

Moving Your Application on the Raspberry Pi to the UC-8100-LX Computer

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About Moxa

Moxa is a leading manufacturer of industrial networking, computing, and automation solutions. With over 25 years of industry experience, Moxa has connected more than 30 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for automation systems. Information about Moxa’s solutions is available at www.moxa.com. You may also contact Moxa by email at info@moxa.com.

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1 Background

The purpose of this document is to help you migrate your application from the Raspberry Pi to Moxa's UC-8100-LX computer so that you can easily move your application from a prototype to mass production and deployment. We highlight some key differences between the Raspberry Pi and Moxa's UC-8100-LX, including cross-compiler toolchain, peripherals, and system information.

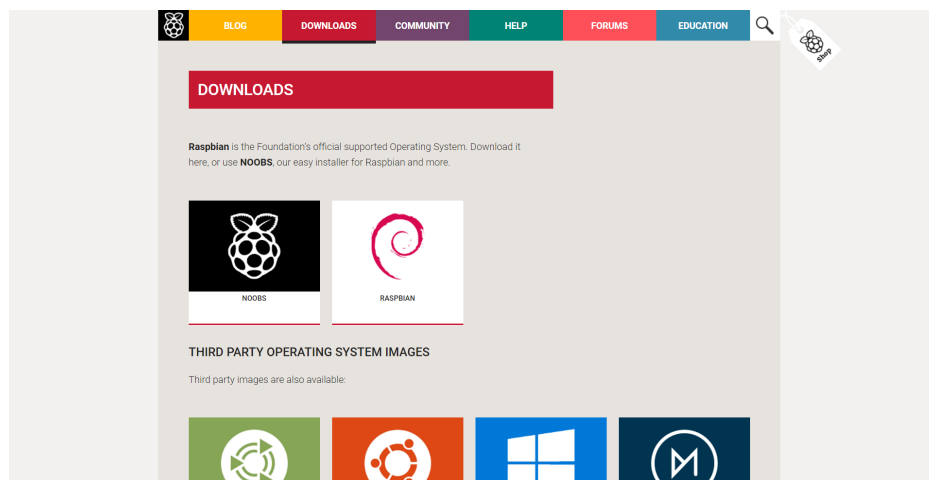
2 Requirement

- UC-8100-LX/ UC-8100-LX-ME
- Raspberry Pi 3 Model B Starter Pack (including 8 GB MicroSD card)

3 Overview

The UC 8100-LX computer comes preinstalled with the Debian Linux distribution, which allows you to share an environment similar to the Raspberry Pi with Raspbian firmware installed.

Figure 1



We highlight a couple of differences between the two platforms to help you migrate your application from the Raspberry Pi to the UC-8100-LX platform based on the following:

- System environment
- Compiler toolchain
- Peripheral device programming

4 System Environment

4.1 Authentication

The default username/password on the Raspberry Pi is `pi/raspberry`, while the UC-8100-LX uses `moxa/moxa`. On the Raspberry Pi, no authentication is required when you switch from the user `pi` to the `root` account. On the contrary, UC-8100-LX requires root account password authentication (which is `moxa`) when you use the `#sudo su` command.

5 Toolchains

Toolchains are utilities that are used to compile source code into executable programs in Linux. In the Linux ARM architectural environment, developers may develop their own programs with native compilers and cross compilers. Native compilers create executables that run only on the same machine/localhost, while cross compilers build programs that work on other machines.

5.1 Native-Compiler Toolchain

The UC-8100-LX comes pre-installed with the Debian distribution of Linux. Like the Raspberry Pi, UC-8100-LX also supports native compilation. To install a native compiler on the Linux ARM platform, you just need to run the following command:

