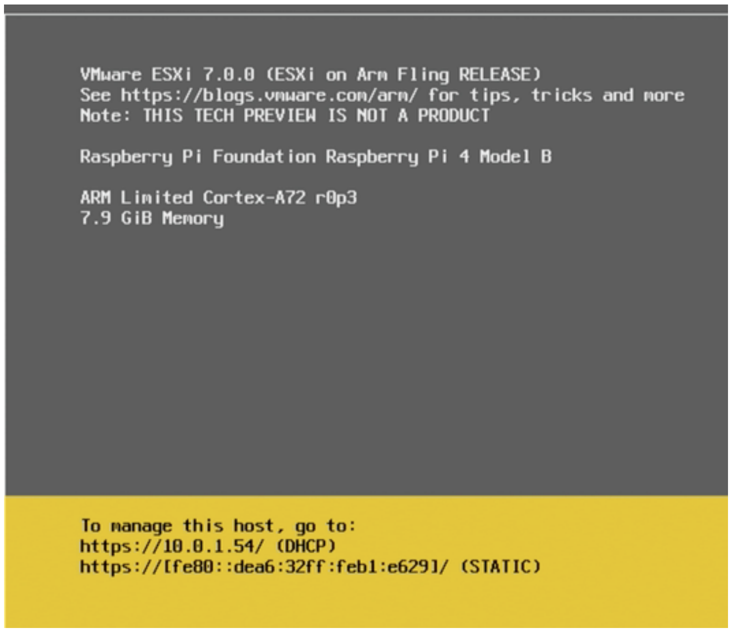
Fling on Raspberry Pi



```
VMware ESXi 7.0.0 (ESXi on Arm Fling RELEASE)
See https://blogs.vmware.com/arm/ for tips, tricks and more
Note: THIS TECH PREVIEW IS NOT A PRODUCT

Raspberry Pi Foundation Raspberry Pi 4 Model B

ARM Limited Cortex-A72 r0p3
7.9 GiB Memory

To manage this host, go to:
https://10.0.1.54/ (DHCP)
https://[fe80::dea6:32ff:feb1:e629]/ (STATIC)
```

1. Info

The Raspberry Pi 4B is a credit-card size single board computer (SBC). It is based on the Broadcom BCM2711 SoC with 4 x Cortex-A72 and supports up to 8GiB RAM. The SBC also has USB3 and GbE connectivity.

See https://www.raspberrypi.org/products/raspberry-pi-4-model-b/specifications/

The anticipated use case is "Far Edge": e.g. a virtualized IoT gateway.

2. Required and supported hardware

Minimally, you need:

- A good power supply
- Raspberry Pi 4 Model B
    - 4GiB or 8GiB (1GiB and 2GiB are not supported)
    - An SD card (for UEFI firmware)
- 1 x micro SD card for UEFI firmware
- 1 x USB drive for installer ISO
- 1 x USB drive (or SATA / NVMe adapter) for the actual ESXi installation
- Console selection
    - HDMI + USB keyboard
    - UART (serial) cable

The following hardware is supported:

- On-board GbE NIC (recommended)
- USB storage
- USB keyboard
- USB networking
- PoE HAT
- HDMI video
- Serial console

As you will note, SD card is not supported. It is only used to keep the UEFI firmware.

2.1. Power Supply

A good power supply is critical, especially for using USB storage.

Description	Amps	Product
Argon ONE Raspberry Pi 4 USB Type C Cable Power Supply	3.5	https://www.amazon.com/gp/product/B07TW4Q693
CanaKit 3.5A Raspberry Pi 4 Power Supply	3.5	https://www.amazon.com/CanaKit-Raspberry-Power-Supply-USB-C/dp/B07TYQRXTK

2.2. Cooling

It is highly recommended to perform active cooling. The Pi runs hot. Passive cooling (heatsinks) help here, but so will a nice quiet 5V Noctua fan. Cooling and cases are highly individual and may involve some handywork.

2.3. HDMI

Use a micro-HDMI adapter or cable like https://www.amazon.com/CanaKit-Raspberry-Micro-HDMI-Cable/dp/B07TTKD38N.

2.4. HATs

2.4.1. PoE

These can be used for building clusters of Pies. Note that it is highly recommended to provide additional active cooling. PoE HATs make an already hot Pi run even hotter, without any space for passive cooling elements and (at best) puny fans.

Description	Product	Comments
GeeekPi Raspberry Pi 4 PoE HAT	https://www.amazon.com/gp/product/B0833PP65P	Fan works. Largest fan so far seen on a PoE hat and there is space for heatsinks.

UCTRONICS PoE HAT for Raspberry Pi 4	https://www.amazon.com/UCTRONICS-Raspberry-Ethernet-Expansion-Cooling/dp/B082ZJYCS3	Fan works. No space for heatsinks.
Official Raspberry Pi Power Over Ethernet	https://www.amazon.com/poe-hat/dp/B07GR9XQJH	Fan doesn't spin due to missing UEFI support. No space for heatsinks. **Must use external cooling!**

2.4.2. Other HATs

Not supported. This includes any kind of I2C, SPI or GPIO extension or connectivity.

2.5. Optional Serial Console

ESXi-Arm on Pi is entirely usable via HDMI + USB keyboard, yet for developers and power users alike, the importance of a serial connection cannot be overstated. In ESXi it gives you convenient access to system log, console and basic management interface (DCUI), especially if you chose to operate your Pi headless.

Note: Get a USB-to-TTL serial cable. The cable must be for 3.3V, not 5V.

VID	PID	Description	Product	Comments
0403	6001	DTECH FTDI USB to TTL Serial 3.3V Adapter Cable	https://www.amazon.com/dp/product/B07RBKCW3S	

2.6. USB devices

IMPORTANT: USB device can consume significant power and thus put a stress on Pi's power circuits. Some USB devices can consume so much power (e.g. NVMe enclosure) that the Pi will simply not work, be unstable or have unstable USB behavior. For anything short of a basic USB key, use a powered USB3 hub.

Note: Some of these USB devices have Type-C plugs. The expectation is that they will be plugged (directly or via hub) into the front (USB3) ports. Use a mechanical adapter such as https://www.amazon.com/gp/product/B07LF72431. Do not plug these into the Type-C port on the Pi for performance reasons.

See the lists and notes in the main ESXi-Arm Fling Doc.

3. Preparation

Setup involves ensuring Raspberry Pi microcode (e.g. for USB) is up-to-date, deploying the UEFI firmware and preparing the installer USB drive.

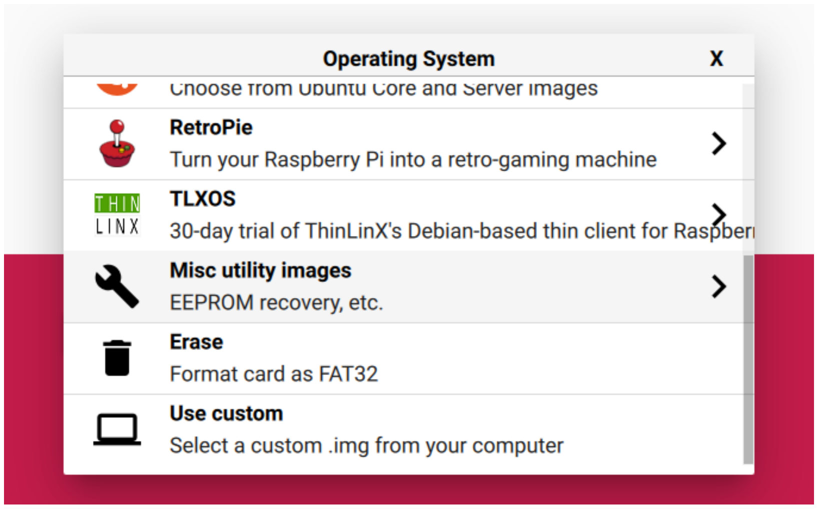
3.1. Ensure Raspberry Pi EEPROM is updated

This is critical to a stable USB experience and reasonable temperatures. Thanks to Florian Grehl of Virten.net who initially shared this simplified procedure.

You need:

- SD Card
- HDMI Screen (optional)
- Raspberry Pi Imager Tool for your OS: https://www.raspberrypi.org/downloads/

Deploy the Raspberry Pi 4 EEPROM boot recovery onto the SD card:


Operating System X

Choose from Ubuntu Core and Server images

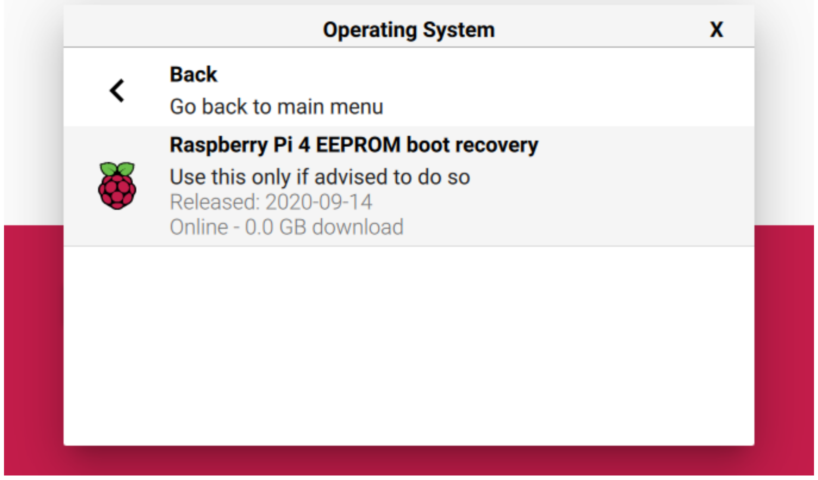
RetroPie
Turn your Raspberry Pi into a retro-gaming machine

TLXOS
30-day trial of ThinLinX's Debian-based thin client for Raspberr

Misc utility images
EEPROM recovery, etc.

