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iptaVMlite

Installation and Usage

Virtual Machine for the 2023 IPTA Student Workshop

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Contents

1 Welcome

Welcome to version 2.0 of iptaVMlite, a custom-built 64-bit virtual machine (VM) image for pulsar astronomers and students.

Based on a minimal install of Linux Debian 11, the VM image contains all the latest versions of available pulsar timing and analysis routines, plotting packages and additional tools, whilst maintaining a small footprint on the host system resources.

You will find installation instructions in section A, general usage information in B, and advanced usage and configuration in sections C and D. Some trouble-shooting tips can be found in section E.

2 Installation Instructions

Before installing the VM, you will need to determine your machine's CPU architecture – this may be Intel(x64)-based or AMD(x64)-based (most PCs running Windows, laptops running Linux, and older Macs), or ARM-based (latest Macs, some PCs).

This is important because you will need to install different virtualization software determined on your architecture. You can determine the system architecture by looking in the operating system settings.

2.1 Installation on Intel/AMD-based architecture

2.1.1 Download and install VirtualBox

This VM was built on Oracle's *VirtualBox* package. To install the image, download and install VirtualBox for your operating system from the link below:

https://www.virtualbox.org/wiki/Downloads

NOTE: If you require the ability to plug in USB 2.0 devices (disabled by default on the VM), you will also need to install the *VirtualBox Extension Pack*.

2.1.2 Import the VM image to VirtualBox

Start VirtualBox, and in the menu select:

File -> Import Appliance

Browse to the image '.ova' file to import, select it, and click

Import

2.1.3 Configure the VM settings (optional)

The default settings are adequate for most needs. However, we suggest you increase the number of CPUs and/or memory if your host system can provide them.

When the image has completed importing, click *Settings* to change any of the VM parameters. There are many options available to configure, including add CPU cores, memory etc.

Increase the available memory with the slider:

Settings -> System -> Motherboard -> Base memory

Increase the number of CPUs to 2 or 4 with the slider:

Settings -> System -> Processor

Click 'OK' to save the settings.

See section 4 'Advanced Usage' for further information.

2.1.4 Start the VM

Click 'Start' on VirtualBox Manager – the VM should boot to a graphical desktop within a few minutes.

If you experience problems with the display size (for example too small), see the troubleshooting section 6.3.

2.2 Installation on ARM-based architecture (Mac OSX only)

2.2.1 Download and install UTM

https://mac.getutm.app/

2.2.2 Import the VM image to UTM

Start UTM, and in the menu select:
File -> Open

Then browse to the '.utm' directory of the image, select it, and click
Open

2.2.3 Configure the VM settings (optional)

The default settings are adequate for most needs. However, we suggest you increase the number of CPUs and/or memory if your host system can provide them.

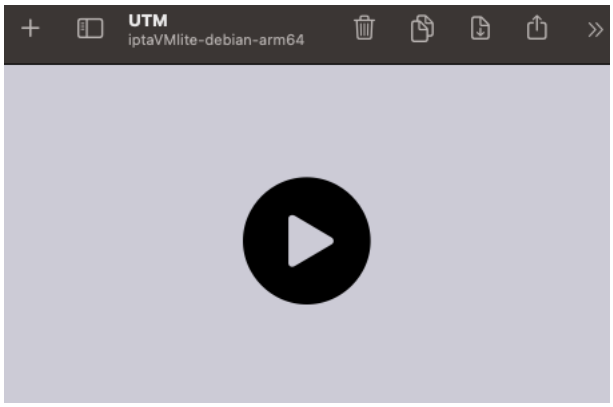
When the image has completed importing, click *Settings* to change any of the VM parameters. There are many options available to configure, including add CPU cores, memory etc.

To make changes, right-click on the image and select:

Edit

2.2.4 Start the VM

Click the play button – the VM should boot to a graphical desktop within a few minutes.



3 General Usage

3.1 Logging in to the VM in graphical desktop mode (default)

If you have configured the VM for graphical desktop mode, continue by logging in via the desktop login screen with the following credentials:

User: *pulsar*

Password: *pulsarvm*

You will be greeted with a terminal and information about the VM.

3.2 Basic functionality

3.2.1 Listing available software

To list the versions of installed software, in the terminal type:

```
versions
```

3.2.2 Plotting

Both *Gnuplot* and *PGPLOT* are installed.