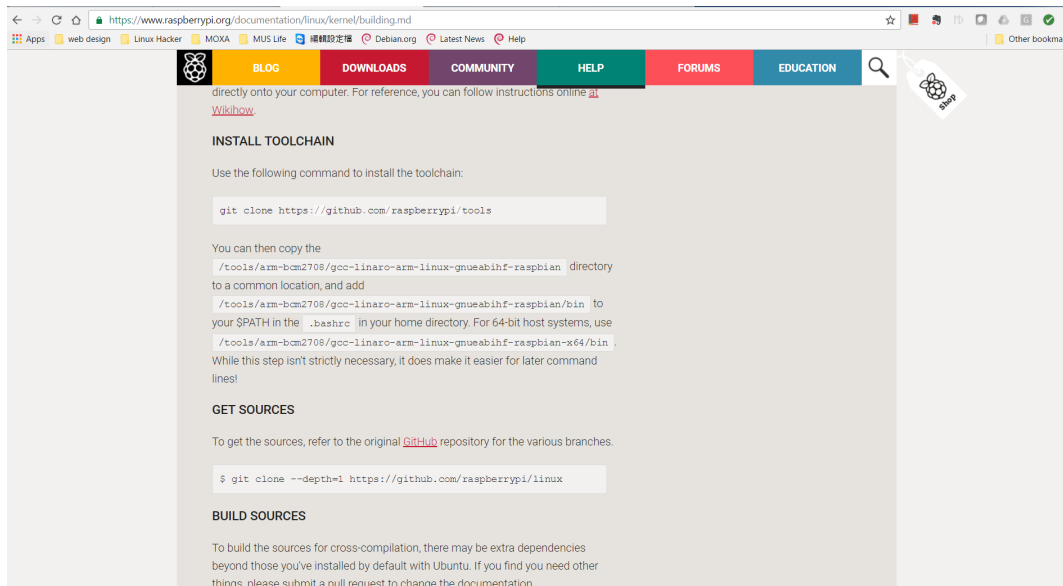
```
apt-get install build-essential
```

5.2 Cross-Compiler Toolchain and Environment Settings

Many users prefer to build ARM environments on x86/x86-64 machines. To be able to do this, they need to install the cross-compiler toolchain. The UC-8100-LX and Raspberry Pi have different naming conventions for the cross-compiler toolchain, but their binaries are compatible.

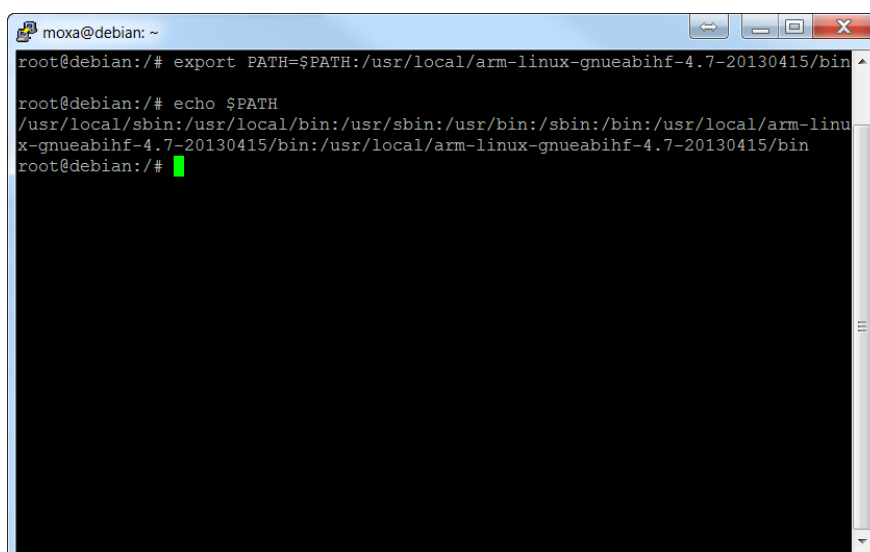
The cross-compiler toolchain for Raspberry Pi can be downloaded from the GitHub server using the **Git** tool to clone the source files (see [Figure 2](#)). For the UC-8100-LX, you can download the toolchain from the Moxa website.

Figure 2



The installation consists of using a shell script to extract the toolchain into the `/usr/local` directory. Once the installation is complete, you need to setup the PATH environment variable for your user account. The naming convention for the PATH variable is different in the two hardware platforms. On the Raspberry Pi, the PATH environment variable is set to `/tools/arm-bcm2708/gcc-linaro-arm-linux-gnueabi-hf-raspbian/bin` and on the UC-8100-LX, it is set to `/usr/local/arm-linux-gnueabi-hf-4.7-20130415/bin`.

