CASE 2

# XZ Utils backdoor vulnerability

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# EXECUTIVE SUMMARY

## Objective

In March 2024, a critical backdoor vulnerability (CVE-2024-3094) was discovered in XZ Utils, a set of free software command-line lossless data compressors widely used in Linux systems. This vulnerability allowed unauthorized remote access and could lead to remote code execution (RCE), enabling an attacker to run commands on a victim's machine from a remote location.
The chosen topic for this project is "Penetration Testing and Vulnerability Scanning" from Module 2 of the course. This topic was selected because it directly aligns with the case we are recreating. The XZ Utils backdoor vulnerability is a perfect example of a security threat that can be detected and mitigated through penetration testing and vulnerability scanning. By recreating this case, we can gain a deeper understanding of these critical cybersecurity practices and their role in protecting software systems from threats. This project aims to recreate this case, demonstrating the process of exploiting the vulnerability and the steps taken to detect and mitigate it.

## Background

In the realm of cybersecurity, one of the most critical tasks is to identify and mitigate vulnerabilities in software systems. This project focuses on the recreation of a real-world case involving a backdoor vulnerability (CVE-2024-3094) discovered in XZ Utils, a set of free software command-line lossless data compressors widely used in Linux systems.

## Methodology

- Understanding the Case
  - Research and understand the details of the XZ Utils backdoor vulnerability, including how it was inserted, how it works, its impact, and how it was discovered and fixed.
- Choosing the Topic
  - Select a relevant topic from the course modules that aligns with the case.
- Recreating the Case
  - Use Python programming and various cybersecurity tools to recreate the case, simulating the exploitation of the vulnerability and its detection and mitigation.
- Analysis and Learning
  - Analyze the results, draw conclusions, and document the skills developed during the project.

**Key Findings**

- Through this project, I will demonstrate the importance of penetration testing and vulnerability scanning in detecting and mitigating cybersecurity threats.
- I will also highlight the potential dangers of backdoor vulnerabilities and the need for regular software updates and patches.

**Recommendations**

- Regularly conduct penetration testing and vulnerability scanning to detect potential security threats.
- Keep all software systems up-to-date and apply patches promptly to fix known vulnerabilities.
- Be vigilant about the potential for backdoor vulnerabilities, especially in widely used software systems.

**Conclusion**

This project provides valuable insights into the world of cybersecurity, particularly in the areas of penetration testing and vulnerability scanning. By recreating the XZ Utils backdoor vulnerability case, I will gain a deeper understanding of how such vulnerabilities can be exploited and the importance of proactive measures in detecting and mitigating such threats.

**Project Milestones**

1. Understanding the XZ Utils backdoor vulnerability case.
2. Selecting the relevant topic from the course modules.
3. Recreating the case using Python programming and cybersecurity tools (Failed to complete).
4. Analyzing the results and drawing conclusions (Failed to complete).

**Materials List**

1. Python programming environment.
2. Cybersecurity tools for penetration testing and vulnerability scanning.
3. Documentation on the XZ Utils backdoor vulnerability case.

**Deliverables**

1. Detailed Project Report
   - A comprehensive report documenting the entire process of recreating the XZ Utils backdoor vulnerability case, including the understanding of the case, selection of the topic, recreation of the case, and analysis of the results.
2. Python Code
   - Python scripts used to simulate the exploitation of the vulnerability and its detection and mitigation. This includes code for penetration testing, vulnerability scanning, and other relevant tasks.
3. Vulnerability Assessment and Remediation Plan
   - A detailed plan outlining the steps taken to assess the XZ Utils backdoor vulnerability and the measures implemented to mitigate it.
4. Case Recreation Results (Failed to complete)
   - Detailed results of the case recreation, including the output of the Python scripts, the findings of the vulnerability assessment, and the effectiveness of the remediation measures.

**Professional Accomplishments**

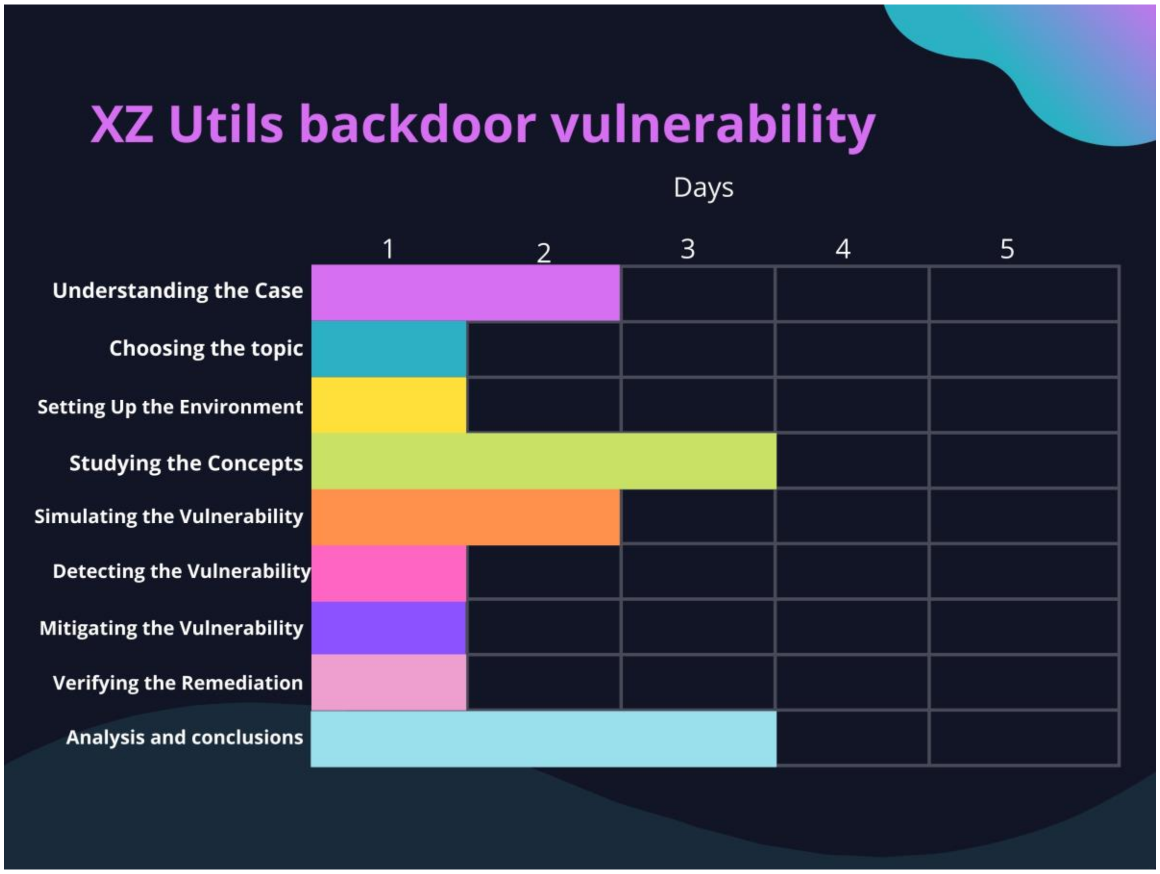
1. Enhanced Understanding of Penetration Testing and Vulnerability Scanning
   - Through this project, I have developed a deeper understanding of penetration testing and vulnerability scanning, two critical practices in cybersecurity.
   - I have gained hands-on experience in using these techniques to detect and mitigate a real-world cybersecurity threat.
2. Experience in Recreating a Real-World Cybersecurity Case

- By tying to recreate the XZ Utils backdoor vulnerability case, I have gained valuable experience in how to deal with a real-world cybersecurity issue.
- This has provided me with insights into how vulnerabilities are exploited and the importance of proactive measures in detecting and mitigating such threats.

3. Ability to Analyze and Interpret Cybersecurity Findings
   - I have developed the ability to analyze the results of a cybersecurity case recreation, draw meaningful conclusions, and make recommendations for future actions.
   - This includes interpreting the output of Python scripts, assessing the severity of vulnerabilities, and evaluating the effectiveness of remediation measures.

# PROJECT SCHEDULE MANAGEMENT

## Gantt Chart



## Repository

https://github.com/Fersi-Ferssa/XZ-Utils-backdoor-vulnerability

# Milestone 1: Understanding the XZ0020Utils backdoor vulnerability case

## 1. Research the XZ Utils Backdoor Vulnerability (CVE-2024-3094)

The XZ Utils backdoor vulnerability, officially known as CVE-2024-3094, was discovered on March 28, 2024. This vulnerability is a result of a software supply chain compromise impacting versions 5.6.0 and 5.6.1 of XZ Utils. The U.S. Cybersecurity and Infrastructure Security Agency (CISA) has recommended organizations to downgrade to a previous non-compromised XZ Utils version.

XZ Utils is a set of free software command-line lossless data compressors, including lzma and xz, for Unix-like operating systems and, from version 5.0 onwards, Microsoft Windows. For compression/decompression, the Lempel–Ziv–Markov chain algorithm (LZMA) is used. XZ Utils is nearly ubiquitous in Linux. It provides lossless data compression on virtually all Unix-like operating systems, including Linux. XZ Utils provides critical functions for compressing and decompressing data during all kinds of operations. XZ Utils also supports the legacy .lzma format, making this component even more crucial.

## 2. Understand the technical details

The vulnerability exists in the source tarballs of the affected XZ versions. The vulnerable versions contain malicious code that can modify functions during the liblzma (data compression library) build process. This results in a modified liblzma library that can be used by any software linked against this library, intercepting and modifying the data interaction with this library.

The backdoor is designed to allow a malicious actor to break the authentication and, from there, gain unauthorized access to the entire system. The backdoor works by injecting code during a key phase of the login process. The backdoor was deliberately concealed by the developer. It gets incorporated into the binary during the RPM or DEB packaging process for x86-64 architecture, using gcc and gnu linker, under the guise of a “test” step. Consequently, the compromised binary is distributed within the RPM or DEB package.

## 3. Learn about the affected systems

Several Linux distributions are affected by this vulnerability. These include Fedora Rawhide, Fedora 41, Debian testing, unstable and experimental distributions versions 5.5.1alpha-0.1 to 5.6.1-1, openSUSE Tumbleweed and openSUSE MicroOS, and Kali Linux.

For a system to be vulnerable to CVE-2024-3094, several conditions must be met:

- The system must use glibc, specifically for IFUNC support.
- XZ Utils version 5.6.0 or 5.6.1, or the corresponding versions of liblzma, must be installed.

## 4. Understand the mitigation measures

To mitigate the risk posed by CVE-2024-3094, CISA recommends developers and users to downgrade XZ Utils to an uncompromised version—such as XZ Utils 5.4.6 Stable. In addition, users should keep their system software up to date, including the Linux kernel, SSH, and systemd.

# Milestone 2: Selecting the relevant topic from the course modules

In the context of the XZ Utils backdoor vulnerability case study, we have identified Module 2: Penetration Testing and Vulnerability Scanning as the most pertinent topic for our project. This module provides a comprehensive understanding of key concepts such as penetration testing, vulnerability scanning, and various cybersecurity resources.

**Penetration Testing**

The XZ Utils backdoor vulnerability serves as an ideal example of a security flaw that could be discovered and exploited through penetration testing.

In this instance, a threat actor was able to inject malicious code into the XZ Utils software, thereby creating a backdoor that facilitated unauthorized remote access to the system.

Penetration testing is a manual process that is usually performed after a specific amount of time has passed. It begins with a phase known as reconnaissance or footprinting, which involves gathering information about the target. The rules of engagement, which define the limitations or parameters of a penetration test, are an integral part of this process.

By focusing on this topic, we can delve into the techniques and tools employed in penetration testing, and how they can be utilized to uncover such vulnerabilities.

**Vulnerability Scanning**

Upon the discovery of a vulnerability, it becomes crucial to evaluate its potential impact and the risk it poses to the system. This is where vulnerability scanning comes into play; vulnerability scanning involves identifying, classifying, and prioritizing vulnerabilities in computer systems. It’s important to note that the best approach for vulnerability scanning is not to scan all systems all the time, but rather to focus on systems with known vulnerabilities.

In the case of the XZ Utils vulnerability, a scan could potentially detect the presence of the backdoor, triggering further investigation and ultimately leading to the mitigation of the threat. Updated information about the latest vulnerabilities is readily available to enhance the effectiveness of scanning software.

