RN2483_Silica Documentation

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Silica

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Contents

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Date 26 Aug 2016

Reference name QorIQ T1040

CHAPTER 1

QorIQ® T1040 Reference Design Board

QorIQ T1040RDB Board

CHAPTER 2

INTRODUCTION

The QorIQ® T1040 Reference Design Board is a high-performance computing evaluation, development and test platform for QorIQ T1040 communications processors built on Power Architecture® technology.

The boards, with 1.5 GHz T1040 processor and rich I/O mix, are for evaluation of QorIQ T1 in networking and Ethernet applications, such as mixed control and data plane in fixed routers, switches, Internet access devices, firewall and other packet-filtering applications, as well as general-purpose embedded computing.

The T1040RDB board can help shorten your time to market. It can be used for software development and performance evaluation prior to the customers' own board being ready.

Features

- **Processor** QorIQ® T1040, 1.5 GHz core with 1600 MT/s DDR3L data rate
- **Memory**
  - 2GB unbuffered DDR3L SDRAM UDIMM/RDIMM (64-bit bus), 1600 MHz data rate
  - 128MB NOR Flash, 16-bit
  - 2GB SLC NAND Flash
  - SD Connector to Interface
  - SATA interface
- **PCI Express**
  - One x4 PCIe slot
  - Two Mini-PCIe connectors
- **USB 2.0** Dual USB slot, connected to USB PHY
- **Ethernet**
  - One onboard SGMII 10/100/1G Ethernet ports
  - Two onboard RGMII 10/100/1G Ethernet ports
  - Two onboard QSGMII 10/100/1G For 8 GE ports

- **Two UART** ports at up to 115200 bps
- **TDM** One FXO and Four FXS ports

Developement tools

NXP releases Linux® SDK for QorIQ® Processors including support for QorIQ® T1040 ARM-based with Yocto system.

Features

- Linux kernel and device drivers
- Yocto Embedded Linux development environment
- GNU tools (compilers, linkers, etc.)
- Bootloaders and firmware
- Libraries and middleware
- Reference applications
- Linux root filesystem
- Deployment mechanisms

Document references

The board reference documentation is available on the NXP website website.

Contents:

Quick start guide

This document will guide you from installing the **Linux® SDK 1.7 for QorIQ® Processors of NXP** on a Ubuntu **14.04** and build all the files necessary to run the board. It's a simple guide "ready to go" in order to be able to create your own Linux distribution from scratch reading this only page. The binaries generated will be installed in the NOR flash of the board. The Yocto Project is used in this SDK, this is an open source collaboration project that provides templates, tools and methods to help you create custom Linux-based systems for embedded boards products. At the end of the next steps you will have a linux system ready to boot on your board **T1040RDB**.

The first step to do is preparing on the host machine a linux operating system. In this guide we have used a virtual machine in order to develop on the SDK. So the first step is installing a virtual machine with **Ubuntu 14.04 32bit**.

Download VirtualBox

If you don't know any virtual machine, we will explain here where download one of them and how to install Ubuntu 14.04 32bit. We have used **VirtualBox**, you can get VirtualBox installer from here:

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

Download the version that suits your host operating system. You need to download and install the **Extension Pack** as well.

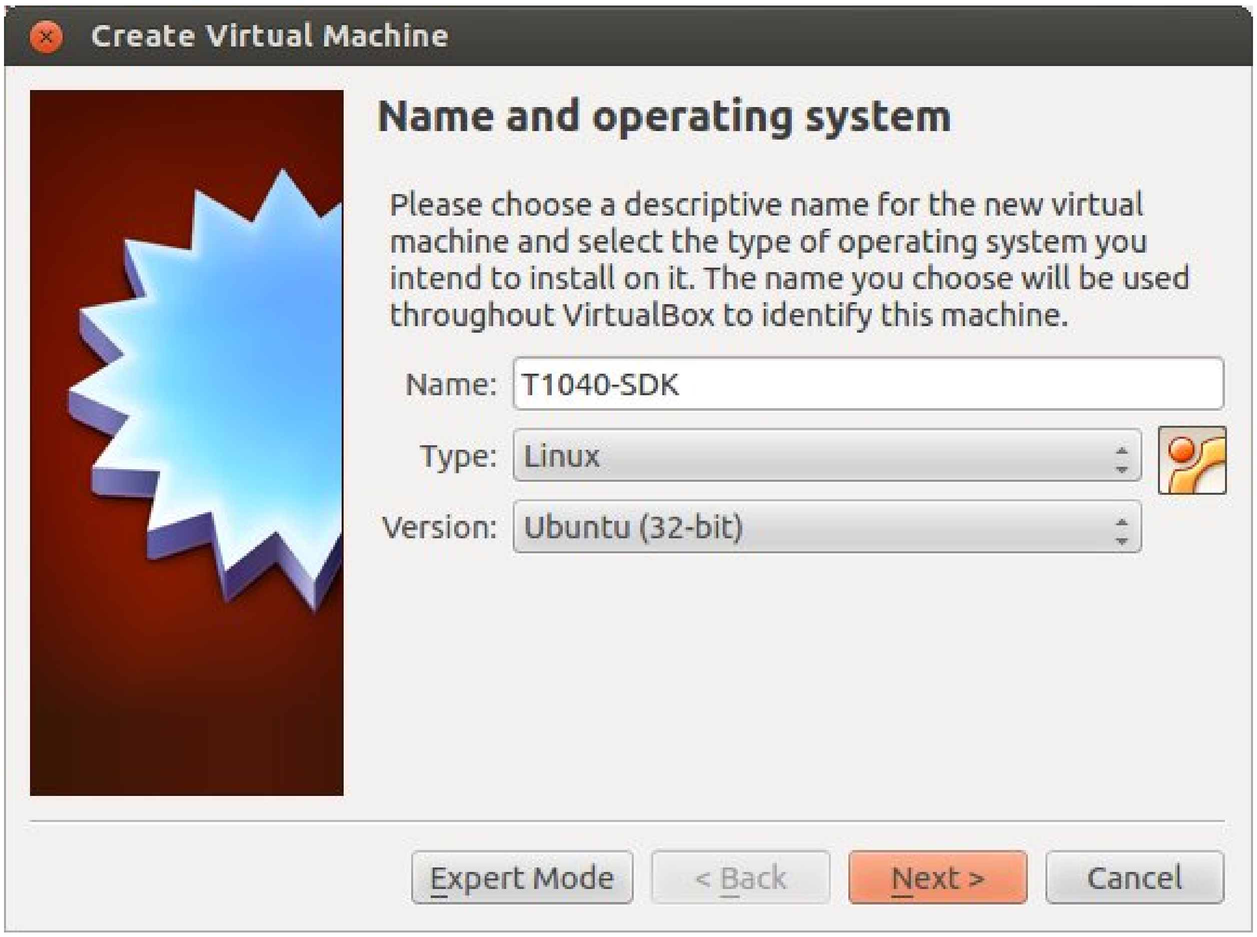
Important: Make sure that the extension pack has the same version of VirtualBox.

Install the software with all the default options.

Create a new Virtual Machine

Create the VirtualBox image clicking on **New** button.

Insert a name, for example **T1040-SDK**. Select **Linux**, **Ubuntu (32-bit)**



Name and operating system

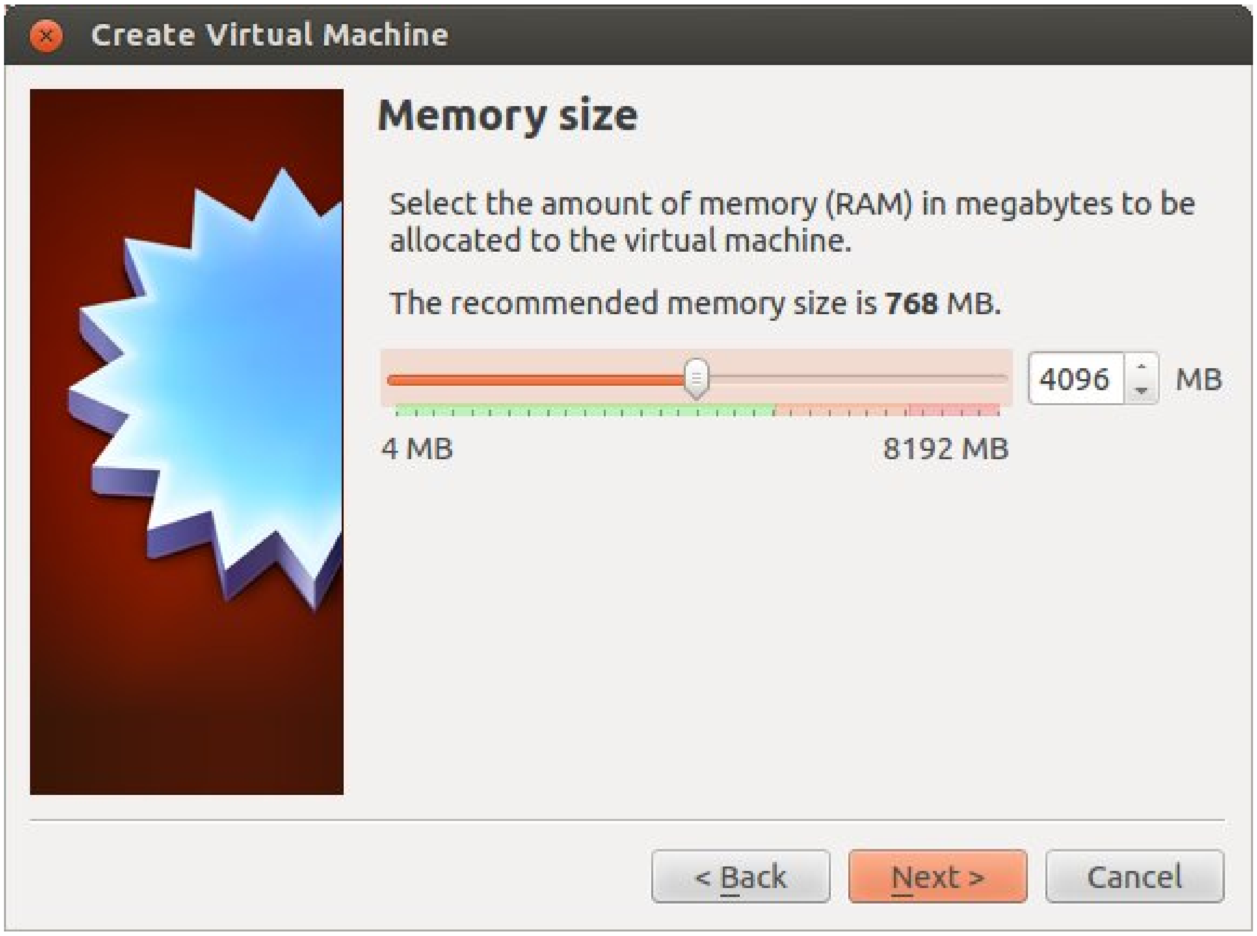
Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.

Name: T1040-SDK

Type: Linux

Version: Ubuntu (32-bit)

Allocate memory resource for the virtual machine, it is important have at least 2GB.