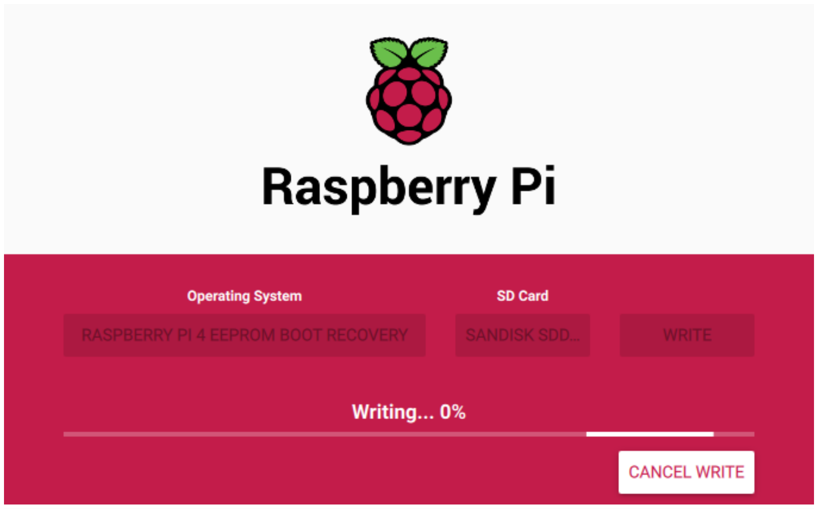
Erase
Format card as FAT32

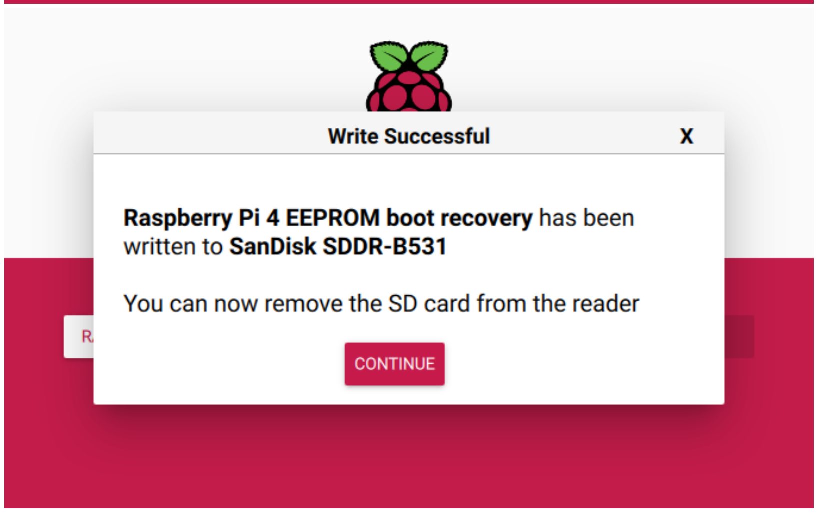
Use custom
Select a custom .img from your computer


Operating System X

Back
Go back to main menu

Raspberry Pi 4 EEPROM boot recovery
Use this only if advised to do so
Released: 2020-09-14
Online - 0.0 GB download





Raspberry Pi 4 EEPROM boot recovery has been written to **SanDisk SDDR-B531**

You can now remove the SD card from the reader

Plug SD card into the Pi and power up device, eventually with HDMI screen connected. From the EEPROM bootloader rescue documentation:

```
"If successful, the green LED light will blink rapidly (forever), otherwise an error pattern will be displayed.
If a HDMI display is attached then screen will display green for success or red if failure a failure occurs."
```

3.2. Setup UEFI on SD Card

The SD card will be only used for UEFI firmware, so don't bother with a big card. The SD card is required, and configurations where the UEFI firmware is booted from USB or network are not covered here or supported.

3.2.1. Download the necessary bits

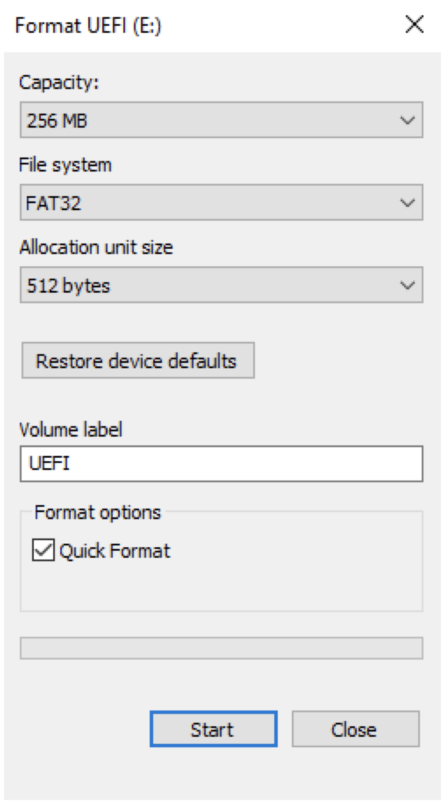
- Download the latest official Raspberry Pi Firmware and extract the contents to your computer, you should have a folder called **firmware-master**. This corresponds to the microcode necessary to initialize the Raspberry Pi.
- Download the latest community Raspberry Pi 4 UEFI firmware and extract the contents to your compute you should have a folder called **RPi4_UEFI_Firmware_v1.20**. This is the firmware necessary to boot ESXi-Arm.

3.2.2. Prepare SD card.

Format the SD card with a single FAT32 (MSDOS) partition. If you just used the SD Card to update the EEPROM, you just need to delete the recovery files.

3.2.2.1. On Windows

Open up Windows Explorer and identify the SD Card and select "Format" and create FAT32 partition. In the example below, the partition label is called UEFI:


Format UEFI (E:)

Capacity: 256 MB

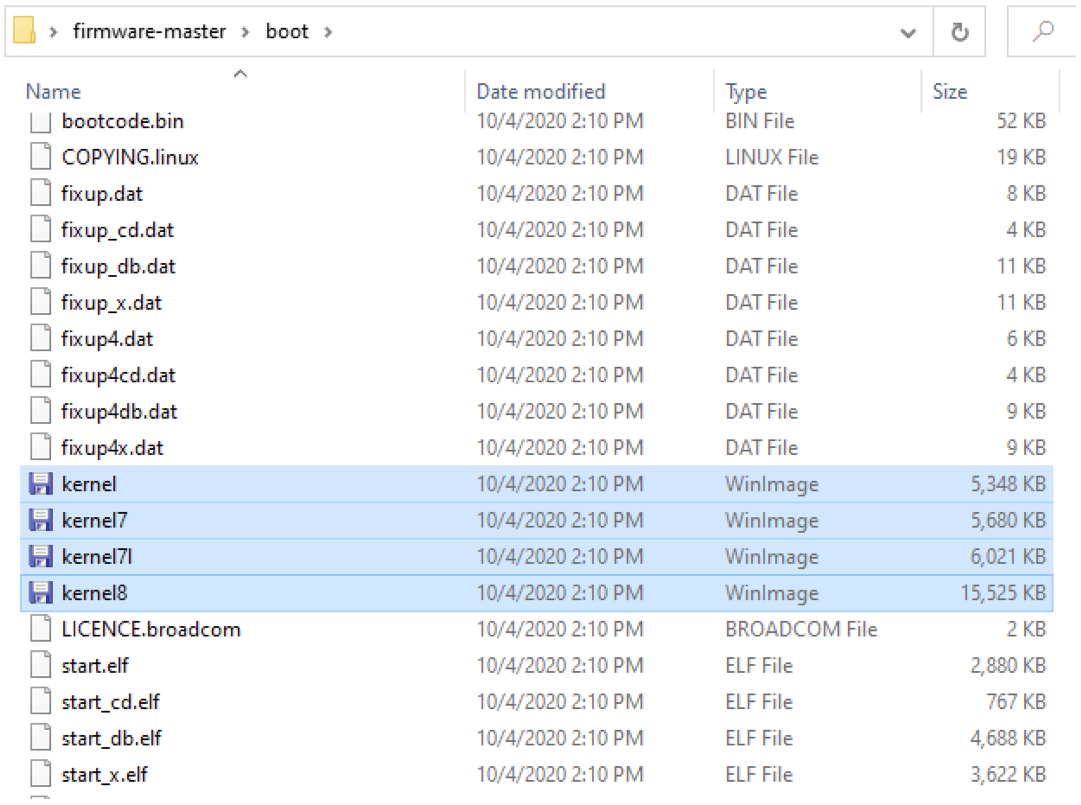
File system: FAT32

Allocation unit size: 512 bytes

Volume label: UEFI

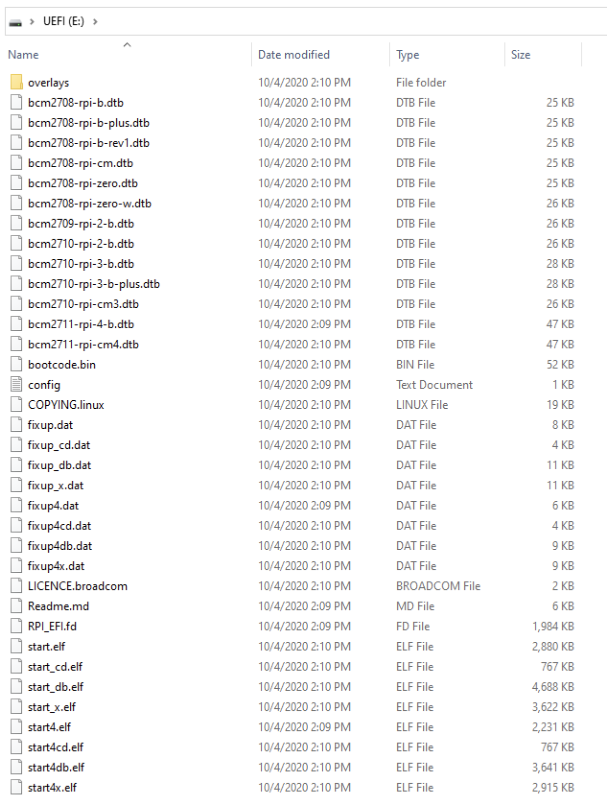
Format options: [✓ Quick Format]