**Cybersecurity Resources**

This topic also necessitates an understanding of the myriad resources available for cybersecurity, such as vulnerability databases, threat maps, and file and code repositories. These resources can offer invaluable information about known vulnerabilities, thereby informing our approach to penetration testing and vulnerability scanning.
Additionally, the module introduces two key data management tools used for collecting and analyzing data: the Security Information and Event Management (SIEM) tool and a Security Orchestration, Automation, and Response (SOAR) tool. These tools play a crucial role in managing security events and responding to security incidents.

Furthermore, the module delves into the concept of a cybersecurity framework, a series of documented processes used to define policies and procedures for implementing and managing security controls in an enterprise environment. It also highlights the importance of regulations and standards as cybersecurity resources. Regulations provide a set of rules that must be followed, while standards are documents approved through consensus by a recognized standardization body. Both of these resources provide guidelines for maintaining a secure environment.

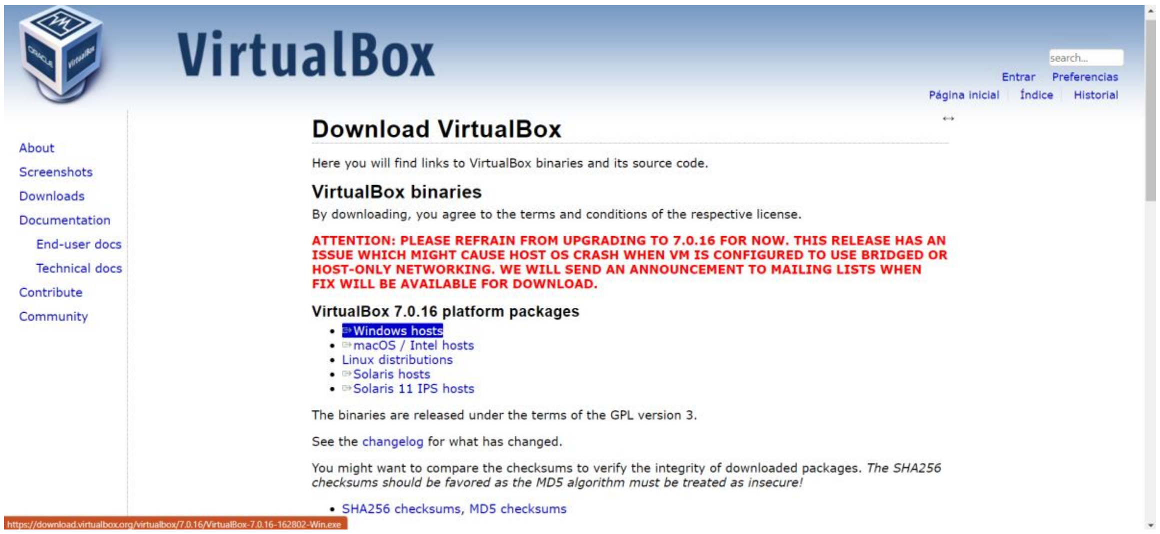
Lastly, the module emphasizes that deep vulnerabilities can only be exposed through actual attacks that use the mindset of a threat actor. This is a critical aspect of penetration testing, as it involves thinking like a threat actor to uncover vulnerabilities that might otherwise remain hidden.

By focusing on these aspects, we aim to gain a deeper understanding of these concepts and apply them effectively to recreate and analyze the XZ Utils backdoor vulnerability case. This approach will allow us to explore the practical applications of the concepts learned in Module 2 and their relevance in real-world cybersecurity scenarios.

# Milestone 3: Recreating the case using Python programming and cybersecurity tools

## 1. Setting up the environment

### 1. Install a Virtual Machine software



VirtualBox

search...

Entrar | Preferencias

Página inicial | Índice | Historial

About
Screenshots
Downloads
Documentation
End-user docs
Technical docs
Contribute
Community

**Download VirtualBox**

Here you will find links to VirtualBox binaries and its source code.

**VirtualBox binaries**

By downloading, you agree to the terms and conditions of the respective license.

ATTENTION: PLEASE REFRAIN FROM UPGRADING TO 7.0.16 FOR NOW. THIS RELEASE HAS AN ISSUE WHICH MIGHT CAUSE HOST OS CRASH WHEN VM IS CONFIGURED TO USE BRIDGED OR HOST-ONLY NETWORKING. WE WILL SEND AN ANNOUNCEMENT TO MAILING LISTS WHEN FIX WILL BE AVAILABLE FOR DOWNLOAD.

**VirtualBox 7.0.16 platform packages**

- Windows hosts
- macOS / Intel hosts
- Linux distributions
- Solaris hosts
- Solaris 11 IPS hosts

The binaries are released under the terms of the GPL version 3.

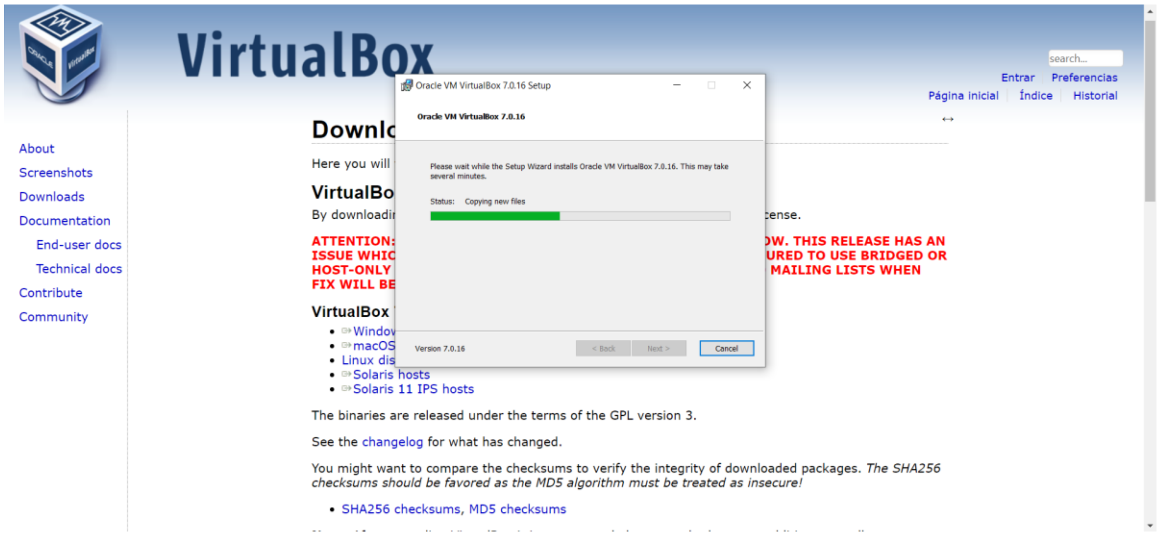
See the changelog for what has changed.

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

https://download.virtualbox.org/virtualbox/7.0.16/VirtualBox-7.0.16-162802-Win.exe

Figure 3.1.1.1 | Download VirtualBox.



Oracle VM VirtualBox 7.0.16 Setup

**Oracle VM VirtualBox 7.0.16**

Please wait while the Setup Wizard installs Oracle VM VirtualBox 7.0.16. This may take several minutes.

Status: Copying new files

Version 7.0.16

< Back | Next > | Cancel

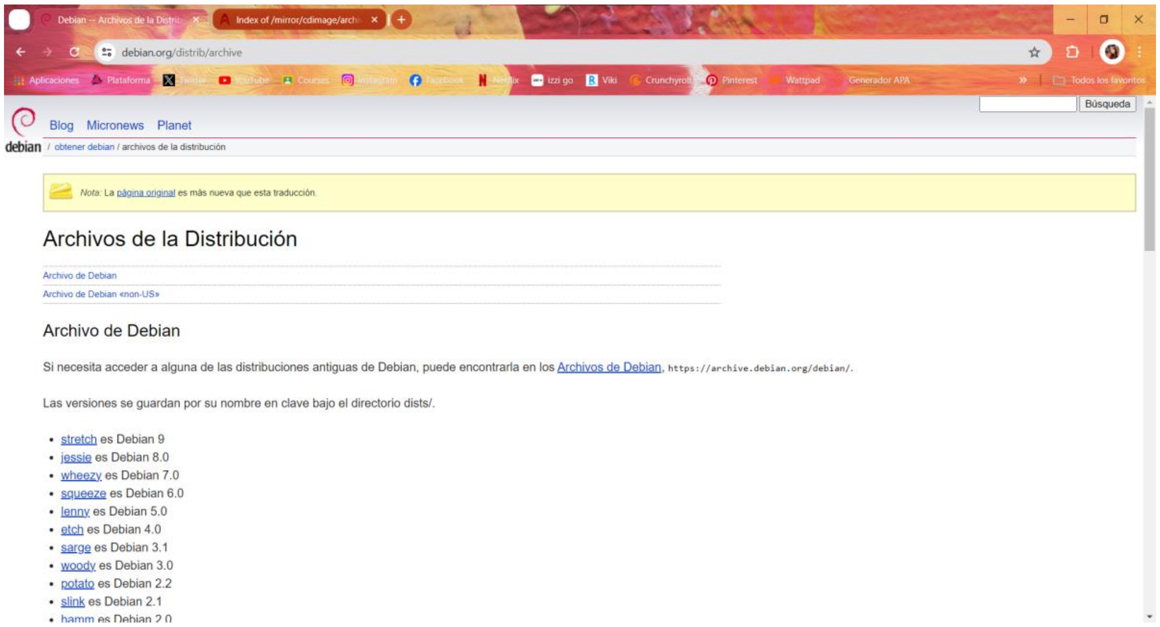
Figure 3.1.1.2 | Install VirtualBox.

## 2. Download a Linux distribution

### 1. Choose a Linux distribution

First, I decided on a Linux distribution that was affected by the XZ Utils backdoor vulnerability by choosing an older version of Debian.

### 2. Find the distribution


debian.org/distrib/archive
Blog
Micronews
Planet
Búsqueda
debian / obtener debian / archivos de la distribución

*Nota:* La página original es más nueva que esta traducción.

Archivos de la Distribución

Archivo de Debian
Archivo de Debian «non-US»

Archivo de Debian

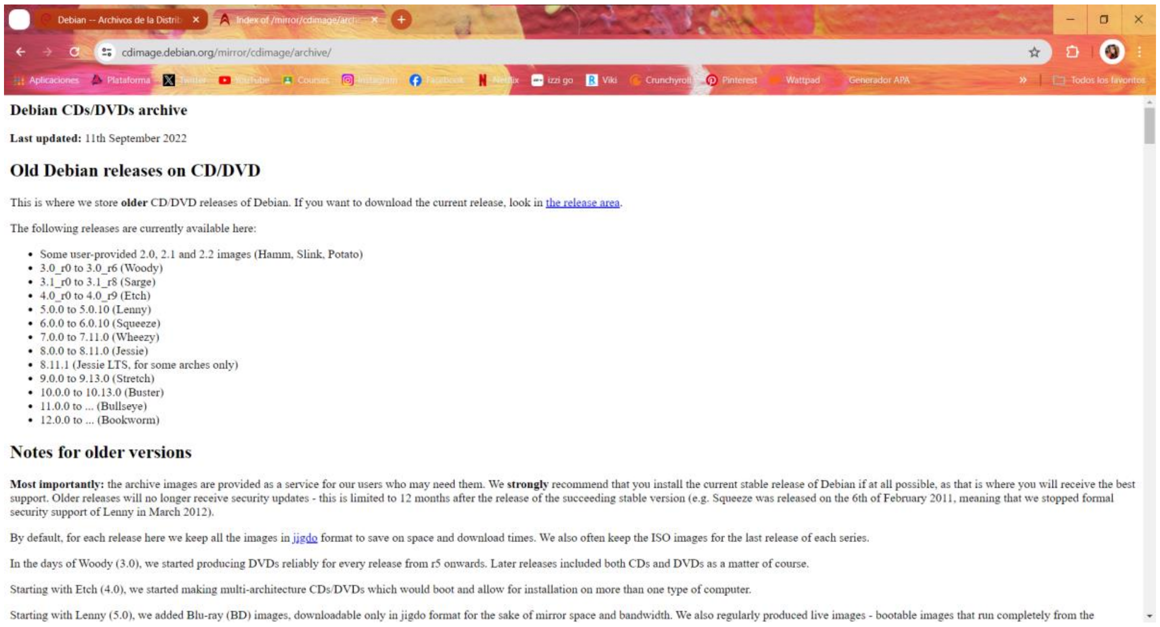
Si necesita acceder a alguna de las distribuciones antiguas de Debian, puede encontrarla en los Archivos de Debian, `https://archive.debian.org/debian/`.

