FA2022 Week 03

Rev/Pwn Setup

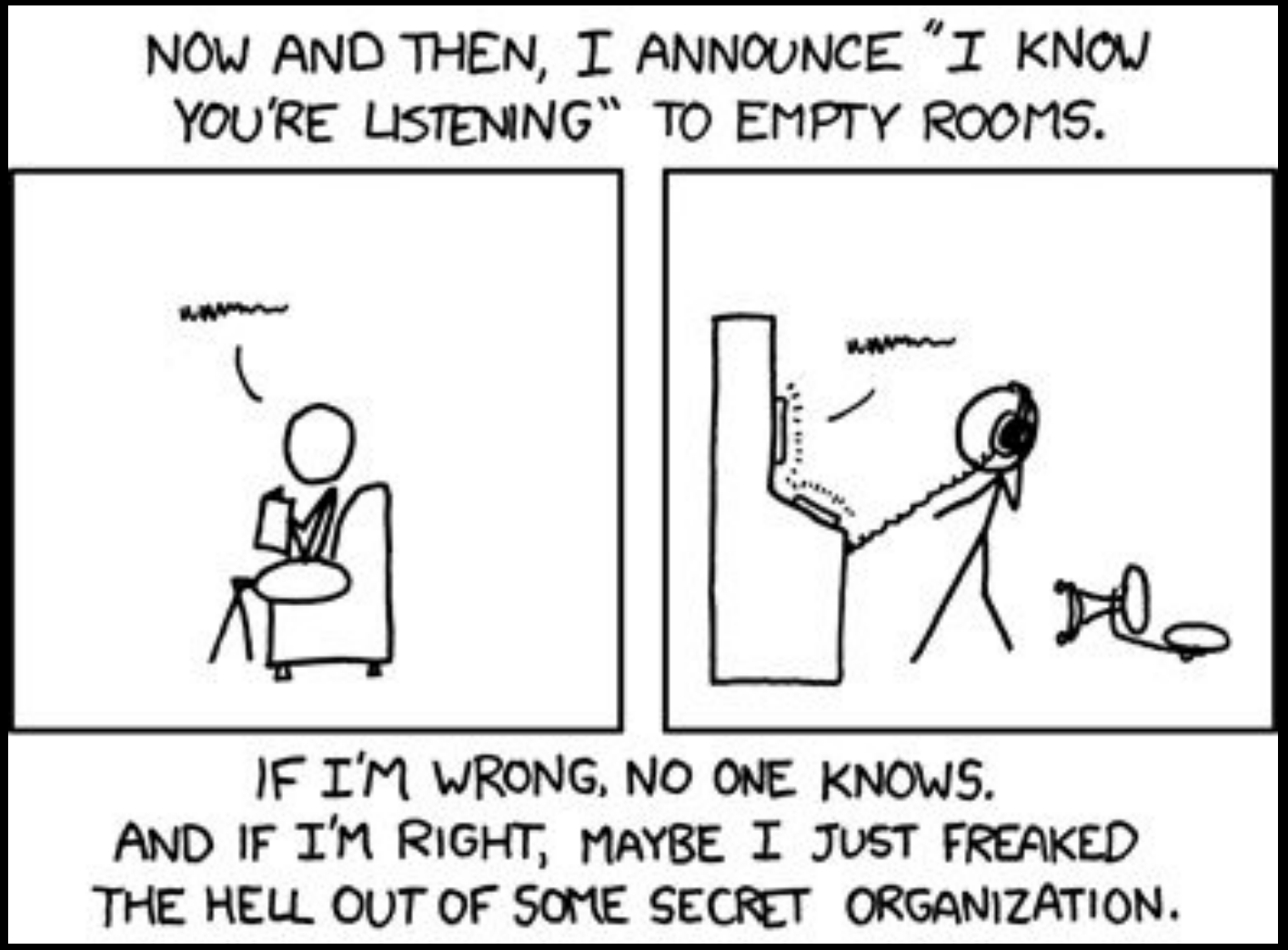
Minh and Pete

Announcements

- Fall CTF 2022
  - This Saturday!!! 12 - 6PM
  - CIF 3039

ctf.sigpwny.com

sigpwny{i_love_nsa_software}

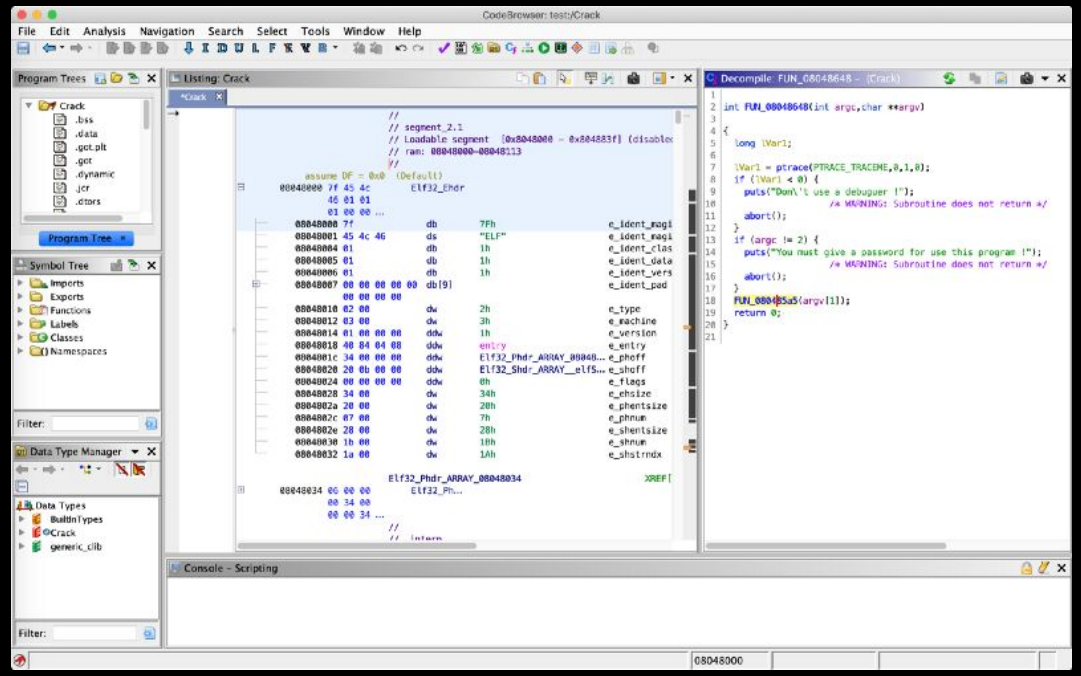


Outline

- **Goal:** Get everyone set up with Ghidra, Python, and pwntools in preparation for Thursday, Reverse Engineering I
- Installing Java Developer Kit
  - Windows
  - Mac Intel
  - Mac M1
  - Linux
- Installing Ghidra
- Installing Python, pwntools, GDB

What is Ghidra?

- Ghidra is a reverse engineering toolkit developed by the NSA and made open source
- Allows you to disassemble applications - essentially turn an unreadable application into readable code