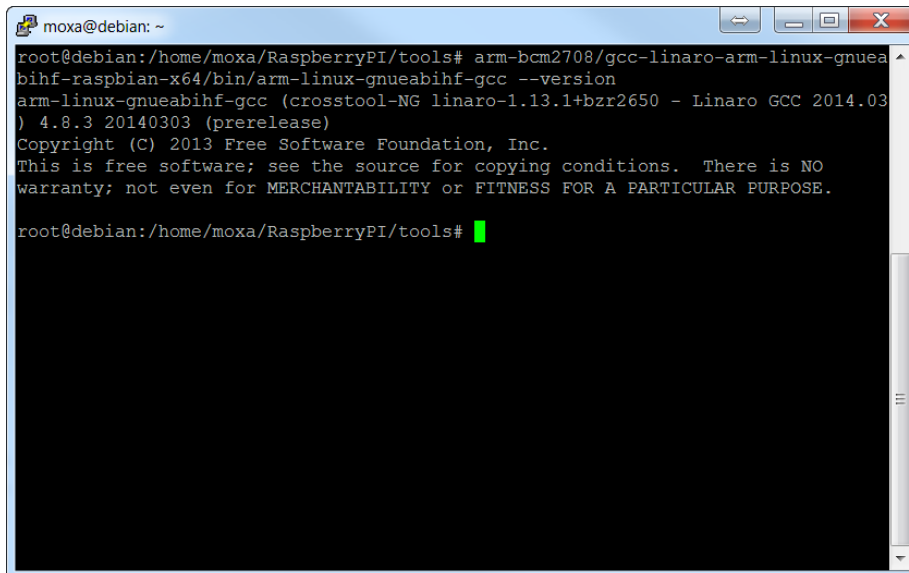
Figure 3



5.3 Cross-Compiler Toolchain Compatibility

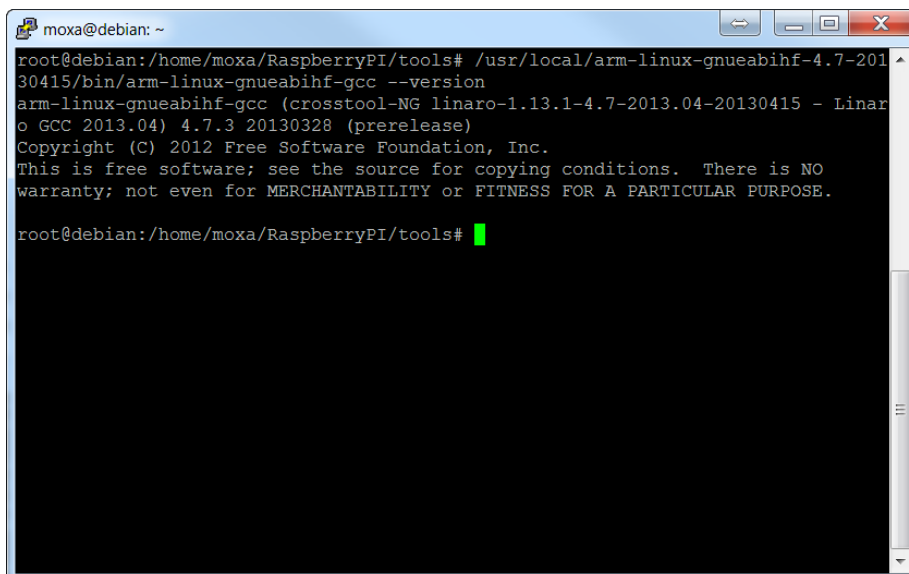
Both the UC-8100-LX and Raspberry Pi platforms share the same cross-compiler binary architecture, which means, the binaries that you run on the Raspberry Pi can be migrated to UC-8100-LX without recompiling the source code.