Las versiones se guardan por su nombre en clave bajo el directorio dists/.

- stretch es Debian 9
- jessie es Debian 8.0
- wheezy es Debian 7.0
- squeeze es Debian 6.0
- lenny es Debian 5.0
- etch es Debian 4.0
- sarge es Debian 3.1
- woody es Debian 3.0
- potato es Debian 2.2
- slink es Debian 2.1
- hamm es Debian 2.0

Figure 3.1.2.1 | Debian official distribution website.

### 3. Select the version



**Debian CDs/DVDs archive**

**Last updated:** 11th September 2022

**Old Debian releases on CD/DVD**

This is where we store **older** CD/DVD releases of Debian. If you want to download the current release, look in the release area.

The following releases are currently available here:

- Some user-provided 2.0, 2.1 and 2.2 images (Hamm, Slink, Potato)
- 3.0_r0 to 3.0_r6 (Woody)
- 3.1_r0 to 3.1_r8 (Sarge)
- 4.0_r0 to 4.0_r9 (Etch)
- 5.0.0 to 5.0.10 (Lenny)
- 6.0.0 to 6.0.10 (Squeeze)
- 7.0.0 to 7.11.0 (Wheezy)
- 8.0.0 to 8.11.0 (Jessie)
- 8.11.1 (Jessie LTS, for some arches only)
- 9.0.0 to 9.13.0 (Stretch)
- 10.0.0 to 10.13.0 (Buster)
- 11.0.0 to ... (Bullseye)
- 12.0.0 to ... (Bookworm)

**Notes for older versions**

**Most importantly:** the archive images are provided as a service for our users who may need them. We **strongly** recommend that you install the current stable release of Debian if at all possible, as that is where you will receive the best support. Older releases will no longer receive security updates - this is limited to 12 months after the release of the succeeding stable version (e.g. Squeeze was released on the 6th of February 2011, meaning that we stopped formal security support of Lenny in March 2012).

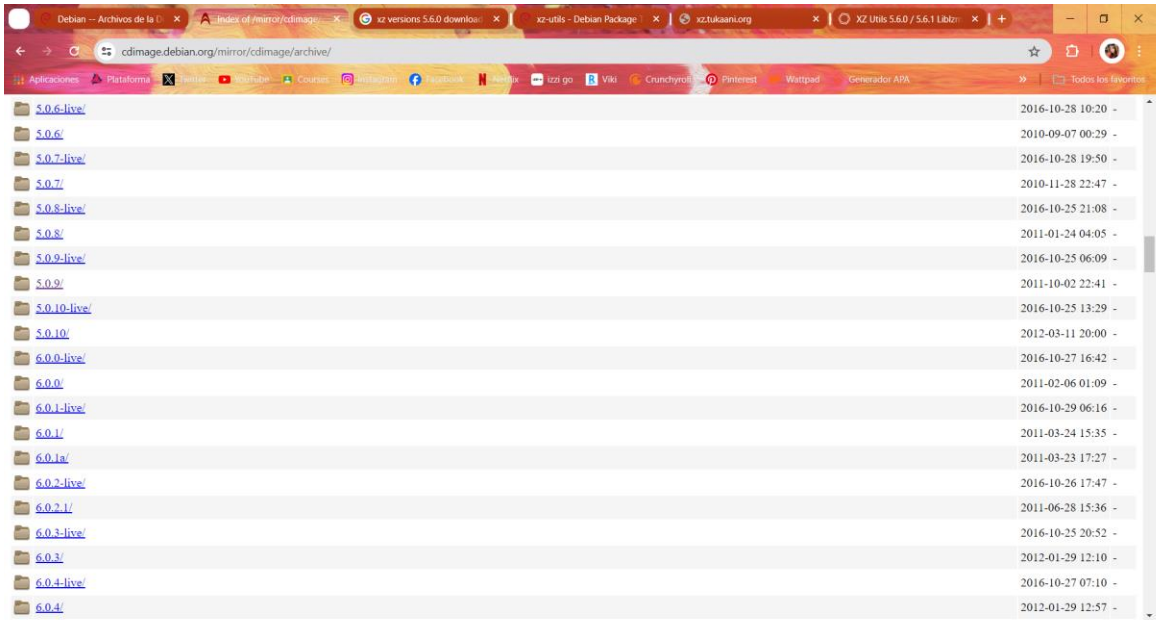
By default, for each release here we keep all the images in jigdo format to save on space and download times. We also often keep the ISO images for the last release of each series.

In the days of Woody (3.0), we started producing DVDs reliably for every release from r5 onwards. Later releases included both CDs and DVDs as a matter of course.

Starting with Etch (4.0), we started making multi-architecture CDs/DVDs which would boot and allow for installation on more than one type of computer.

Starting with Lenny (5.0), we added Blu-ray (BD) images, downloadable only in jigdo format for the sake of mirror space and bandwidth. We also regularly produced live images - bootable images that run completely from the

Figure 3.1.2.2 | Debian older versions page.


Debian -- Archivos de la D
Index of /mirror/cdimage/
xz versions 5.6.0 download
xz-utils - Debian Package
xz.tukaani.org
XZ Utils 5.6.0 / 5.6.1 Liblzm
cdimage.debian.org/mirror/cdimage/archive/

```
5.0.6-live/     2016-10-28 10:20  -
5.0.6/          2010-09-07 00:29  -
5.0.7-live/     2016-10-28 19:50  -
5.0.7/          2010-11-28 22:47  -
5.0.8-live/     2016-10-25 21:08  -
5.0.8/          2011-01-24 04:05  -
5.0.9-live/     2016-10-25 06:09  -
5.0.9/          2011-10-02 22:41  -
5.0.10-live/    2016-10-25 13:29  -
5.0.10/         2012-03-11 20:00  -
6.0.0-live/     2016-10-27 16:42  -
6.0.0/          2011-02-06 01:09  -
6.0.1-live/     2016-10-29 06:16  -
6.0.1/          2011-03-24 15:35  -
6.0.1a/         2011-03-23 17:27  -
6.0.2-live/     2016-10-26 17:47  -
6.0.2.1/        2011-06-28 15:36  -
6.0.3-live/     2016-10-25 20:52  -
6.0.3/          2012-01-29 12:10  -
6.0.4-live/     2016-10-27 07:10  -
6.0.4/          2012-01-29 12:57  -
```

Figure 3.1.2.3 | List of older Debian versions. Versions 5.6.0 or 5.6.1 are unavailable.

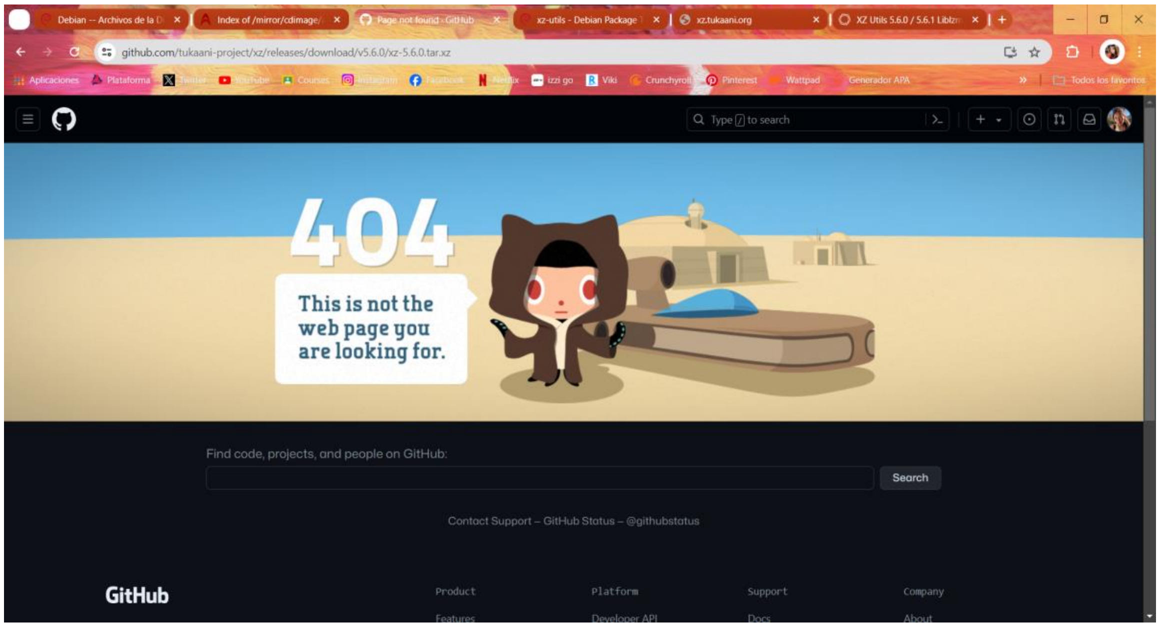
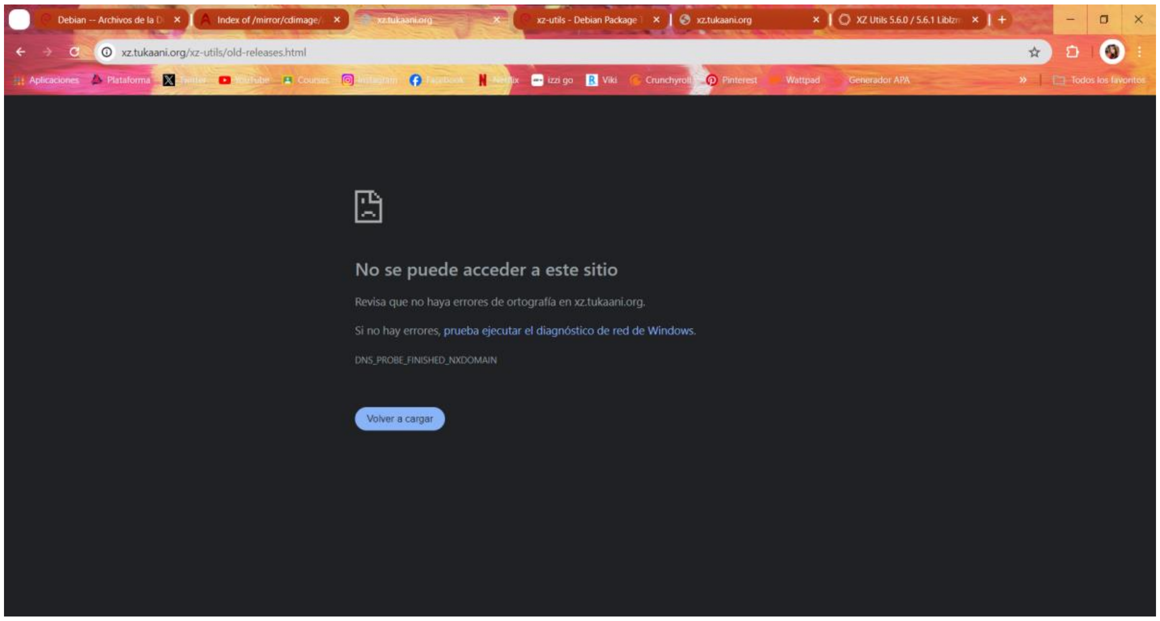

Page not found · GitHub
github.com/tukaani-project/xz/releases/download/v5.6.0/xz-5.6.0.tar.xz
Type / to search
404
This is not the web page you are looking for.
Find code, projects, and people on GitHub:
Search
Contact Support – GitHub Status – @githubstatus
GitHub
Product
Platform
Support
Company
Features
Developer API
Docs
About

Figure 3.1.2.4 | Second alternative to get the XZ Utils 5.6.0 (Failed).



No se puede acceder a este sitio

Revisa que no haya errores de ortografía en xz.tukaani.org.

Si no hay errores, prueba ejecutar el diagnóstico de red de Windows.

