rBOX630-FL

Linux

Software User's Manual

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Chapter 1
Introduction

The extreme compact rBOX630 supports the low power RISC-based module (iMX6) processor with extended temperature range of -40°C to +70°C for using in wide range operating environments. Multiple built-in serial ports, high-speed LANs and USB 2.0 ports enable fast and efficient data computation, communication and acquisition. Its digital I/O feature provides users with the convenience of digital devices connection. Besides, the industrial grade IP40-rated rBOX630 meets Safety Agency requirements and has passed heavy industrial CE and FCC testing.

This user’s manual is for the embedded Linux preinstalled in rBOX630. The embedded Linux is derived from Linux Yocto Board Support Package, which is based on Linux Kernel 3.0.35 and our hardware patches to suit rBOX630.

Software structure

The preinstalled embedded Linux image is located in eMMC Flash memory which is partitioned and formatted to accommodate boot loader, kernel and root filesystem. It follows standard Linux architecture to allow user to easily develop and deploy application software that follows Portable Operating System Interface (POSIX).

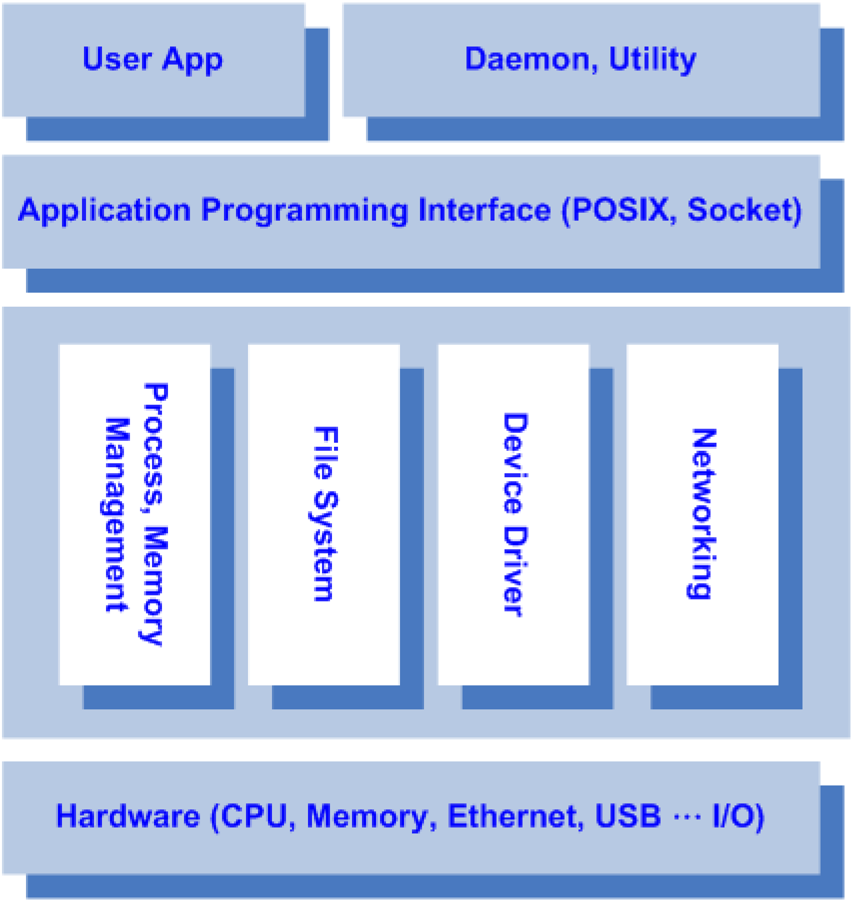
To facilitate user program in monitoring and controlling I/O device such as DIO, CAN, Watchdog Timer, the rBOX630 includes ‘librb217.so’ shared library.

In addition to ext3 and ext4 file system, this embedded Linux kernel is compiled with support for NFS, including server-side, client-side functionality and ‘Root file system on NFS’. Using an NFS root mount we have several advantages such as:

- The root file system is not size-restricted by the device’s storage like Flash memory.
- Change made to application files during development is immediately available to the target device.

For connectivity, this image includes most popular internet protocols, some servers and utilities not only making it easy for downloading/uploading files (Linux kernel, application program) or for debugging, but also communicating to outside world via Ethernet, WiFi and 3G.

For the convenience of manipulating embedded Linux, this image includes lots of popular packages such as busybox, udev, etc.


