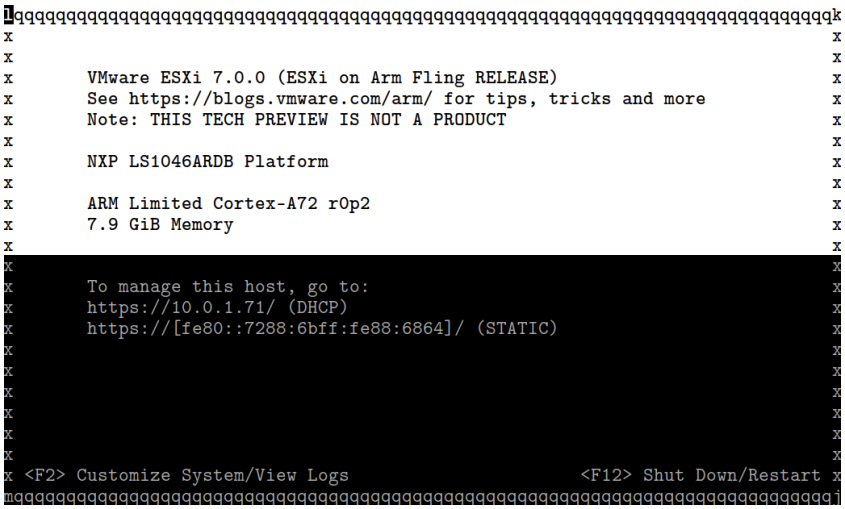
Fling on NXP LS1046A RDB



Info

The NXP LS1046A RDB board is an exhaustive LS1046 evaluation platform, broadly positioned to prototype Industrial PC, Enterprise Router, Central-Office server, and SD-WAN aggregator solutions supporting flexible software deployment.

The RDB based on the NXP LayerScape LS1046A SoC with 4 x Cortex-A72 cores and supports up to 32GiB RAM via a regular DDR4 DIMM. The RDB also has 10 Gb Ethernet, PCIe Gen. 3, SATA 3.0 and USB 3.0.

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

The official support resources, including information on how to buy, are available at https://www.nxp.com/design/qoriq-developer-resources/layerscape-ls1046a-reference-design-board:LS1046A-RDB

Required and supported hardware

Minimally, you need:

- An NXP RDB.
- 1 x USB drive for installer ISO and actual ESXi installation

- 1 x USB NIC
- 1 x microUSB cable for serial console

The following hardware is supported:

- USB storage
- USB networking
- Serial console
- SATA
- PCIe NICs

As you will note, SD card and onboard GbE ports are not supported.

USB devices

IMPORTANT: USB devices can consume significant power. If devices don't work or cause system instability, use a powered USB3 hub.

SATA

There is a SATA power and data connector wedged between the front of the case and the DIMM slot. Use the provided (in the box) extension cable.

PCIe slots.

There are two x1 PCIe slots. These are only functional when the case cover is off. There is also a mPCIe slot and a 12V fan attachment (3 pin) should you need more airflow to cool something (e.g. WiFi).

Supported PCIe devices

Note, because ESXi-Arm does not support MSI/MSI-X interrupts on LS1046A-based platforms, some devices will not work, as their drivers only support MSI-X interrupts.

Intel e1000 NICs supported by the ne1000 driver are known to work.

Preparation

Serial console access

The serial console is provided via the microUSB connector in the front of the board. On the enclosure it is labelled Console.

This USB UART is USB ACM device. With no macOS drivers. Linux is fine.

Note: the USB UART device will not appear on your PC until the RDB is powered.