DNS_PROBE_FINISHED_NXDOMAIN

Figure 3.1.2.5 | Third alternative to get the XZ Utils 5.6.0 (Failed).

## 3. Project breakdown

During the execution of the project's third milestone, second task, and third step, which involved selecting the specific version of Debian affected by the XZ Utils backdoor vulnerability, we encountered an unexpected challenge. The desired version of Debian had been removed from the archives due to the severity of the attack. This presented us with a critical decision point in our project.

Recognizing the importance of adaptability in cybersecurity, we decided to pivot our approach. Instead of focusing on the specific version of Debian that was originally affected, we will now select a different version of Debian that is currently available in the archives.

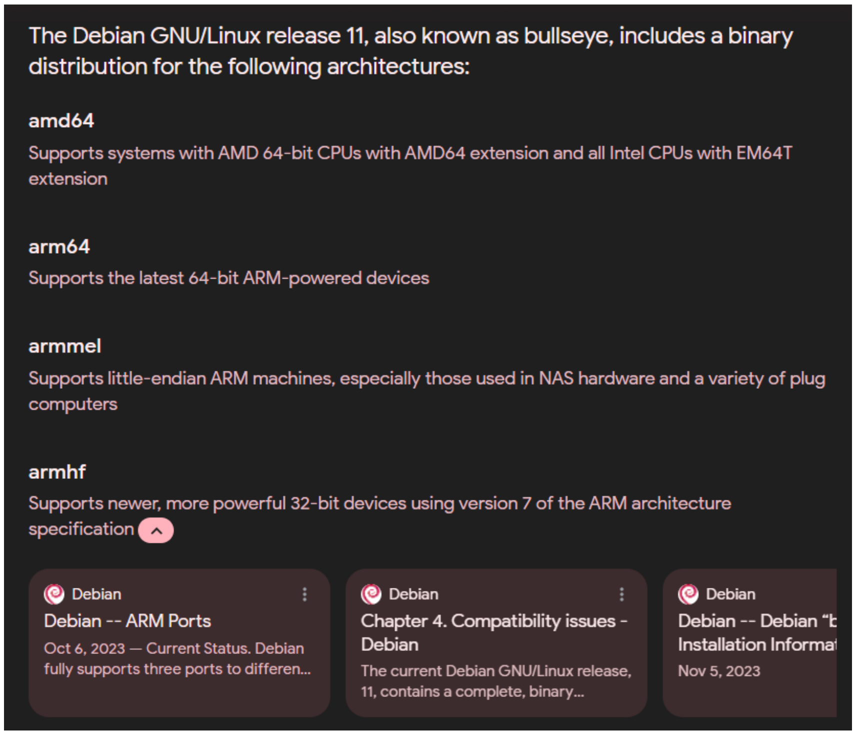
While this version may not have been affected by the XZ Utils backdoor vulnerability, it will still allow us to study and apply the key concepts of penetration testing, vulnerability scanning, and utilizing cybersecurity resources. We believe that this approach will still enable us to achieve our project objectives and gain valuable insights into the practical applications of these concepts in real-world scenarios.

We are confident that this change in course will not only maintain the integrity of our project but also enhance our learning experience by demonstrating the importance of flexibility and resourcefulness in the face of unforeseen challenges.

## 4. Download a different version of Debian

### 1. Research Debian versions alternatives

I researched which versions of Debian are available for download from the Debian Archives making sure to choose a version that is compatible with my system.



The Debian GNU/Linux release 11, also known as bullseye, includes a binary distribution for the following architectures:

**amd64**

Supports systems with AMD 64-bit CPUs with AMD64 extension and all Intel CPUs with EM64T extension

**arm64**

Supports the latest 64-bit ARM-powered devices

**armmel**

Supports little-endian ARM machines, especially those used in NAS hardware and a variety of plug computers

**armhf**

Supports newer, more powerful 32-bit devices using version 7 of the ARM architecture specification

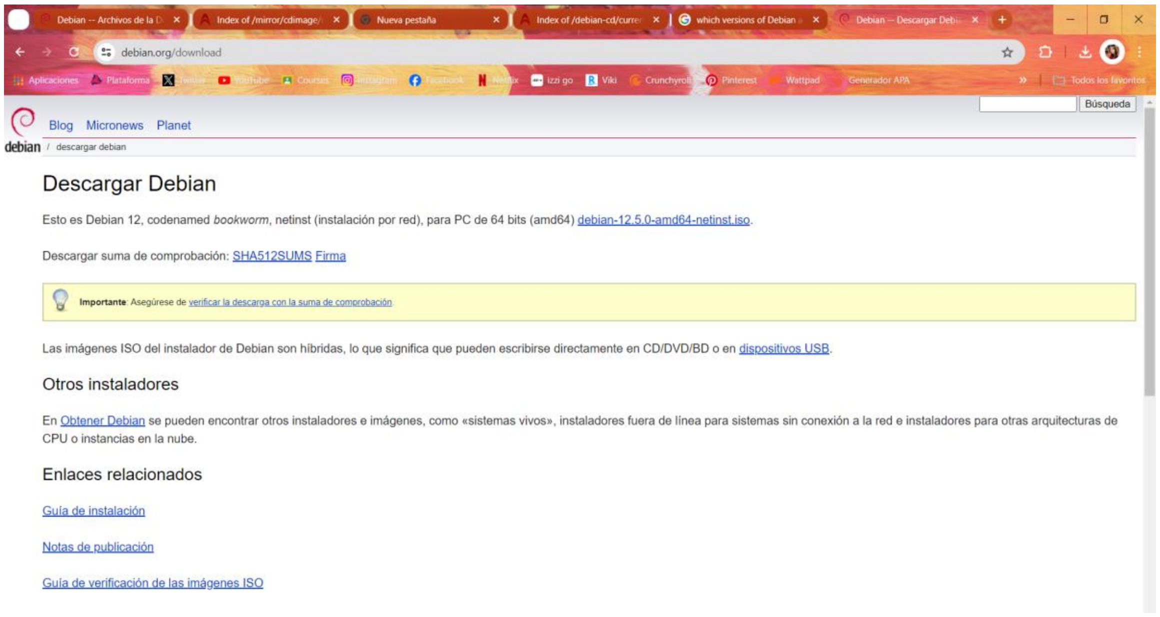
Debian
Debian -- ARM Ports
Oct 6, 2023 — Current Status. Debian fully supports three ports to differen...

Debian
Chapter 4. Compatibility issues - Debian
The current Debian GNU/Linux release, 11, contains a complete, binary...

Debian
Debian -- Debian "b
Installation Informat
Nov 5, 2023

Figure 3.1.4.1 | Research.

### 2. Download the ISO file



Descargar Debian

Esto es Debian 12, codenamed *bookworm*, netinst (instalación por red), para PC de 64 bits (amd64) debian-12.5.0-amd64-netinst.iso.

Descargar suma de comprobación: SHA512SUMS Firma

**Importante**: Asegúrese de verificar la descarga con la suma de comprobación

Las imágenes ISO del instalador de Debian son híbridas, lo que significa que pueden escribirse directamente en CD/DVD/BD o en dispositivos USB.

Otros instaladores

En Obtener Debian se pueden encontrar otros instaladores e imágenes, como «sistemas vivos», instaladores fuera de línea para sistemas sin conexión a la red e instaladores para otras arquitecturas de CPU o instancias en la nube.

Enlaces relacionados

Guía de instalación

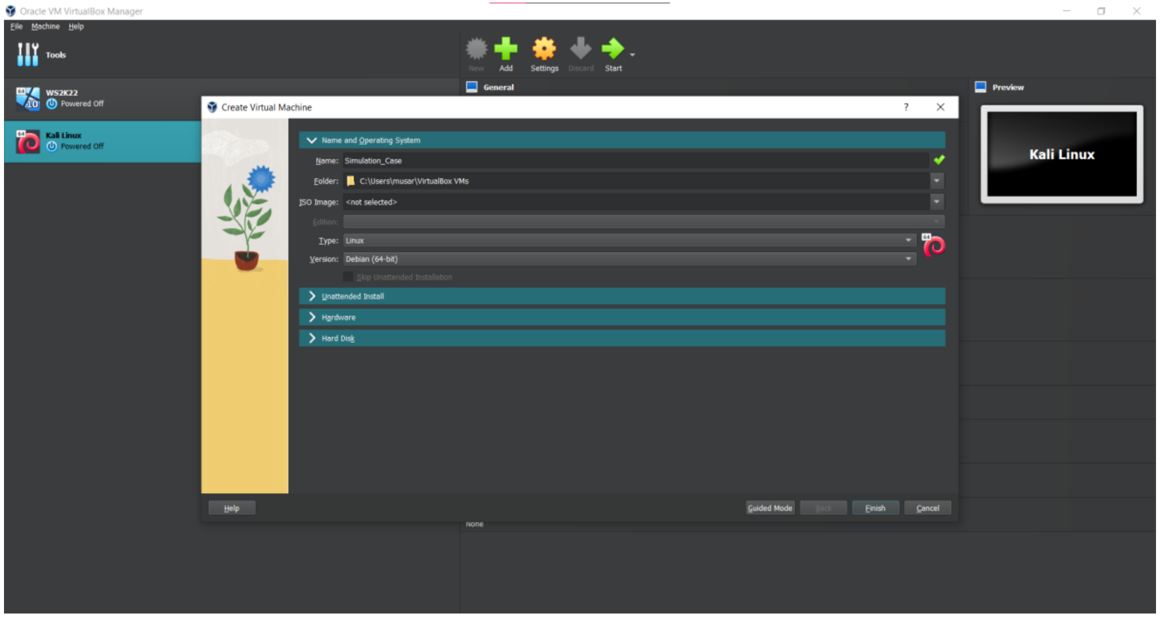
Notas de publicación

Guía de verificación de las imágenes ISO

Figure 3.1.4.2 | Debian amd64 ISO download page.

## 5. Set up the environment

### 1. Create a new Virtual Machine



Name and Operating System

Name: Simulation_Case

Folder: C:\Users\musar\VirtualBox VMs

ISO Image: <not selected>

Edition:

Type: Linux

Version: Debian (64-bit)

Skip Unattended Installation

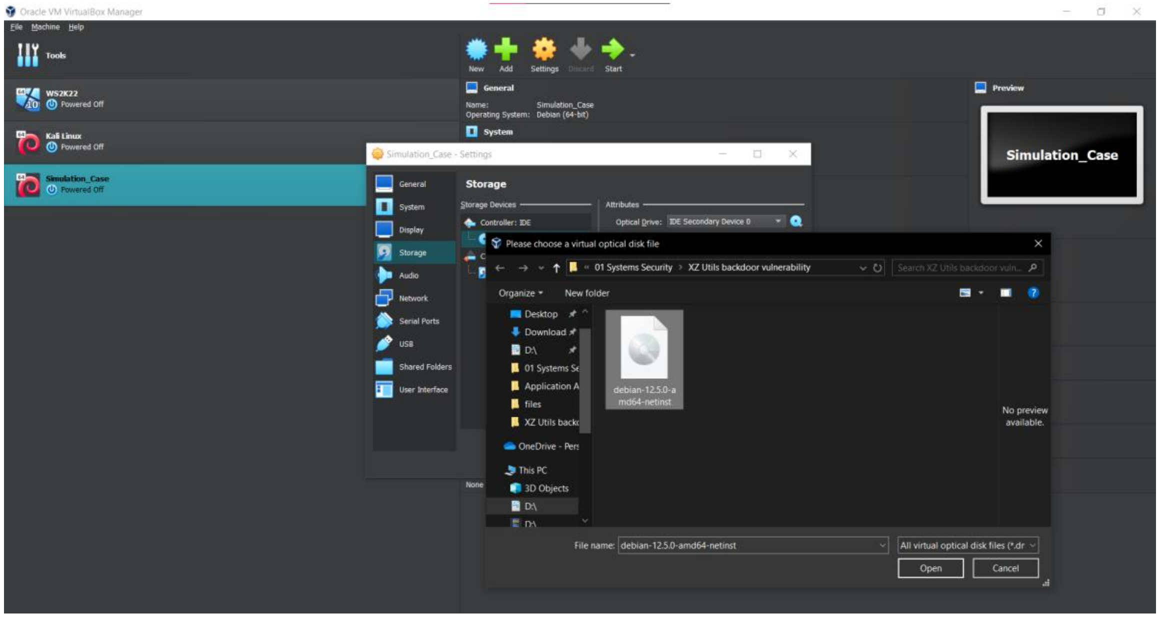
Unattended Install

Hardware

Hard Disk

Figure 3.1.5.1 | Creation of the new Virtual Machine.