User App
Daemon, Utility
Application Programming Interface (POSIX, Socket)
Process, Memory Management
File System
Device Driver
Networking
Hardware (CPU, Memory, Ethernet, USB … I/O)

1.1 Specifications

- **OS: Linux**
  - Kernel: 3.0.35 (with Freescale and Axiomtek hardware modified patch)

- **Support Protocol Types**
  - ICMP.
  - TCP/IP.
  - UDP, DHCP, Telnet, HTTP, HTTPS, SSL, SMTP, ARP, NTP, DNS, PPP, PPPoE, FTP, TFTP, NFS.

- **Shell**
  - Bash

- **File system**
  - NFS, ext3, ext4

- **Daemons**
  - Telnetd: Telnet server daemon
  - FTPD: FTP server daemon

- **Utilities**
  - Telnet: Telnet client program
  - FTP: FTP client program
  - TFTP: Trivial File Transfer Protocol client

- **Packages**
  - **busybox**: Small collection of standard Linux command-line utilities
  - **udev**: A device manager for Linux kernel
  - **dosfstools** : Utilities for making and checking MS-DOS FAT file system
  - **e2fsprogs**: A set of utilities for maintaining the ext2, ext3 and ext4 file systems
  - **ethtool**: A Linux command for displaying or modifying the Network Interface Controller (NIC) parameters
  - **i2c-tools** : A heterogeneous set of I2C tools for Linux
  - **procps** : Utilities to report on the state of the system, including the states of running processes, amount of memory
  - **wireless-tools**: A package of Linux commands (simple text-based utilities/tools) intended to support and facilitate the configuration of wireless devices using the Linux Wireless Extension

- **Development Environment**
  - Host OS/ development OS: Ubuntu 14.04 LTS
  - Toolchain/ cross compiler: ARM, gcc-4.8.1 (Yocto project 1.5.4 Dora)

- **HW’s Lib (Hardware’s Library)**
  - **WiFi (Optional)**
    - Detect signal strength
    - Set AP connection
    - Set web, wpa, wpa2
    - Support search AP

  - **Digital I/O**
    - Read digital input
    - Write digital output

  - **CAN**
    - Support open/write/read/close functions

  - **3G**
    - Set number connection
    - Support user name/password
    - Detect signal strength

  - **GPS**
    - Detect signal strength
    - Support satellite positioning

  - **Watch Dog Timer**
    - Enable
    - Clean
    - Set timer

  - **COM**
    - RS-232/422/485 mode setting

Note

All specifications and images are subject to change without notice.

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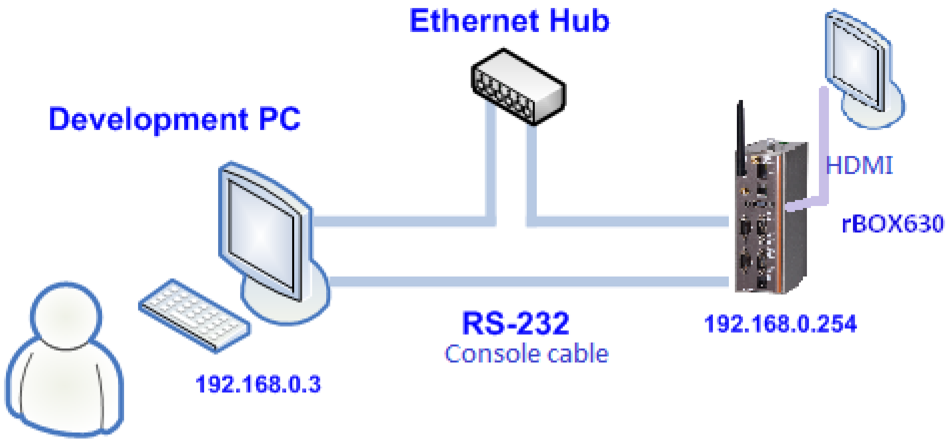
Chapter 2
Getting Started

2.1 Connecting the rBOX630

You can connect the rBOX630 to personal computer (PC) in two ways:

- Serial RS-232 console
- SSH over Ethernet



Note

Please download below data from Axiomtek's website as below list if you have the demand.