To test gnuplot, type

```
gnuplot
```

At the prompt, type

```
gnuplot> test
```

To run the PGPLOT demo, type

```
pgdemo1
```

3.2.3 Viewing postscript files or PDFs

In a terminal, type e.g.

```
xpdf <filename.pdf>
```

3.2.4 Viewing/editing text files

You can view or edit text files with the following text editors:

```
emacs
vim
```

3.2.5 Monitoring system tasks

You can monitor system tasks, CPU/memory usage etc. with

```
htop
```

4 Advanced Usage (VirtualBox only)

4.1 Set up shared folders

The VM is configured with a limited amount of free disk space. You may wish to increase your storage capacity, by configuring a shared folder on the host. Select

Settings -> Shared Folders

Click the green plus sign to add a new share.

Browse to the path of a folder on the host that you require and select it.

- Set ‘Folder Name’ to:

  share

- Set ‘Mount point’ to:

  /home/pulsar/SHARE

- Ensure ‘Make permanent’ is checked
- Ensure ‘Read only’ is left unchecked
- Click 'Ok'.

See the next section for information on how to mount the shared folders.

4.2 Mounting shared folders

Once logged in, if you configured a shared folder, you will need to uncomment a line in the */etc/fstab* file to make the mount permanent across reboots.

Edit the */etc/fstab* file as root user (same password as pulsar):

```
sudo vim /etc/fstab
```

Type ‘i’ to insert text.

Uncomment the ‘share’ line so it looks like this:

#

Custom mount of shared folder (uncomment if required)

share /home/pulsar/SHARE vboxsf gid=1000,uid=1000 0 0

#

Save the file with ‘Esc’ then ‘Shift + ZZ’.

Now mount the filesystems with:

```
sudo mount -a
```

You can now check that the shared folder is mounted, with

```
df -h
```

You should see something like this:

Filesystem Size Used Avail Use% Mounted on

/dev/mapper/vg_iptavmlite-lv_root 6.7G 1.8G 4.6G 28% /

tmpfs 504M 0 504M 0% /dev/shm

/dev/sda1 485M 31M 430M 7% /boot

share 298G 285G 13G 96% /home/pulsar/SHARE

For manual mounting of shared folders, and further information, see section 4.6 below.

4.3 Enabling USB 2.0

If you require USB 2.0 functionality you will need to have installed the *VirtualBox Extension Pack* (section A.1 above), and configured the ports as follows:

Settings -> Ports -> USB

Check ‘*Enable USB Controller*’.

Check ‘*USB 2.0*‘.

Click 'Ok' to complete the set up.

4.4 Logging in to the VM in headless mode

If you have configured the VM for terminal-only 'headless' mode, please follow the steps below.

4.4.1 Mac/Linux users

On a Mac, you will need '*XQuartz*' and '*Terminal*' installed in order to continue.

If you have configured the VM using 'Adapter 1', open a terminal on your host machine and type:

```
ssh -Y -p 2222 pulsar@localhost
```

Don't forget to forward X output by specifying '-Y' above.

Enter the default password for user '*pulsar*':

pulsarvm

Congratulations – you should now be logged in to the VM! You will be greeted by a welcome message and a list of installed software, including where to find notes on how to update installed packages.

4.4.2 Windows users

On Windows machines, you will need '*Xming*' and '*Putty*' installed in order to continue.

Start Putty, and then follow these steps:

set Host Name to 'localhost'

set Port to '2222'

set Connection Type to 'SSH'

in Category -> SSH -> X11, tick 'Enable X11 forwarding'

in Category -> Session, set Saved Session to '*iptaVMlite*'

click 'Save'

click 'Open'

A terminal window should pop up with 'login as:'

Enter '*pulsar*', and hit Return

Enter the password '*pulsarvm*', and hit Return

Congratulations – you should now be logged in to the VM! You will be greeted by a welcome message and a list of installed software, including where to find notes on how to update installed packages.