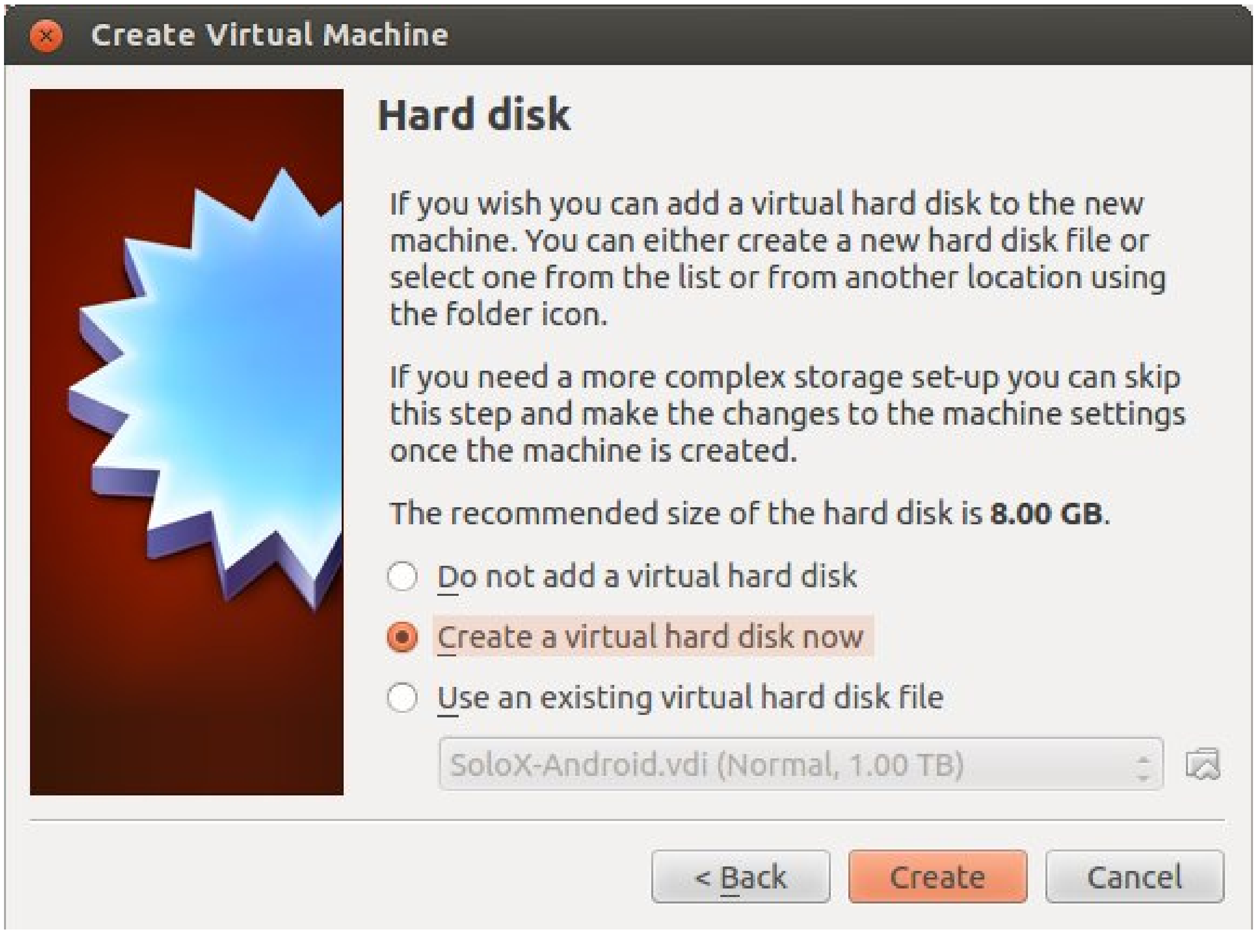
Memory size

Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

The recommended memory size is **768** MB.

4096 MB

Create a virtual hard disk.



Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

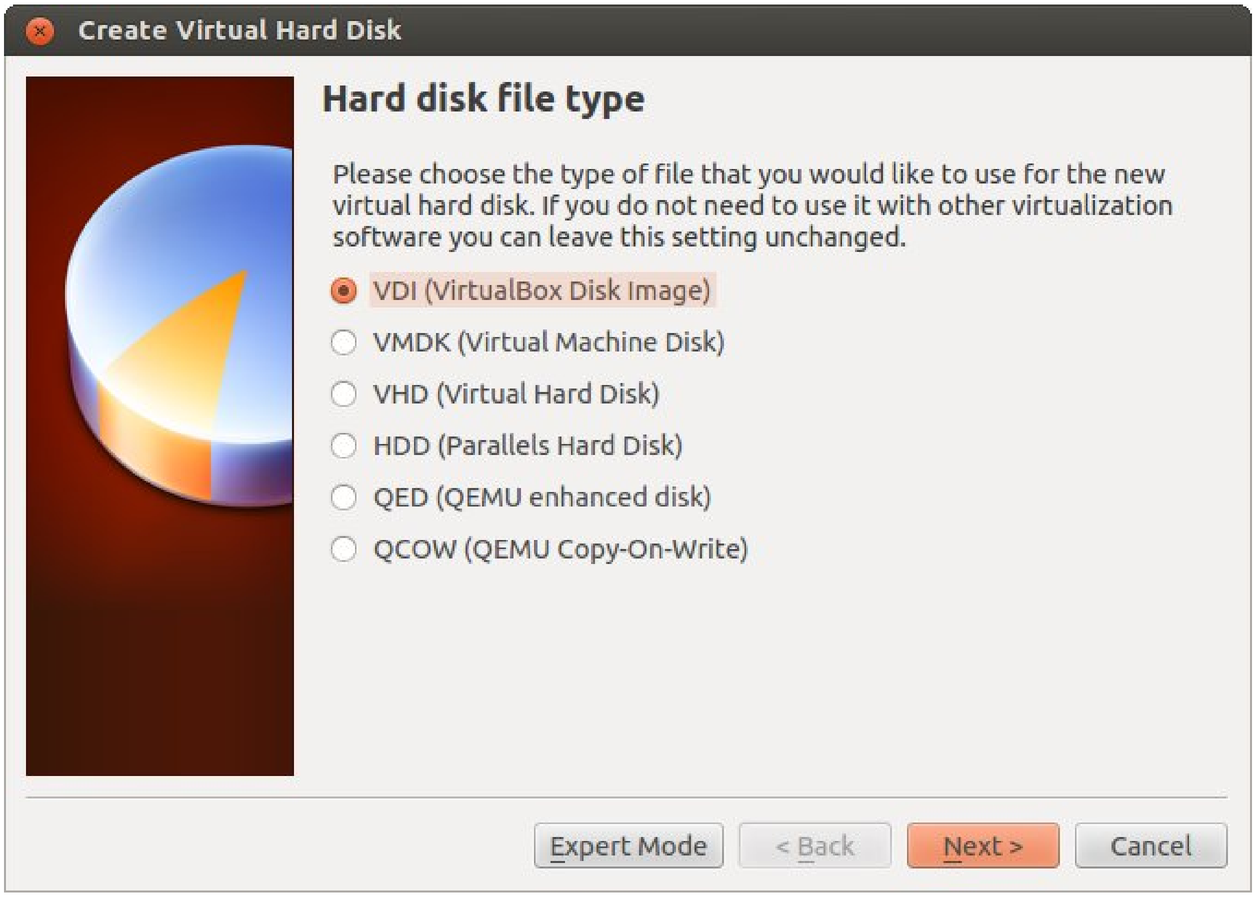
If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **8.00 GB**.

- ○ Do not add a virtual hard disk
- ● Create a virtual hard disk now
- ○ Use an existing virtual hard disk file

SoloX-Android.vdi (Normal, 1.00 TB)

Select VirtualBox Disk Image:

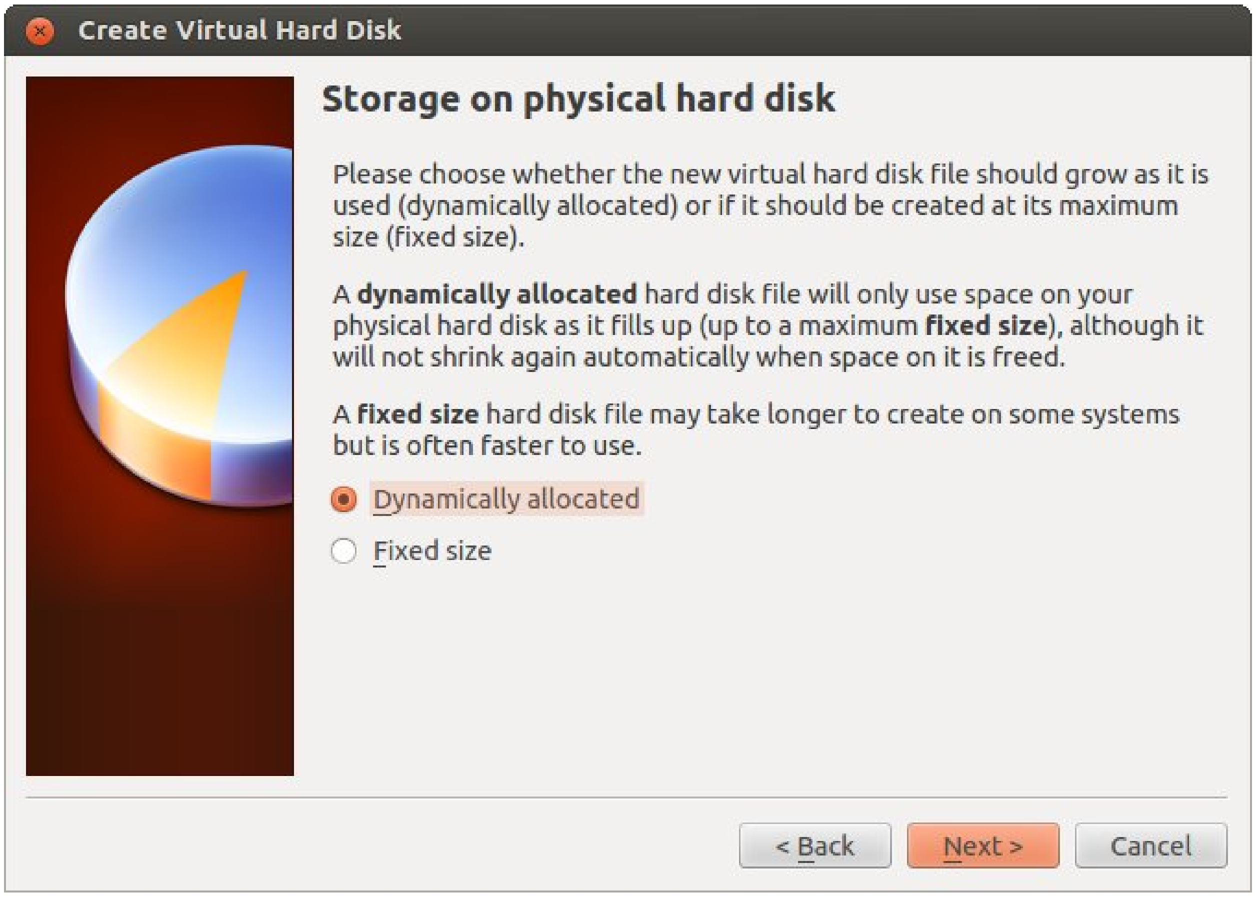


Hard disk file type

Please choose the type of file that you would like to use for the new virtual hard disk. If you do not need to use it with other virtualization software you can leave this setting unchanged.

[✓ VDI (VirtualBox Disk Image)]
VMDK (Virtual Machine Disk)
VHD (Virtual Hard Disk)
HDD (Parallels Hard Disk)
QED (QEMU enhanced disk)
QCOW (QEMU Copy-On-Write)

Click on dynamic allocation, this permit to save space unused



Storage on physical hard disk

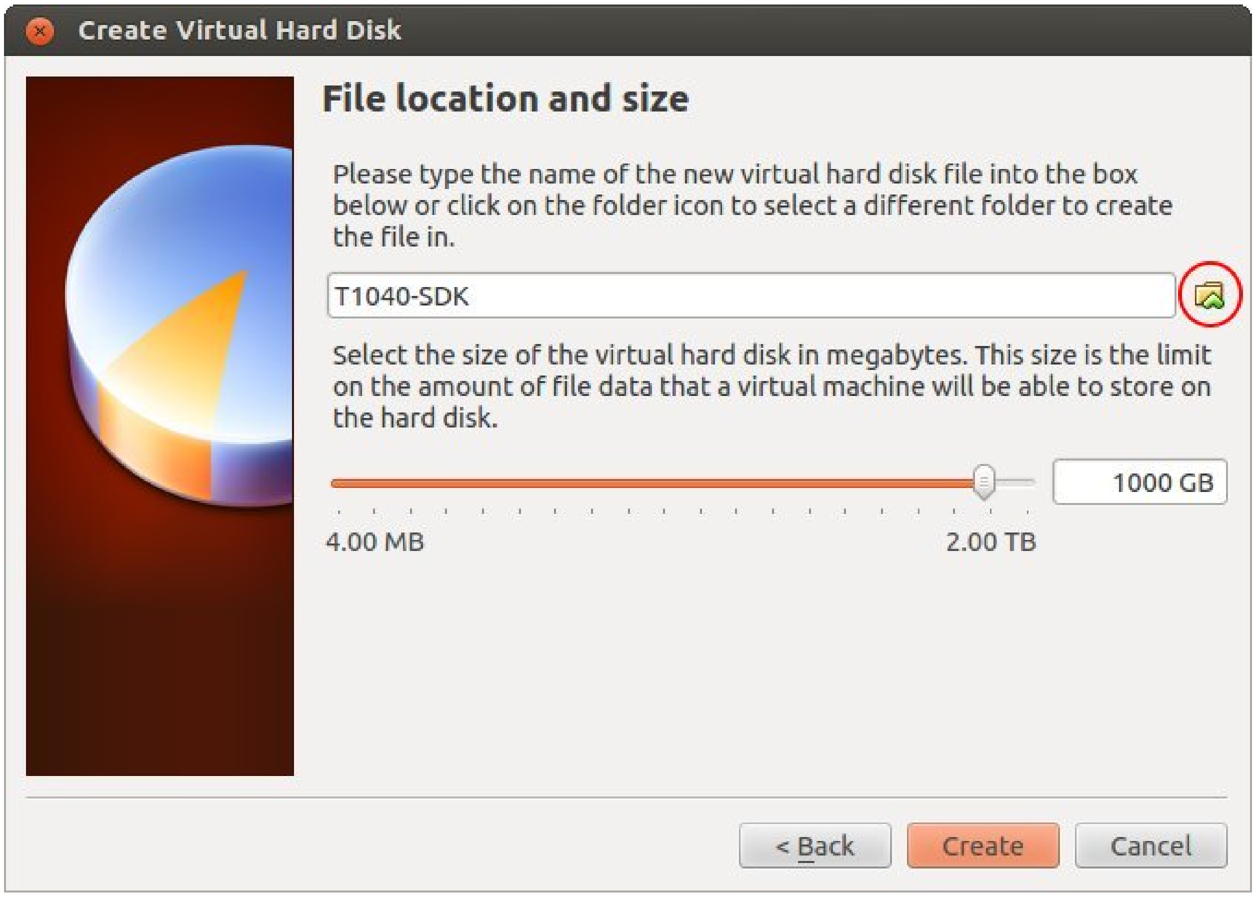
Please choose whether the new virtual hard disk file should grow as it is used (dynamically allocated) or if it should be created at its maximum size (fixed size).