- ***BSP support package.***

http://www.axiomtek.com/products/ViewProduct.asp?view=8947

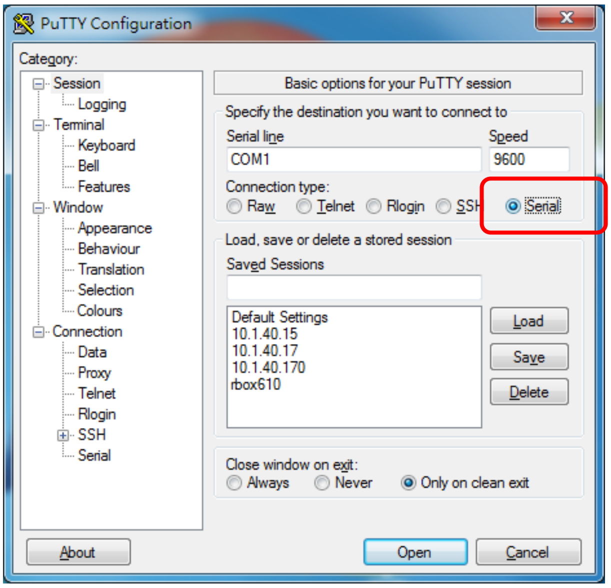
2.1.1 Serial Console

The serial console is a convenient interface for connecting rBOX630 to PC. First of all, it is very important to make sure that your desktop connects to rBOX630 by console cable. Please set the system as follows:

Baudrate: 115200 bps
Parity: None
Data bits: 8
Stop bit: 1
Flow Control: None

Here we use PuTTY to setup and link to the rBOX630. Learn how to do it with these step by step instructions:

1. Open PuTTY and choose 'Serial' as the connection type.



Basic options for your PuTTY session

Specify the destination you want to connect to

Serial line: COM1
Speed: 9600

Connection type:
○ Raw ○ Telnet ○ Rlogin ○ SSH ● Serial

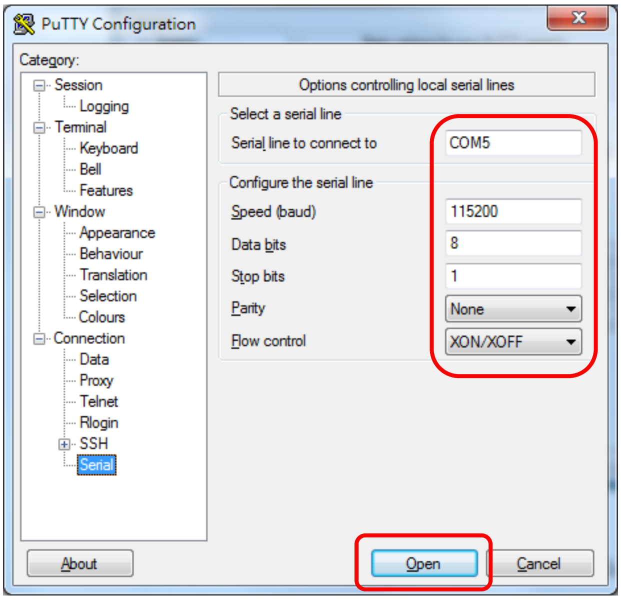
Load, save or delete a stored session

Saved Sessions

Default Settings
10.1.40.15
10.1.40.17
10.1.40.170
rbox610

Close window on exit:
○ Always ○ Never ● Only on clean exit

2. Configure the serial port correctly (see image below). Click Open and power on the rBOX630.



Options controlling local serial lines

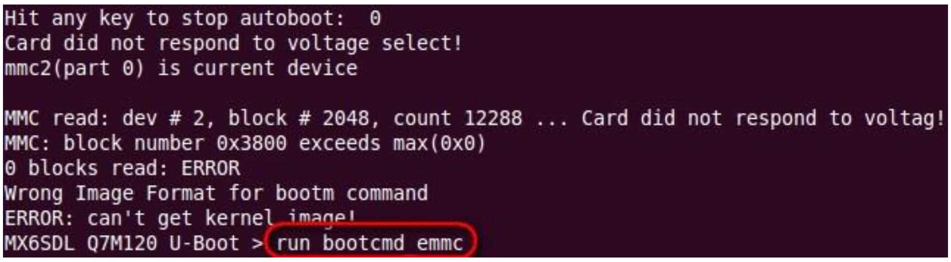
Select a serial line

Serial line to connect to: COM5

Configure the serial line

Speed (baud): 115200
Data bits: 8
Stop bits: 1
Parity: None
Flow control: XON/XOFF