Figure 4



```
moxa@debian: ~  
root@debian:/home/moxa/RaspberryPI/tools# arm-bcm2708/gcc-linaro-arm-linux-gnueabi-hf-raspbian-x64/bin/arm-linux-gnueabi-hf-gcc --version  
arm-linux-gnueabi-hf-gcc (crosstool-NG linaro-1.13.1+bzr2650 - Linaro GCC 2014.03) 4.8.3 20140303 (prerelease)  
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This is free software; see the source for copying conditions. There is NO warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  
root@debian:/home/moxa/RaspberryPI/tools#
```

Figure 5



```
moxa@debian: ~  
root@debian:/home/moxa/RaspberryPI/tools# /usr/local/arm-linux-gnueabi-hf-4.7-20130415/bin/arm-linux-gnueabi-hf-gcc --version  
arm-linux-gnueabi-hf-gcc (crosstool-NG linaro-1.13.1-4.7-2013.04-20130415 - Linaro GCC 2013.04) 4.7.3 20130328 (prerelease)  
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root@debian:/home/moxa/RaspberryPI/tools#
```

However, if your source code on the Raspberry Pi includes access calls to peripherals, you need to change the device file names and system APIs to be able to use the source code on the UC-8100-LX.

6 Peripheral Device Programming

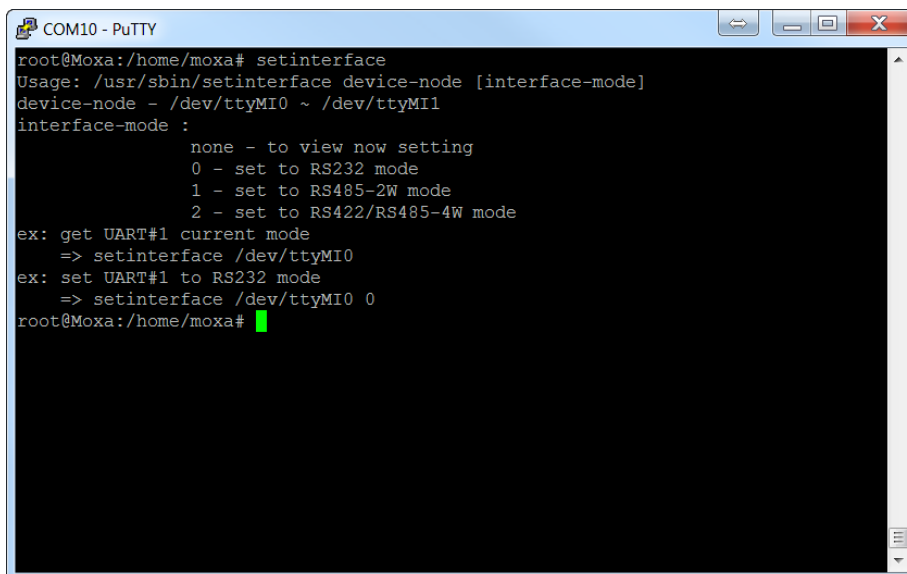
In this section, we discuss the key peripherals and the difference in accessing them in the two platforms.

6.1 Serial Devices

Raspberry Pi 3 provides 2 UART interfaces that the developers can implement. If you use the latest version of RASPBIAN firmware, these interfaces show up as `/dev/serial0` and `/dev/serial1`.

On the UC-8100-LX, the device node interfaces are `/dev/ttyMI0` and `/dev/ttyMI1`. Note that the UC-8100-LX has a 3-in-1 interface for each serial interface. You can use the `setinterface` command to set the RS323, RS422, and RS485 mode for each serial interface as shown in [Figure 6](#).