A **dynamically allocated** hard disk file will only use space on your physical hard disk as it fills up (up to a maximum **fixed size**), although it will not shrink again automatically when space on it is freed.

A **fixed size** hard disk file may take longer to create on some systems but is often faster to use.

[✓ Dynamically allocated] Fixed size

Choose a big size for the hard disk because Yocto uses a lot of space during the building of the distribution. Clicking on the folder icon you can choose where store the hard disk image.


Create Virtual Hard Disk

File location and size

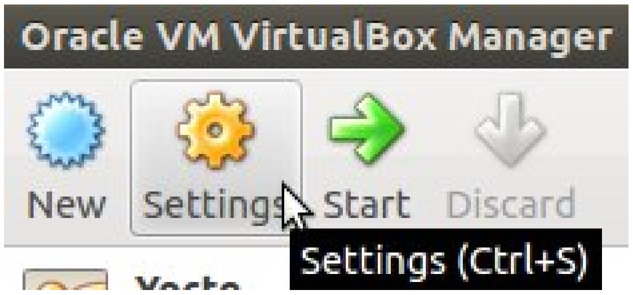
Please type the name of the new virtual hard disk file into the box below or click on the folder icon to select a different folder to create the file in.

T1040-SDK

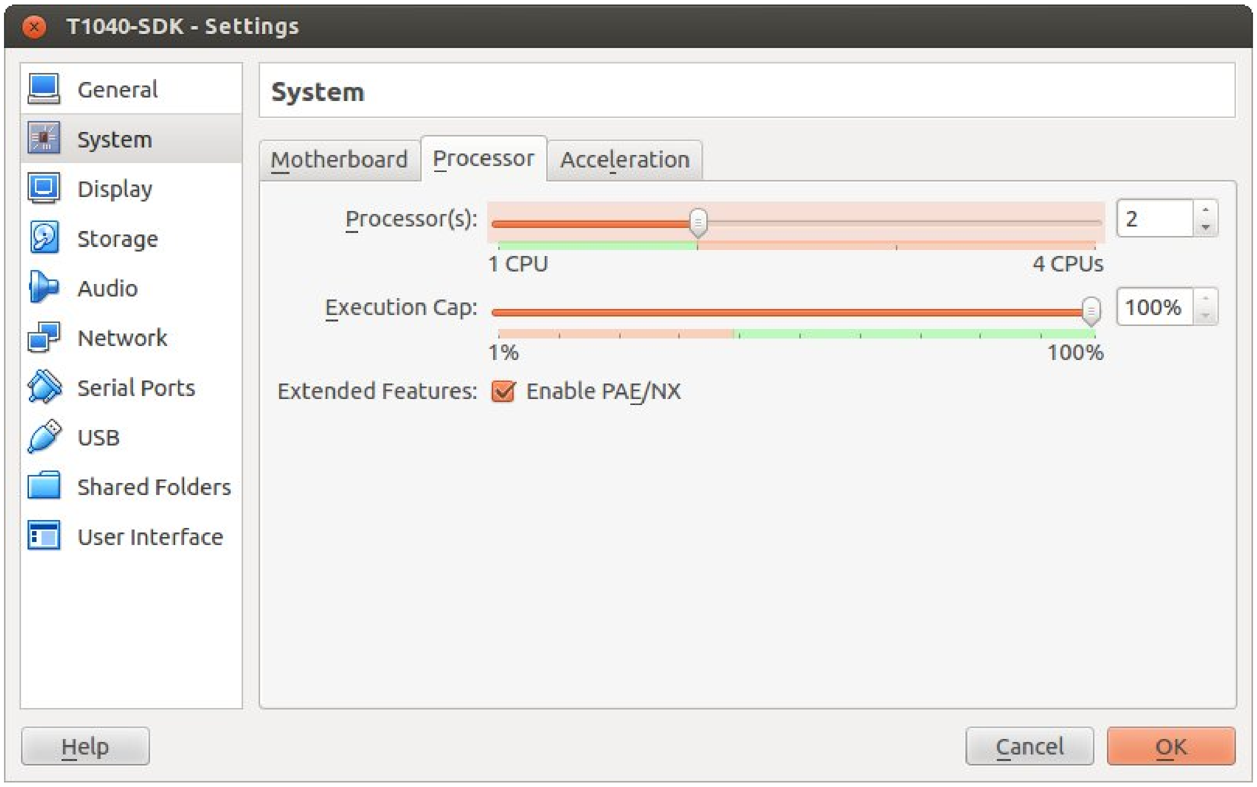
Select the size of the virtual hard disk in megabytes. This size is the limit on the amount of file data that a virtual machine will be able to store on the hard disk.

1000 GB

After this steps the Virtual Machine will be created and you have to open the settings window in order to increase the performances of your virtual machine. First, select the **T1040-SDK** virtual machine from the list of virtual machines, click on the **Settings** icon in the **Oracle VM VirtualBox Manager** window:



Select *Processor* tab to select how many processor **cores** you want to assign to the virtual machine.



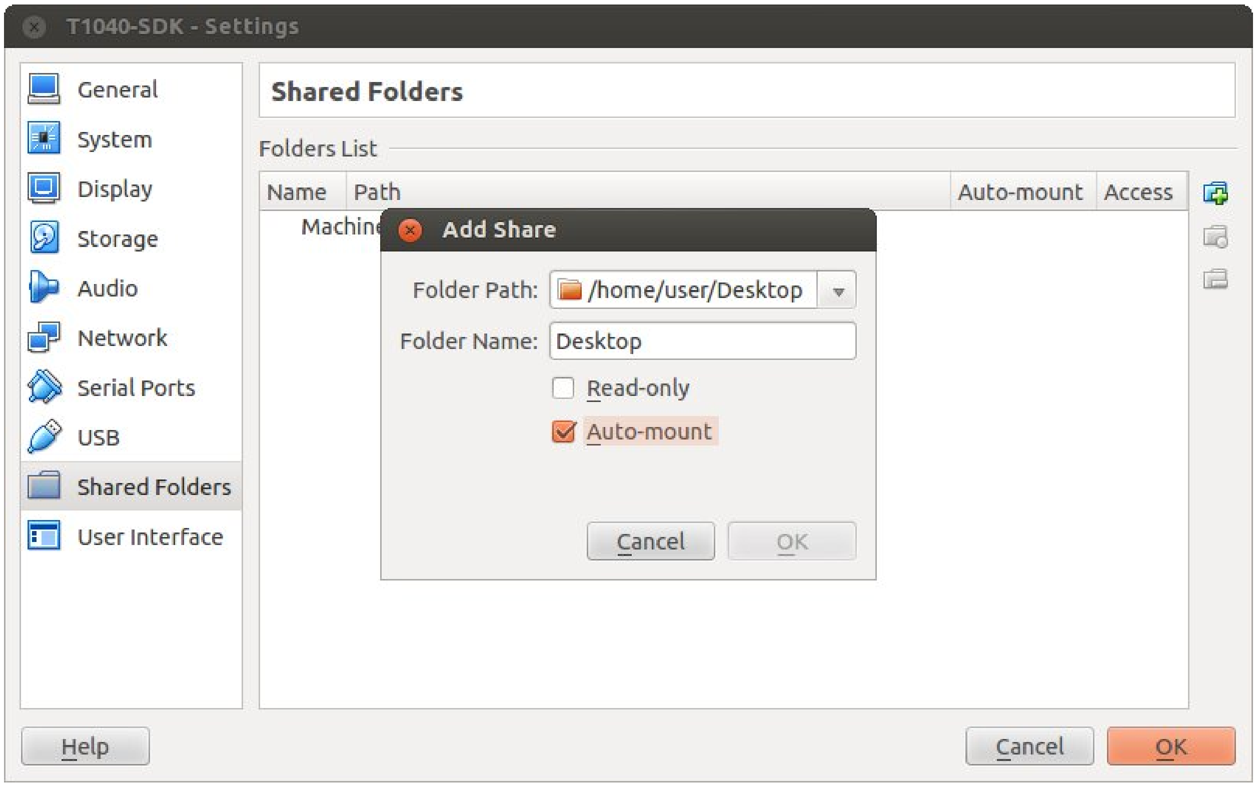
System

Processor(s): 2

Execution Cap: 100%

Extended Features: ✓ Enable PAE/NX

Click on **Shared Folders** and select a folder to share with your host operating system. Make sure that **Auto-mount** check-box is checked.



Shared Folders

Folder Path: /home/user/Desktop

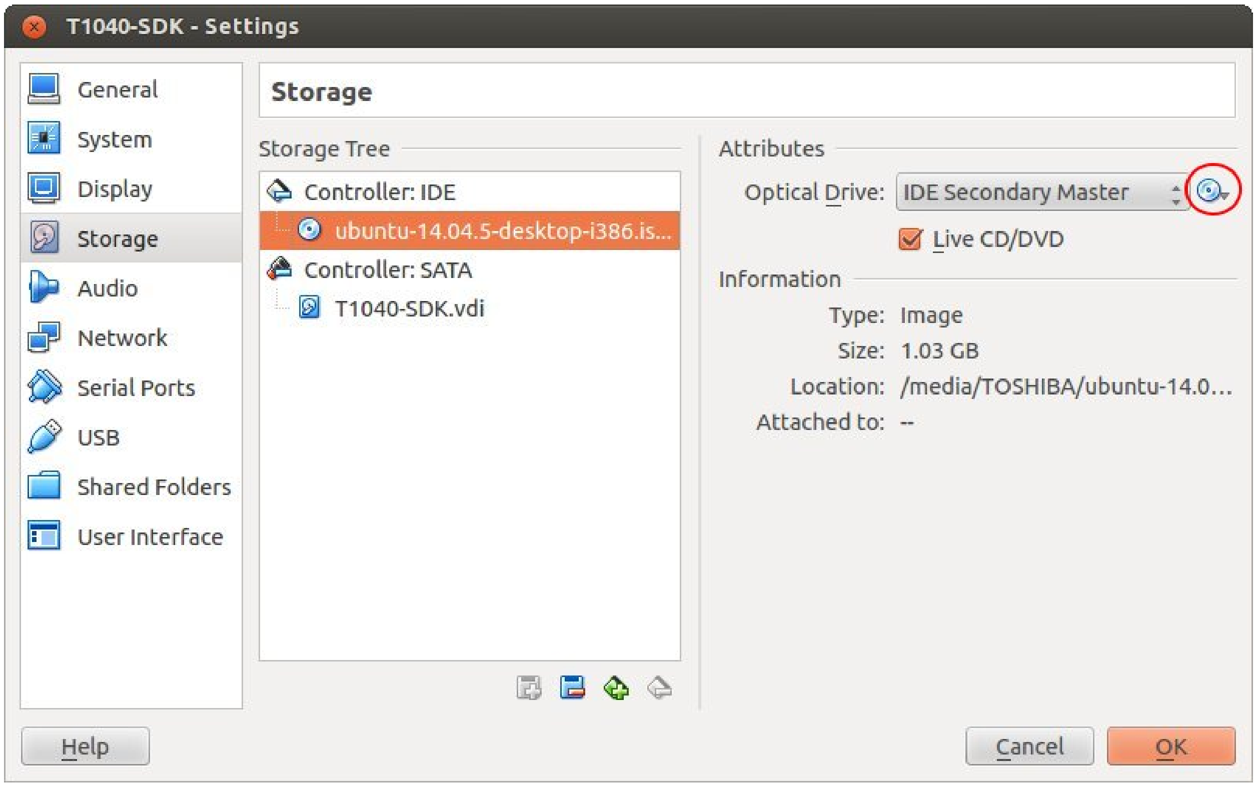
Folder Name: Desktop

☐ Read-only

✓ Auto-mount

Install Ubuntu 14.04 32bit

Download the ISO from Ubuntu website. After the download, in the settings select **Storage** then click on the CD icon named **Empty**, click on the CD icon on the right and choose the Ubuntu iso image **ubuntu-14.04.5-desktop-i386.iso** via **Choose a virtual optical disk file** option.