Extract firmware-master.zip and then delete all files starting with **kernel*.img** within **firmware-master/boot** directory and then copy the entire content of the "boot" directory onto the newly formatted SD card:


firmware-master > boot >

Name	Date modified	Type	Size
bootcode.bin	10/4/2020 2:10 PM	BIN File	52 KB
COPYING.linux	10/4/2020 2:10 PM	LINUX File	19 KB
fixup.dat	10/4/2020 2:10 PM	DAT File	8 KB
fixup_cd.dat	10/4/2020 2:10 PM	DAT File	4 KB
fixup_db.dat	10/4/2020 2:10 PM	DAT File	11 KB
fixup_x.dat	10/4/2020 2:10 PM	DAT File	11 KB
fixup4.dat	10/4/2020 2:10 PM	DAT File	6 KB
fixup4cd.dat	10/4/2020 2:10 PM	DAT File	4 KB
fixup4db.dat	10/4/2020 2:10 PM	DAT File	9 KB
fixup4x.dat	10/4/2020 2:10 PM	DAT File	9 KB
kernel	10/4/2020 2:10 PM	WinImage	5,348 KB
kernel7	10/4/2020 2:10 PM	WinImage	5,680 KB
kernel7l	10/4/2020 2:10 PM	WinImage	6,021 KB
kernel8	10/4/2020 2:10 PM	WinImage	15,525 KB
LICENCE.broadcom	10/4/2020 2:10 PM	BROADCOM File	2 KB
start.elf	10/4/2020 2:10 PM	ELF File	2,880 KB
start_cd.elf	10/4/2020 2:10 PM	ELF File	767 KB
start_db.elf	10/4/2020 2:10 PM	ELF File	4,688 KB
start_x.elf	10/4/2020 2:10 PM	ELF File	3,622 KB

Extract RPi4_UEFI_Firmware_v1.20.zip and copy all files within the **RPi4_UEFI_Firmware_v1.20** directory into the same boot directory (confirm override of files when prompted) on SD card:



Name	Date modified	Type	Size
overlays	10/4/2020 2:10 PM	File folder	
bcm2708-rpi-b.dtb	10/4/2020 2:10 PM	DTB File	25 KB
bcm2708-rpi-b-plus.dtb	10/4/2020 2:10 PM	DTB File	25 KB
bcm2708-rpi-b-rev1.dtb	10/4/2020 2:10 PM	DTB File	25 KB
bcm2708-rpi-cm.dtb	10/4/2020 2:10 PM	DTB File	25 KB
bcm2708-rpi-zero.dtb	10/4/2020 2:10 PM	DTB File	25 KB
bcm2708-rpi-zero-w.dtb	10/4/2020 2:10 PM	DTB File	26 KB
bcm2709-rpi-2-b.dtb	10/4/2020 2:10 PM	DTB File	26 KB
bcm2710-rpi-2-b.dtb	10/4/2020 2:10 PM	DTB File	26 KB
bcm2710-rpi-3-b.dtb	10/4/2020 2:10 PM	DTB File	28 KB
bcm2710-rpi-3-b-plus.dtb	10/4/2020 2:10 PM	DTB File	28 KB
bcm2710-rpi-cm3.dtb	10/4/2020 2:10 PM	DTB File	26 KB
bcm2711-rpi-4-b.dtb	10/4/2020 2:09 PM	DTB File	47 KB
bcm2711-rpi-cm4.dtb	10/4/2020 2:10 PM	DTB File	47 KB
bootcode.bin	10/4/2020 2:10 PM	BIN File	52 KB
config	10/4/2020 2:09 PM	Text Document	1 KB
COPYING.linux	10/4/2020 2:10 PM	LINUX File	19 KB
fixup.dat	10/4/2020 2:10 PM	DAT File	8 KB
fixup_cd.dat	10/4/2020 2:10 PM	DAT File	4 KB
fixup_db.dat	10/4/2020 2:10 PM	DAT File	11 KB
fixup_x.dat	10/4/2020 2:10 PM	DAT File	11 KB
fixup4.dat	10/4/2020 2:09 PM	DAT File	6 KB
fixup4cd.dat	10/4/2020 2:10 PM	DAT File	4 KB
fixup4db.dat	10/4/2020 2:10 PM	DAT File	9 KB
fixup4x.dat	10/4/2020 2:10 PM	DAT File	9 KB
LICENCE.broadcom	10/4/2020 2:10 PM	BROADCOM File	2 KB
Readme.md	10/4/2020 2:09 PM	MD File	6 KB
RPI_EFI.fd	10/4/2020 2:09 PM	FD File	1,984 KB
start.elf	10/4/2020 2:10 PM	ELF File	2,880 KB
start_cd.elf	10/4/2020 2:10 PM	ELF File	767 KB
start_db.elf	10/4/2020 2:10 PM	ELF File	4,688 KB
start_x.elf	10/4/2020 2:10 PM	ELF File	3,622 KB
start4.elf	10/4/2020 2:09 PM	ELF File	2,231 KB
start4cd.elf	10/4/2020 2:10 PM	ELF File	767 KB
start4db.elf	10/4/2020 2:10 PM	ELF File	3,641 KB
start4x.elf	10/4/2020 2:10 PM	ELF File	2,915 KB

4GB Pi 4 only: Edit the **config.txt** file on the SD Card and append **gpu_mem=16**:

Eject the SD Card and then put the SD card into the Pi.

3.2.2.2. On macOS

Identify the disk using the following command and make note of the disk path (e.g. /dev/diskX):

```
$ diskutil list

/dev/disk6 (internal, physical):
   #:                       TYPE NAME                    SIZE       IDENTIFIER
   0:     FDisk_partition_scheme                        *63.9 GB    disk6
   1:             Windows_FAT_32 boot                    268.4 MB   disk6s1
   2:                      Linux                         63.6 GB    disk6s2
```

Create FAT32 partition on the SD Card by running the following command and providing disk path. The partition label will be called **UEFI**, you can choose another name if you wish:

```
$ diskutil partitionDisk /dev/disk6 1 MBRFormat "MS-DOS" UEFI R
```

Delete all files starting with **kernel*.img** within **firmware-master/boot** directory and then copy the entire content of the "boot" directory onto the newly formatted SD card:

```
$ rm ~/Desktop/firmware-master/boot/kernel*.img
$ cp -rf ~/Desktop/firmware-master/boot/* /Volumes/UEFI
```

Copy all files within the **RPi4_UEFI_Firmware_v1.20** directory into the same boot directory on SD card:

```
cp -rf ~/Desktop/RPi4_UEFI_Firmware_v1.20/* /Volumes/UEFI
```

4GB Pi 4 only: Edit the **config.txt** file on the SD Card and append **gpu_mem=16**:

```
echo "gpu_mem=16" >> /Volumes/UEFI/config.txt
```

Eject the SD Card:

```
diskutil eject /dev/disk6
```

Now put the SD card into the Pi.

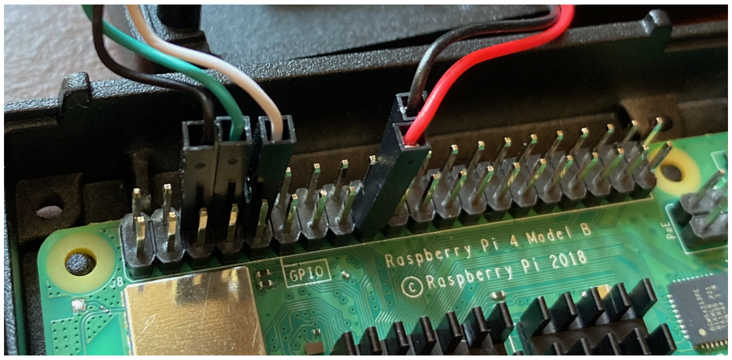
3.3. Decide on your console choice

The choices are:

- HDMI + USB keyboard (if you choose this option, skip to 3.4)
  - Required to update Raspberry Pi's microcode EEPROM via Pi OS
  - Access to UEFI setup
  - Preferred for installing ESXi-Arm
- Serial console
  - Access to UEFI setup
  - Supported for installing ESXi-Arm

If you choose HDMI and a USB keyboard, **make sure to use the leftmost HDMI port**.

If you chose to wire up the serial port, connect the cable to the UART pins on the board. The three pins you would need to connect are GND, TX and RX.



3.3.1. Wiring

Note the connections are as follows, with the TX pin on the cable going to the RXD and vice-verse. If you get this wrong, you will see no output.

Black (GND)	GND (Ground, pin 6)
Green (RX)	TXD (GPIO 14, pin 8)
White (TX)	RXD (GPIO 15, pin 10)

3.3.2. Terminal emulator

Fire up your terminal emulation and connect to the device on your PC. The parameters used to open this port:

Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

3.3.2.1. 'screen' terminal emulator

Note: device names below may be different. Check your system.

On Linux:

```
$ screen /dev/ttyUSB0 115200
```

On macOS:

```
$ screen /dev/tty.usbserial-A900UE2E
```

3.3.2.2. 'minicom' terminal emulator

Note: device names below may be different. Check your system.

With **minicom**, you will have to configure settings the first time you use it. To access menus, you will have to use the **CTRL** key in Linux, and **ESC** key on macOS. These directions will refer to this key as **META**.

