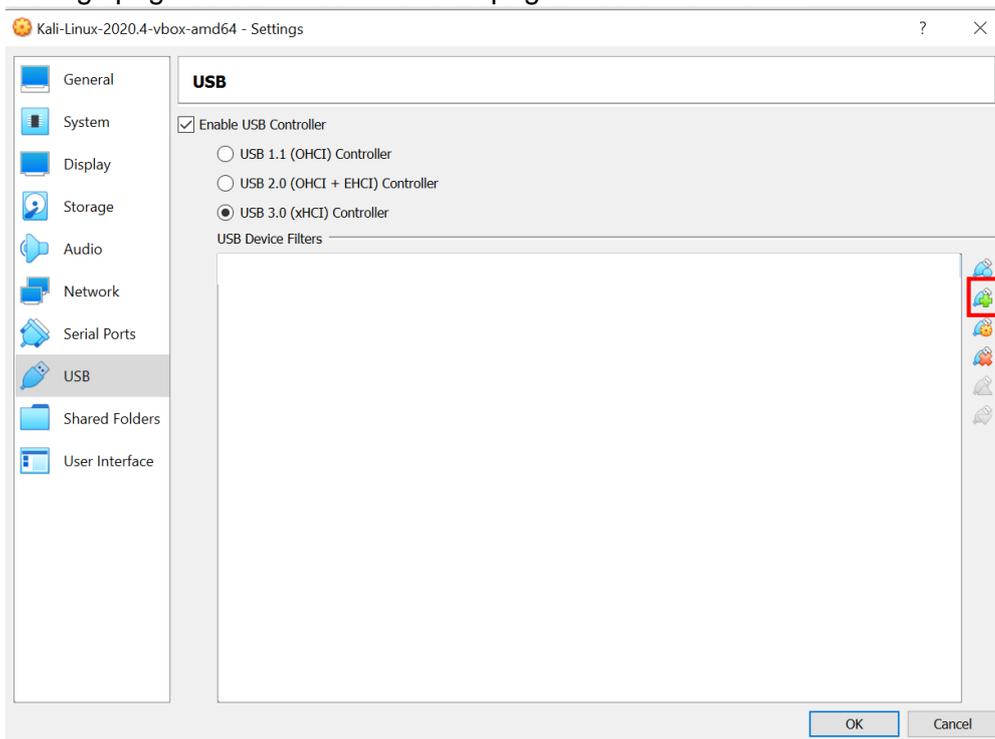
- Here you will be able to import the Kali Linux image they you previously downloaded using "Import" and finding your download file location. You will then be presented with the Kali Linux environment that you have downloaded under "Tools" and your page should look something like this:



USB Wireless Adapter with Kali Linux Setup

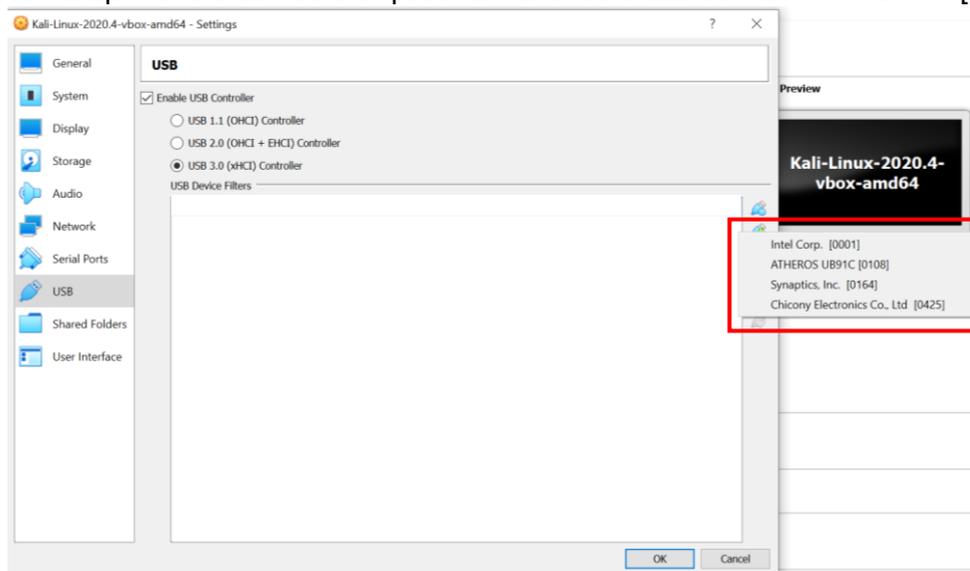
Steps:

1. Within your VirtualBox application you are able to specify your settings and attach your Wireless Adapter. I have used the Alfa Network AWUS036NHA AR9271L Atheros Chipset as it is one of the best Wi-Fi Adapters for penetration testing, however, you can pick whichever one you prefer but it must be compatible with the environment and available to be put in monitor mode. A list of compatible Wi-Fi adapters can be found here: <https://www.kalilinux.in/2020/07/wifi-adapter-kali-linux-2020.html>
2. Click settings to open the Kali Linux machine settings and click “USB” within the settings page. You will be met with a page that looks like this:

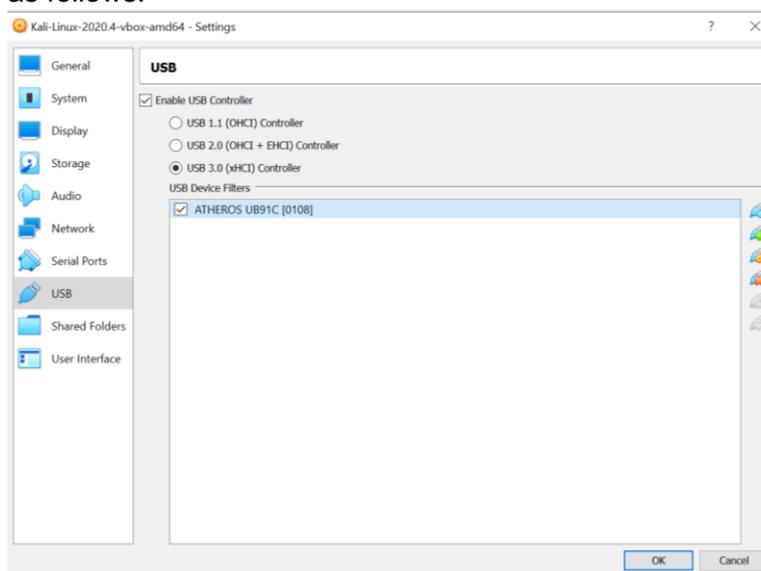


3. My Wi-Fi adapter uses USB 3.0, but you can choose which one yours uses in the “Enable USB Controller” USB selection settings.

4. Click on the USB + icon highlighted above and look for your Wi-Fi adapter. This will come up with the device's chipset name. Mine is the "ATHEROS UB91C [0108].



5. Once you have clicked to add the device it should show up in the USB Device Filters as follows:



6. You can then click "OK" to add the adapter to Kali.
7. Before we can start Kali Linux, we must install a VirtualBox Extension pack to allow VirtualBox to use the adapter. The link to the extension pack page is on the VirtualBox download page that was previously visited

(<https://www.virtualbox.org/wiki/Downloads>).

• [Solaris hosts](#)

- [Solaris 11 IPS hosts](#)

The binaries are released under the terms of the GPL version 2.

See the [changelog](#) for what has changed.

You might want to compare the checksums to verify the integrity of downloaded packages. *The SHA256 checksums should be favored as the MD5 algorithm must be treated as insecure!*

- [SHA256 checksums, MD5 checksums](#)

Note: After upgrading VirtualBox it is recommended to upgrade the guest additions as well.

VirtualBox 6.1.22 Oracle VM VirtualBox Extension Pack

- [All supported platforms](#)

Support for USB 2.0 and USB 3.0 devices, VirtualBox RDP, disk encryption, NVMe and PXE boot for Intel cards. See [this chapter from the User Manual](#) for an introduction to this Extension Pack. The Extension Pack binaries are released under the [VirtualBox Personal Use and Evaluation License \(PUEL\)](#). *Please install the same version extension pack as your installed version of VirtualBox.*

VirtualBox 6.1.22 Software Developer Kit (SDK)

- [All platforms](#)

User Manual

The VirtualBox User Manual is included in the VirtualBox packages above. If, however, you would like to take a look at it without having to install the whole thing, you also access it here:

- [User Manual \(HTML version\)](#)

You may also like to take a look at our [frequently asked questions list](#).