T1040-SDK - Settings

General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
User Interface

Storage

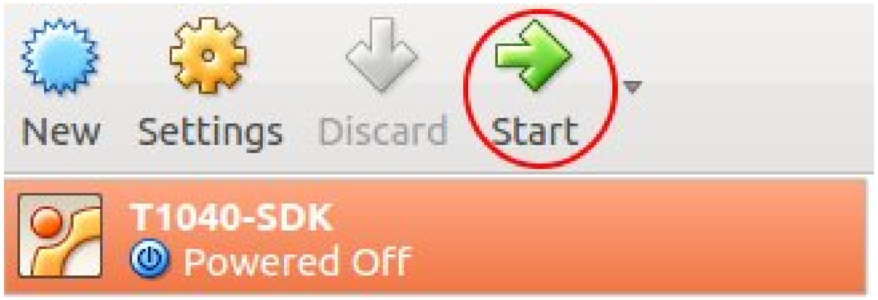
Storage Tree
Controller: IDE
ubuntu-14.04.5-desktop-i386.is...
Controller: SATA
T1040-SDK.vdi

Attributes
Optical Drive: IDE Secondary Master
Live CD/DVD

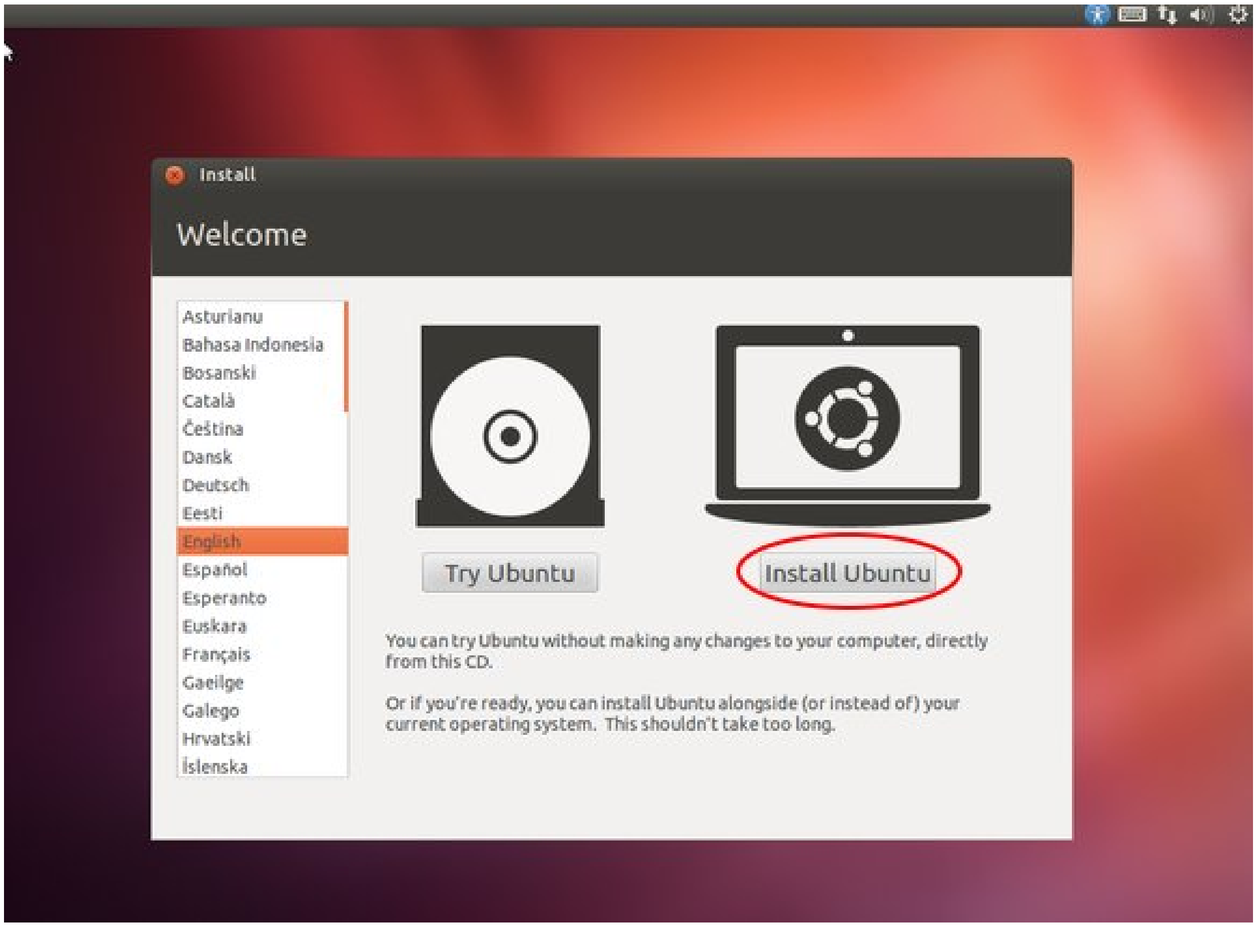
Information
Type: Image
Size: 1.03 GB
Location: /media/TOSHIBA/ubuntu-14.0...
Attached to: --

Help
Cancel
OK

Click on **Ok** button. Then start the virtual machine:



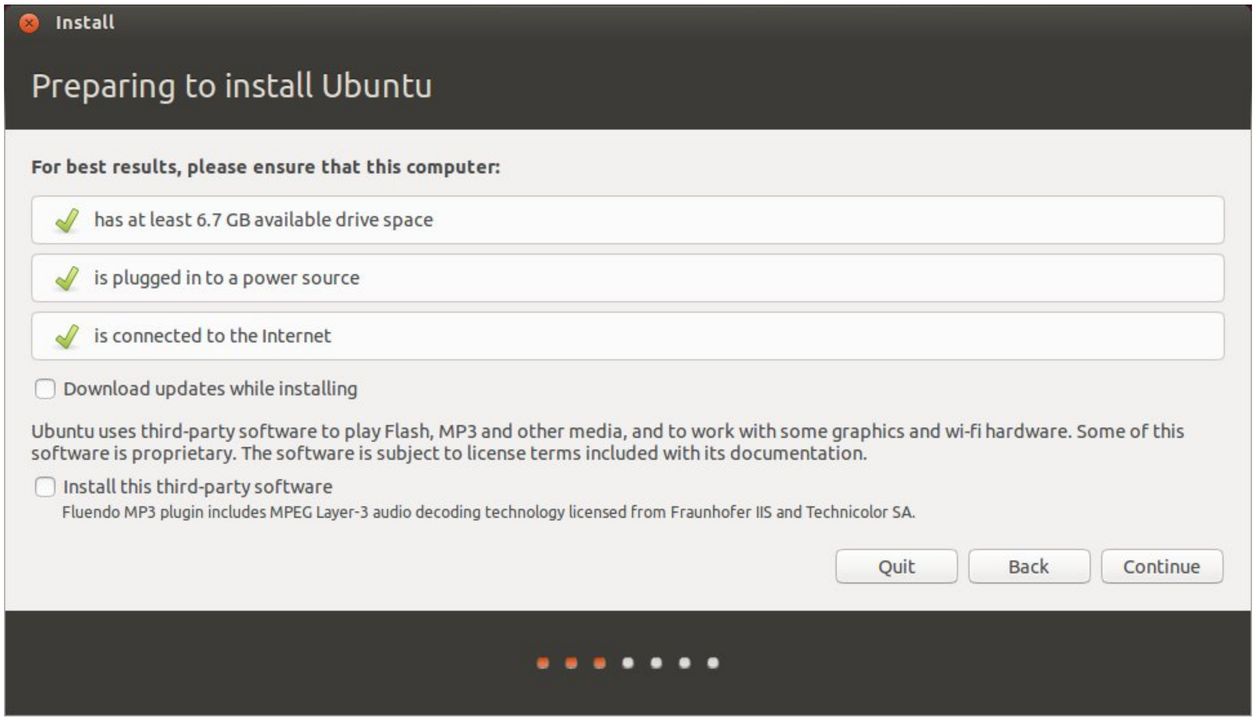
When you are running Ubuntu Live System with Installation Wizard, choose your language and click “Install Ubuntu” button.



You can try Ubuntu without making any changes to your computer, directly from this CD.

Or if you're ready, you can install Ubuntu alongside (or instead of) your current operating system. This shouldn't take too long.

Skip “Downloads update while installing” and “install this third-part software” and click on **continue** button.



For best results, please ensure that this computer:

- ✓ has at least 6.7 GB available drive space
- ✓ is plugged in to a power source
- ✓ is connected to the Internet

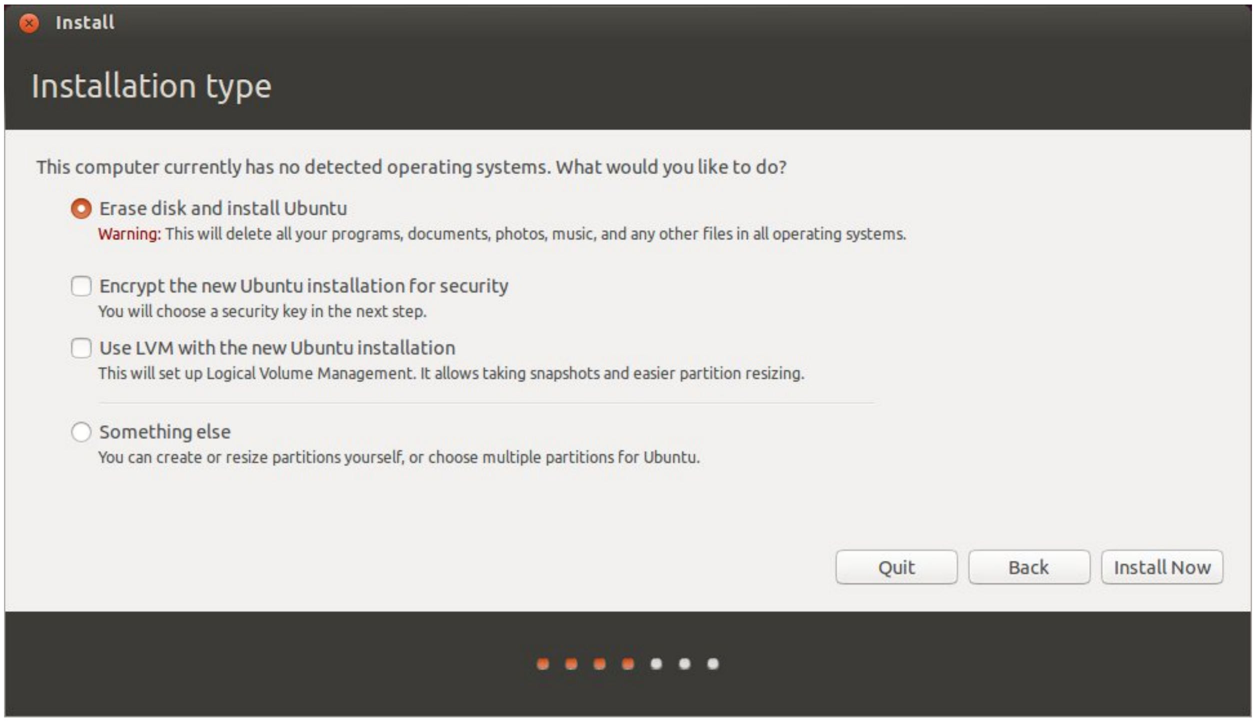
☐ Download updates while installing

Ubuntu uses third-party software to play Flash, MP3 and other media, and to work with some graphics and wi-fi hardware. Some of this software is proprietary. The software is subject to license terms included with its documentation.

☐ Install this third-party software

Fluendo MP3 plugin includes MPEG Layer-3 audio decoding technology licensed from Fraunhofer IIS and Technicolor SA.

Select **Erase disk and install Ubuntu** and click on **Install Now**


Install

Installation type

This computer currently has no detected operating systems. What would you like to do?

[✓ Erase disk and install Ubuntu]
Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems.