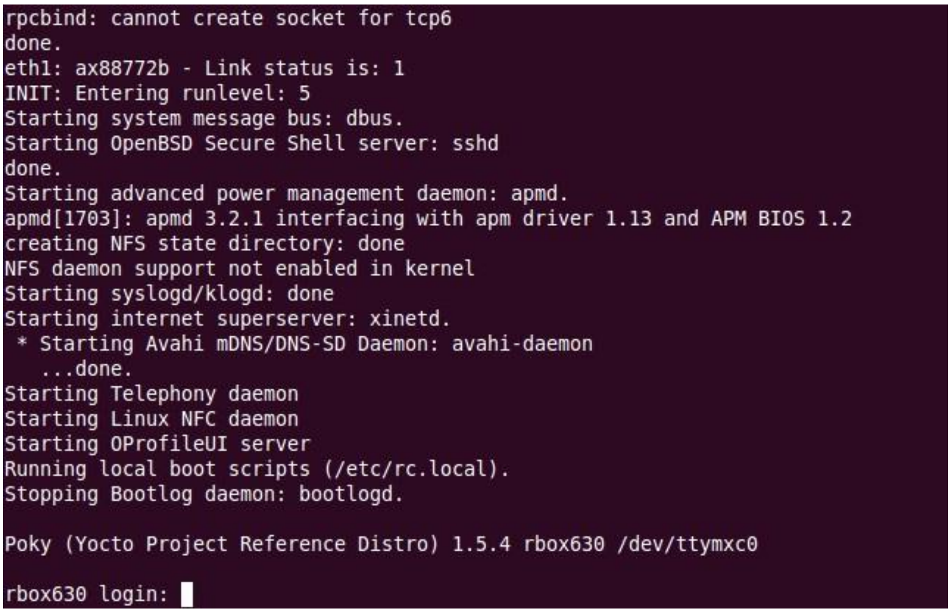
3. The Bootloader default booting system setup to SD Card, If you don’t have bootable SD Card and want boot from eMMC, Try type this command on u-boot.



```
Hit any key to stop autoboot:  0
Card did not respond to voltage select!
mmc2(part 0) is current device

MMC read: dev # 2, block # 2048, count 12288 ... Card did not respond to voltag!
MMC: block number 0x3800 exceeds max(0x0)
0 blocks read: ERROR
Wrong Image Format for bootm command
ERROR: can't get kernel image!
MX6SDL Q7M120 U-Boot > run bootcmd emmc
```

4. If connection is established successfully, you should see the following image.

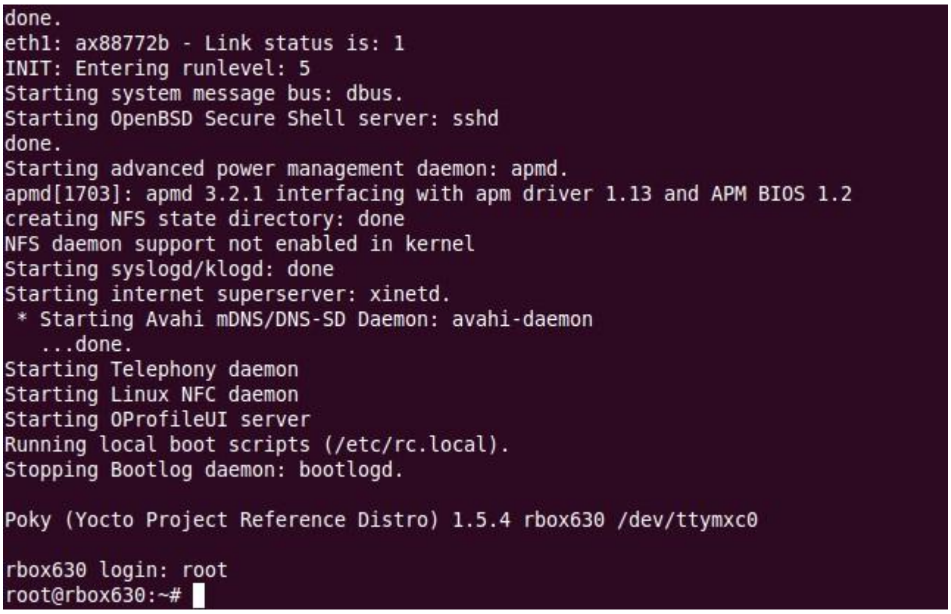


```
rpcbind: cannot create socket for tcp6
done.
eth1: ax88772b - Link status is: 1
INIT: Entering runlevel: 5
Starting system message bus: dbus.
Starting OpenBSD Secure Shell server: sshd
done.
Starting advanced power management daemon: apmd.
apmd[1703]: apmd 3.2.1 interfacing with apm driver 1.13 and APM BIOS 1.2
creating NFS state directory: done
NFS daemon support not enabled in kernel
Starting syslogd/klogd: done
Starting internet superserver: xinetd.
 * Starting Avahi mDNS/DNS-SD Daemon: avahi-daemon
   ...done.
Starting Telephony daemon
Starting Linux NFC daemon
Starting OProfileUI server
Running local boot scripts (/etc/rc.local).
Stopping Bootlog daemon: bootlogd.

Poky (Yocto Project Reference Distro) 1.5.4 rbox630 /dev/ttymxc0

rbox630 login: █
```