JDK on Windows

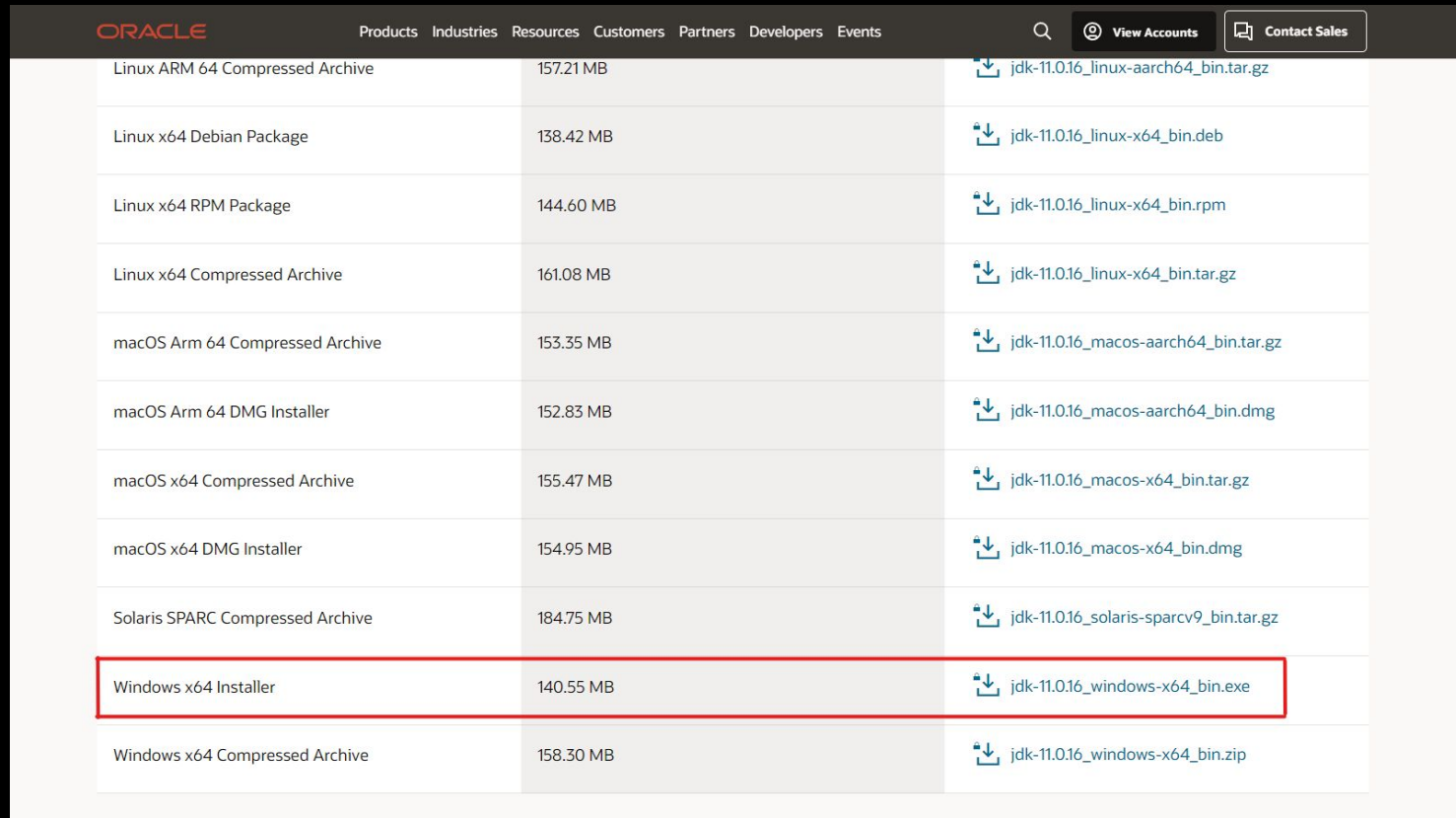
Installing Java Developer Kit

Install JDK 11 (not JRE!) from Oracle

https://www.oracle.com/java/technologies/javase/jdk11-archive-downloads.html

or Google

"oracle java se 11"

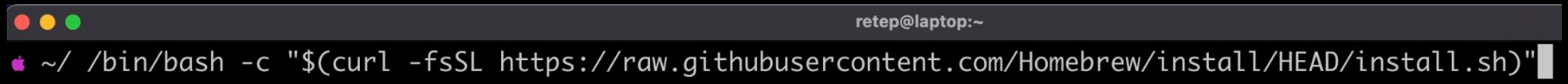


Linux ARM 64 Compressed Archive	157.21 MB	jdk-11.0.16_linux-aarch64_bin.tar.gz
Linux x64 Debian Package	138.42 MB	jdk-11.0.16_linux-x64_bin.deb
Linux x64 RPM Package	144.60 MB	jdk-11.0.16_linux-x64_bin.rpm
Linux x64 Compressed Archive	161.08 MB	jdk-11.0.16_linux-x64_bin.tar.gz
macOS Arm 64 Compressed Archive	153.35 MB	jdk-11.0.16_macos-aarch64_bin.tar.gz
macOS Arm 64 DMG Installer	152.83 MB	jdk-11.0.16_macos-aarch64_bin.dmg
macOS x64 Compressed Archive	155.47 MB	jdk-11.0.16_macos-x64_bin.tar.gz
macOS x64 DMG Installer	154.95 MB	jdk-11.0.16_macos-x64_bin.dmg
Solaris SPARC Compressed Archive	184.75 MB	jdk-11.0.16_solaris-sparcv9_bin.tar.gz
Windows x64 Installer	140.55 MB	jdk-11.0.16_windows-x64_bin.exe
Windows x64 Compressed Archive	158.30 MB	jdk-11.0.16_windows-x64_bin.zip

JDK on Intel/M1 Mac

Installing Java Developer Kit

Go to https://brew.sh and run the setup command



If it is already installed, make sure to update with `brew update`

Install openjdk java11 or newer: `brew install java11`

Linking Java

```
==> Caveats
For the system Java wrappers to find this JDK, symlink it with
  sudo ln -sfn /opt/homebrew/opt/openjdk@11/libexec/openjdk.jdk /Library/Java/JavaVirtualMachines/openjdk-11.jdk

openjdk@11 is keg-only, which means it was not symlinked into /opt/homebrew,
because this is an alternate version of another formula.

If you need to have openjdk@11 first in your PATH, run:
  echo 'export PATH="/opt/homebrew/opt/openjdk@11/bin:$PATH"' >> ~/.zshrc
```

Link your Java JDK

THESE COMMANDS SHOULD BE COPIED FROM END OF BREW OUTPUT

```
sudo ln -sfn /opt/homebrew/opt/openjdk@11/libexec/openjdk.jdk
/Library/Java/JavaVirtualMachines/openjdk-11.jdk
```

Run `java -version` to check that openjdk 11 (or newer) is found

```
 ~/ java -version
openjdk version "11.0.16.1" 2022-08-12
OpenJDK Runtime Environment Homebrew (build 11.0.16.1+0)
OpenJDK 64-Bit Server VM Homebrew (build 11.0.16.1+0, mixed mode)
 ~/
```

If it isn't found, add jdk11 to your path

```
echo 'export PATH="/opt/homebrew/opt/openjdk@11/bin:$PATH"' > ~/.zshrc
&& source ~/.zshrc
```