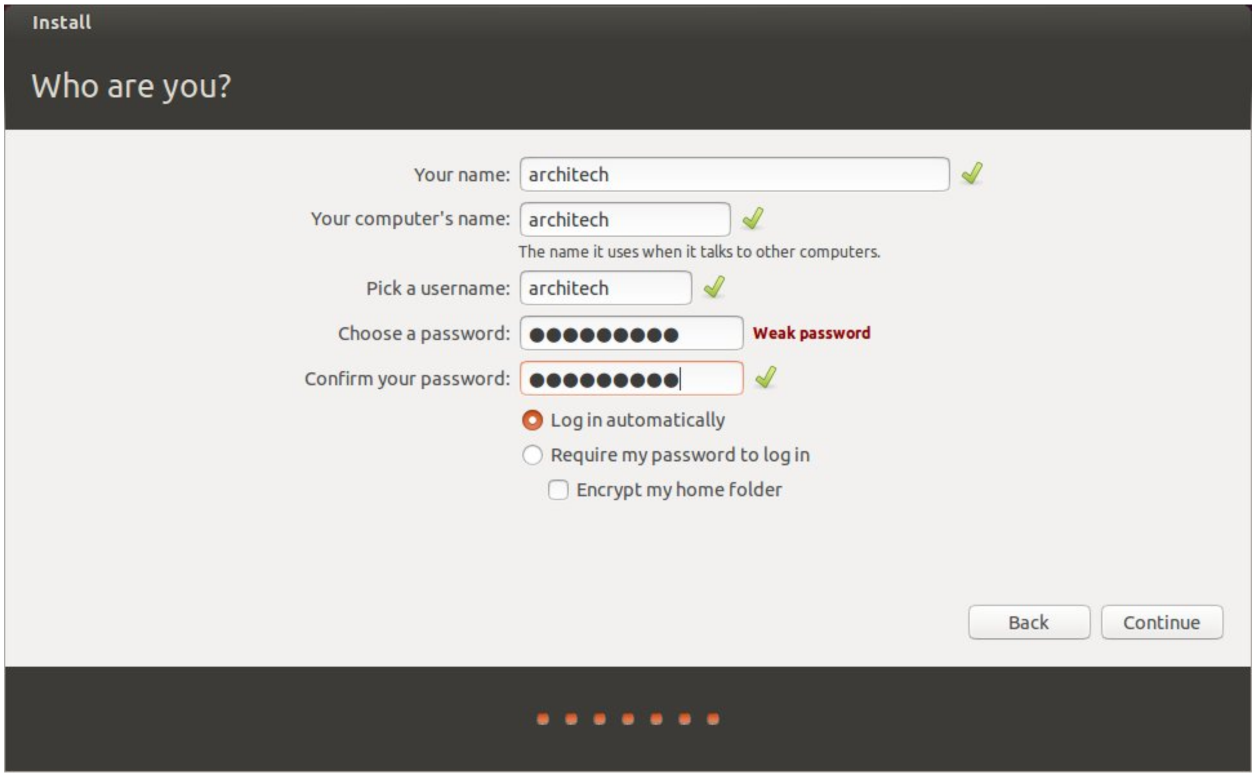
☐ Encrypt the new Ubuntu installation for security
You will choose a security key in the next step.

☐ Use LVM with the new Ubuntu installation
This will set up Logical Volume Management. It allows taking snapshots and easier partition resizing.

○ Something else
You can create or resize partitions yourself, or choose multiple partitions for Ubuntu.

Continue the installation confirming your chose and set your time zone. After the selecting keyboard window you will have to insert **User Name** and **Password**. We have used these data:

- user: **architech**
- computer's name: **architech**
- password: **architech**
- log in automatically checked


Install

Who are you?

Your name: architech

Your computer's name: architech

The name it uses when it talks to other computers.

Pick a username: architech

Choose a password: ●●●●●●●●● Weak password

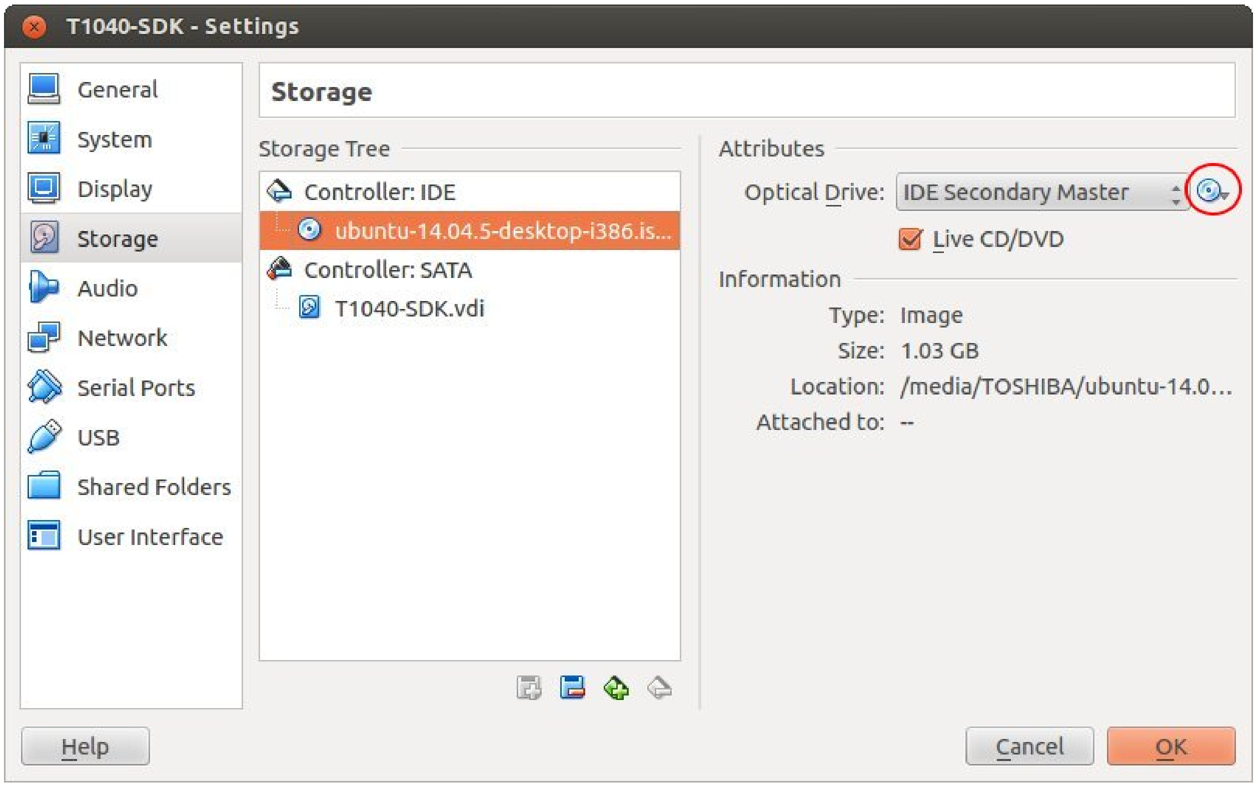
Confirm your password: ●●●●●●●●●

[✓ Log in automatically]

Require my password to log in

Encrypt my home folder

Press continue and wait the end of the installation. Remember to remove the virtual CD, you have to open the setting window of the T1040-SDK machine and **remove the storage from the CD** icon marked in red.


T1040-SDK - Settings

Storage

Storage Tree

Controller: IDE

ubuntu-14.04.5-desktop-i386.is...

Controller: SATA

T1040-SDK.vdi

Attributes

Optical Drive: IDE Secondary Master

[✓ Live CD/DVD]

Information

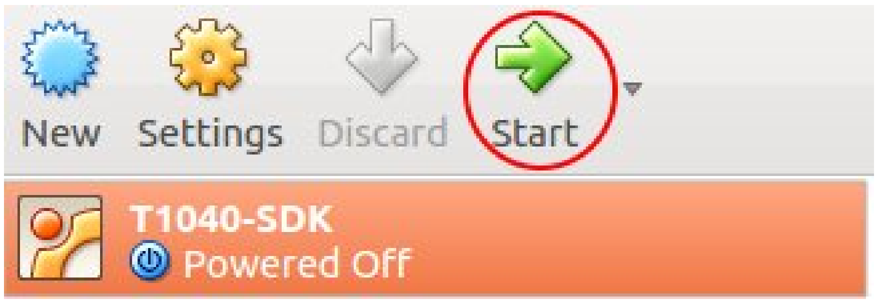
Type: Image

Size: 1.03 GB

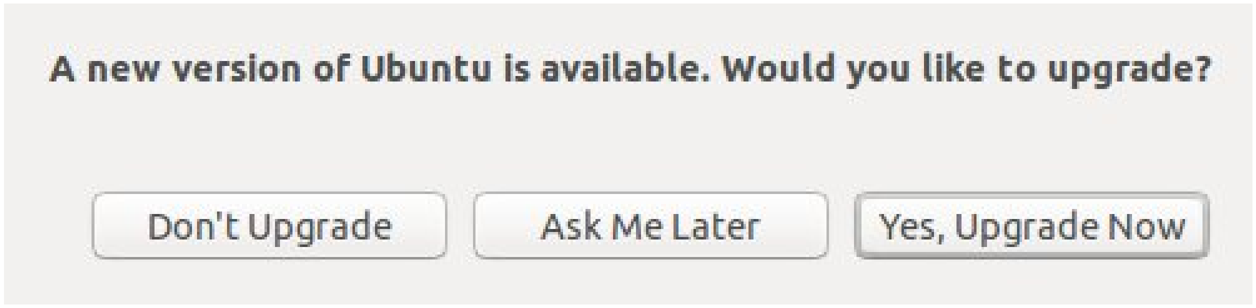
Location: /media/TOSHIBA/ubuntu-14.0...

Attached to: --

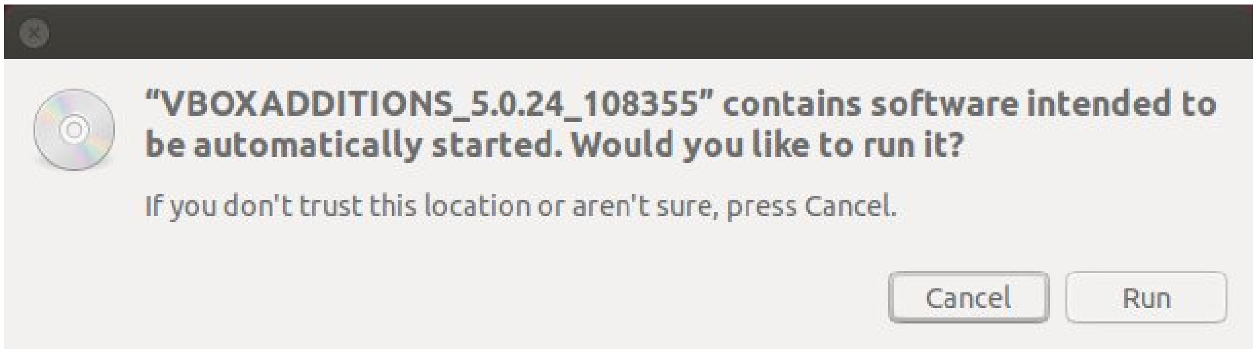
Once the virtual machine is ready, start the virtual machine



If a window will appear asking to upgrade Ubuntu, select **Don't Upgrade**.


A new version of Ubuntu is available. Would you like to upgrade?

Before to start the installation of the SDK it is better install the Guest Addition, click on **Devices** -> **Insert Guest Additions CD image...**


"VBOXADDITIONS_5.0.24_108355" contains software intended to be automatically started. Would you like to run it?

If you don't trust this location or aren't sure, press Cancel.

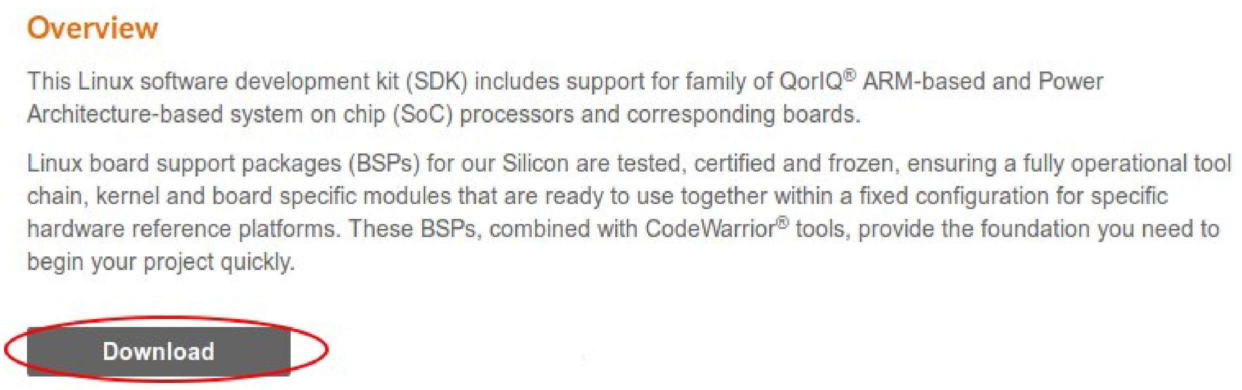
Click on **Run** button and install the addons. It is required the password for root privilege, in our example is **architech**. Now open a terminal and use this command

```
sudo adduser architech vboxsf
```

where **architech** is your username. Reboot the virtual machine.