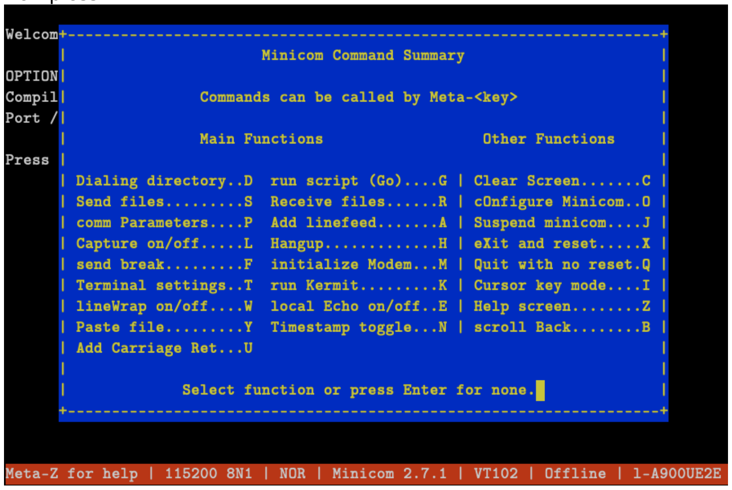
On Linux:

```
$ minicom -c on -D /dev/ttyUSB0
```

On macOS:

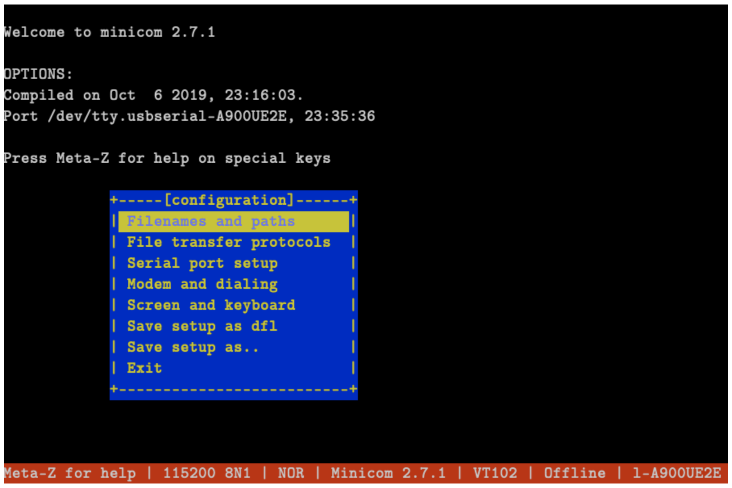
```
$ minicom -c on -D /dev/tty.usbserial-A900UE2E
```

Now press **META-Z**:



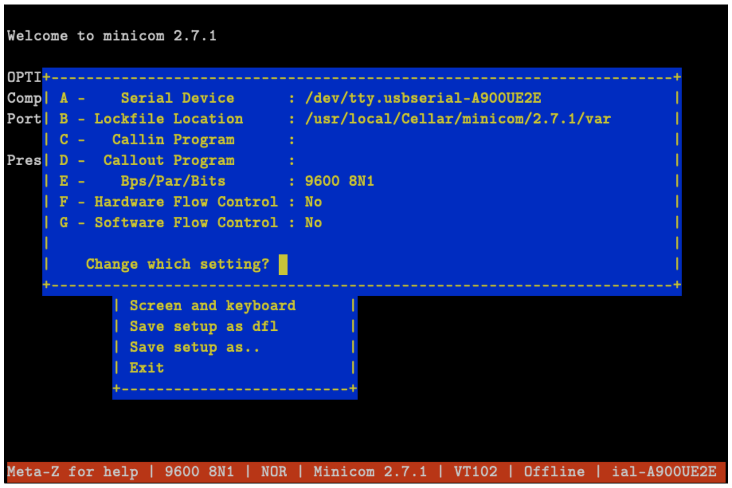
```
Welcom+-----------------------------------------------------------------+
      |                    Minicom Command Summary                      |
OPTION|                                                                 |
Compil|              Commands can be called by Meta-<key>               |
Port /|                                                                 |
      |              Main Functions                  Other Functions    |
Press |                                                                 |
      | Dialing directory..D  run script (Go)....G | Clear Screen.......C |
      | Send files.........S  Receive files......R | cOnfigure Minicom..O |
      | comm Parameters....P  Add linefeed.......A | Suspend minicom....J |
      | Capture on/off.....L  Hangup.............H | eXit and reset.....X |
      | send break.........F  initialize Modem...M | Quit with no reset.Q |
      | Terminal settings..T  run Kermit.........K | Cursor key mode....I |
      | lineWrap on/off....W  local Echo on/off..E | Help screen........Z |
      | Paste file.........Y  Timestamp toggle...N | scroll Back........B |
      | Add Carriage Ret...U                                            |
      |                                                                 |
      |             Select function or press Enter for none.            |
      +-----------------------------------------------------------------+

Meta-Z for help | 115200 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | 1-A900UE2E
```

Now press **O**:

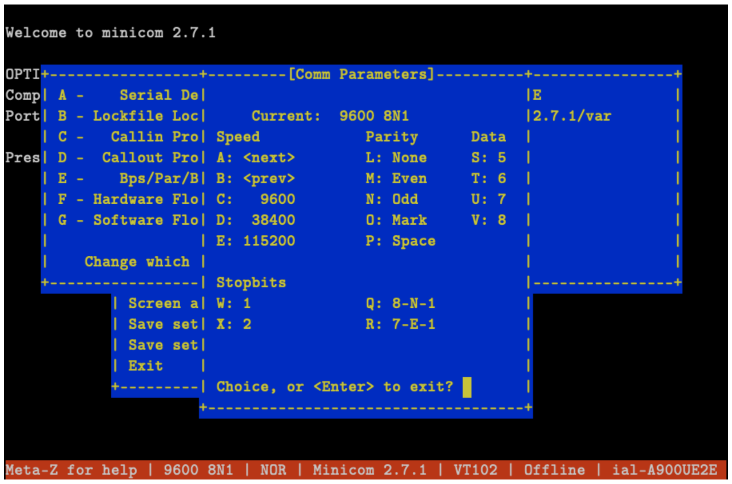


```
Welcome to minicom 2.7.1

OPTIONS:
Compiled on Oct  6 2019, 23:16:03.
Port /dev/tty.usbserial-A900UE2E, 23:35:36

Press Meta-Z for help on special keys

            +-----[configuration]------+
            | Filenames and paths      |
            | File transfer protocols  |
            | Serial port setup        |
            | Modem and dialing        |
            | Screen and keyboard      |
            | Save setup as dfl        |
            | Save setup as..          |
            | Exit                     |
            +--------------------------+

Meta-Z for help | 115200 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | 1-A900UE2E
```

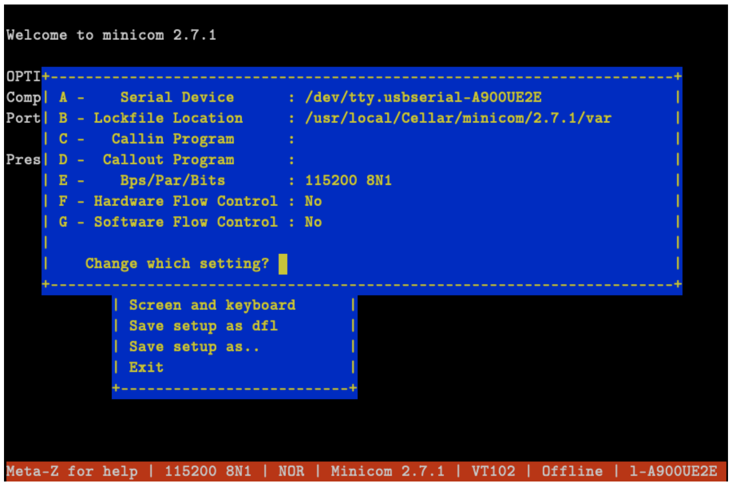
Use arrow key to navigate to **Serial port setup** and press the **ENTER**:


```
Welcome to minicom 2.7.1

OPTI+-----------------------------------------------------------------------+
Comp| A -    Serial Device      : /dev/tty.usbserial-A900UE2E               |
Port| B - Lockfile Location     : /usr/local/Cellar/minicom/2.7.1/var       |
    | C -   Callin Program      :                                           |
Pres| D -  Callout Program      :                                           |
    | E -    Bps/Par/Bits       : 9600 8N1                                  |
    | F - Hardware Flow Control : No                                        |
    | G - Software Flow Control : No                                        |
    |                                                                       |
    |    Change which setting?                                              |
    +-----------------------------------------------------------------------+
            | Screen and keyboard      |
            | Save setup as dfl        |
            | Save setup as..          |
            | Exit                     |
            +--------------------------+

Meta-Z for help | 9600 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | ial-A900UE2E
```

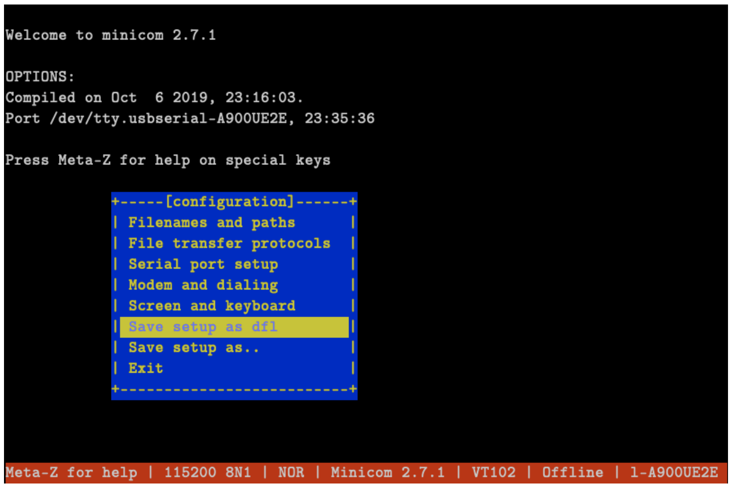
Now press **E**:


```
Welcome to minicom 2.7.1

OPTI+-----------------+---------[Comm Parameters]----------+----------------+
Comp| A -    Serial De|                                    |E               |
Port| B - Lockfile Loc|     Current:  9600 8N1             |2.7.1/var       |
    | C -   Callin Pro| Speed            Parity      Data  |                |
Pres| D -  Callout Pro| A: <next>        L: None     S: 5  |                |
    | E -    Bps/Par/B| B: <prev>        M: Even     T: 6  |                |
    | F - Hardware Flo| C:   9600        N: Odd      U: 7  |                |
    | G - Software Flo| D:  38400        O: Mark     V: 8  |                |
    |                 | E: 115200        P: Space          |                |
    |    Change which |                                    |                |
    +-----------------| Stopbits                           |----------------+
            | Screen a| W: 1             Q: 8-N-1          |
            | Save set| X: 2             R: 7-E-1          |
            | Save set|                                    |
            | Exit    |                                    |
            +---------| Choice, or <Enter> to exit?        |
                      +------------------------------------+

Meta-Z for help | 9600 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | ial-A900UE2E
```