JDK on Linux

Note that we recommend installing JDK and Ghidra on Windows instead of WSL

Installing JDK

```
sudo apt update
sudo apt install openjdk-11-jdk
```

- Newer JDKs are OK

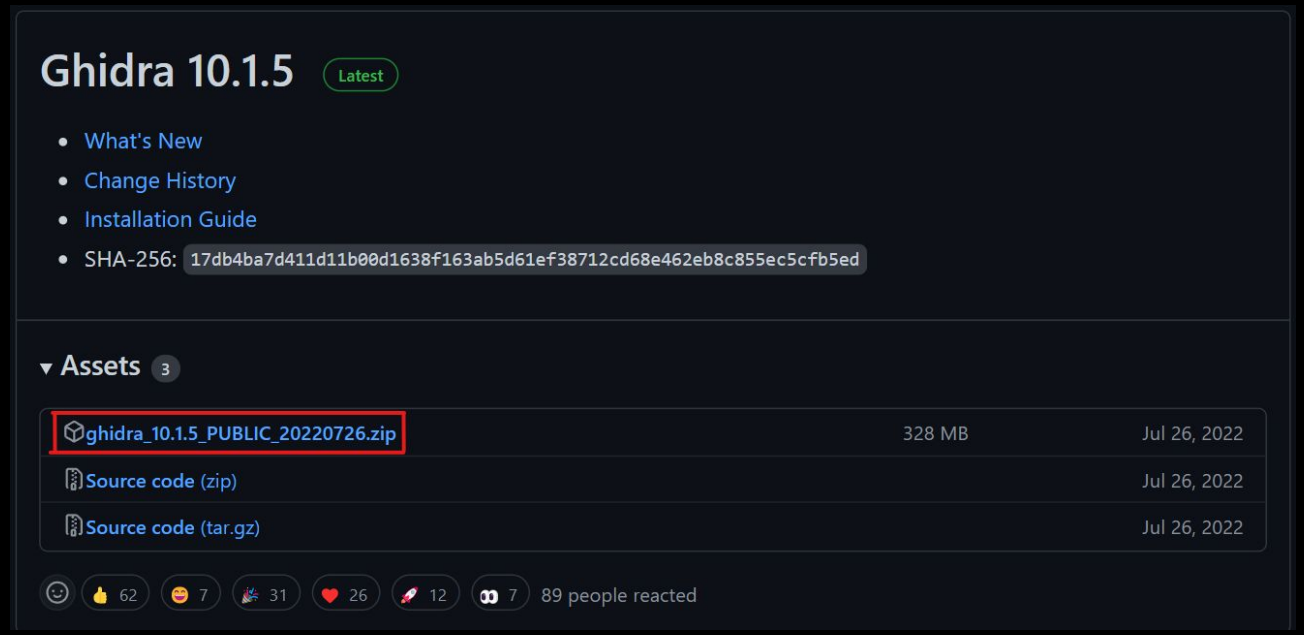
That's it!

Downloading Ghidra

https://github.com/NationalSecurityAgency/ghidra/releases

or Google "github ghidra release"

Download the public archive in assets for the latest release (ghidra_X.X.X_PUBLIC_XXXXXXXX.zip, not Source code.zip)



Running Ghidra

Windows:

Double click `ghidraRun.bat`

Mac/Linux:

Open Terminal, navigate to the directory where Ghidra is downloaded using something like `` `cd ~/Downloads/ghidra_XX` ``

Make ghidraRun executable: `` `chmod +x ./ghidraRun` ``

Launch Ghidra: `` `./ghidraRun` ``

Python and Pwntools

What is pwntools?

pwntools is a CTF framework and exploit development library.
Intended to make exploit writing as simple as possible.

```
>>> sh = process('/bin/sh')
>>> sh.sendline(b'sleep 3; echo hello world;')
>>> sh.recvline(timeout=1)
b''
>>> sh.recvline(timeout=5)
b'hello world\n'
>>> sh.close()
```

Installing Python

Mac:

```
brew install python
python3 -m ensurepip
```

Windows (WSL)/Linux:

```
sudo apt update && sudo apt install python3
python3-pip
```

We recommend Windows users use Python/pwntools in WSL rather than native Windows

Installing Pwntools

```
pip3 install pwntools
```

OR

```
pip install pwntools
```

M1 Setup before pwntools

```
$ git clone
https://github.com/unicorn-e
ngine/unicorn.git
$ brew install cmake
$ brew install qemu
$ cd unicorn/bindings/python
$ python setup.py install
```

If you get "command not found" you may need to reboot for Python/pip to be added to PATH

Installing GDB

Non M1 Mac:

```
brew install gdb
```

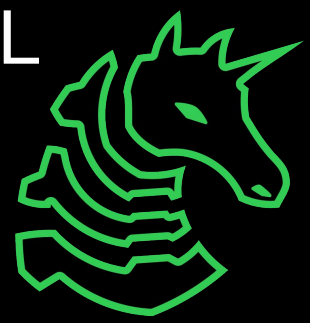
M1 Mac:

x86 emulator required, stick around

Windows (WSL)/Linux:

```
sudo apt install gdb
```

We recommend Windows users use Python/pwntools in WSL rather than native Windows



Next Meetings

If you are on a M1 Mac please stick around!

2022-09-22 - This Thursday

- Reverse Engineering I
- Use the tools we installed today to reverse engineer apps!