Download SDK 1.7

The next step is to install the **Linux® SDK for QorIQ® Processors of NXP**. After the registration on their website you can download the SDK from this page. Clicking on **Download** button.

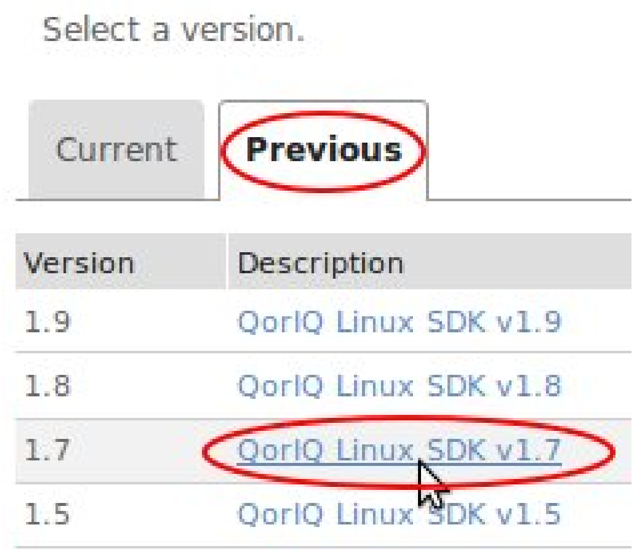


Overview

This Linux software development kit (SDK) includes support for family of QorIQ® ARM-based and Power Architecture-based system on chip (SoC) processors and corresponding boards.

Linux board support packages (BSPs) for our Silicon are tested, certified and frozen, ensuring a fully operational tool chain, kernel and board specific modules that are ready to use together within a fixed configuration for specific hardware reference platforms. These BSPs, combined with CodeWarrior® tools, provide the foundation you need to begin your project quickly.

Then you have to click on **previous** tab and on **QorIQ Linux SDK v1.7** link. We are using a previous version because the newest version doesn't support the **T1040RDB** board anymore.



Select a version.

Version	Description
1.9	QorIQ Linux SDK v1.9
1.8	QorIQ Linux SDK v1.8
1.7	QorIQ Linux SDK v1.7
1.5	QorIQ Linux SDK v1.5

There will be shown you a list of images, you have to download the file **Source: QorIQ Linux SDK V1.7 Yocto Source ISO**, size 3.1GB. The other links are binary files, these are useless for us because we will build the Linux distribution by ourself.

If you have downloaded the ISO file without the Virtual Machine then use the shared folder created previously in order to import the file.

Installation

Following these steps you will install the SDK in short time:

1. Open a terminal and move into the directory where there is the ISO image file, then use these commands:

```
mkdir iso
sudo mount -o loop "QorIQ Linux SDK V1.7 Yocto Source ISO.iso" iso
```

Note: In this iso there is the **START_HERE.html** file, this is the **official SDK** guide. Use this guide to go further in details about the SDK and its features.

2. Configure **/etc/sudoers** file:

```
sudo visudo
```

add the following line in the **User Privilege** section:

```
architech ALL = NOPASSWD: /usr/bin/apt-get
```

3. Install the SDK using all the deault options

```
cd iso
./install
```

Accept the terms pressing **q** key and confirming writing **yes**, then press **enter** key. Installation path in this example is **/home/architech/**. This procedure will require some hours.

```
cd ~/QorIQ-SDK-V1.7-20141218-yocto
./poky/scripts/host-prepare.sh
source ./poky/fsl-setup-poky -m t1040rdb-64b -j 4
```

The option **-j 4** is used to tell Bitbake how many tasks can be executed at the same time. These are related to the number of processors of your (virtual) machine, and should be set with a number that is two times the number of processors on your (virtual) machine. If for example, your (virtual) machine has/sees 2 cores, then you should set those variables with the number **4**.

Now you have the Yocto installed and ready to build a Linux distribution. Every time you will want build a Linux distribution using Yocto you will have to open a terminal and enter the following commands:

```
cd ~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/
source ./SOURCE_THIS
```

In this way you will have the build environment ready. Finally Remember to unmount the image with the command:

```
sudo umount <PATH_TO_THE_ISO>/iso
```

Build Linux Distribution

Supposing you are using a terminal and you are in the *~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/* directory with the Yocto environment ready to build, you can choose which Linux distribution you want compile. The possibility are:

- **fsl-image-minimal**: contains basic packages to boot up a board
- **fsl-image-core**: contains common open source packages and FSL specific packages.
- **fsl-image-full**: contains all packages in the full package list.
- **fsl-image-flash**: contains all the user space apps needed to deploy the fsl-image-full image to a USB stick, hard drive, or other large physical media.
- **fsl-image-virt**: contains toolkit to interact with the virtualization capabilities of Linux
- **fsl-image-x11**: freescale image with a very basic X11 image with a terminal

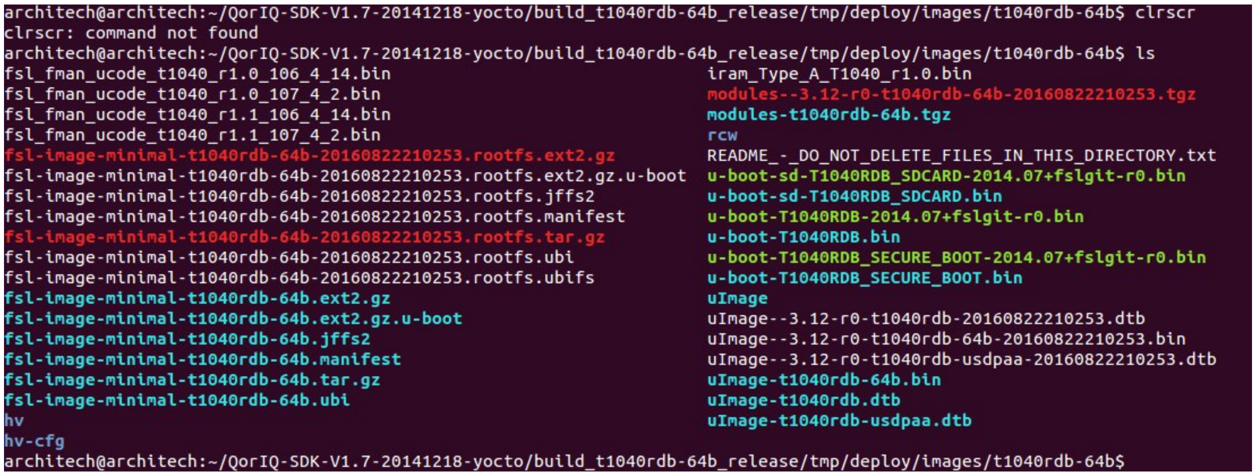
In our guide we have built the **fsl-image-minimal**. This distribution is very minimal and it is used just to have a system running with essential services. It does not contain Freescale special SDK packages such as USDPAA, etc. So running the next command Yocto will start to download from internet and compile all the packages necessary to create the distribution. For this reason it is mandatory have a internet connection available or the building will fail.

```
bitbake fsl-image-minimal
```

This task will require a lot of time, few hours. If there will be problems, the first thing is to check the internet connection and the space available on the virtual machine.

Flashing the Linux Distribution

When the compiling is finished you have the binary files in the directory *~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b/*, this directory will look like this one:



```
architech@architech:~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b$ clrscr
clrscr: command not found
architech@architech:~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b$ ls
fsl_fman_ucode_t1040_r1.0_106_4_14.bin                                iram_Type_A_T1040_r1.0.bin
fsl_fman_ucode_t1040_r1.0_107_4_2.bin                                 modules--3.12-r0-t1040rdb-64b-20160822210253.tgz
fsl_fman_ucode_t1040_r1.1_106_4_14.bin                                modules-t1040rdb-64b.tgz
fsl_fman_ucode_t1040_r1.1_107_4_2.bin                                 rcw
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.ext2.gz          README_-_DO_NOT_DELETE_FILES_IN_THIS_DIRECTORY.txt
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.ext2.gz.u-boot   u-boot-sd-T1040RDB_SDCARD-2014.07+fslgit-r0.bin
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.jffs2            u-boot-sd-T1040RDB_SDCARD.bin
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.manifest         u-boot-T1040RDB-2014.07+fslgit-r0.bin
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.tar.gz           u-boot-T1040RDB.bin
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.ubi              u-boot-T1040RDB_SECURE_BOOT-2014.07+fslgit-r0.bin
fsl-image-minimal-t1040rdb-64b-20160822210253.rootfs.ubifs            u-boot-T1040RDB_SECURE_BOOT.bin
fsl-image-minimal-t1040rdb-64b.ext2.gz                                uImage
fsl-image-minimal-t1040rdb-64b.ext2.gz.u-boot                         uImage--3.12-r0-t1040rdb-20160822210253.dtb
fsl-image-minimal-t1040rdb-64b.jffs2                                  uImage--3.12-r0-t1040rdb-64b-20160822210253.bin
fsl-image-minimal-t1040rdb-64b.manifest                               uImage--3.12-r0-t1040rdb-usdpaa-20160822210253.dtb
fsl-image-minimal-t1040rdb-64b.tar.gz                                 uImage-t1040rdb-64b.bin
fsl-image-minimal-t1040rdb-64b.ubi                                    uImage-t1040rdb.dtb
hv                                                                    uImage-t1040rdb-usdpaa.dtb
hv-cfg
architech@architech:~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b$
```

In this directory these files corrispond to:

- the **bootloader** named **u-boot**
- the **microcode binaries** named **fsl_fman_ucode**
- the **Reset Configuration Word** named **rcw_1400MHz**, you can find them in rcw/RR_P_66 folder.
- the **Linux kernel** named **uImage**
- the **Device Tree** named **uImage-t1040rdb.dtb**
- the **root file system** named **fsl-image-minimal-t1040rdb-64b**

Now we have to upload these files into the NOR flash. The easy way to do this is running the bootloader **u-boot** pre-installed on the T1040RDB and using a TFTP server on the host machine permitting to the u-boot to download the files and upload them into the NOR flash.

Installing the TFTP server

In the virtual machine install following packages:

```
sudo apt-get install xinetd tftpd tftp
```

Create /etc/xinetd.d/tftp file

```
sudo nano /etc/xinetd.d/tftp
```

and put this entry:

```
service tftp
{
protocol        = udp
port            = 69
socket_type     = dgram
wait            = yes
user            = nobody
server          = /usr/sbin/in.tftpd
server_args     = /home/<ENTER YOUR HOME NAME>/QorIQ-SDK-V1.7-20141218-yocto/build_
↪t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b
disable         = no
}
```

and change the properties of the **t1040rdb-64b** directory. **<ENTER YOUR HOME NAME>** in our example is **architech**.

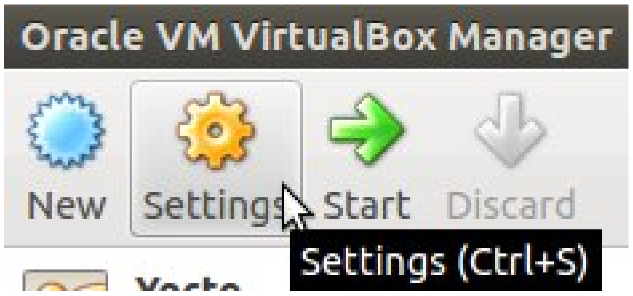
```
sudo chmod -R 777 /home/<ENTER YOUR HOME NAME>/QorIQ-SDK-V1.7-20141218-yocto/build_
↪t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b
sudo chown -R nobody /home/<ENTER YOUR HOME NAME>/QorIQ-SDK-V1.7-20141218-yocto/build_
↪t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b
```

Restart the xinetd service.