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
```

'screen' terminal emulator

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

On Linux:

```
$ screen /dev/ttyACM0 115200
```

'minicom' terminal emulator

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

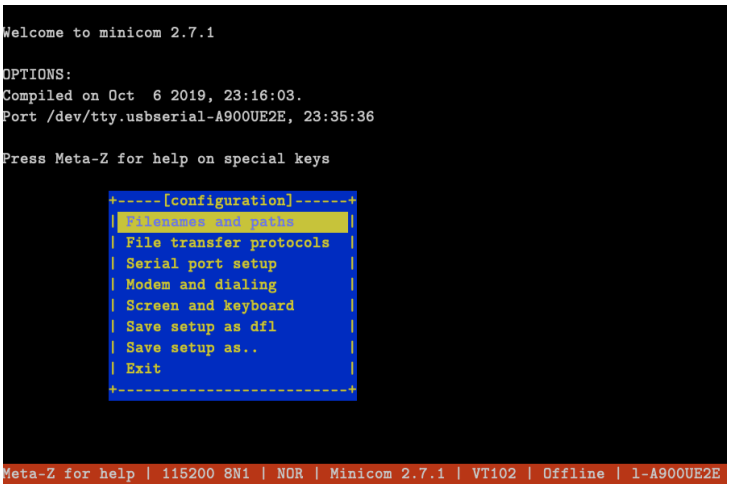
With **minicom**, you will have to configure settings the first time you use it.

On Linux:

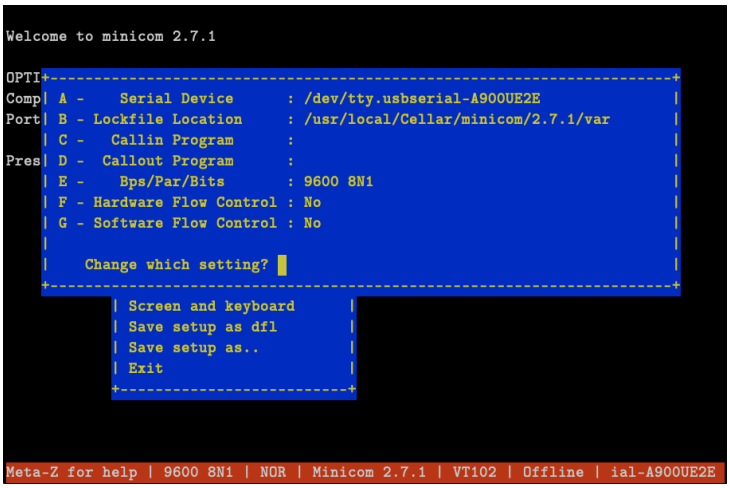
```
$ minicom -c on -D /dev/ttyACM0
```

Now press **CTRL-Z**:

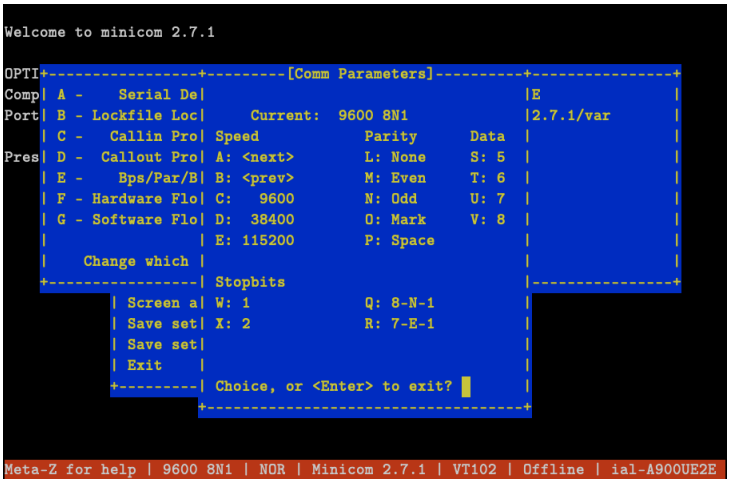
Now press **O**:



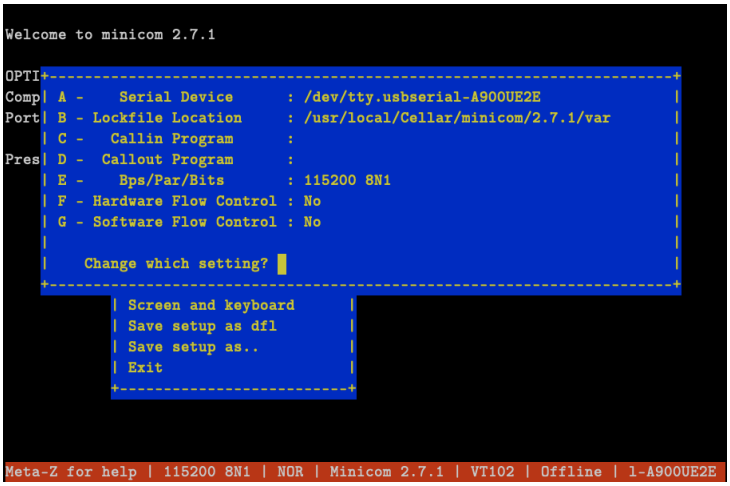
Use arrow key to navigate to **Serial port setup** and press the **ENTER**:



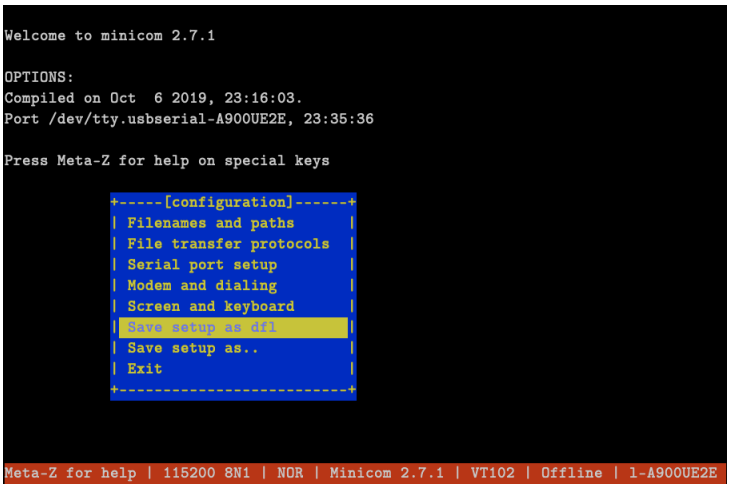
Now press **E**:



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



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**.



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

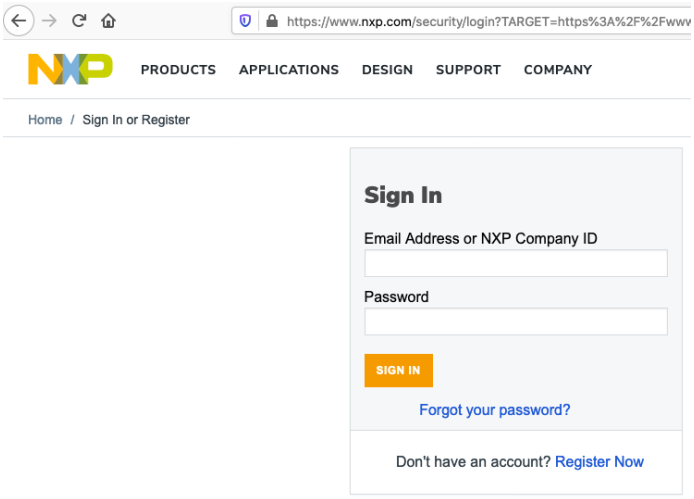
Flashing UEFI firmware

UEFI needs to be flashed to SPI flash. Most likely you'll have a device that comes with U-boot on SD card and nothing in SPI. Updating the firmware once you have UEFI is quite a bit easier.