Next time you start *Putty*, you can use the saved session you created by following these steps:

select the saved session *'iptaVMlite*'

click 'Load'

click 'Open'

4.5 Command-line VM control

The *iptaVMlite* VM behaviour can be controlled at the command line on the host. Here are some examples:

Import

```
VBoxManage import iptaVMlite_*.ova
```

Start

```
VBoxManage startvm iptaVMlite_--type headless
```

Poweroff

```
VBoxManage controlvm iptaVMlite poweroff
```

Pause

```
VBoxManage controlvm iptaVMlite pause
```

Resume

```
VBoxManage controlvm iptaVMlite resume
```

Adding a shared folder (VM must be powered off before running this command)

```
VBoxManage sharedfolder add iptaVMlite --name share --hostpath </path/to/host/folder>
```

To simplify the above usage, just add some aliases to your .bash_profile or .bashrc as follows, for example:

alias startVM='VBoxManage startvm iptaVMlite --type headless'

4.6 Manage shared folder configuration

If configured in */etc/fstab*, shared folders are auto-mounted at boot time, where mount configuration including mount points and permissions can be found in the line:

mount -t vboxsf -o umask=0022,gid=1000,uid=1000 share /home/pulsar/SHARE

Where 'share' is the Folder Name you gave in step 4.1 above, and '/home/pulsar/SHARE' is the default mount point on the VM.

To mount shared folders in the VM manually, run:

```
sudo mount -t vboxsf -o umask=0022,gid=1000,uid=1000 share /home/pulsar/SHARE
```

To unmount, run:

```
sudo umount /home/pulsar/SHARE
```

4.7 Setting up the Bridged Network Adapter (Adapter 2)

The *iptaVMlite* VM is configured with a default and optional network adapter. The default is 'Adapter 1'. This adapter is configured with 'NAT' – Network Address Translation – it uses port forwarding from the localhost and is the easiest and most suitable to set up, but the VM will not be accessible from the rest of your network.

If you are connecting to a network, you can configure your VM with its own IP address, such that it will be accessible from anywhere on the LAN.

Adapter 2 is configured as a 'Bridged Adapter' and suitable for a network where the VM can obtain an IP address over DHCP. However, this adapter is suitable on any other network operating with a DHCP server, such as a home Wi-Fi network.

On the 'Adapter 2' tab, ensure 'Enable Network Adapter' is checked, and in the 'Attached to' drop-down list select

Bridged Adapter

Then select the adapter 'Name' from the drop-down list. If for example you are using a Mac on a Wi-Fi network, you may see an item like this

en1: Wi-Fi (AirPort)

Next, on tab 'Adapter 1', ensure 'Enable Network Adapter' is un-checked. Click 'Ok' and start your VM.

While the VM is booting, open a terminal on your host machine and type

```
ping iptaVMlite
```

If the network has been correctly configured, and the VM has received an IP address via DHCP, the ping command should return with something like

64 bytes from iptaVMlite.localdomain (192.168.2.160)…

If the ping was successful, you can now SSH in to the VM as the default user '*pulsar*' with