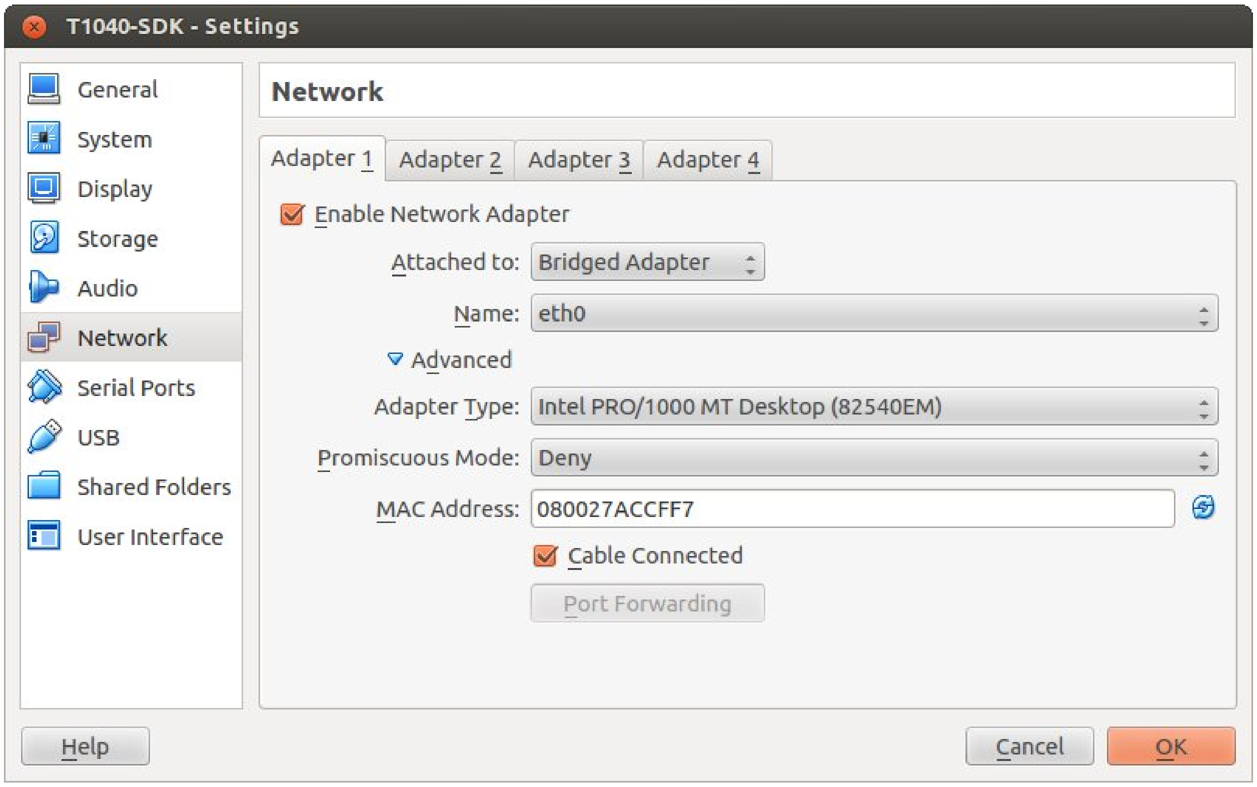
```
sudo /etc/init.d/xinetd restart
```

You must allow udp port 69 in firewall.

We need change the configuration for the network from the setting of the virtual machine, shut down Ubuntu and click on settings button:



Go in the network settings and change the connection to: **Bridged Adapter**



☑ Enable Network Adapter

Attached to: Bridged Adapter

Name: eth0

Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

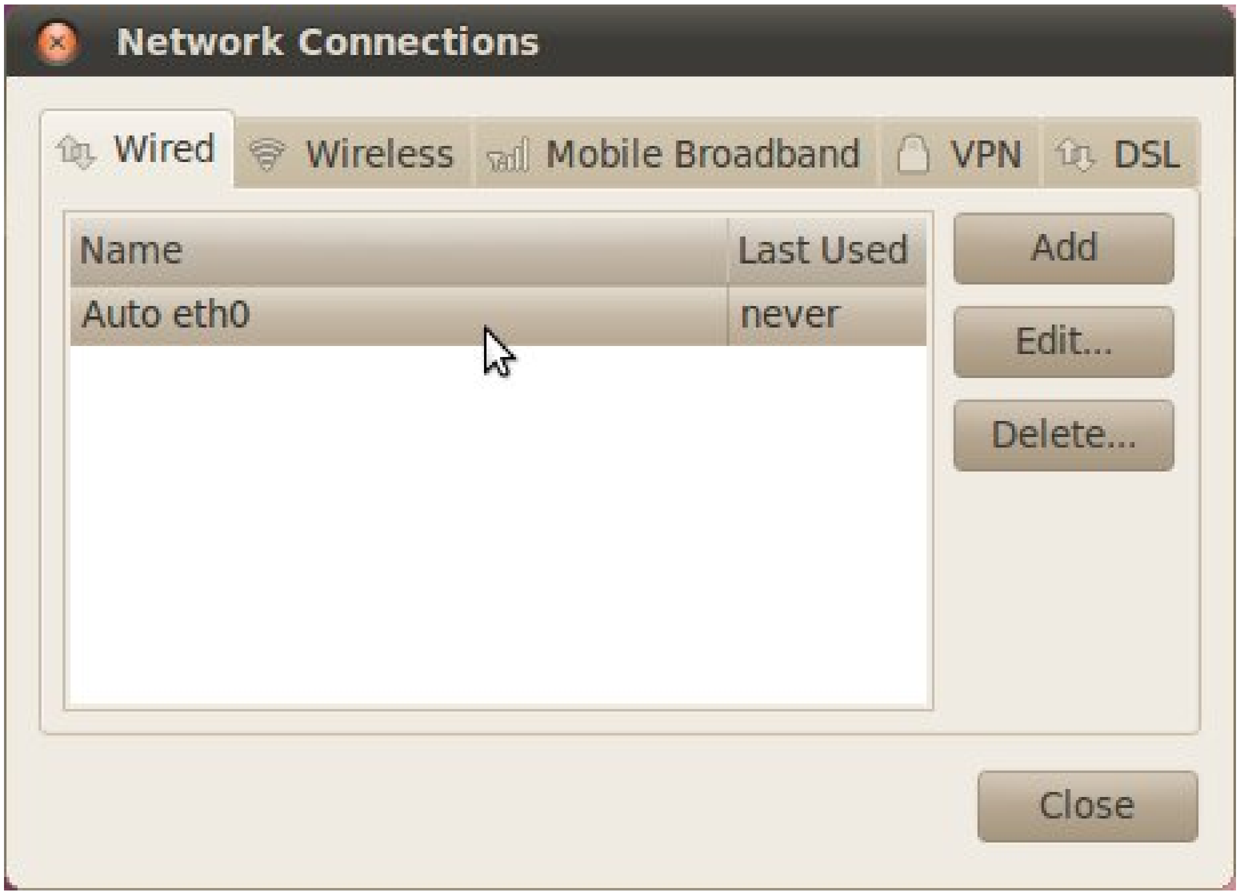
Promiscuous Mode: Deny

MAC Address: 080027ACCFF7

☑ Cable Connected

Turn on the vitual machine and an important thing to do is to set the IP address of the virtual machine as static. To do this follow the next steps inside the virtual machine:

1. Right-click on network connection icon. Select *Edit Connections...*.
2. In *Wired* tab, select *Auto eth0* and press *Edit...* button.



3. Click to *IPv4 Settings*, click on *Add* button and insert the following address:

- *Address*: 192.168.2.1
- *Netmask*: 255.255.255.0

Leave *Gateway* empty.

4. Click on Apply.

Warning: this setting make your virtual machine not connected to the internet, so if you want rebuild another image from yocto you have to reset the network settings as before the change.

Flash the NOR

Reading from the official SDK guide, the NOR flash on the board can be seen as two flash banks. The board DIP switch configuration (for T1040RDB, SW3[5:7]) preselects bank 0 as the hardware default bank.

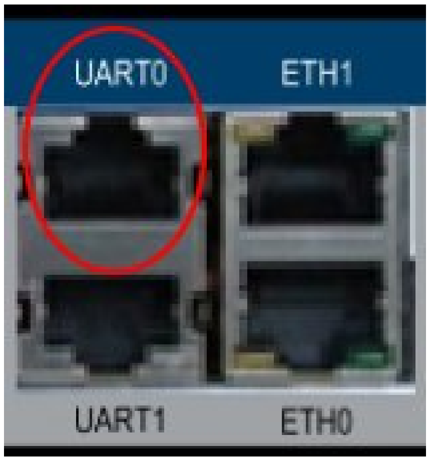
To protect the default U-Boot in bank 0, it is a convention employed by Freescale to deploy work images into the alternate bank, and then switch to the alternate bank for testing. Switching to the alternate bank can be done in software and effectively swaps the first bank with the second bank, thereby putting the alternate bank in the bank 0 address range until further configuration or until a reset occurs. This protects banks 0 and keeps the board bootable under all circumstances.

So we will boot the system from the bank 0 but we will write our files into the **bank 4**. In this way if something goes wrong we have the bank 0 with a bootable system. The area of the flash memory where we put our compiled file are the following:

Range Start	Range End	Definition	Size
0xebf40000	0xebffffff	U-Boot (alternate bank)	768 KB
0xec800000	0xec8fffff	Hardware device tree (alternate bank)	1 MB
0xec000000	0xec01ffff	RCW (alternate bank)	128 KB
0xebf00000	0xebf0ffff	FMAN Ucode (alternate bank)	64 KB
0xec800000	0xec8fffff	Hardware device tree (alternate bank)	1 MB
0xec020000	0xec7fffff	Linux.uImage (alternate bank)	7 MB + 875 MB

Here the steps for upload the files:

1. Connect the UART cable from the T1040RDB **UART0** port and your PC.



Open a terminal and launch **minicom**

```
sudo minicom -ws
```

If minicom is not installed, you can install it with:

```
sudo apt-get install minicom
```

then you can setup your port with these parameters:

```
+-----------------------------------------------------------------------+
| A -    Serial Device      : /dev/ttyS0                                |
| B - Lockfile Location     : /var/lock                                 |
| C -   Callin Program      :                                           |
| 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                     |
        | Exit from Minicom        |
        +--------------------------+
```

If on your system the device has not been recognized as **/dev/ttyS0**, just replace **/dev/ttyXXX** with the proper device.

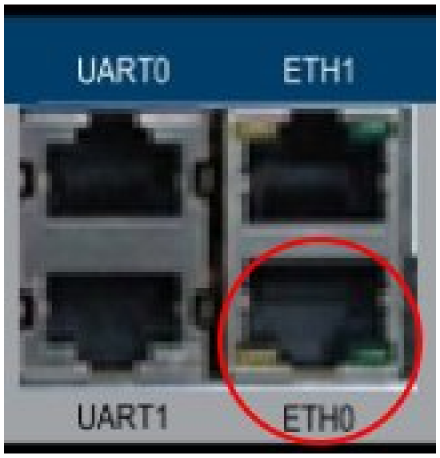
Once you are done configuring the serial port, you are back to *minicom* main menu and you can select *exit*.

2. Power on the board and press a key in order to enter in the command line of the u-boot before the countdown goes to zero.

```
U-Boot 2014.01-00004-g6cefa6e (Aug 28 2014 - 14:16:01)

CPU0:  T1040E, Version: 1.1, (0x85280011)
Core:  e5500, Version: 2.1, (0x80241021)
Clock Configuration:
       CPU0:1400 MHz, CPU1:1400 MHz, CPU2:1400 MHz, CPU3:1400 MHz,
       CCB:600  MHz,
       DDR:800  MHz (1600 MT/s data rate) (Asynchronous), IFC:150  MHz
       QE:300  MHz
       FMAN1: 600 MHz
       QMAN:  300 MHz
       PME:   300 MHz
L1:    D-cache 32 KiB enabled
       I-cache 32 KiB enabled
Reset Configuration Word (RCW):
       00000000: 0c18000e 0e000000 00000000 00000000
       00000010: 66000002 80000002 ec027000 01000000
       00000020: 00000000 00000000 00000000 00032810
       00000030: 00000000 0342500f 00000000 00000000
Board: T1040RDB
Board rev: 0x01 CPLD ver: 0x06, vBank: 0
... more booting messages ...
Hit any key to stop autoboot:  0
=>
```

3. Connect the ethernet cable from the board to the PC.



Check ethernet connection, by default the u-boots sets its IP to **192.168.2.105** and the server **192.168.2.1**. Try to ping from the board to the PC:

```
=> ping 192.168.2.1
Using FM1@DTSEC4 device
host 192.168.2.1 is alive
```

If all is ok the response will be **is alive** otherwise try to check the firewall on your PC.