## 2. Install Debian



Name: Simulation_Case
Operating System: Debian (64-bit)

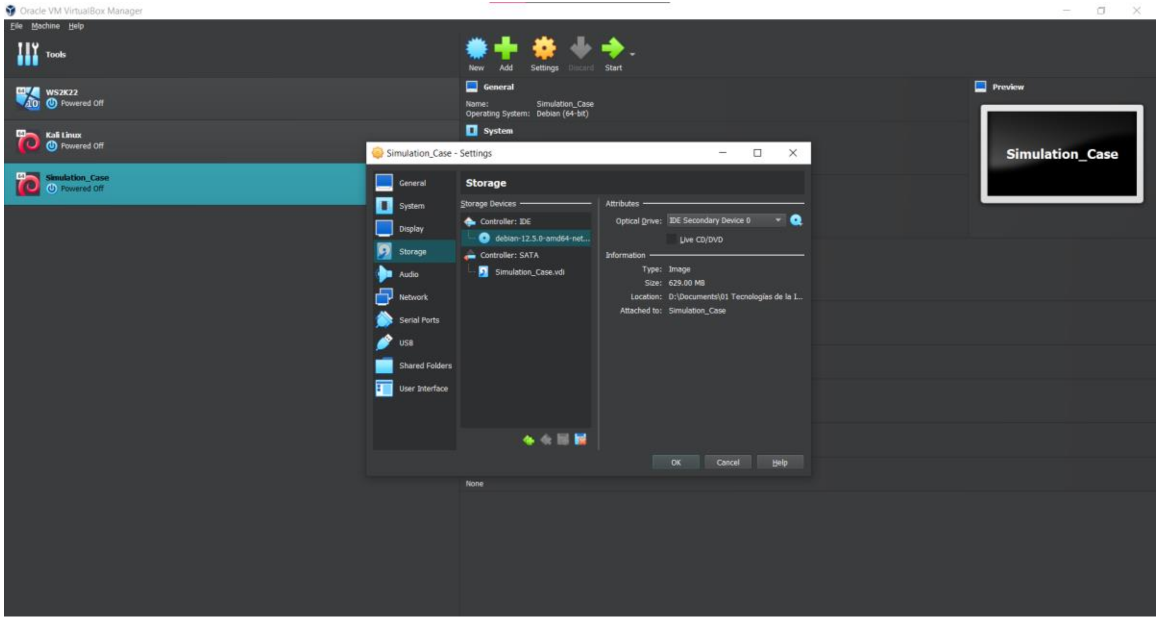
Optical Drive: IDE Secondary Device 0

« 01 Systems Security › XZ Utils backdoor vulnerability

debian-12.5.0-amd64-netinst

File name: debian-12.5.0-amd64-netinst
All virtual optical disk files (*.dr

Figure 3.1.5.2 | Mount of the Debian ISO file (1.0)



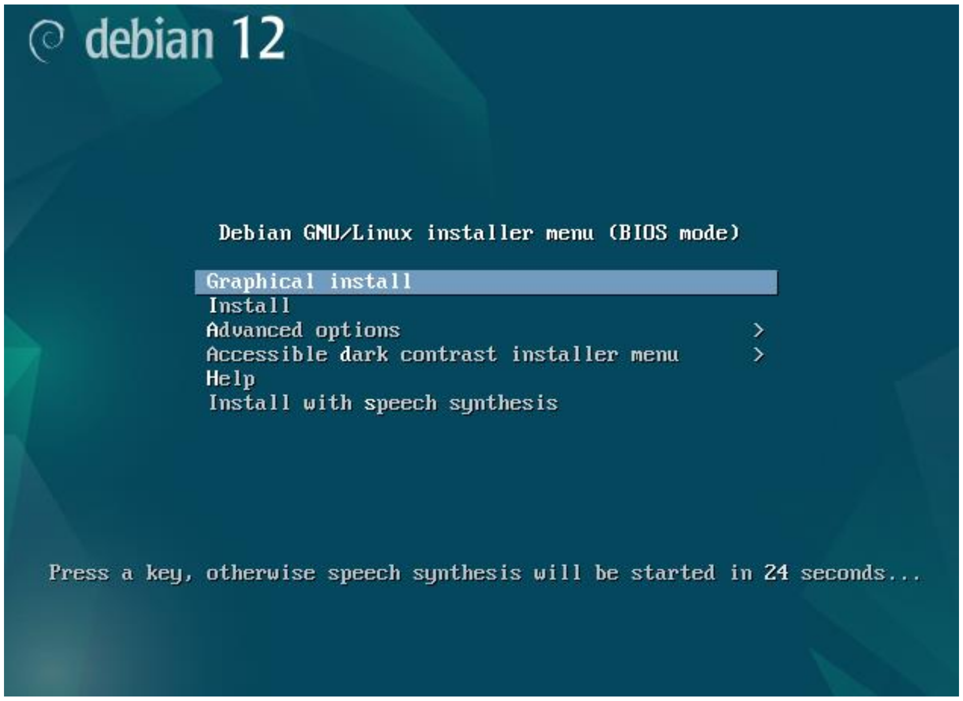
Name: Simulation_Case
Operating System: Debian (64-bit)

Controller: IDE
debian-12.5.0-amd64-net...
Controller: SATA
Simulation_Case.vdi

Optical Drive: IDE Secondary Device 0
Live CD/DVD

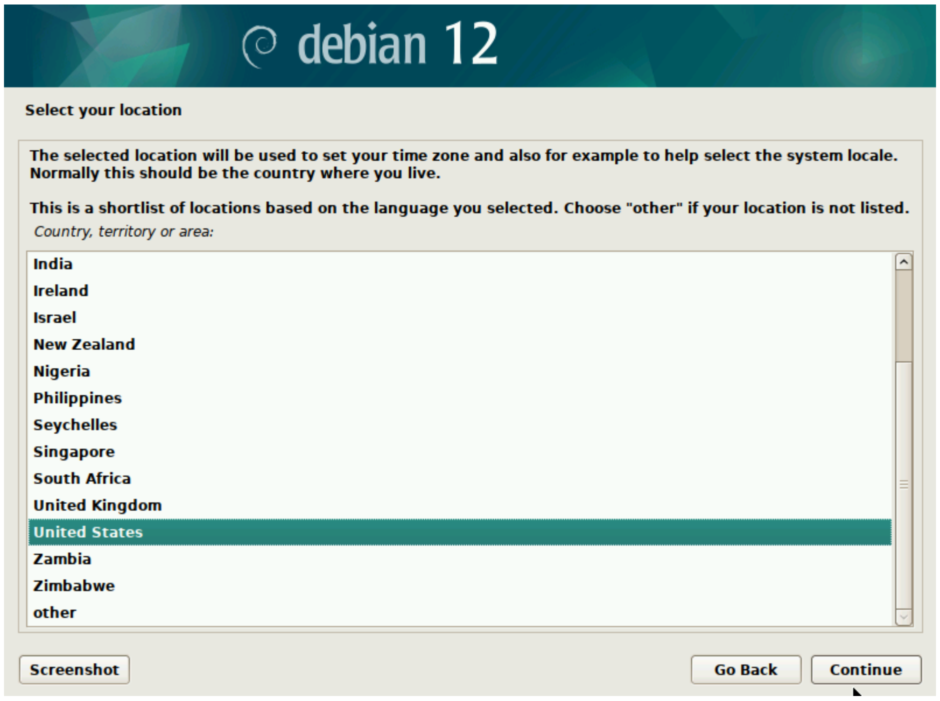
Type: Image
Size: 629.00 MB
Location: D:\Documents\01 Tecnologías de la I...
Attached to: Simulation_Case

Figure 3.1.5.3 | Mount of the Debian ISO file (2.0)



```
debian 12

Debian GNU/Linux installer menu (BIOS mode)

Graphical install
Install
Advanced options                                >
Accessible dark contrast installer menu         >
Help
Install with speech synthesis

Press a key, otherwise speech synthesis will be started in 24 seconds...
```

Figure 3.1.5.4 | Installation page of the new virtual machine.



debian 12

Select your location

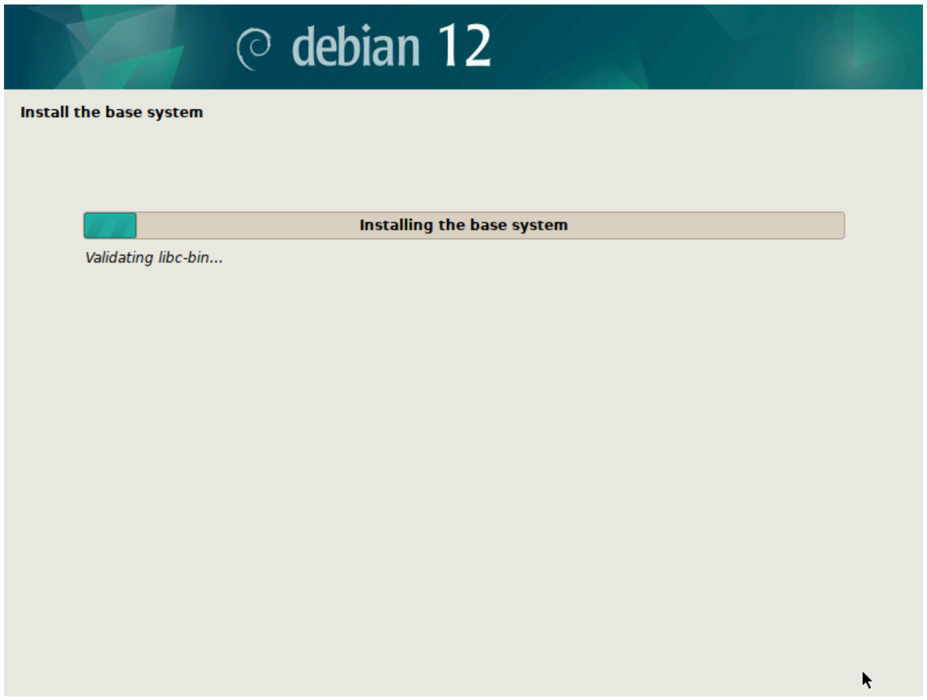
The selected location will be used to set your time zone and also for example to help select the system locale. Normally this should be the country where you live.

This is a shortlist of locations based on the language you selected. Choose "other" if your location is not listed.

*Country, territory or area:*

India
Ireland
Israel
New Zealand
Nigeria
Philippines
Seychelles
Singapore
South Africa
United Kingdom
United States
Zambia
Zimbabwe
other

Figure 3.1.5.5 | Configuration of Debian (1.0).

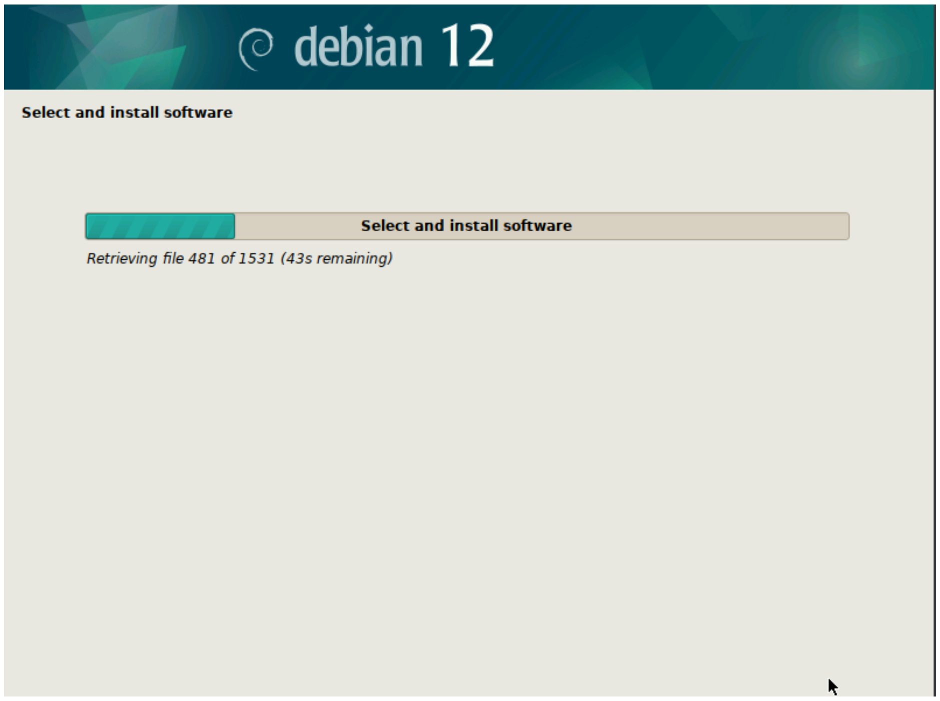


Install the base system

Installing the base system

Validating libc-bin...