2022-09-24 - This Saturday

- Fall CTF 2022
- fallctf.sigpwny.com

2022-09-25 - Next Sunday

- **No meeting**

x86 VM on M1 Mac

For debugging and running x86 applications

Warning

- M1 macs run a ARM-based processor
- We want to run a x86-based linux VM
- Virtualization
  - Fast
  - Docker, VirtualBox
  - Target architecture must be same as hardware architecture

- Emulation
  - Slow
  - qemu, UTM
  - Hardware architecture can be anything

x86 VM Install

Install UTM

- mac.getutm.app

Download an AMD64/x86 VM (e.g. Ubuntu 22.04 LTS)

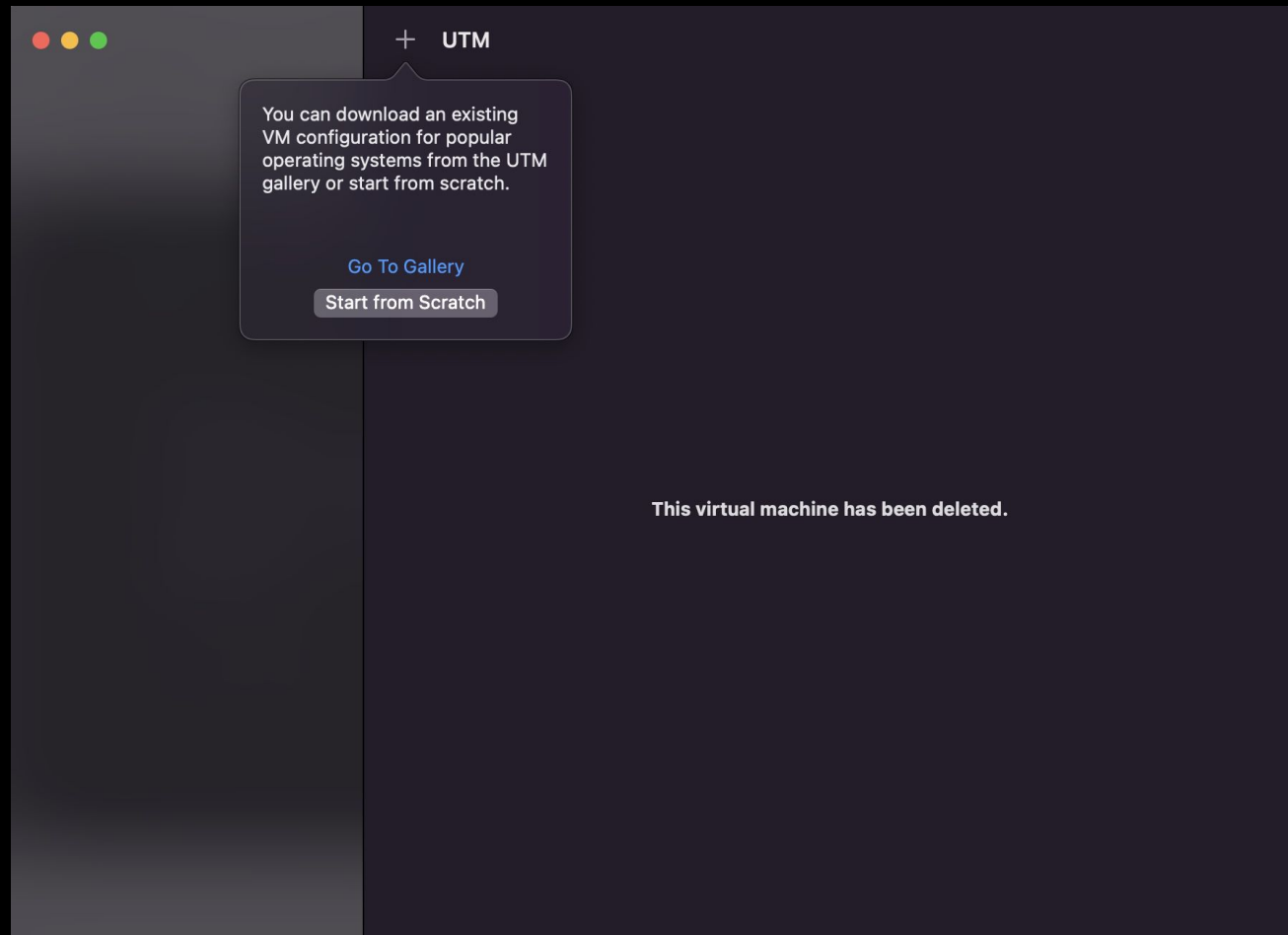
- ubuntu.com/download/desktop

Ubuntu Server 22.04 recommended

- Desktop GUI will be extremely slow

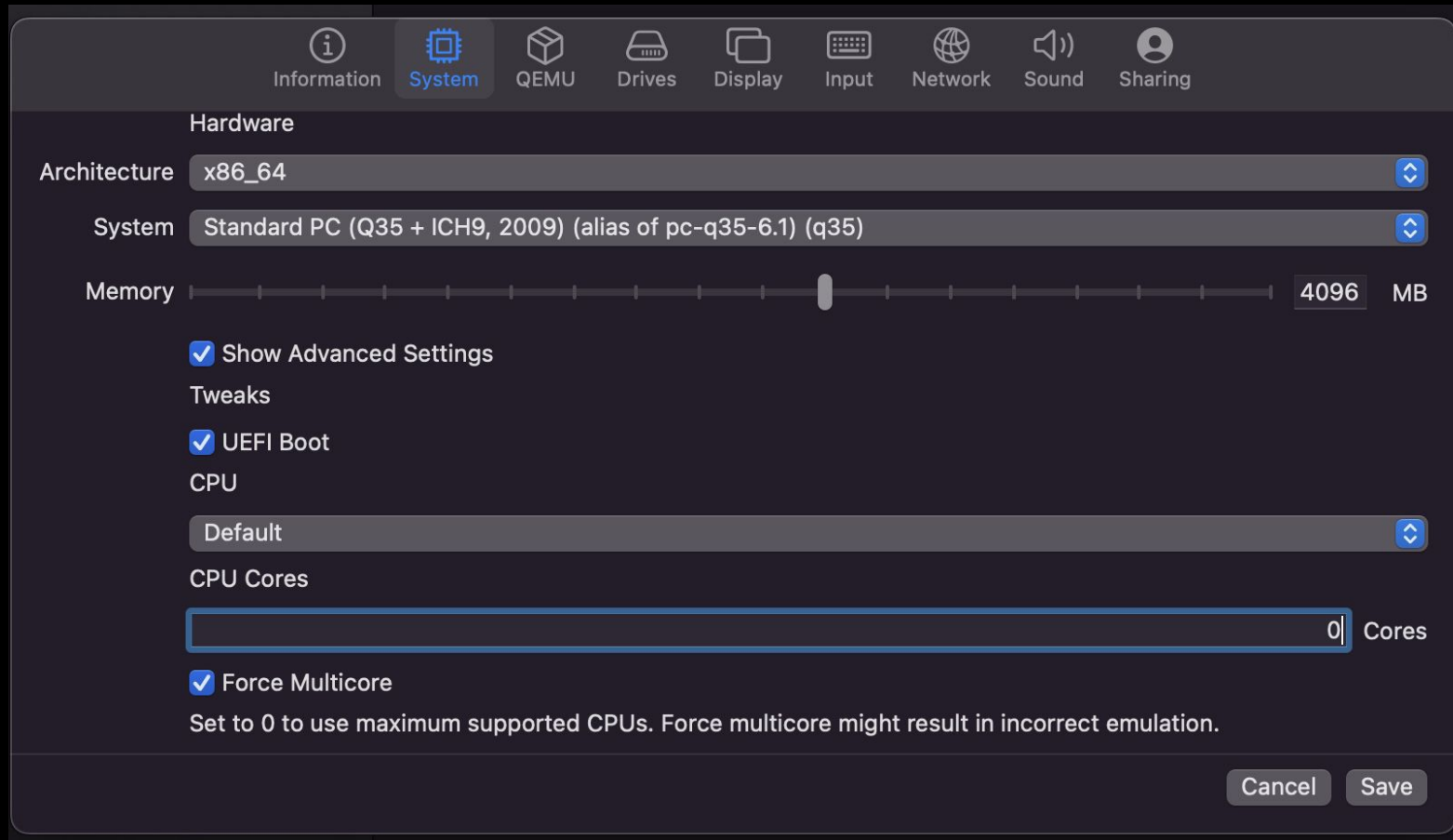
x86 VM Install

- Open UTM
- “Start from Scratch”