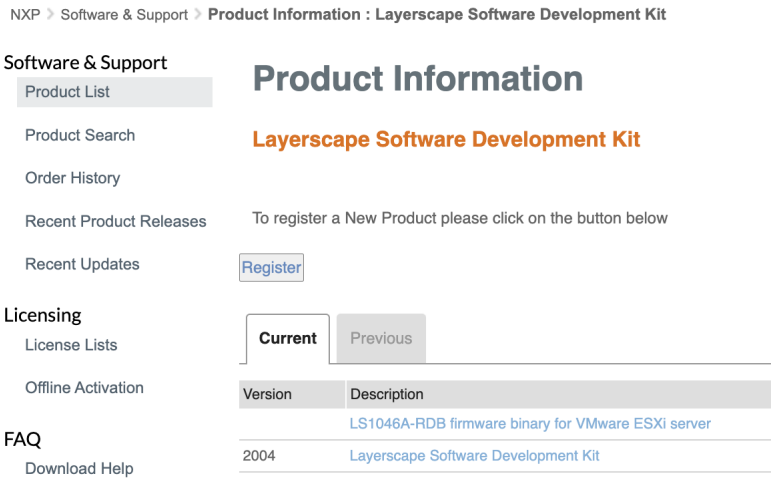
Downloading firmware

Go to https://www.nxp.com/webapp/swlicensing/sso/downloadSoftware.sp?catid=LAYERSCAPE-LS1046A-RDB

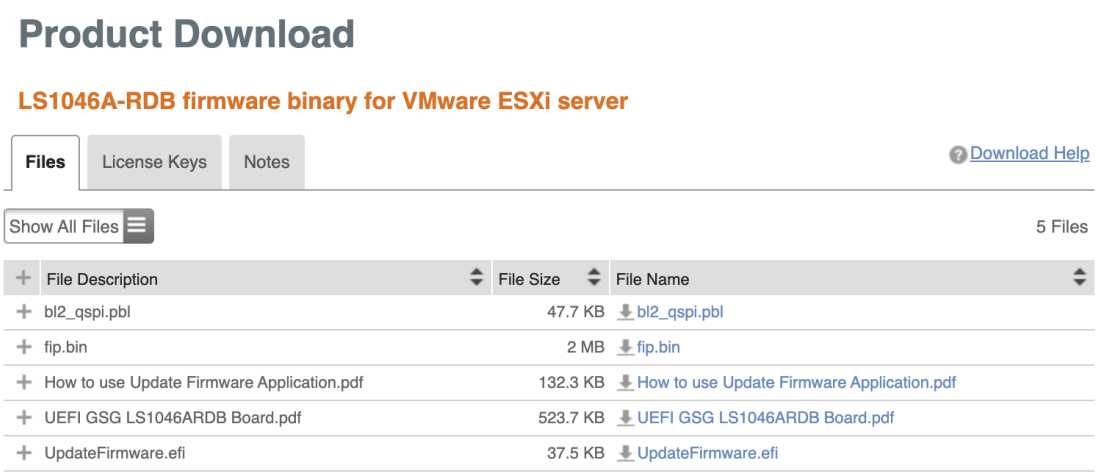
Log in with your NXP support account, or create one:



You should see a download for ESXi:



You'll need all the files under the **LS1046A-RDB firmware binary for VMware ESXi server** label:



If you're flashing a brand new device (i.e. that boots U-boot from SD card or QSPI), you also need to grab the **firmware_ls1046ardb_uboot_qspiboot.img** file:

```
$ wget http://www.nxp.com/lgfiles/sdk/lsdk2004/firmware_ls1046ardb_uboot_qspiboot.img
```

From U-Boot

There are 3 switch (DIP) block on the board.

- Start with switch settings SW3 = 01001110, SW4 = 00111011, SW5 = 00100000 and use the SD card that comes with the board. This has a working U-Boot.
- Put the files on a USB stick.

Once U-Boot gets to a command prompt, do the following to flash images to SPI:

```
=> usb start && usb dev 0

// Flash the main recovery image
=> fatload usb 0:1 $load_addr firmware_ls1046ardb_uboot_qspiboot.img
=> sf probe 0:0
=> sf erase 0x00 +$filesize
=> sf write $load_addr 0x00 $filesize
=> sf probe 0:1
=> sf erase 0x00 +$filesize
=> sf write $load_addr 0x00 $filesize

// Flash "bl2_qspi.pbl" to NOR Flash at address: 0x0
=> fatload usb 0:1 $load_addr bl2_qspi.pbl
=> sf probe 0:0
=> sf erase 0x0 +$filesize
=> sf write $load_addr 0x0 $filesize
=> sf probe 0:1
=> sf erase 0x0 +$filesize
=> sf write $load_addr 0x0 $filesize

// Flash "fip.bin" to NOR Flash at address: 0x10000
=> fatload usb 0:1 $load_addr fip.bin
=> sf probe 0:0
=> sf erase 0x100000 +$filesize
=> sf write $load_addr 0x100000 $filesize
=> sf probe 0:1
=> sf erase 0x0 +$filesize
=> sf write $load_addr 0x0 $filesize
```

Now flip switch settings to SW3 = 01001110, SW4 = 00111011, SW5 = 00100010 (QSPI boot)

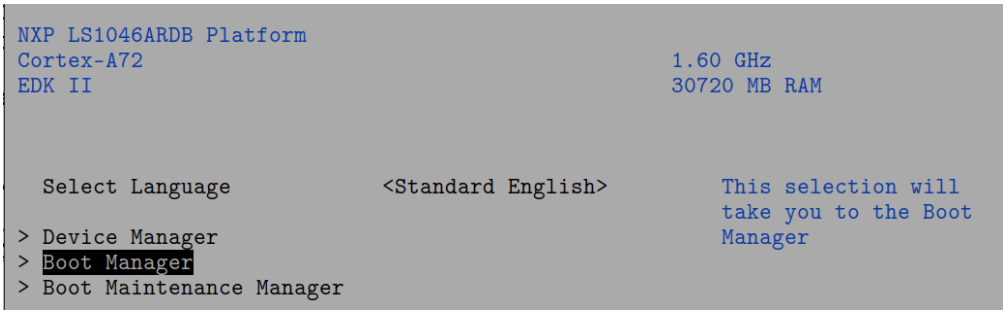
Power cycle the board.

From UEFI

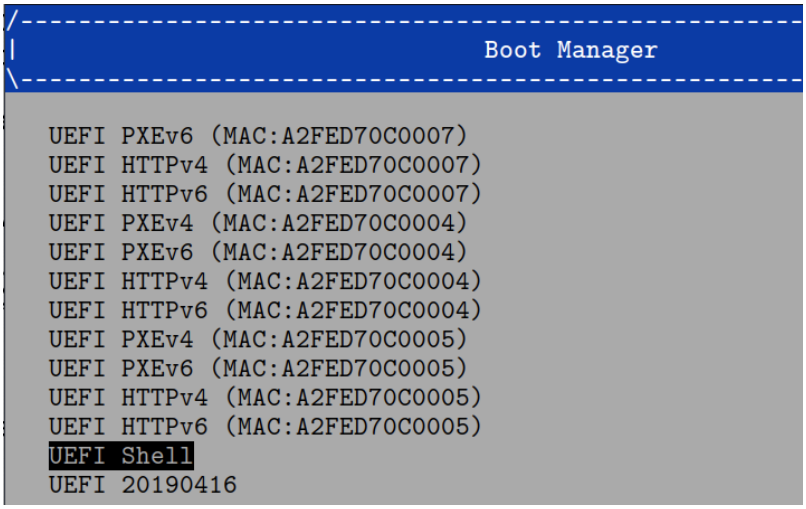
This assumes **UpdateFirmware.efi**, **bl2_qspi.pbl** and **fip.bin** are copied to SD card or USB drive.

Turn the system on by plugging in the power supply.

Enter UEFI configuration by mashing the **ESC** key. Then, use the arrow keys to navigate to **Boot Manager**:

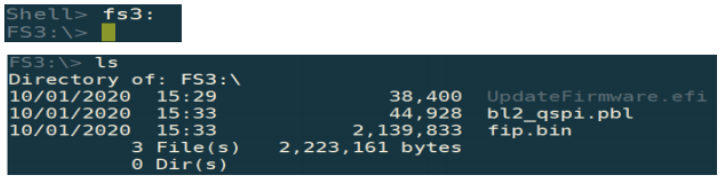


Press **ENTER**, then navigate UEFI Shell:



Press **ENTER**. Shell will start.

Find the right fsX that contains the firmware update application and files. It may be called something else, like **fs0** or **fs1**:



Program the firmware and reset the board.