Figure 3.1.5.6 | Configuration of Debian (2.0).

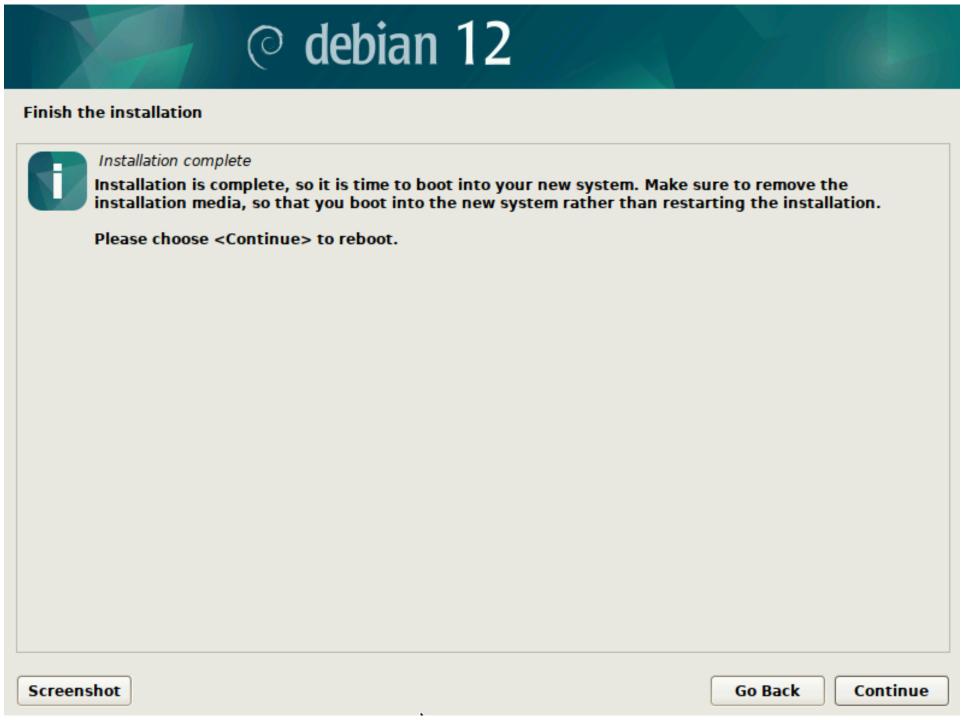


Select and install software

Select and install software

Retrieving file 481 of 1531 (43s remaining)

Figure 3.1.5.7 | Configuration of Debian (3.0).


Finish the installation

*Installation complete*

Installation is complete, so it is time to boot into your new system. Make sure to remove the installation media, so that you boot into the new system rather than restarting the installation.

Please choose <Continue> to reboot.

Figure 3.1.5.8 | Configuration of Debian (4.0).

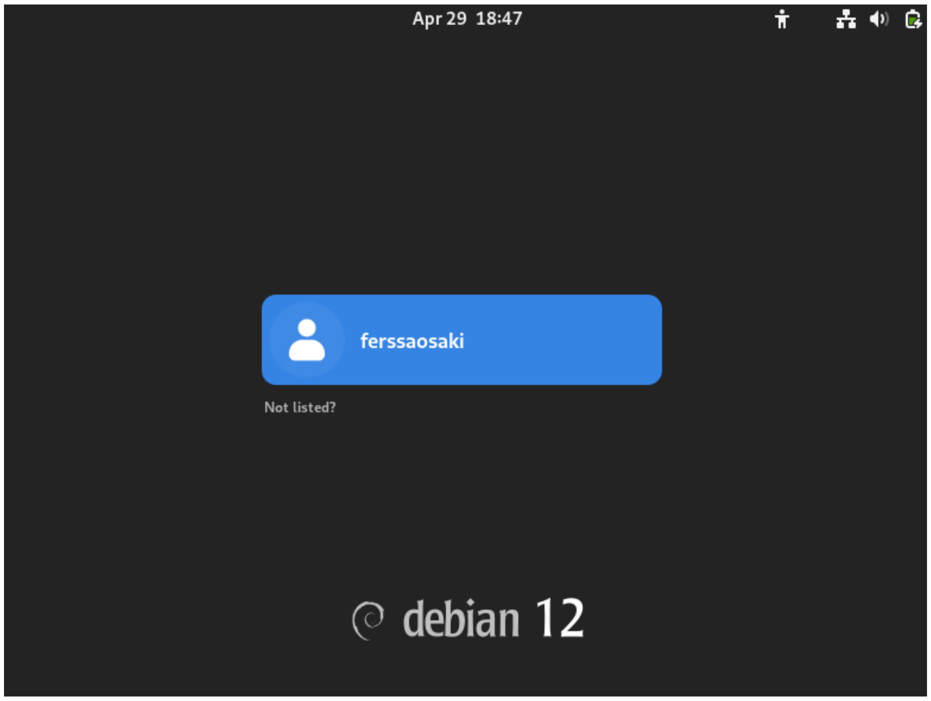
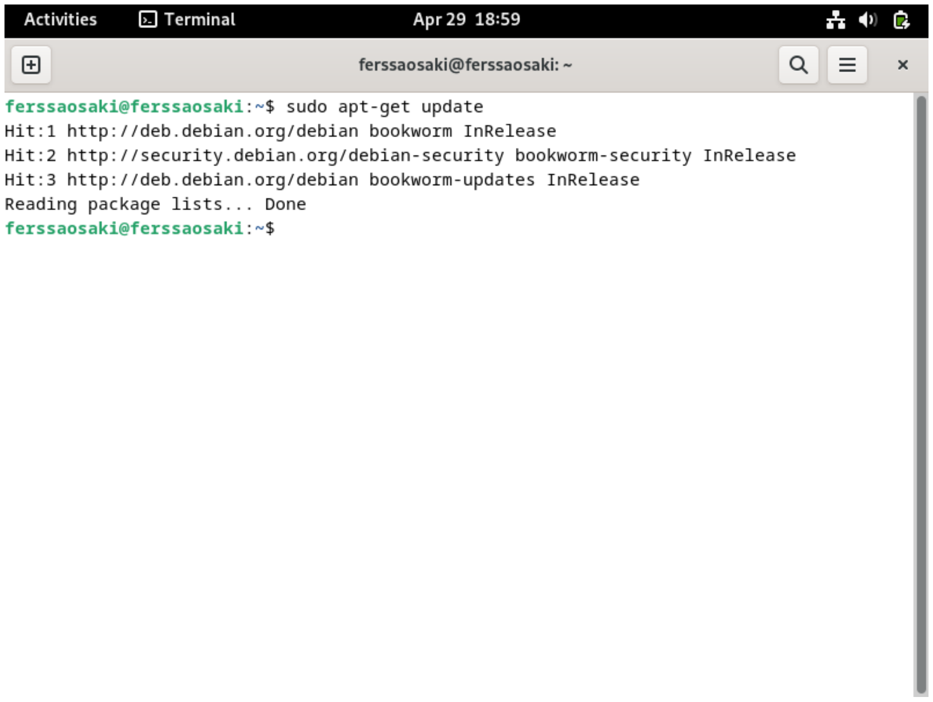


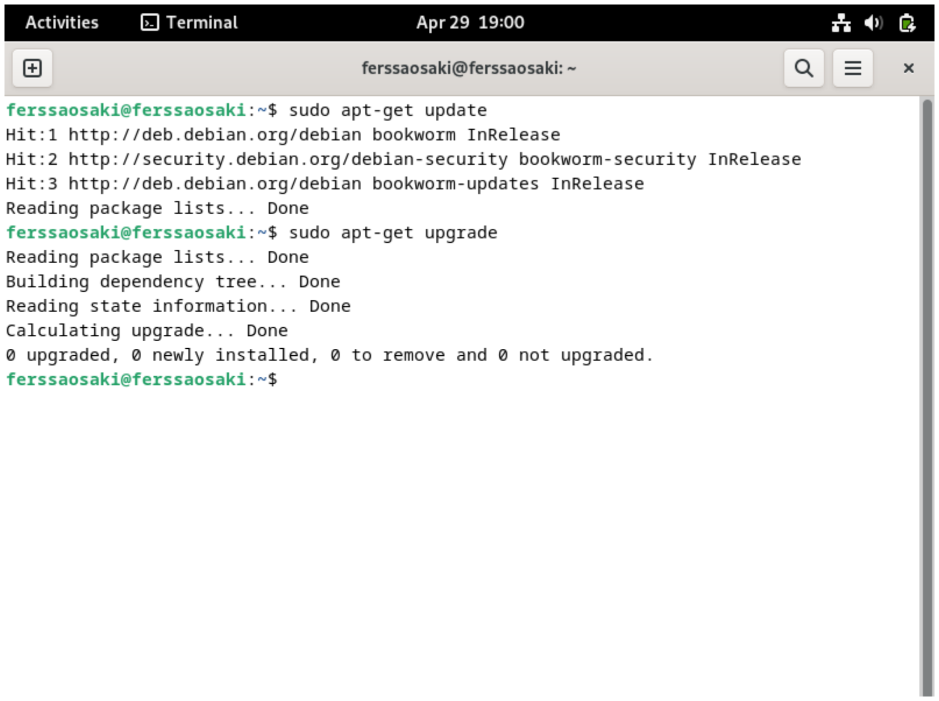
Figure 3.1.5.8 | Home page of the new virtual machine powered by Debian 12.

## 3. Update the system



```
ferssaosaki@ferssaosaki:~$ sudo apt-get update
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://security.debian.org/debian-security bookworm-security InRelease
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease
Reading package lists... Done
ferssaosaki@ferssaosaki:~$
```

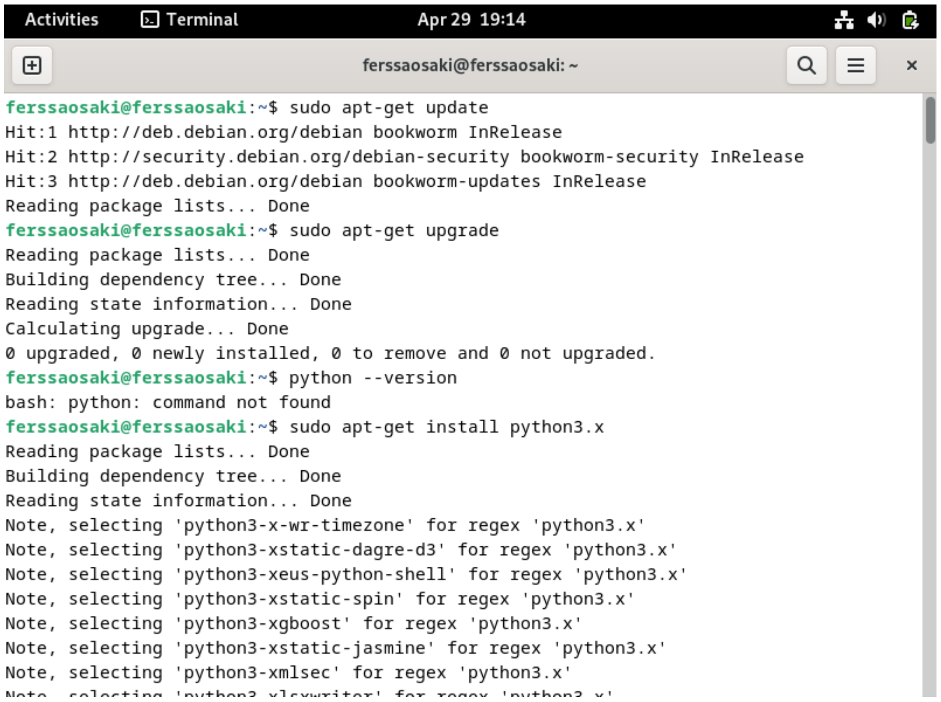
Figure 3.1.5.9 | Update of the VM.



```
ferssaosaki@ferssaosaki:~$ sudo apt-get update
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://security.debian.org/debian-security bookworm-security InRelease
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease
Reading package lists... Done
ferssaosaki@ferssaosaki:~$ sudo apt-get upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ferssaosaki@ferssaosaki:~$
```

Figure 3.1.5.10 | Upgrade of the VM.