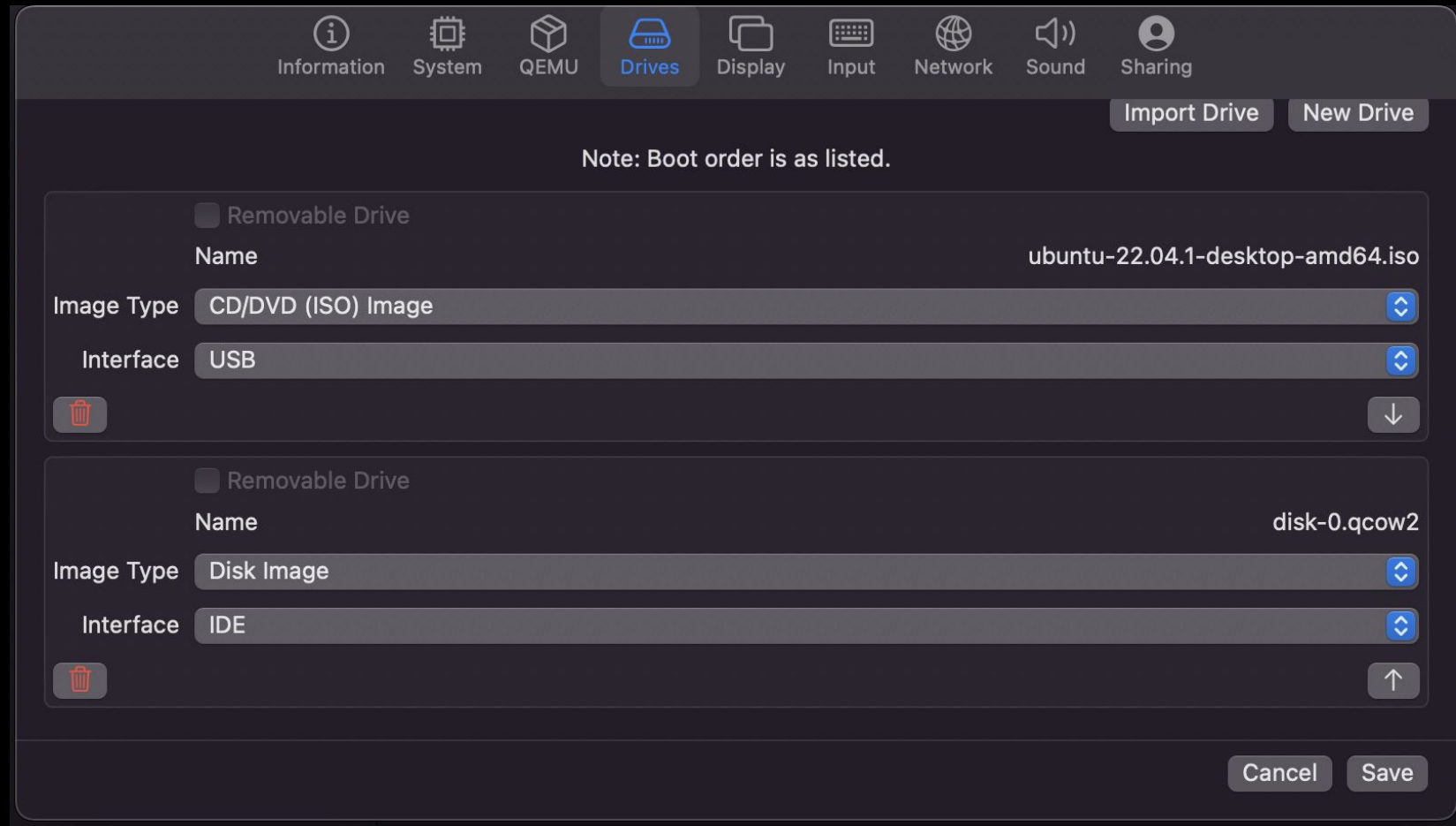
x86 VM Install

- Set the architecture
- Set the memory limit to 4 or more GB
- Turn on Force Multicore with 0 Cores



x86 VM Install

- Add the ISO as a USB device
- Create a second IDE Disk > 20GB