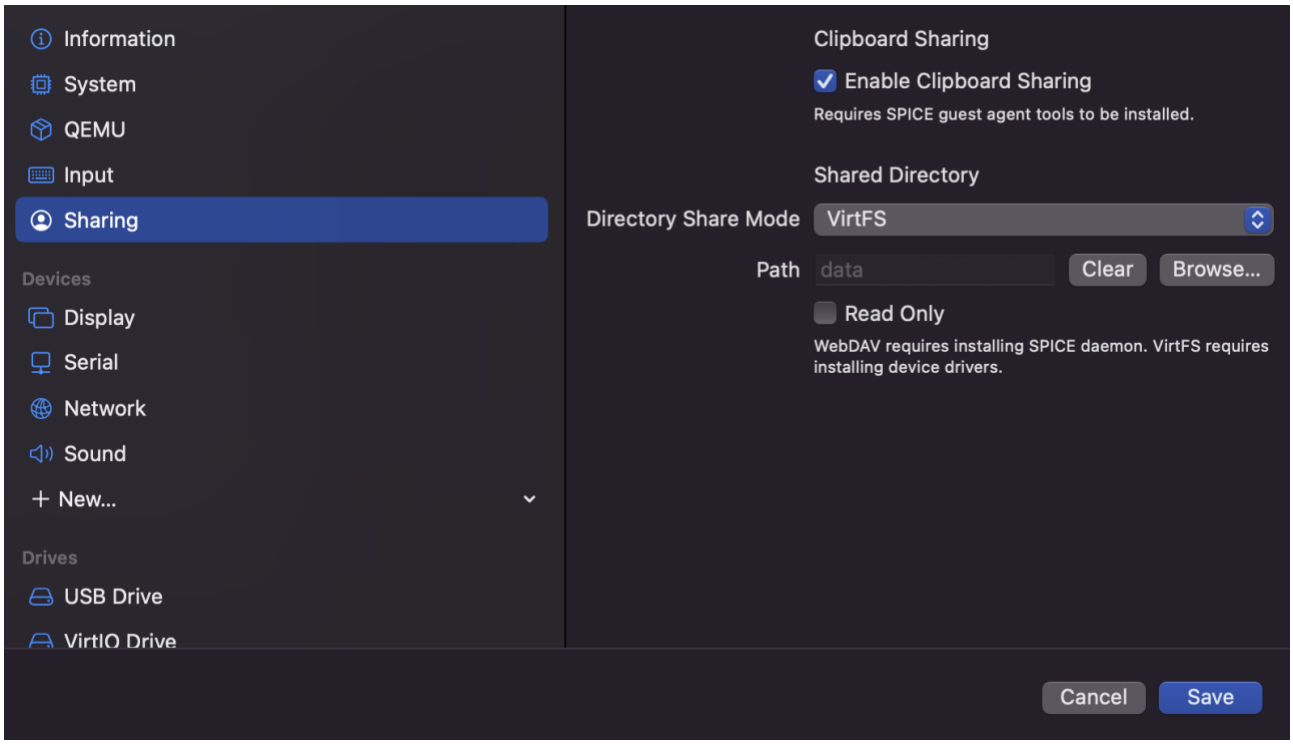
```
ssh -Y pulsar@iptaVMlite
```

5 Advanced Usage (UTM only)

5.1 Set up shared folders

The VM is configured with a limited amount of free disk space. You may wish to increase your storage capacity, by configuring a shared folder on the host. With the VM powered off, open settings and select:

Sharing



Select 'VirtFS' as share mode, browse to the path of the directory you wish to share and click 'Save'.

Now start the VM, login and configure the mount path by editing the */etc/fstab* file:

```
sudo vim /etc/fstab
```

Uncomment the line starting with 'share' so it looks like this:

#

Custom mount of VirtFS shared folder (uncomment if required)

share /home/pulsar/SHARE 9p trans=virtio,version=9p2000.L,rw,_netdev,nofail 0 0

#

Save the file, set the permissions, and mount the filesystems:

```
sudo chown -R $USER /home/pulsar/SHARE

sudo mount -a
```

You can now check that the shared folder is mounted, with

```
df -h
```

You should see something like this:

Filesystem Size Used Avail Use% Mounted on

/dev/mapper/vg_iptavmlite-lv_root 6.7G 1.8G 4.6G 28% /

tmpfs 504M 0 504M 0% /dev/shm

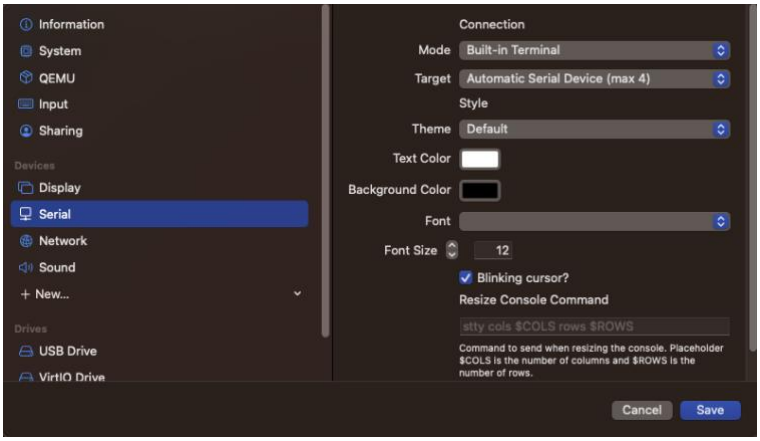
/dev/sda1 485M 31M 430M 7% /boot

share 298G 285G 13G 96% /home/pulsar/SHARE

5.2 Logging into the VM in headless mode

You may like to configure the VM in headless mode, and access it via SSH in a terminal – please follow the steps below:

1. Go into the VM settings (right-click -> Edit)
2. Create ‘New’ -> ‘Serial’, and ‘Save’



3. Start the VM
4. Login to the terminal that pops up
5. Get the IP address of the VM instance with e.g.

```
ifconfig
```