```
fs3:\> UpdateFirmware.efi -f bl2_qspi.pbl -d 1 -of 0x0
fs3:\> UpdateFirmware.efi  -f fip.bin -d 1 -of 0x100000
fs3:\> reset
```

Install ESXi-Arm

Follow the generic installation steps, with a few caveats.

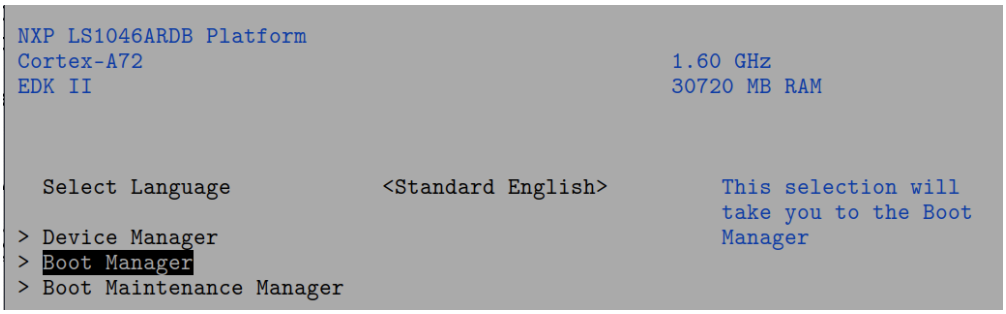
- Because the FRWY only has two USB ports, and one the ports has to be occupied by a USB NIC, you will have to flash the ISO to the same drive you intend to use for ESXi-Arm.
- Because only the serial console is available, you will not be able to pass any advanced options to installer (e.g. **autoPartitionOSDataSize** via **Shift-O** in the ESXi bootloader)

Automated installation.

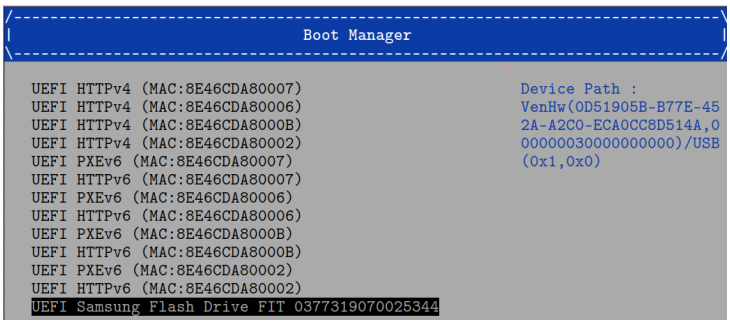
If using a kickstart script, the NIC name for a USB NIC is **vusb0**. The NIC name for a PCIe NIC is **vmnic0**.

Booting the installer

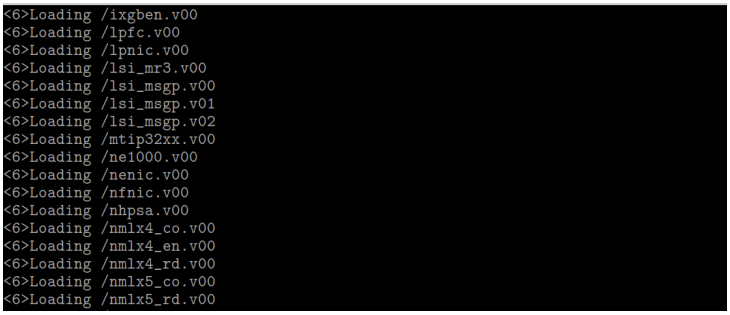
Plug in the USB NIC and USB key with installer into the FRWY and turn the system on by plugging in the power supply. Enter UEFI configuration by mashing the **ESC** key. Then, use the arrow keys to navigate to **Boot Manager**:



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