## 4. Install necessary software



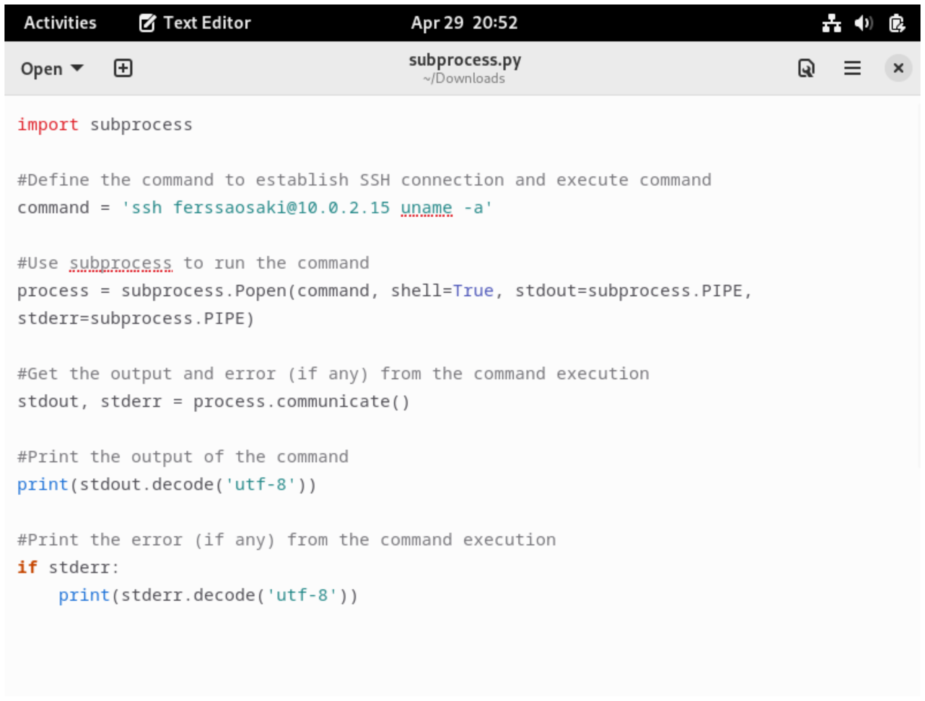
```
ferssaosaki@ferssaosaki:~$ sudo apt-get update
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://security.debian.org/debian-security bookworm-security InRelease
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease
Reading package lists... Done
ferssaosaki@ferssaosaki:~$ sudo apt-get upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ferssaosaki@ferssaosaki:~$ python --version
bash: python: command not found
ferssaosaki@ferssaosaki:~$ sudo apt-get install python3.x
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'python3-x-wr-timezone' for regex 'python3.x'
Note, selecting 'python3-xstatic-dagre-d3' for regex 'python3.x'
Note, selecting 'python3-xeus-python-shell' for regex 'python3.x'
Note, selecting 'python3-xstatic-spin' for regex 'python3.x'
Note, selecting 'python3-xgboost' for regex 'python3.x'
Note, selecting 'python3-xstatic-jasmine' for regex 'python3.x'
Note, selecting 'python3-xmlsec' for regex 'python3.x'
Note, selecting 'python3-xlsxwriter' for regex 'python3.x'
```

Figure 3.1.5.11 | Installation of Pyhton.

## 6. Simulate the vulnerability

### 1. Write a Python script to simulate the exploitation

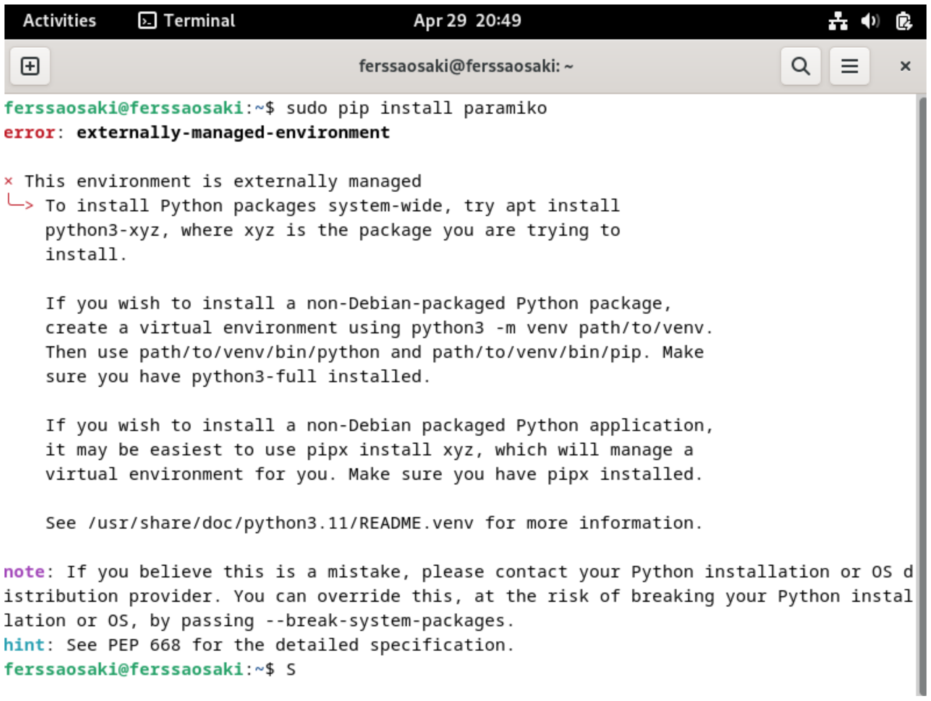
I wrote a Python script to simulate the exploitation of the vulnerability. This script mimics the actions of an attacker exploiting the backdoor. It attempts to establish a remote SSH connection to the VM using the backdoor, send an arbitrary payload, and execute it on the VM.



```python
import subprocess

#Define the command to establish SSH connection and execute command
command = 'ssh ferssaosaki@10.0.2.15 uname -a'

#Use subprocess to run the command
process = subprocess.Popen(command, shell=True, stdout=subprocess.PIPE,
stderr=subprocess.PIPE)

#Get the output and error (if any) from the command execution
stdout, stderr = process.communicate()

#Print the output of the command
print(stdout.decode('utf-8'))

#Print the error (if any) from the command execution
if stderr:
    print(stderr.decode('utf-8'))
```

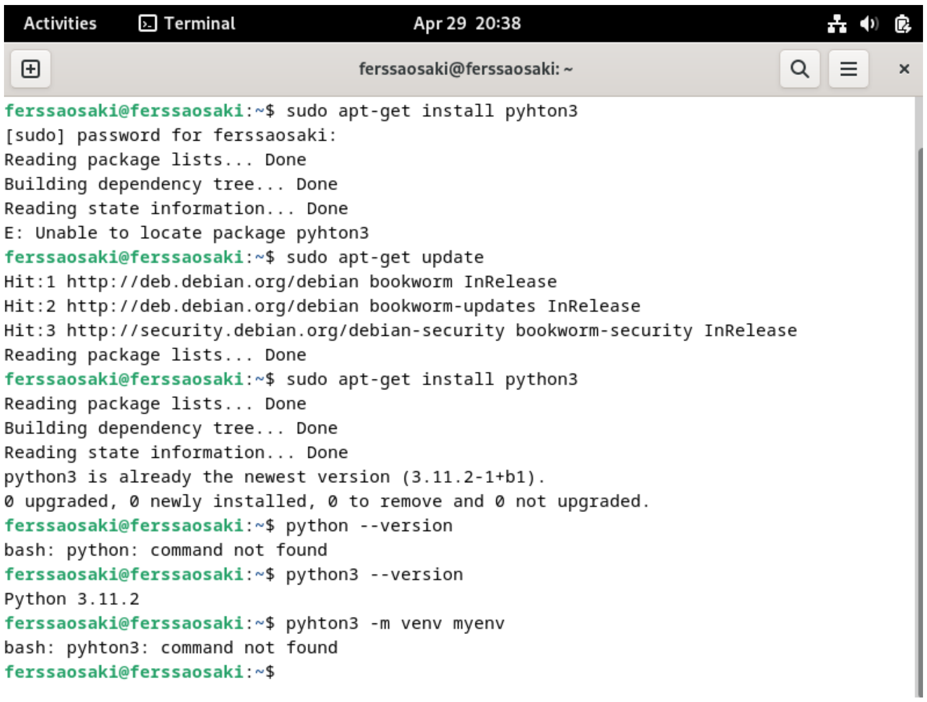
Figure 3.1.6.1 | Python script.

## 2. Run the Python script that stimulates the exploitation



```
ferssaosaki@ferssaosaki:~$ sudo pip install paramiko
error: externally-managed-environment

× This environment is externally managed
╰─> To install Python packages system-wide, try apt install
    python3-xyz, where xyz is the package you are trying to
    install.

    If you wish to install a non-Debian-packaged Python package,
    create a virtual environment using python3 -m venv path/to/venv.
    Then use path/to/venv/bin/python and path/to/venv/bin/pip. Make
    sure you have python3-full installed.

    If you wish to install a non-Debian packaged Python application,
    it may be easiest to use pipx install xyz, which will manage a
    virtual environment for you. Make sure you have pipx installed.

    See /usr/share/doc/python3.11/README.venv for more information.

note: If you believe this is a mistake, please contact your Python installation or OS d
istribution provider. You can override this, at the risk of breaking your Python instal
lation or OS, by passing --break-system-packages.
hint: See PEP 668 for the detailed specification.
ferssaosaki@ferssaosaki:~$ S
```

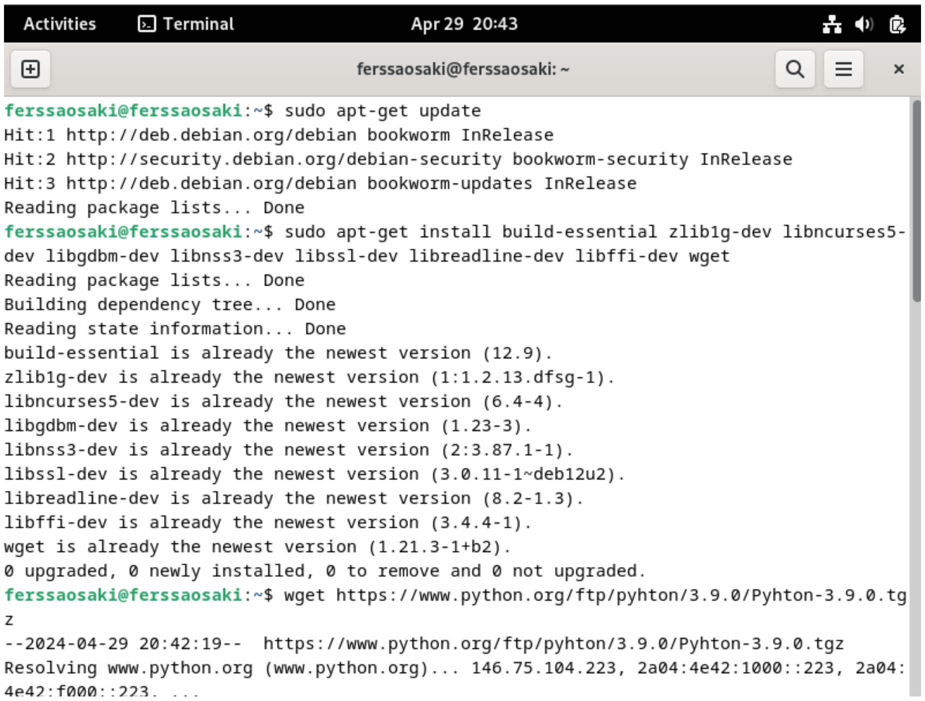
Figure 3.1.6.2 | First attempt to try running the script (Failed).