6. Open a terminal on your host machine and SSH in to the VM with e.g.:

```
ssh -Y pulsar@<ip_address>
```

6 Troubleshooting

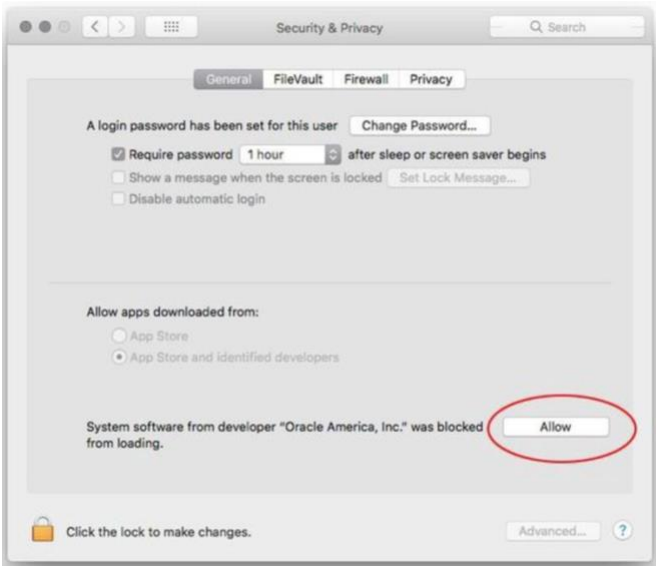
6.1 Kernel driver errors (VirtualBox only)

The VM fails to start and shows kernel driver errors like those below:

Solution for Mac users:

- Quit VirtualBox
- Open System Preferences/Security & Privacy:

- Click ‘Allow’ in the window below:



6.2 Shared folder prevents VM from booting (VirtualBox only)

The VM hangs and/or fails to boot. This situation can occur if the host machine shared folder configured in Settings does not exist. The boot sequence is expecting the shared folder to exist when */etc/fstab* is read.

Solution:

- Close the VM
- In *Settings -> Shared Folders*, add the correct path to the host machine folder
- Boot the VM
- If you no longer require a shared folder, comment out the 'share' line in the */etc/fstab* file

6.3 Graphical desktop display is too small (VirtualBox only)

Solution:

Auto re-sizing of the display may need to be enabled with:

VirtualBox VM -> View

Then click (or tick):

Auto-resize Guest Display

The display window can now be resized by dragging a corner.

You may still need to increase the 'scale factor' if the display contents are too small.

Select:

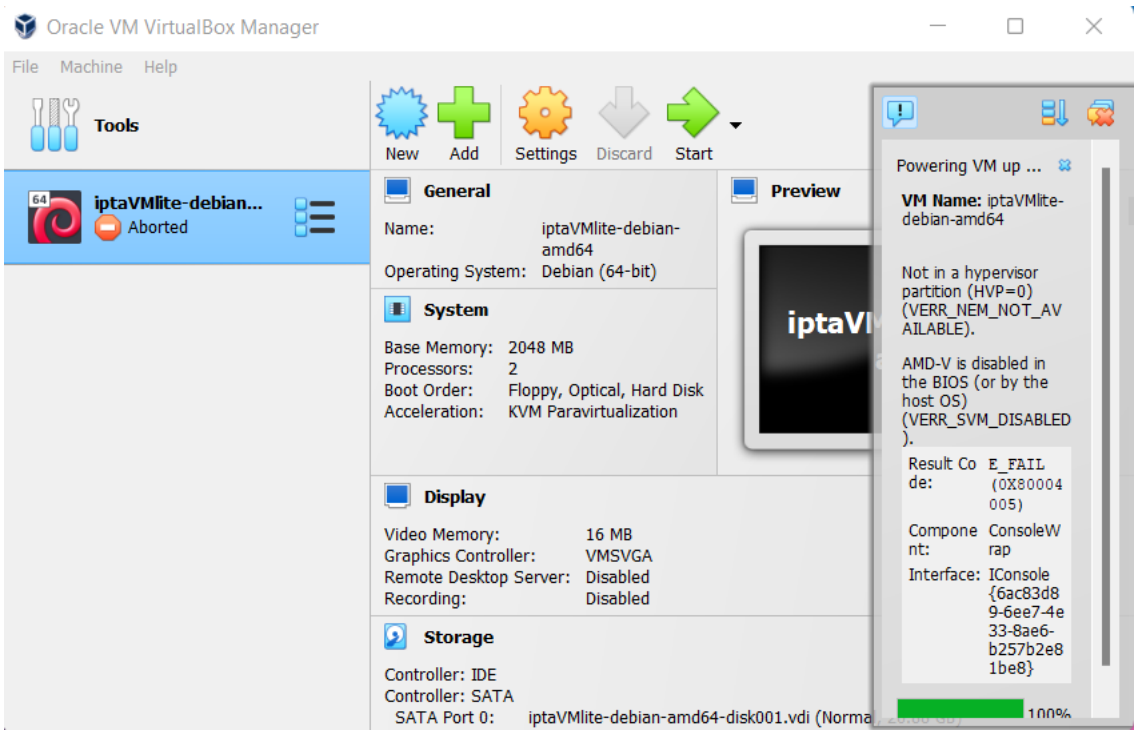
Settings -> Display

Adjust the 'Scale Factor' slider to greater than 100% and click OK.

Note: if you change the scale, you may need to also adjust the font-size in 'Terminal' settings once you have logged in.

6.4 Hypervisor error (VirtualBox only)

On an AMD-based machine, you may experience the following hypervisor error when trying to start the VM:

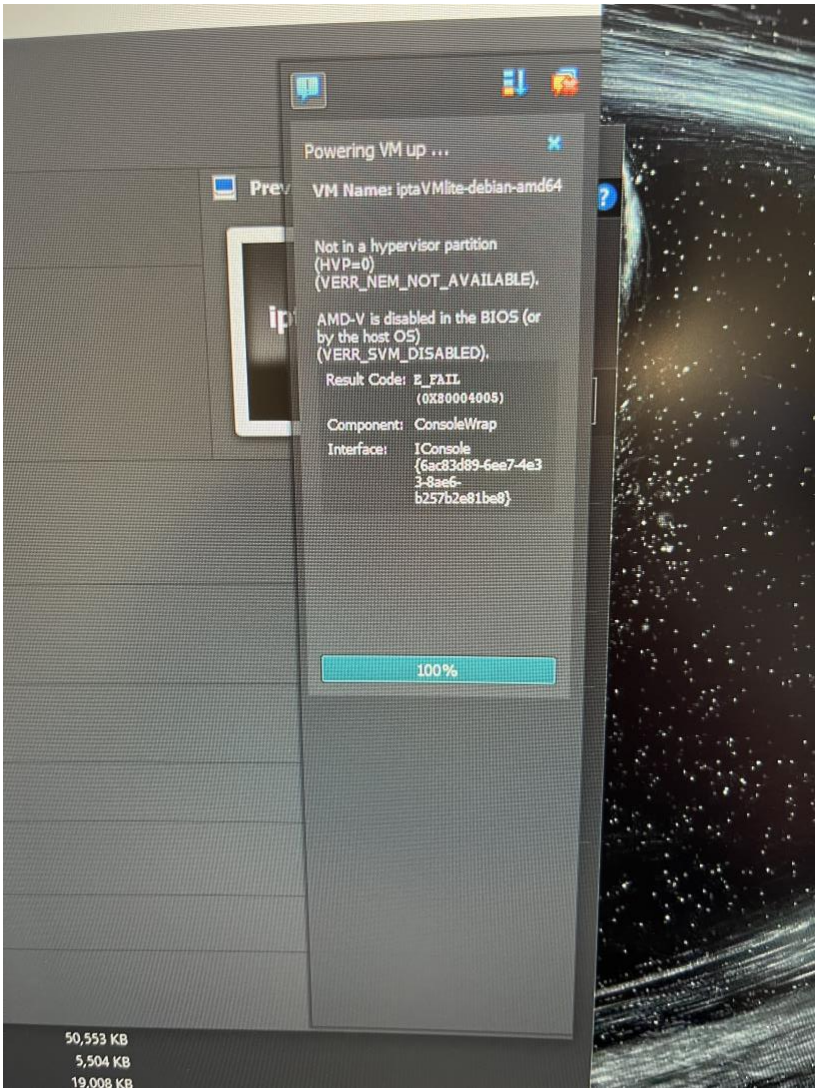


Solution:

You will need to enable virtualisation in your system's BIOS settings.

6.5 AMD-V is disabled (VirtualBox only)

You may come across the following AMD-V error if you are running on AMD architecture:



In this case, the secure virtual machine option in the advanced CPU settings in the BIOS was not enabled. Without enabling the secure virtual machine (SVM) setting, the VM will not boot.

Solution:

Re-boot the machine, enter the BIOS settings and set secure virtual machine to “enabled”.

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