4. Upload the **U-BOOT**:

```
tftp 0x1000000 u-boot-T1040RDB.bin
protect off 0xebf40000 +$filesize
erase 0xebf40000 +$filesize
cp.b 0x1000000 0xebf40000 $filesize
protect on 0xebf40000 +$filesize
```

5. Upload the **RCW**:

```
tftp 0x1000000 rcw/RR_P_66/rcw_1400MHz.bin
protect off 0xec000000 +$filesize
erase 0xec000000 +$filesize
cp.b 0x1000000 0xec000000 $filesize
protect on 0xec000000 +$filesize
```

6. Upload the microcode **FMAN**. The file to choose depends on the version type of the T1040 processor. From the official guide you can read: There are microcode binaries for the Frame Manager hardware block that is in QorIQ products. Specific platforms require specific binaries, and those also have to match specific software versions (i.e., match Frame Manager Driver version). See the U-Boot log for T1040 version information (e.g., T1040E version 1.0) and also for the version of FMan microcode currently flashed on the T1040RDB (e.g. microcode version 106.4.14). For QorIQ SDK 1.7, one of the following FMan microcode binaries should be used:

For silicon revision 1.0:

```
fsl_fman_ucode_t1040_r1.0_106_4_14.bin
fsl_fman_ucode_t1040_r1.0_107_4_2.bin
```

For silicon revision 1.1:

```
fsl_fman_ucode_t1040_r1.1_106_4_14.bin
fsl_fman_ucode_t1040_r1.1_107_4_2.bin
```

So, seeing on the u-boot you can see directly which version is loaded in the NOR. In our case it was:

```
...
Firmware 'Microcode version 0.0.1 for T1040 r1.0' for 1040 V1.0
...
Fman1: Uploading microcode version 106.4.14
```

In this case (r1.0, 106.4.14) the commands will be:

```
tftp 0x1000000 fsl_fman_ucode_t1040_r1.0_106_4_14.bin
protect off 0xEBF00000 +$filesize
erase 0xEBF00000 +$filesize
cp.b 0x1000000 0xEBF00000 $filesize
protect on 0xEBF00000 +$filesize
```

7. We don't upload in the NOR the Linux kernel, device tree and the root filesystem because if we will build another distribution we will be free to change it without using the flash memory. So the idea is download them from the TFTP server into the RAM and launch them directly from there. The first thing to do now is reboot the T1040RDB using the bank 4. To do this is necessary launch this command from the u-boot:

```
cpld reset altbank
```

Then we will upload the file necessary and set a boot variable:

```
setenv bootargs "root=/dev/ram rw console=ttyS0,115200 ramdisk_size=700000"
tftp 0x1000000 uImage-t1040rdb-64b.bin
tftp 0x2000000 fsl-image-minimal-t1040rdb-64b.ext2.gz.u-boot
tftp 0x3000000 uImage-t1040rdb.dtb
```

As you can see the correct roof file system is with the postfix **.ext2.gz.u-boot**. With the next command you will launch the Linux Operating System:

```
bootm 0x1000000 0x2000000 0x3000000
```

The boot of the kernel will show you a screen like this one:

```
=> bootm 0x1000000 0x2000000 0x3000000
## Booting kernel from Legacy Image at 01000000 ...
  Image Name:   Linux-3.12.19-rt30-QorIQ-SDK-V1.
  Image Type:   PowerPC Linux Kernel Image (gzip compressed)
  Data Size:    5123563 Bytes = 4.9 MiB
  Load Address: 00000000
  Entry Point:  00000000
  Verifying Checksum ... OK
## Loading init Ramdisk from Legacy Image at 02000000 ...
  Image Name:   fsl-image-minimal-t1040rdb-64b-2
 Image Type:   PowerPC Linux RAMDisk Image (gzip compressed)
   Data Size:    3312699 Bytes = 3.2 MiB
  Load Address: 00000000
  Entry Point:  00000000
  Verifying Checksum ... OK
## Flattened Device Tree blob at 03000000
  Booting using the fdt blob at 0x3000000
  Uncompressing Kernel Image ... OK
  Loading Ramdisk to 2fcd7000, end 2ffffc3b ... OK
  Loading Device Tree to 03fe4000, end 03fffb65 ... OK
Warning: MAC address for l2switch not found
Using CoreNet Generic machine description
MMU: Supported page sizes
        4 KB as direct
     1024 KB as direct
     2048 KB as direct
     4096 KB as direct
    16384 KB as direct
    65536 KB as direct
   262144 KB as direct
  1048576 KB as direct
MMU: Book3E HW tablewalk not supported
Found initrd at 0xc00000002fcd7000:0xc00000002ffffc3b
No /soc@ffe000000/qman@318000 property 'fsl,qman-fqd', using memblock_
↪alloc(0000000000400000)
No /soc@ffe000000/qman@318000 property 'fsl,qman-pfdr', using memblock_
↪alloc(0000000002000000)
Qman ver:0a01,03,01,03
No /soc@ffe000000/bman@31a000 property 'fsl,bman-fbpr', using memblock_
↪alloc(0000000001000000)
Bman ver:0a02,02,01
pme: No /soc@ffe000000/pme@316000 property 'fsl,pme-pdsr', using memblock_
↪alloc(0x0000000001000000)
pme: No /soc@ffe000000/pme@316000 property 'fsl,pme-sre', using memblock_
↪alloc(0x0000000000a00000)
No USDPAA memory, no 'usdpaa_mem' bootarg
```

```
bootconsole [udbg0] enabled
CPU maps initialized for 1 thread per core
Starting Linux PPC64 #1 SMP Mon Aug 22 23:43:34 BST 2016
-----------------------------------------------------
ppc64_pft_size                = 0x0
physicalMemorySize            = 0x80000000
ppc64_caches.dcache_line_size = 0x40
ppc64_caches.icache_line_size = 0x40
-----------------------------------------------------
 <- setup_system()
Linux version 3.12.19-rt30-QorIQ-SDK-V1.7+g6619b8b (architech@architech) (gcc version␣
↪4.8.1 (GCC) ) #1 SMP Mon Aug 22 23:43:34 BST 2016
...
...
Poky (Yocto Project Reference Distro) 1.6.1 t1040rdb /dev/ttyS0
t1040rdb login:
```

The booting process finish with the login **t1040rdb login:**. Enter **root** as username, it is not required any password. Will be showed the shell:

```
root@t1040rdb:~#
```

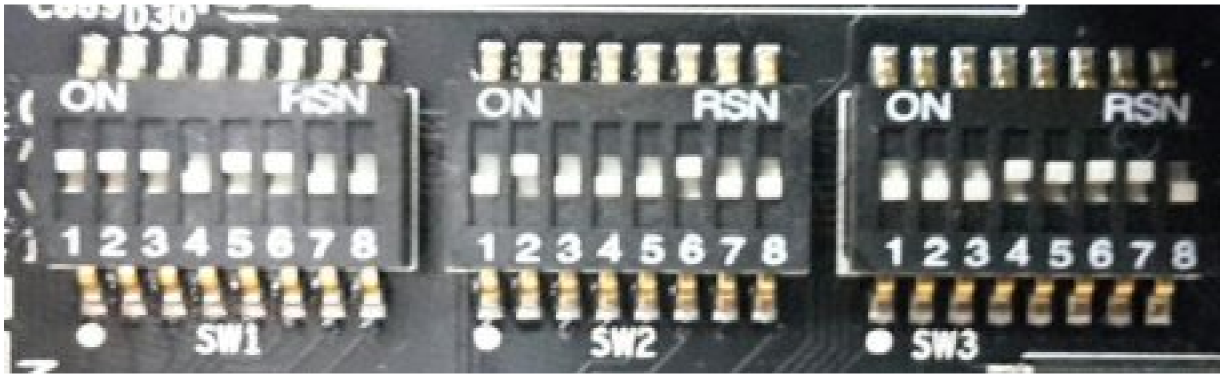
Boot directly with Bank 4

If you want run directly the u-boot from the bank 4 when you turn-on the T1040RDB then you have to change its switch. This is the configuration:

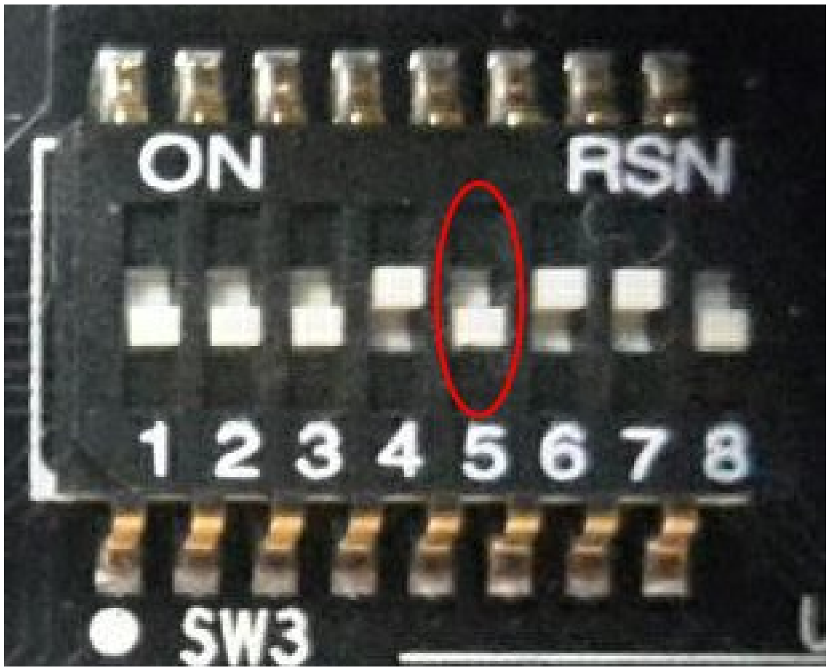
SW3 pin 5 -> OFF, with this set the boot starts from Bank **4**.

Default switches:

	1	2	3	4	5	6	7	8
SW1	ON	ON	ON	OFF	ON	ON	OFF	OFF
SW2	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
SW3	OFF	OFF	OFF	ON	ON	ON	ON	OFF



Changing the **SW3 pin 5**:



At the boot will be showd this screen:

```
U-Boot 2014.01-00004-g6cefa6e (Aug 28 2014 - 14:16:01)

CPU0:  T1040E, Version: 1.1, (0x85280011)
Core:  e5500, Version: 2.1, (0x80241021)
Clock Configuration:
       CPU0:1400 MHz, CPU1:1400 MHz, CPU2:1400 MHz, CPU3:1400 MHz,
       CCB:600  MHz,
       DDR:800  MHz (1600 MT/s data rate) (Asynchronous), IFC:150  MHz
       QE:300  MHz
       FMAN1: 600 MHz
       QMAN:  300 MHz
       PME:   300 MHz
L1:    D-cache 32 KiB enabled
       I-cache 32 KiB enabled
Reset Configuration Word (RCW):
       00000000: 0c18000e 0e000000 00000000 00000000
       00000010: 66000002 80000002 ec027000 01000000
       00000020: 00000000 00000000 00000000 00032810
       00000030: 00000000 0342500f 00000000 00000000
Board: T1040RDB
Board rev: 0x01 CPLD ver: 0x06, vBank: 4
... more booting messages ...
Hit any key to stop autoboot:  0
```

As you can see the booting message “Board rev: 0x01 CPLD ver: 0x06, **vBank: 4**” shows boot from Bank number 4.

Qormino u-boot

Qormino is a new hybrid component that embeds a QorIQ T1040 processor and 1 GB of memory (DDR3L with ECC) on the same substrate. As it contains the DDR bus, that makes the design of a new platform faster. Meanwhile, the DDR controller has to be configured with the Qormino properties, depending on the design and the memory modules as well. In this page you will download the patch file that will allow you to build an u-boot compatible with Qormino board. In order to follow the next steps correctly you have to install the **Linux® SDK 1.7 for QorIQ® Processors of NXP**.

1. Download this patch
2. Unzip the files in **/home/<ENTER YOUR HOME NAME>/QorIQ-SDK-V1.7-20141218-yocto/meta-fsl-ppc/recipes-bsp/u-boot/**

```
tar -zxvf u-boot.tar.gz -C /home/<ENTER YOUR HOME NAME>/QorIQ-SDK-V1.7-20141218-yocto/
↪meta-fsl-ppc/recipes-bsp/u-boot/
```

3. Now you will have in **u-boot** folder these files:

```
u-boot
|
|- u-boot-qoriq_2014.07.bb
|- u-boot-qoriq_%.bbappend
|- files
   |- 0001-Set-DDR-controller-properties-for-QT1040.patch
   |- 0002-boards.patch
```

4. Launch Yocto environment using the commands:

```
cd ~/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/
source ./SOURCE_THIS
```

5. Now you are ready to build the new u-boot version:

```
bitbake virtual/bootloader
```

6. You will find the bootloader in the following path **/home/<ENTER YOUR HOME NAME>/QorIQ-SDK-V1.7-20141218-yocto/build_t1040rdb-64b_release/tmp/deploy/images/t1040rdb-64b**

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