Activities Terminal Apr 29 20:38

ferssaosaki@ferssaosaki: ~

```
ferssaosaki@ferssaosaki:~$ sudo apt-get install pyhton3
[sudo] password for ferssaosaki:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package pyhton3
ferssaosaki@ferssaosaki:~$ sudo apt-get update
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://deb.debian.org/debian bookworm-updates InRelease
Hit:3 http://security.debian.org/debian-security bookworm-security InRelease
Reading package lists... Done
ferssaosaki@ferssaosaki:~$ sudo apt-get install python3
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3 is already the newest version (3.11.2-1+b1).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ferssaosaki@ferssaosaki:~$ python --version
bash: python: command not found
ferssaosaki@ferssaosaki:~$ python3 --version
Python 3.11.2
ferssaosaki@ferssaosaki:~$ pyhton3 -m venv myenv
bash: pyhton3: command not found
ferssaosaki@ferssaosaki:~$
```

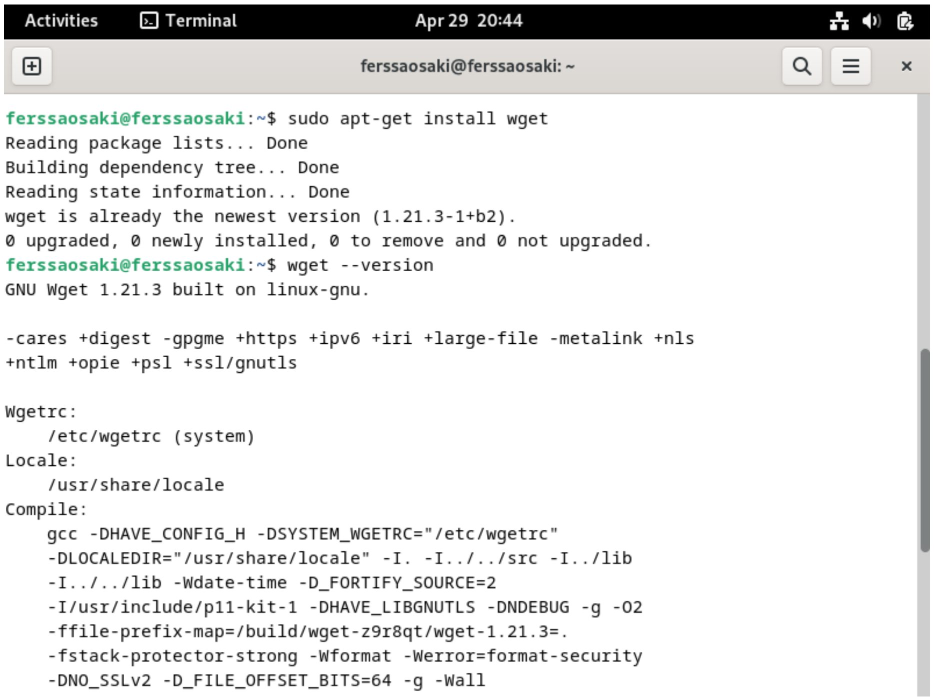
Figure 3.1.6.3 | Second attempt to try running the script (Failed).


Activities Terminal Apr 29 20:43

ferssaosaki@ferssaosaki: ~

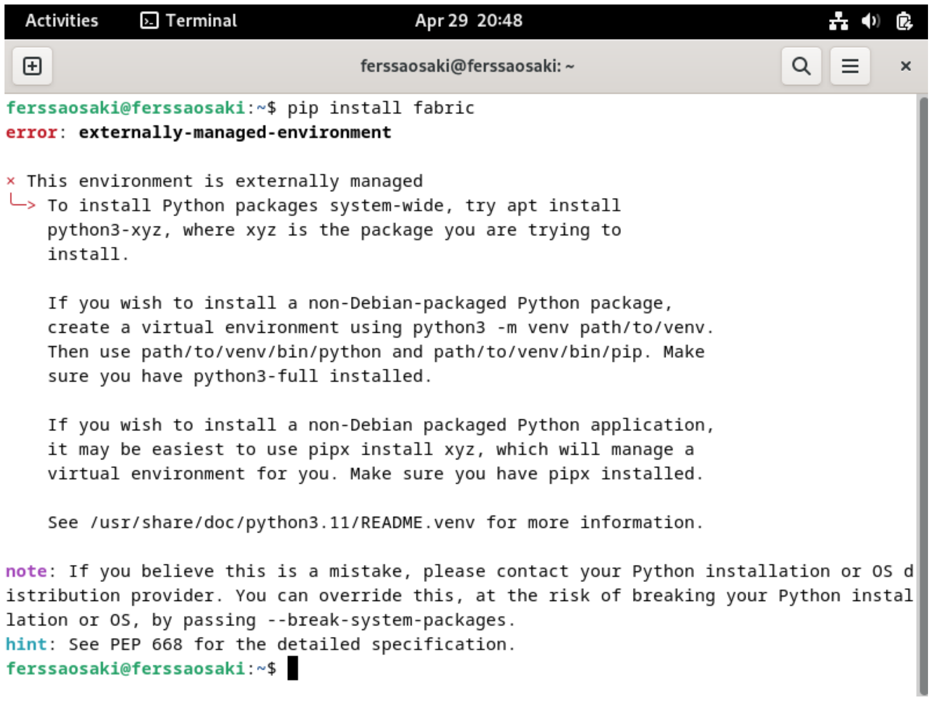
```
ferssaosaki@ferssaosaki:~$ sudo apt-get update
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://security.debian.org/debian-security bookworm-security InRelease
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease
Reading package lists... Done
ferssaosaki@ferssaosaki:~$ sudo apt-get install build-essential zlib1g-dev libncurses5-
dev libgdbm-dev libnss3-dev libssl-dev libreadline-dev libffi-dev wget
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
build-essential is already the newest version (12.9).
zlib1g-dev is already the newest version (1:1.2.13.dfsg-1).
libncurses5-dev is already the newest version (6.4-4).
libgdbm-dev is already the newest version (1.23-3).
libnss3-dev is already the newest version (2:3.87.1-1).
libssl-dev is already the newest version (3.0.11-1~deb12u2).
libreadline-dev is already the newest version (8.2-1.3).
libffi-dev is already the newest version (3.4.4-1).
wget is already the newest version (1.21.3-1+b2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ferssaosaki@ferssaosaki:~$ wget https://www.python.org/ftp/pyhton/3.9.0/Pyhton-3.9.0.tg
z
--2024-04-29 20:42:19--  https://www.python.org/ftp/pyhton/3.9.0/Pyhton-3.9.0.tgz
Resolving www.python.org (www.python.org)... 146.75.104.223, 2a04:4e42:1000::223, 2a04:
4e42:f000::223, ...
```

Figure 3.1.6.4 | Third attempt to try running the script (Failed).



```
ferssaosaki@ferssaosaki:~$ sudo apt-get install wget
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
wget is already the newest version (1.21.3-1+b2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ferssaosaki@ferssaosaki:~$ wget --version
GNU Wget 1.21.3 built on linux-gnu.

-cares +digest -gpgme +https +ipv6 +iri +large-file -metalink +nls
+ntlm +opie +psl +ssl/gnutls

Wgetrc:
    /etc/wgetrc (system)
Locale:
    /usr/share/locale
Compile:
    gcc -DHAVE_CONFIG_H -DSYSTEM_WGETRC="/etc/wgetrc"
    -DLOCALEDIR="/usr/share/locale" -I. -I../../src -I../lib
    -I../../lib -Wdate-time -D_FORTIFY_SOURCE=2
    -I/usr/include/p11-kit-1 -DHAVE_LIBGNUTLS -DNDEBUG -g -O2
    -ffile-prefix-map=/build/wget-z9r8qt/wget-1.21.3=.
    -fstack-protector-strong -Wformat -Werror=format-security
    -DNO_SSLv2 -D_FILE_OFFSET_BITS=64 -g -Wall
```

Figure 3.1.6.5 | Fourth attempt to try running the script (Failed).



```
ferssaosaki@ferssaosaki:~$ pip install fabric
error: externally-managed-environment

× This environment is externally managed
╰─> To install Python packages system-wide, try apt install
    python3-xyz, where xyz is the package you are trying to
    install.

    If you wish to install a non-Debian-packaged Python package,
    create a virtual environment using python3 -m venv path/to/venv.
    Then use path/to/venv/bin/python and path/to/venv/bin/pip. Make
    sure you have python3-full installed.

    If you wish to install a non-Debian packaged Python application,
    it may be easiest to use pipx install xyz, which will manage a
    virtual environment for you. Make sure you have pipx installed.

    See /usr/share/doc/python3.11/README.venv for more information.

note: If you believe this is a mistake, please contact your Python installation or OS d
istribution provider. You can override this, at the risk of breaking your Python instal
lation or OS, by passing --break-system-packages.
hint: See PEP 668 for the detailed specification.
ferssaosaki@ferssaosaki:~$ 
```

Figure 3.1.6.6 | Fifth attempt to try running the script (Failed).

# 7. Project breakdown and conclusions

## 1. Breakdown explanation

My goal was to recreate the attack scenario, providing me with valuable insights and a deeper understanding of real-world cybersecurity threats. However, I encountered a series of unforeseen challenges that significantly hindered my progress. The first hurdle was the unavailability of the specific version of Debian that was affected by the XZ Utils backdoor vulnerability. This version had been removed from the archives due to the severity of the attack. Despite my best efforts to adapt to this situation by choosing a different version of Debian, I was unable to proceed as originally planned.

As I delved deeper into the setup process, I faced additional technical issues. I encountered errors when trying to install necessary packages, such as paramiko, using the pip package manager. Despite numerous attempts to resolve these issues, including installing pip for Python 3 and updating the system's package list, the errors persisted.

I also faced challenges with the virtual machine (VM) setup. Despite correctly mounting the Debian ISO file and allocating appropriate resources to the VM, I encountered errors suggesting that the VM could not find an operating system to boot from. I tried various solutions, including checking the boot order and verifying the integrity of the ISO file, but to no avail.

Each of these challenges was met with determination and a strong problem-solving approach. I researched extensively, attempted multiple solutions, and sought help from various resources. However, the persistent issues with the VM and package installation proved to be insurmountable within my given timeframe.

Given these circumstances, I made the difficult decision to conclude the project. While I was unable to achieve my initial objective of recreating the attack, the journey was filled with valuable learning experiences. I gained a deeper understanding of the complexities of setting up a secure environment, the importance of adaptability in the face of challenges, and the intricacies of various tools and systems.

## 2. Project conclusions

Putting aside the challenges encountered, this project provided me with a valuable opportunity to delve into the practical aspects of cybersecurity. I gained hands-on experience with setting up a secure environment, dealing with technical issues, and making critical decisions under pressure.

While I was unable to recreate the XZ Utils backdoor vulnerability as initially planned, I learned about the importance of adaptability in cybersecurity. When faced with the unavailability of the specific Debian version affected by the vulnerability, I learned to pivot and choose a different version. This experience highlighted the dynamic nature of cybersecurity and the need to be flexible and resourceful.

The technical issues I encountered during the setup process provided me with a deeper understanding of the complexities involved in setting up a secure environment. I learned

about the intricacies of various tools and systems, and how seemingly minor issues can lead to significant roadblocks. This experience underscored the importance of thorough troubleshooting and problem-solving skills in cybersecurity.
Despite the project’s premature conclusion, I believe that the knowledge and skills I gained from this experience are invaluable. I now have a deeper understanding of real-world cybersecurity threats, the importance of penetration testing and vulnerability scanning, and the practical challenges involved in mitigating such threats.

In conclusion, while the project did not go as planned, it was a valuable learning experience. It provided me with a deeper understanding of cybersecurity concepts, enhanced my problem-solving skills, and highlighted the importance of adaptability and resourcefulness in the face of challenges. I look forward to applying these learnings in my future endeavors in the field of cybersecurity.

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