- Leave all other settings (Display, Input, etc.) default



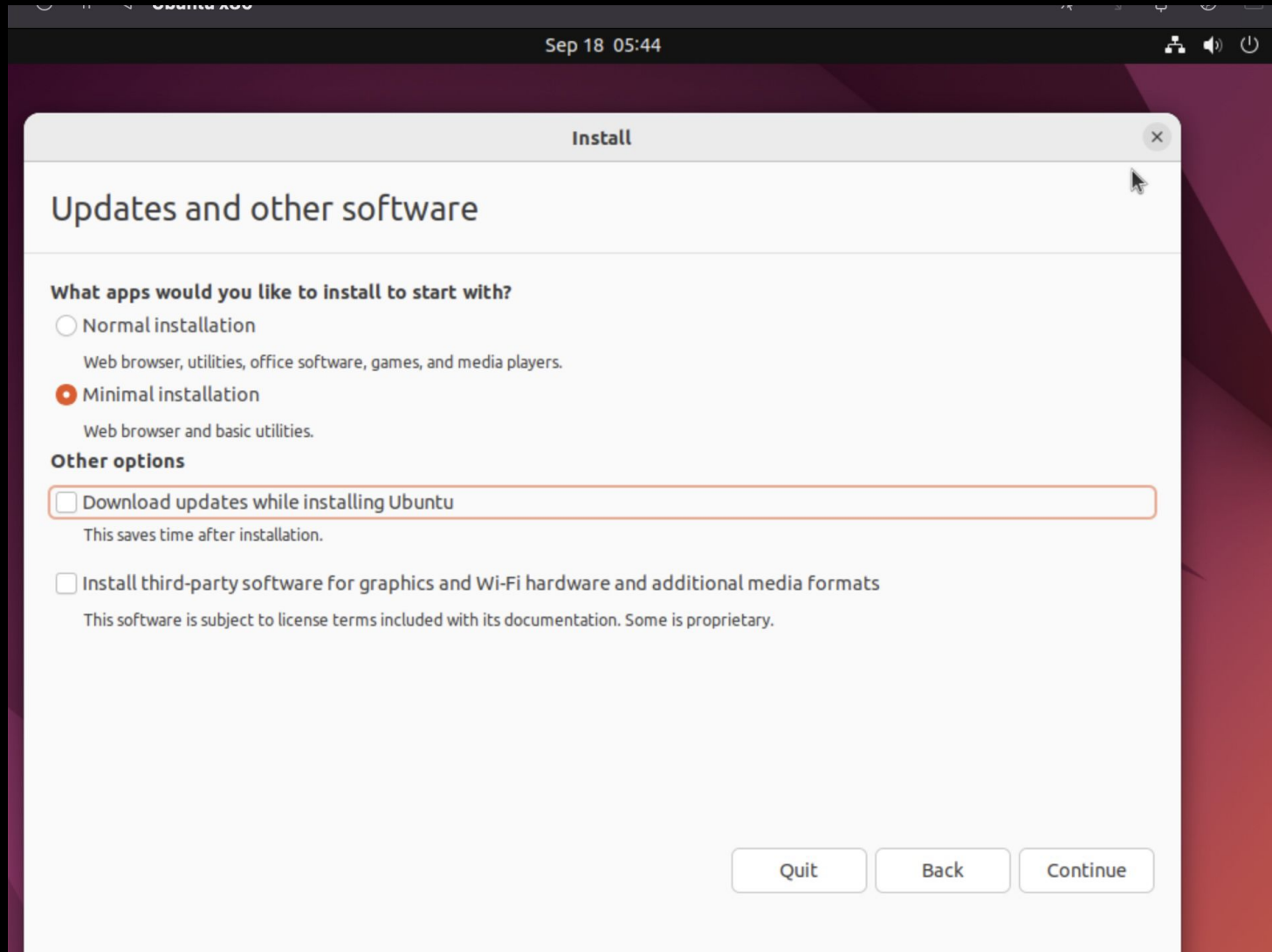
x86 VM Install

Desktop

- Follow normal Ubuntu installation
- Install the minimal installation and don’t download updates