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



NTP

The RDB does have a battery RTC. The time may not have been set correctly. It is highly recommended that you configure NTP, especially if adding the RDB to a vCenter (ideally, matching the NTP servers used by vCenter to avoid time skew issues).

Known issues

Hardware

Flaky USB in UEFI or ESXi

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

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.

Plugging devices while system is on.

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

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

ESXi-Arm

My PCIe NIC doesn't work

MSI/MSI-X interrupts are not supported on the LS1046A today, and this may preclude some PCIe devices from working correctly (e.g. **igbn** driver for some Intel NICs). Use a different PCIe NIC (e.g an **ne1000** driver one for Intel NICs) or a USB NIC.

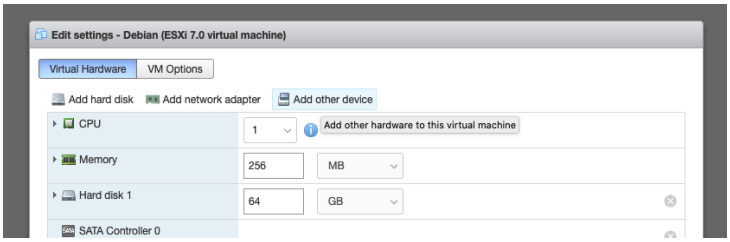
PCIe device cannot be toggled for pass-through

Update firmware. The first version published by NXP accidentally omitted the firmware configuration for SMMU (IOMMU).

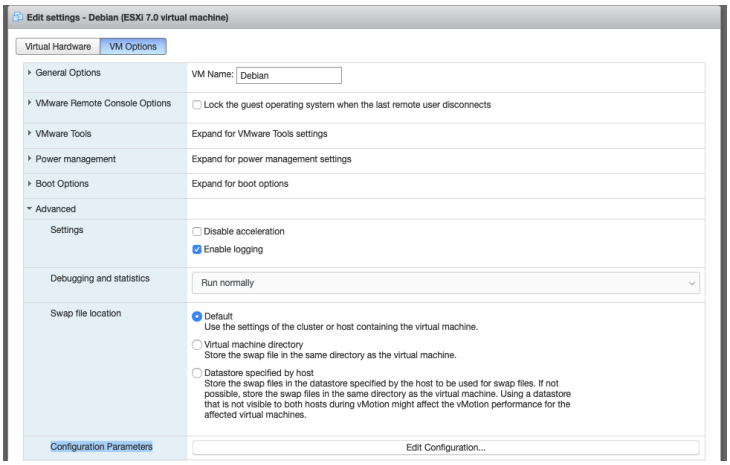
Passed-through PCIe device: VM powers off