VirtualBox older builds

8. If you scroll down on the page you should see “VirtualBox [Current Version] Oracle VirtualBox Extension Pack”. Again, my version is 6.1.22 but you should download whatever version is most recently available. You can also get your current VirtualBox version by going to: Help → About VirtualBox in the VirtualBox Manager. If you do not have the latest version of VirtualBox, you can search for your versions Extension Pack by going to “Virtual Box Older Builds” and looking for the extension pack

VirtualBox
Download VirtualBox (Old Builds)

- [VirtualBox 6.1 \(active maintenance\)](#)
- [VirtualBox 6.0 \(no longer supported, support ended 2020/07\)](#)
- [VirtualBox 5.2 \(no longer supported, support ended 2020/07\)](#)
- [VirtualBox 5.1 \(no longer supported, support ended 2018/04\)](#)
- [VirtualBox 5.0 \(no longer supported, support ended 2017/05\)](#)
- [VirtualBox 4.3 \(no longer supported, support ended 2015/12\)](#)
- [VirtualBox 4.2 \(no longer supported, support ended 2015/12\)](#)
- [VirtualBox 4.1 \(no longer supported, support ended 2015/12\)](#)
- [VirtualBox 4.0 \(no longer supported, support ended 2015/12\)](#)

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9. Once it has downloaded you can find it in your downloads. Here you can double click the file to automatically add it to VirtualBox. Go through the terms and conditions and setup the extension pack.
10. Before starting the Virtua Machine, you must physically disconnect the Wireless Adapter and then reconnect it once Kali has fully loaded.

Within the Kali Linux Machine

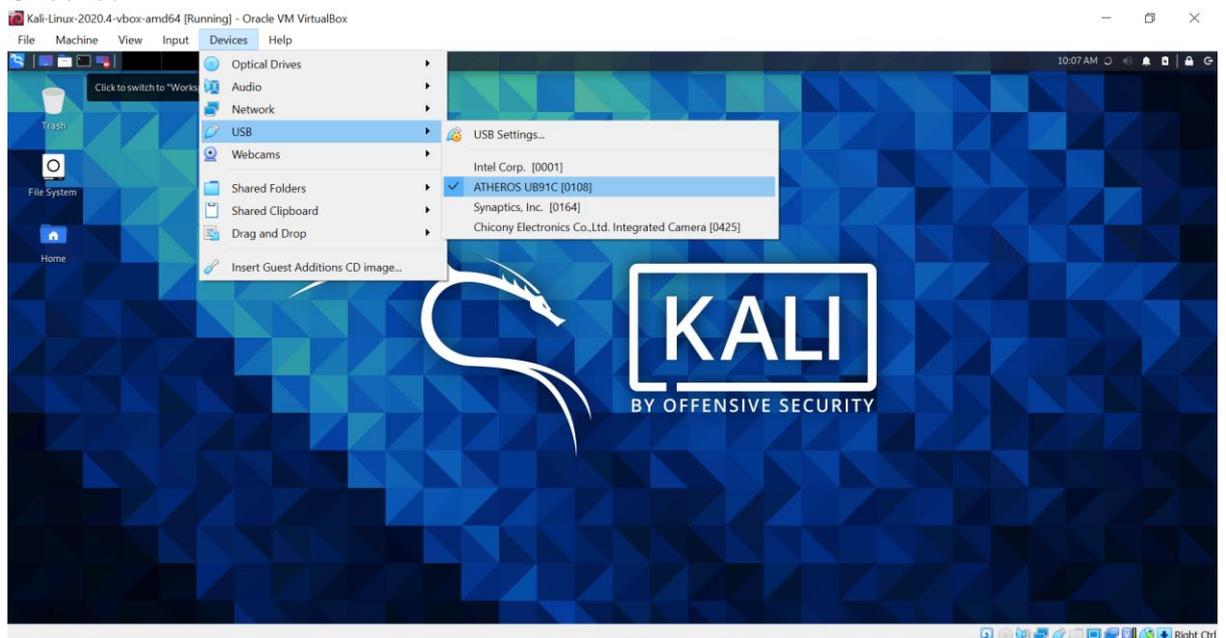
Steps:

1. To start Kali Linux, you must click “Start” in the VirtualBox Manager. Next you will be asked to enter a username and password. Here you can use the username “kali” and the password “kali” to sign in as a guest. The password “kali” will also be used to access applications which require root privileges or password entry.
2. Once the adapter is connected you want to make sure that it is attached to Kali. For this you want to go to the top of your screen, click Devices → USB and make sure your adapter is “checked”. If it is not checked just click it to check it.

Unchecked:



Checked:



Congratulations! Your Kali Linux environment is now ready for you to perform your own penetration testing implementation as seen in the final report. Your Wi-Fi adapter is also ready for use and can perform many functionalities such as connecting Kali Linux to the Internet and performing attacks in monitoring mode, etc.