Press **E** again, then **ENTER**.


```
Welcome to minicom 2.7.1

OPTI+-----------------------------------------------------------------------+
Comp| A -    Serial Device      : /dev/tty.usbserial-A900UE2E               |
Port| B - Lockfile Location     : /usr/local/Cellar/minicom/2.7.1/var       |
    | C -   Callin Program      :                                           |
Pres| D -  Callout Program      :                                           |
    | E -    Bps/Par/Bits       : 115200 8N1                                |
    | F - Hardware Flow Control : No                                        |
    | G - Software Flow Control : No                                        |
    |                                                                       |
    |    Change which setting?                                              |
    +-----------------------------------------------------------------------+
            | Screen and keyboard      |
            | Save setup as dfl        |
            | Save setup as..          |
            | Exit                     |
            +--------------------------+

Meta-Z for help | 115200 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | l-A900UE2E
```

Make sure settings **F** and **G** both say **No** to any kind of flow control. Press **ENTER** when done, then navigate to **Save setup as dfl** and press **ENTER**.

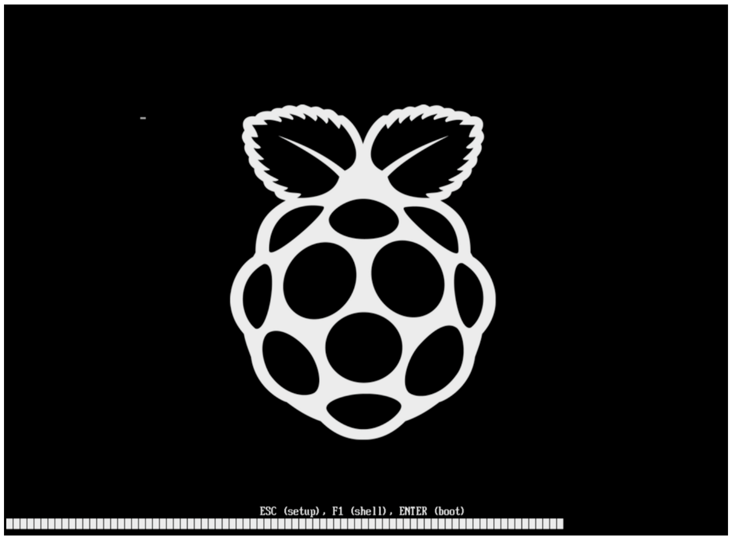

```
Welcome to minicom 2.7.1

OPTIONS:
Compiled on Oct  6 2019, 23:16:03.
Port /dev/tty.usbserial-A900UE2E, 23:35:36

Press Meta-Z for help on special keys

            +-----[configuration]------+
            | Filenames and paths      |
            | File transfer protocols  |
            | Serial port setup        |
            | Modem and dialing        |
            | Screen and keyboard      |
            | Save setup as dfl        |
            | Save setup as..          |
            | Exit                     |
            +--------------------------+

Meta-Z for help | 115200 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | 1-A900UE2E
```

Use **ESC** to exit out of the menus.

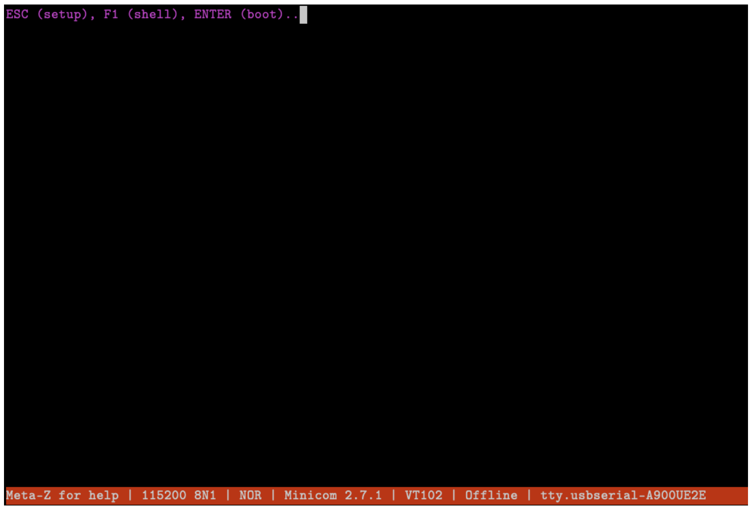
3.4. UEFI firmware configuration

You can use either HDMI + USB keyboard or a serial console. The output is duplicated to both. To enter UEFI setup, apply power to the Raspberry Pi, then keep mashing the **ESC** key when prompted.

With an HDMI screen, this is when you see the Raspberry Pi logo.

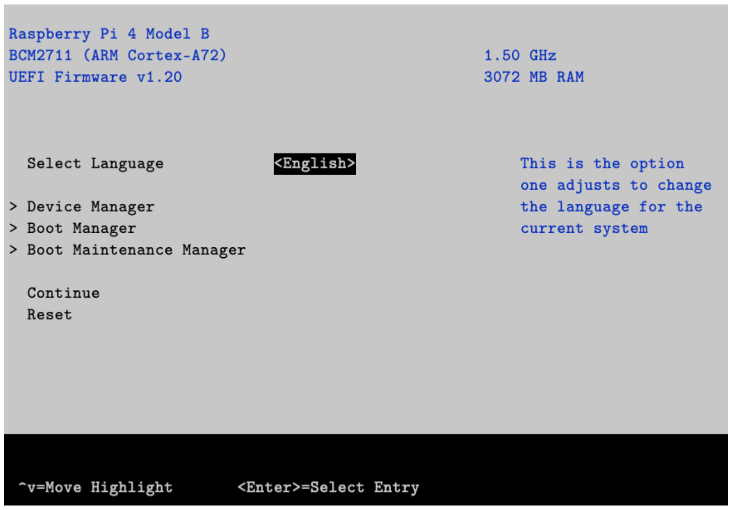

```
ESC (setup), F1 (shell), ENTER (boot)
```

With a serial console, this is when you see this:



```
ESC (setup), F1 (shell), ENTER (boot)..

Meta-Z for help | 115200 8N1 | NOR | Minicom 2.7.1 | VT102 | Offline | tty.usbserial-A900UE2E
```

In either case, the output will be identical - the configuration home page:

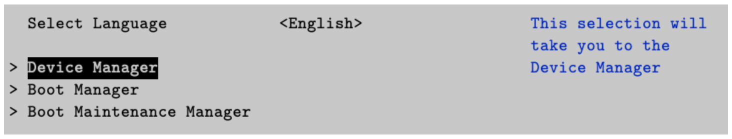


```
Raspberry Pi 4 Model B
BCM2711 (ARM Cortex-A72)                                  1.50 GHz
UEFI Firmware v1.20                                       3072 MB RAM


  Select Language              <English>                   This is the option
                                                           one adjusts to change
> Device Manager                                           the language for the
> Boot Manager                                             current system
> Boot Maintenance Manager

  Continue
  Reset



 ^v=Move Highlight       <Enter>=Select Entry
```

3.4.1. Disable 3GiB memory limit

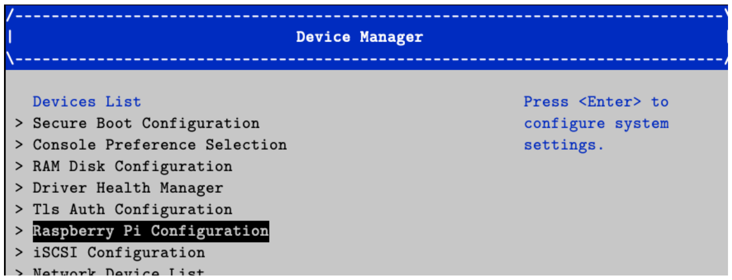
The Raspberry Pi 4 UEFI is configured with a default limit of 3GiB of memory for OS compatibility purposes. This will prevent the ESXi installer from proceeding, and needs to be disabled.