Figure 6



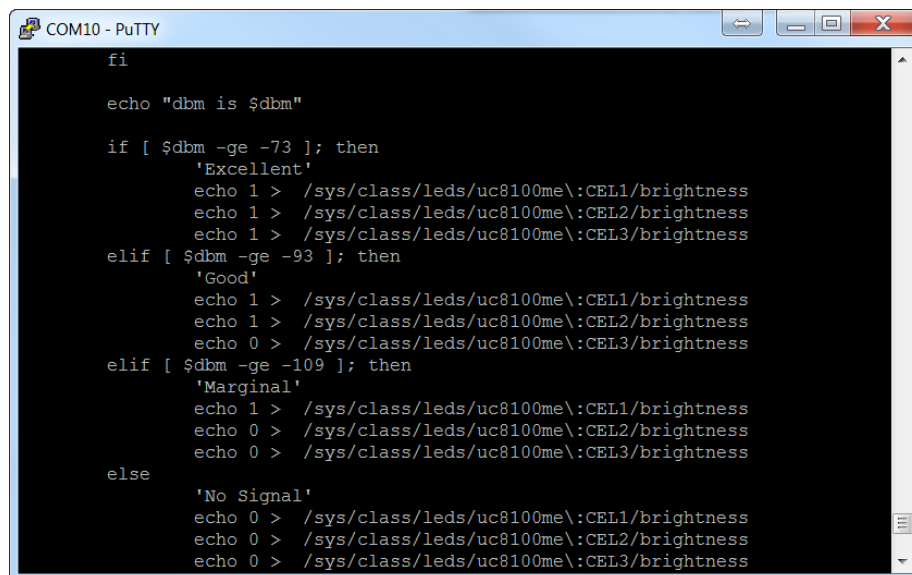
```
COM10 - PuTTY
root@moxa:/home/moxa# setinterface
Usage: /usr/sbin/setinterface device-node [interface-mode]
device-node - /dev/ttyMI0 ~ /dev/ttyMI1
interface-mode :
    none - to view now setting
    0 - set to RS232 mode
    1 - set to RS485-2W mode
    2 - set to RS422/RS485-4W mode
ex: get UART#1 current mode
=> setinterface /dev/ttyMI0
ex: set UART#1 to RS232 mode
=> setinterface /dev/ttyMI0 0
root@moxa:/home/moxa#
```

6.2 LEDs

On Raspberry Pi 3, you can either install the *wiringPi* (gpio example) or a Python example code to turn the LEDs on/off. Controlling the UC-8100-LX LEDs is much easier. By default, all signal LEDs on the UC-8100-LX are controlled by the `chk_signal` script. This program mainly reads the signal from cellular/Wi-Fi modules and changes the LED status according to the signal strength.

Before you run the `chk_signal` script, you must stop the script using the `#killall -9 chk_signal` command to ensure that the process is not running. The LEDs are controlled by using the `echo` command and the values 0, 1. The value 1 turns the LED on, while 0 turns the LED off. The LED control file is located at `/sys/class/leds/UC-8100me:CEL[X]/brightness` where [X] is the location of the LEDs with the options 1, 2, and 3. See the example in [Figure 7](#) for information on turning the LEDs on:

Figure 7



```
COM10 - PuTTY
fi
echo "dbm is $dbm"
if [ $dbm -ge -73 ]; then
    'Excellent'
    echo 1 > /sys/class/leds/uc8100me:CEL1/brightness
    echo 1 > /sys/class/leds/uc8100me:CEL2/brightness
    echo 1 > /sys/class/leds/uc8100me:CEL3/brightness
elif [ $dbm -ge -93 ]; then
    'Good'
    echo 1 > /sys/class/leds/uc8100me:CEL1/brightness
    echo 1 > /sys/class/leds/uc8100me:CEL2/brightness
    echo 0 > /sys/class/leds/uc8100me:CEL3/brightness
elif [ $dbm -ge -109 ]; then
    'Marginal'
    echo 1 > /sys/class/leds/uc8100me:CEL1/brightness
    echo 0 > /sys/class/leds/uc8100me:CEL2/brightness
    echo 0 > /sys/class/leds/uc8100me:CEL3/brightness
else
    'No Signal'
    echo 0 > /sys/class/leds/uc8100me:CEL1/brightness
    echo 0 > /sys/class/leds/uc8100me:CEL2/brightness
    echo 0 > /sys/class/leds/uc8100me:CEL3/brightness
```

7 Additional Reading

<https://www.raspberrypi.org/downloads/>

<https://www.raspberrypi.org/documentation/linux/kernel/building.md>

<http://www.moxa.com/product/uc-8100.htm>