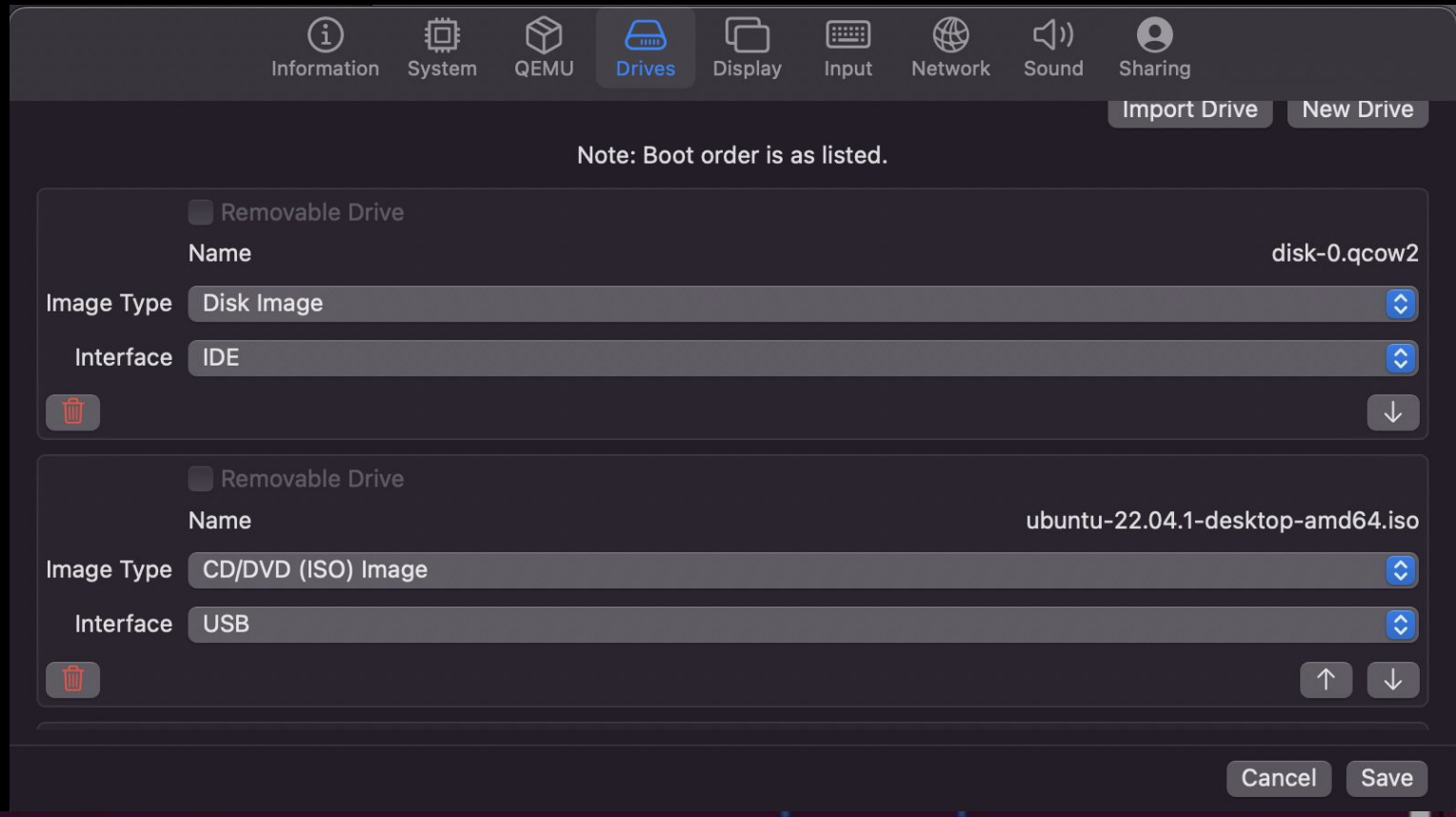
Server

- Accept all defaults



x86 VM Install

- After the installer finishes, remove the USB drive from the “Drives” section
- Restart UTM




```
retep@retep-Standard-PC-Q35-ICH9-2009:~$ uname -a
Linux retep-Standard-PC-Q35-ICH9-2009 5.15.0-47-generic #51-Ubuntu SMP Thu Aug 1
1 07:51:15 UTC 2022 x86_64 x86_64 x86_64 GNU/Linux
```

SIGPwny