Using arrow keys, first navigate to **Device Manager:**



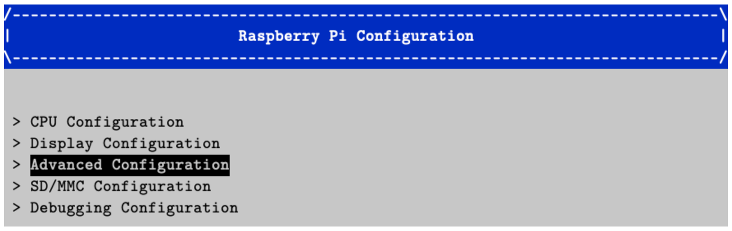
```
  Select Language              <English>                   This selection will
                                                           take you to the
> Device Manager                                           Device Manager
> Boot Manager
> Boot Maintenance Manager
```

Press **ENTER** and navigate to **Raspberry Pi Configuration**:



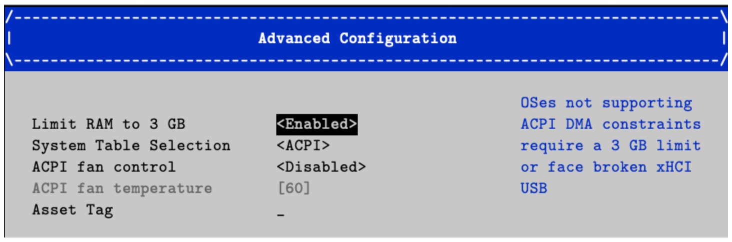
```
/------------------------------------------------------------------------\
|                             Device Manager                             |
\------------------------------------------------------------------------/

   Devices List                                          Press <Enter> to
 > Secure Boot Configuration                             configure system
 > Console Preference Selection                          settings.
 > RAM Disk Configuration
 > Driver Health Manager
 > Tls Auth Configuration
 > Raspberry Pi Configuration
 > iSCSI Configuration
 > Network Device List
```

Press **ENTER** and navigate to **Advanced Configuration**:



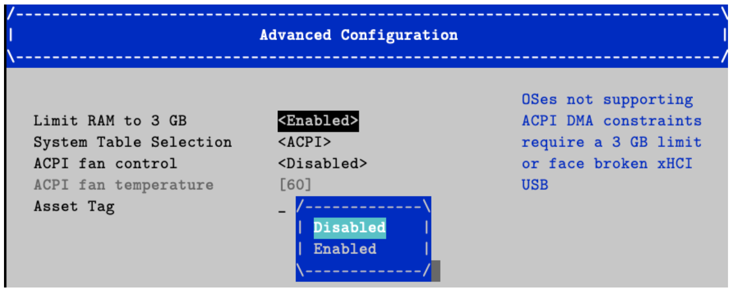
```
Raspberry Pi Configuration

> CPU Configuration
> Display Configuration
> Advanced Configuration
> SD/MMC Configuration
> Debugging Configuration
```

The **Limit RAM to 3GB** setting should already be selected, as it is the first setting on the page:



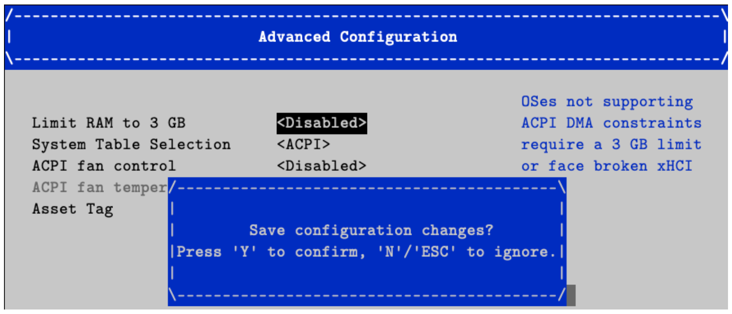
```
Advanced Configuration

                                                  OSes not supporting
Limit RAM to 3 GB          <Enabled>              ACPI DMA constraints
System Table Selection     <ACPI>                 require a 3 GB limit
ACPI fan control           <Disabled>             or face broken xHCI
ACPI fan temperature       [60]                   USB
Asset Tag                  _
```

Press **ENTER** and use arrow keys to select **Disabled**:



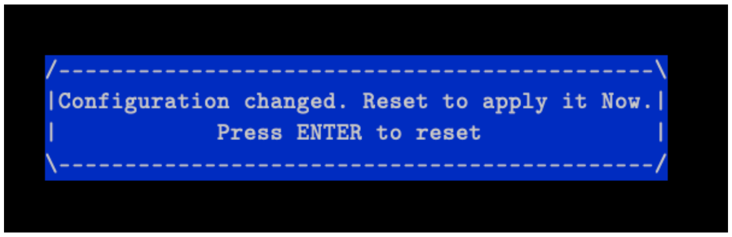
```
Advanced Configuration

                                                  OSes not supporting
Limit RAM to 3 GB          <Enabled>              ACPI DMA constraints
System Table Selection     <ACPI>                 require a 3 GB limit
ACPI fan control           <Disabled>             or face broken xHCI
ACPI fan temperature       [60]                   USB
Asset Tag                  _
                             | Disabled  |
                             | Enabled   |
```

Press **ENTER** again, then **F10** to save settings:



```
Advanced Configuration

                                                  OSes not supporting
Limit RAM to 3 GB          <Disabled>             ACPI DMA constraints
System Table Selection     <ACPI>                 require a 3 GB limit
ACPI fan control           <Disabled>             or face broken xHCI
ACPI fan temper
Asset Tag
                  Save configuration changes?
          Press 'Y' to confirm, 'N'/'ESC' to ignore.
```

Press Y, then **ESC** three times to get back to the home page. Then navigate to **Continue** and press **ENTER.**

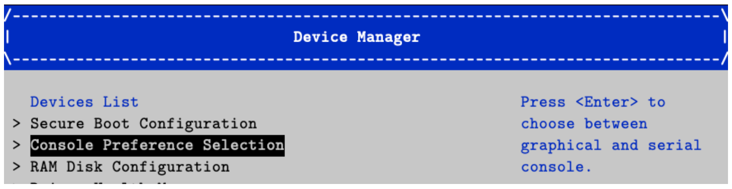


```
Configuration changed. Reset to apply it Now.
          Press ENTER to reset
```

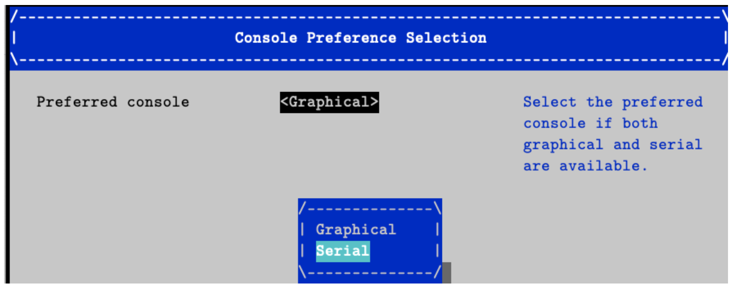
Press **ENTER** again. The Pi will reboot.

3.4.2. Console Preference Selection

The console preference setting only matters if you have an HDMI screen connected to the Pi. If the screen is not connected, the serial port will be exposed to the booted OS, and ESXi will use it as it will detect a headless mode.

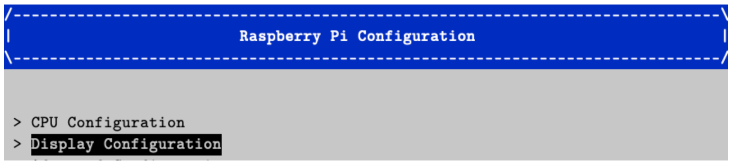

```
/---------------------------------------------------------------------------\
|                              Device Manager                               |
\---------------------------------------------------------------------------/

  Devices List                                        Press <Enter> to
> Secure Boot Configuration                           choose between
> Console Preference Selection                        graphical and serial
> RAM Disk Configuration                              console.
```

If the HDMI screen is connected, the serial port will not be exposed to the booted OS by default. Change the setting to Serial if you want to use the serial port in ESXi.

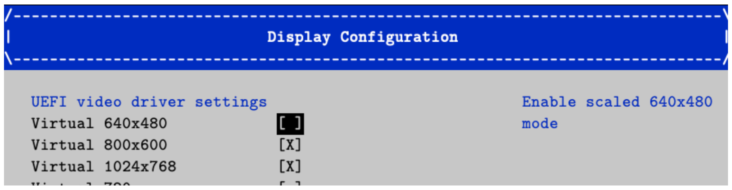

```
/---------------------------------------------------------------------------\
|                       Console Preference Selection                        |
\---------------------------------------------------------------------------/

  Preferred console         <Graphical>               Select the preferred
                                                      console if both
                                                      graphical and serial
                                                      are available.

                              /-------------\
                              | Graphical   |
                              | Serial      |
                              \-------------/
```

3.4.3. Raspberry Pi Display Configuration

The display settings can be used to force a particular resolution to improve legibility:


```
/---------------------------------------------------------------------------\
|                          Raspberry Pi Configuration                       |
\---------------------------------------------------------------------------/


> CPU Configuration
> Display Configuration
```

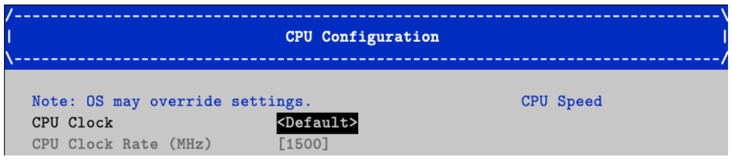
For example, with a small screen this may work well:


```
/---------------------------------------------------------------------------\
|                           Display Configuration                           |
\---------------------------------------------------------------------------/

  UEFI video driver settings                          Enable scaled 640x480
  Virtual 640x480           [ ]                       mode
  Virtual 800x600           [X]
  Virtual 1024x768          [X]
```

3.4.4. Raspberry Pi CPU Configuration

It is not recommended to mess with these. Regardless of the MHz reported, the Pi won't go over 1500 without additional settings in **config.txt** on the SD card.

Note: do not overclock. Not only are you compromising stability, but memory and I/O performance may suffer up to 2x.

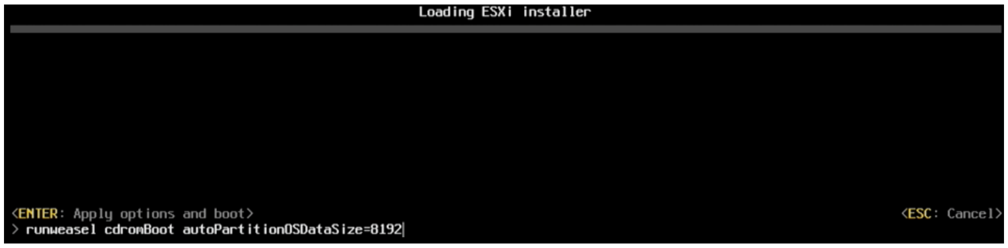

```
/---------------------------------------------------------------------------\
|                             CPU Configuration                             |
\---------------------------------------------------------------------------/

  Note: OS may override settings.                     CPU Speed
  CPU Clock                 <Default>
  CPU Clock Rate (MHz)      [1500]
```

4. Install ESXi-Arm

Follow the generic installation steps, with a few caveats.