Most PCIe devices use MSIs. MSI/MSI-X interrupts are not supported on the LS1046A today, and MSIs cannot be virtualized if a passed-through device is using legacy interrupts, but a workaround is possible.

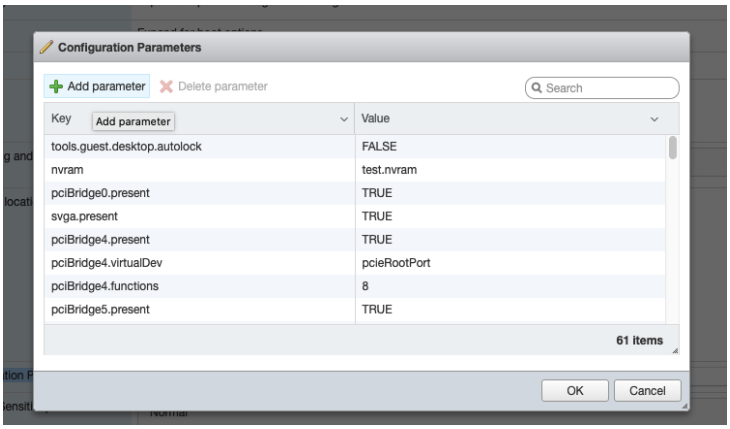
Open the VM configuration:



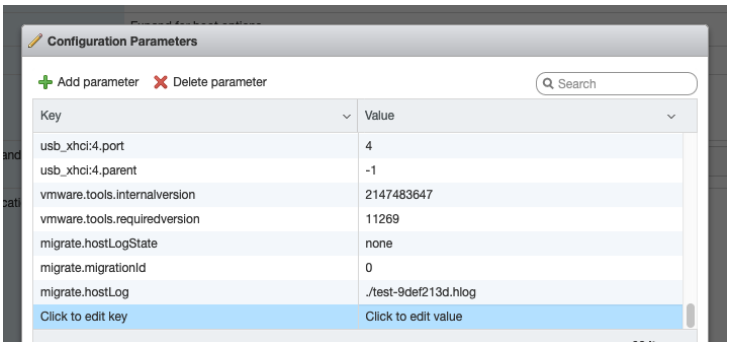
Click on **VM Options**, and expand the **Advanced** group of settings:



Click on **Edit Configuration.**

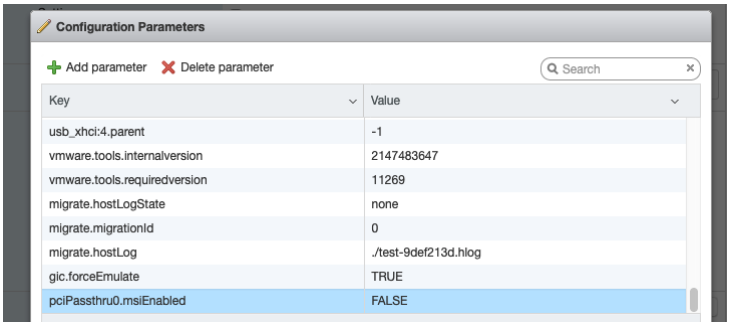


Click **Add parameter**:

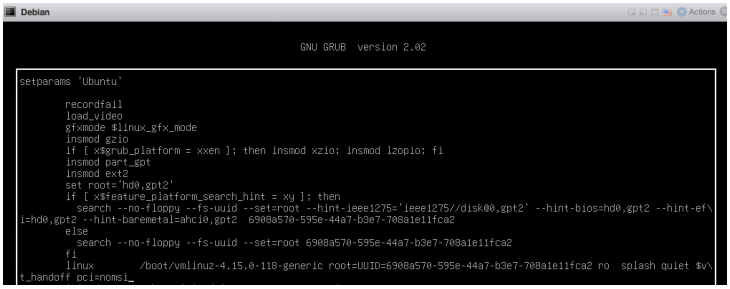


Edit the row that says **Click to edit key**, setting **Key** to **gic.forceEmulate** and **Value** to **TRUE**.

Now add another parameter, setting **Key** to **pciPassthru0.msiEnabled** and **Value** to **FALSE**.



Add **pci=nomsi** Linux kernel boot option inside the VM:



Passed-through PCIe device: VM powers off with SMMU error

The VM crashes, and VMKernel **dmesg** says something about SMMU errors caused by the passed-through device. This has been seen with passing through the Qualcomm Atheros QCA6174 802.11ac Wireless Network Adapter, into VMs with less than 512MiB RAM.

Give the VM at least 512 MiB RAM.