On the Raspberry Pi, ESXi only supports installation to USB storage or iSCSI LUNs.

It is recommended to use HDMI video + USB for installation itself. If you need to pass any advanced options to installer (e.g. via **Shift-O** in the ESXi bootloader), this cannot be done using serial console today.



```
Loading ESXi installer

<ENTER: Apply options and boot>                                  <ESC: Cancel>
> runweasel cdromBoot autoPartitionOSDataSize=8192
```

E.g. Append **autoPartitionOSDataSize=8192** for an 8GB VMFS-L partition, and the rest available for a datastore.

For more details on changing the default OSData volume, please see this blog post.

4.1. Power

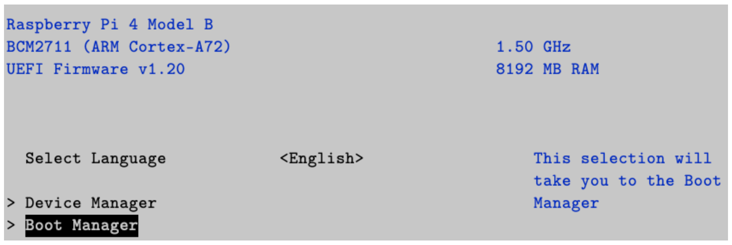
Make sure to use a solid power supply. If plugging in USB NICs or any storage beyond a very basic USB thumb drive, consider using a powered USB hub.

4.2. Automated installation

If using a kickstart script, the NIC name for onboard GbE is **vmnic128**.

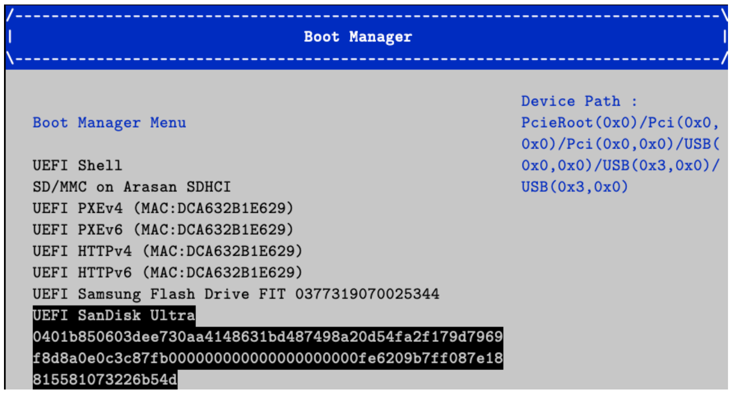
4.3. Booting the installer

Plug in the USB key with installer into the Pi, and power on (or cycle) the Pi. Enter UEFI configuration by mashing the **ESC** key. Then, use the arrow keys to navigate to **Boot Manager**:



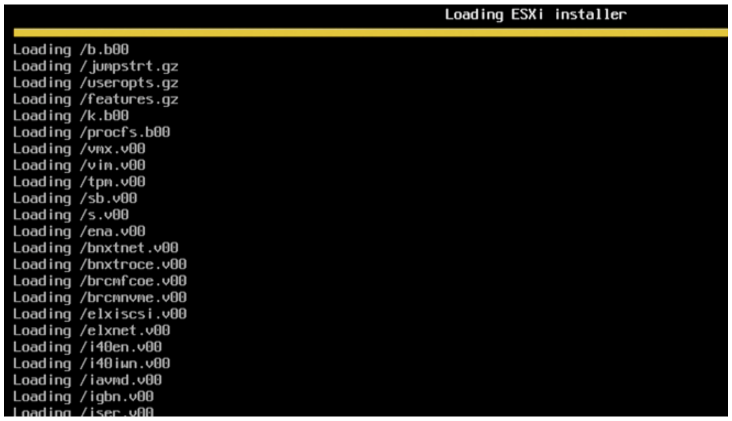
```
Raspberry Pi 4 Model B
BCM2711 (ARM Cortex-A72)                            1.50 GHz
UEFI Firmware v1.20                                 8192 MB RAM


  Select Language           <English>                   This selection will
                                                        take you to the Boot
> Device Manager                                        Manager
> Boot Manager
```

Press **ENTER**, then navigate to the USB drive with the installer.



```
/------------------------------------------------------------------------------\
|                              Boot Manager                                    |
\------------------------------------------------------------------------------/

                                                    Device Path :
   Boot Manager Menu                                PcieRoot(0x0)/Pci(0x0,
                                                    0x0)/Pci(0x0,0x0)/USB(
   UEFI Shell                                       0x0,0x0)/USB(0x3,0x0)/
   SD/MMC on Arasan SDHCI                           USB(0x3,0x0)
   UEFI PXEv4 (MAC:DCA632B1E629)
   UEFI PXEv6 (MAC:DCA632B1E629)
   UEFI HTTPv4 (MAC:DCA632B1E629)
   UEFI HTTPv6 (MAC:DCA632B1E629)
   UEFI Samsung Flash Drive FIT 0377319070025344
   UEFI SanDisk Ultra
   0401b850603dee730aa4148631bd487498a20d54fa2f179d7969
   f8d8a0e0c3c87fb00000000000000000000fe6209b7ff087e18
   815581073226b54d
```

Press **ENTER**, and the installer will boot:



```
                                            Loading ESXi installer
Loading /b.b00
Loading /jumpstrt.gz
Loading /useropts.gz
Loading /features.gz
Loading /k.b00
Loading /procfs.b00
Loading /vmx.v00
Loading /vim.v00
Loading /tpm.v00
Loading /sb.v00
Loading /s.v00
Loading /ena.v00
Loading /bnxtnet.v00
Loading /bnxtroce.v00
Loading /brcmfcoe.v00
Loading /brcmnvme.v00
Loading /elxiscsi.v00
Loading /elxnet.v00
Loading /i40en.v00
Loading /i40iwn.v00
Loading /iavmd.v00
Loading /igbn.v00
Loading /iser.v00
```

You should be able to follow the generic installation steps.

Note: If you're using the official Raspberry Pi USB keyboard, **F11** is the combination of **Fn** and **F1**.

4.3.1. Installation target

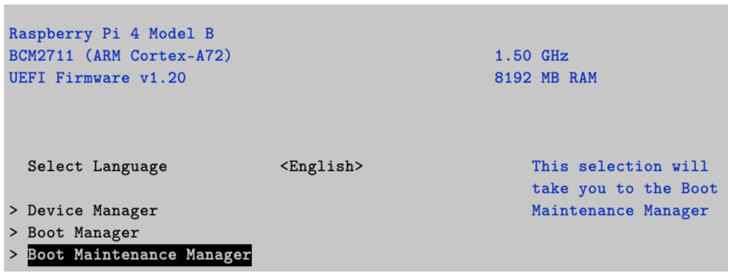
The easiest way to install ESXi is to use a USB stick as installation target. You can re-use the USB stick that you booted the installer from (it will be overwritten), or insert a second USB stick that you install ESXi on.

You also can install on a remote iSCSI target, which requires some additional setup in the Raspberry Pi UEFI. See the main Fling document.

4.4. Post install

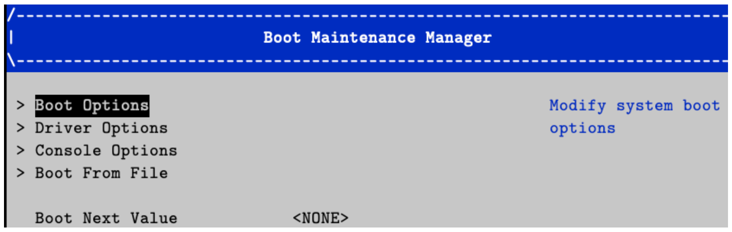
The Pi does not have real NVRAM for UEFI boot settings. This means that operating systems like ESXi have read access to the NVRAM, but not write access. The side-effect here is that the ESXi installer will not be able to update boot options, and boot into ESXi may take a really long time as other boot options fail.

After ESXi install completes, remove the install USB drive. After the system reboots, re-enter UEFI setup and navigate to **Boot Maintenance Manager**:



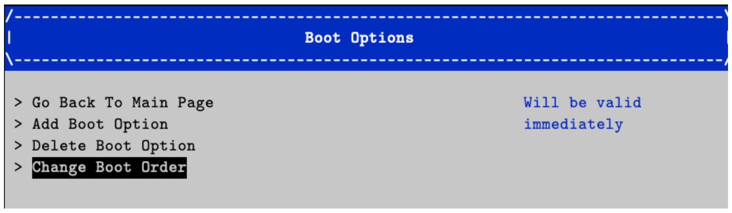
```
Raspberry Pi 4 Model B
BCM2711 (ARM Cortex-A72)                              1.50 GHz
UEFI Firmware v1.20                                   8192 MB RAM


  Select Language             <English>                   This selection will
                                                          take you to the Boot
> Device Manager                                          Maintenance Manager
> Boot Manager
> Boot Maintenance Manager
```

Press **ENTER** and select **Boot Options**:



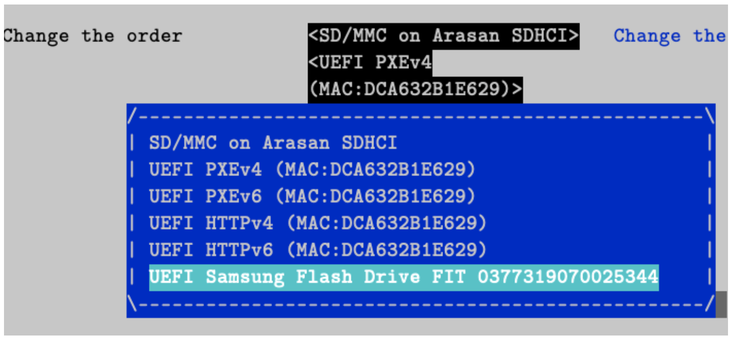
```
/------------------------------------------------------------------------------
|                          Boot Maintenance Manager
\------------------------------------------------------------------------------

 > Boot Options                                            Modify system boot
 > Driver Options                                          options
 > Console Options
 > Boot From File

   Boot Next Value              <NONE>
```

Press **ENTER** and select **Change Boot Order**:



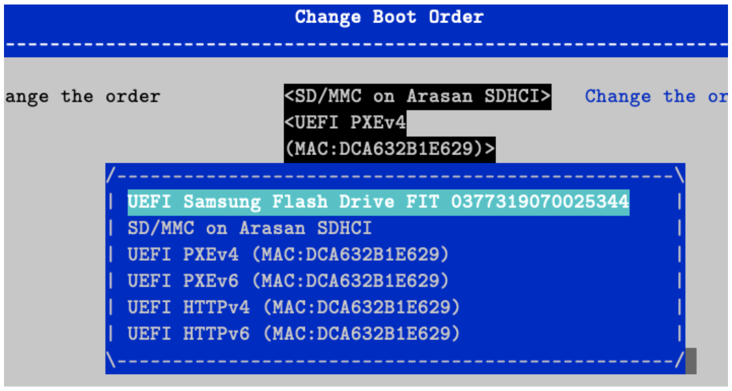
```
/------------------------------------------------------------------------------\
|                              Boot Options                                    |
\------------------------------------------------------------------------------/

> Go Back To Main Page                                    Will be valid
> Add Boot Option                                         immediately
> Delete Boot Option
> Change Boot Order
```

Press **ENTER** twice, and use arrow keys to navigate to the only USB drive you see:



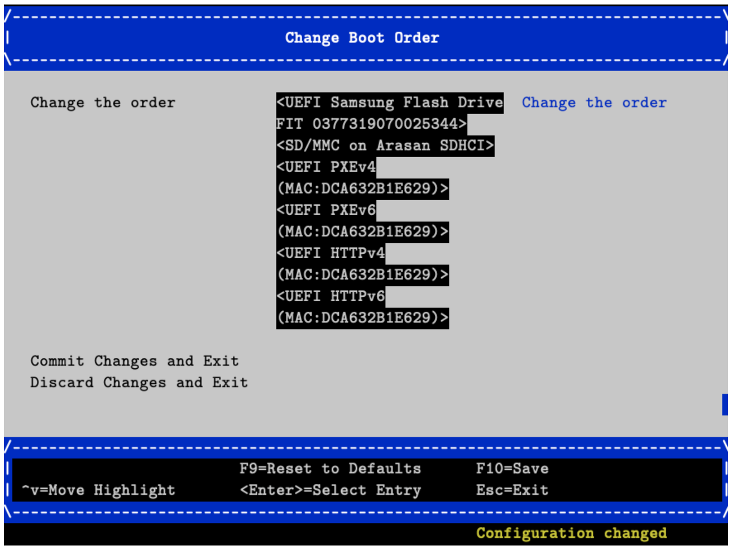
```
Change the order              <SD/MMC on Arasan SDHCI>   Change the
                              <UEFI PXEv4
                              (MAC:DCA632B1E629)>
         /-----------------------------------------------\
         | SD/MMC on Arasan SDHCI                        |
         | UEFI PXEv4 (MAC:DCA632B1E629)                 |
         | UEFI PXEv6 (MAC:DCA632B1E629)                 |
         | UEFI HTTPv4 (MAC:DCA632B1E629)                |
         | UEFI HTTPv6 (MAC:DCA632B1E629)                |
         | UEFI Samsung Flash Drive FIT 0377319070025344 |
         \-----------------------------------------------/
```

Keep pressing the **+** key until the drive is at the top of the list. You definitely want to skip any network options as they take a long time to time out.



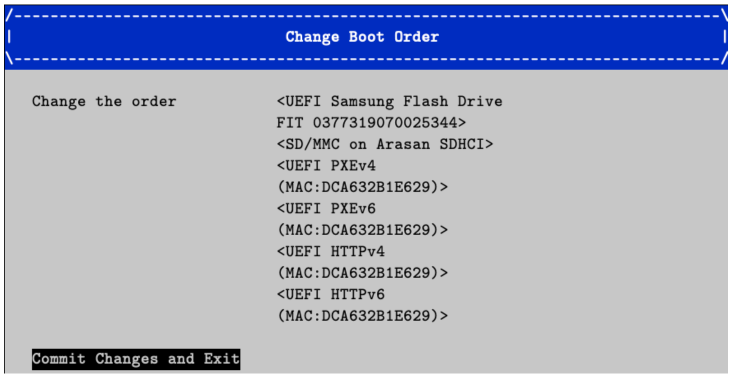
```
                         Change Boot Order
-------------------------------------------------------------------

ange the order             <SD/MMC on Arasan SDHCI>   Change the or
                           <UEFI PXEv4
                           (MAC:DCA632B1E629)>
        /-----------------------------------------------\
        | UEFI Samsung Flash Drive FIT 0377319070025344 |
        | SD/MMC on Arasan SDHCI                        |
        | UEFI PXEv4 (MAC:DCA632B1E629)                 |
        | UEFI PXEv6 (MAC:DCA632B1E629)                 |
        | UEFI HTTPv4 (MAC:DCA632B1E629)                |
        | UEFI HTTPv6 (MAC:DCA632B1E629)                |
        \-----------------------------------------------/
```

Press **ENTER** to complete the selection.

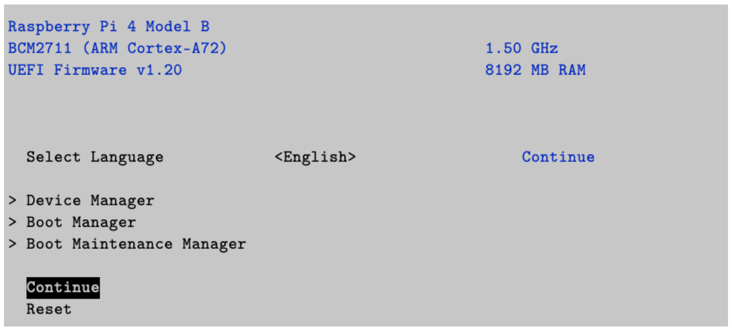


```
/---------------------------------------------------------------------\
|                          Change Boot Order                          |
\---------------------------------------------------------------------/

  Change the order           <UEFI Samsung Flash Drive  Change the order
                             FIT 0377319070025344>
                             <SD/MMC on Arasan SDHCI>
                             <UEFI PXEv4
                             (MAC:DCA632B1E629)>
                             <UEFI PXEv6
                             (MAC:DCA632B1E629)>
                             <UEFI HTTPv4
                             (MAC:DCA632B1E629)>
                             <UEFI HTTPv6
                             (MAC:DCA632B1E629)>

  Commit Changes and Exit
  Discard Changes and Exit

/---------------------------------------------------------------------\
|                      F9=Reset to Defaults      F10=Save             |
| ^v=Move Highlight    <Enter>=Select Entry      Esc=Exit             |
\---------------------------------------------------------------------/
                                                 Configuration changed
```

Now navigate to **Commit Changes and Exit**:


```
/----------------------------------------------------------------------------\
|                             Change Boot Order                              |
\----------------------------------------------------------------------------/

  Change the order           <UEFI Samsung Flash Drive
                             FIT 0377319070025344>
                             <SD/MMC on Arasan SDHCI>
                             <UEFI PXEv4
                             (MAC:DCA632B1E629)>
                             <UEFI PXEv6
                             (MAC:DCA632B1E629)>
                             <UEFI HTTPv4
                             (MAC:DCA632B1E629)>
                             <UEFI HTTPv6
                             (MAC:DCA632B1E629)>

  Commit Changes and Exit
```

Press **ENTER** and **ESC** out as before to the main UEFI setup screen. Navigate to **Continue**:


```
Raspberry Pi 4 Model B
BCM2711 (ARM Cortex-A72)                           1.50 GHz
UEFI Firmware v1.20                                8192 MB RAM



  Select Language           <English>                  Continue

> Device Manager
> Boot Manager
> Boot Maintenance Manager

  Continue
  Reset
```

ESXi will boot.

4.5. NTP

The Pi does not have a battery backed RTC. Consequently, its notion of time will reset back to the UEFI firmware build date on every boot. Thus, you **must** configure NTP if you wish to add the Pi to a vCenter (ideally, matching the NTP servers used by vCenter to avoid time skew issues).

5. Known issues

5.1. Hardware

5.1.1. Flaky USB in UEFI or ESXi

I/O errors, device not enumerating or disappearing (works in UEFI, not ESXi).

5.1.1.1. This is largely due to power issues.

Workaround: Use a powered hub, especially if using power hungry USB-SATA or USB-NVMe enclosures, or USB NICs with embedded USB hubs.

5.1.1.2. Plugging devices while system is on.

The USB3 implementation on the Pi is a bit sensitive. Could also be due to power fluctuations.

Workaround: Avoid hot plugging devices directly into the Pi if you can.

5.2. UEFI Firmware

5.2.1. Synchronous Exception at 0x00000000371013D8

See https://github.com/pftf/RPi4/issues/97. The **RPI_EFI.FD** image on the SD card, which is the UEFI firmware and the emulated NVRAM, occasionally gets corrupted.

Workaround: You will have to copy a fresh RPI_EFI.FD over to the SD card. Make sure to change UEFI settings again (disable 3G limit and update boot order).

5.2.2. Official Pi PoE hat fan doesn't work

See https://github.com/pftf/RPi4/issues/101.

Workaround: Either use a different PoE hat or provide active cooling (recommended regardless).

5.3. ESXi-Arm

5.3.1. USB performance

USB3 implementation quirks in the Raspberry Pi 4 and their ESXi workarounds mean significant overhead for some kinds of I/O, such as USB NICs or USB devices pass-through to VMs. USB GbE NICs are known to top out at 200mbps.

Workaround: Use the onboard GbE NIC if possible.