5. To login, please enter ‘root’ (with no password).



```
done.
eth1: ax88772b - Link status is: 1
INIT: Entering runlevel: 5
Starting system message bus: dbus.
Starting OpenBSD Secure Shell server: sshd
done.
Starting advanced power management daemon: apmd.
apmd[1703]: apmd 3.2.1 interfacing with apm driver 1.13 and APM BIOS 1.2
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   ...done.
Starting Telephony daemon
Starting Linux NFC daemon
Starting OProfileUI server
Running local boot scripts (/etc/rc.local).
Stopping Bootlog daemon: bootlogd.

Poky (Yocto Project Reference Distro) 1.5.4 rbox630 /dev/ttymxc0

rbox630 login: root
root@rbox630:~# █
```
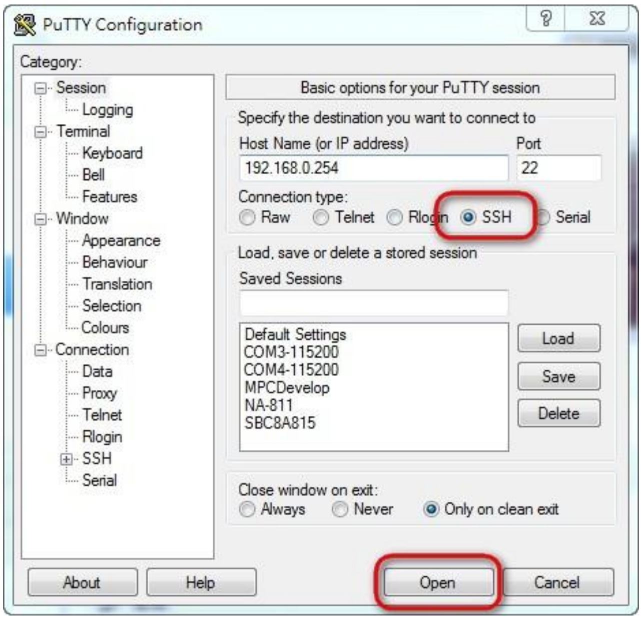

2.1.2 SSH over Ethernet

Now, we are going to connect the rBOX630 to PC over Ethernet. The following illustrations show how to do it under Windows® and Linux environment.
Note: rBOX630 LAN2 default IP address is 192.168.0.254.

For Windows® users:

1. Here we also use PuTTY to setup and link. Open PuTTY and choose 'SSH' as the connection type. Then set the IP address to 192.168.0.254 and click Open.



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): 192.168.0.254

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

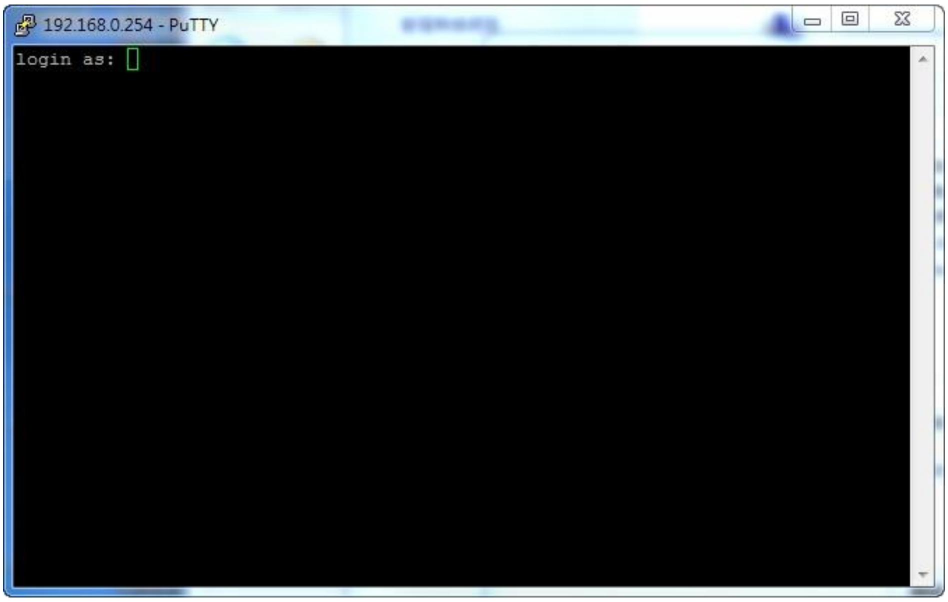
Load, save or delete a stored session

Saved Sessions

Default Settings
COM3-115200
COM4-115200
MPCDevelop
NA-811
SBC8A815

Close window on exit: ○ Always ○ Never ● Only on clean exit

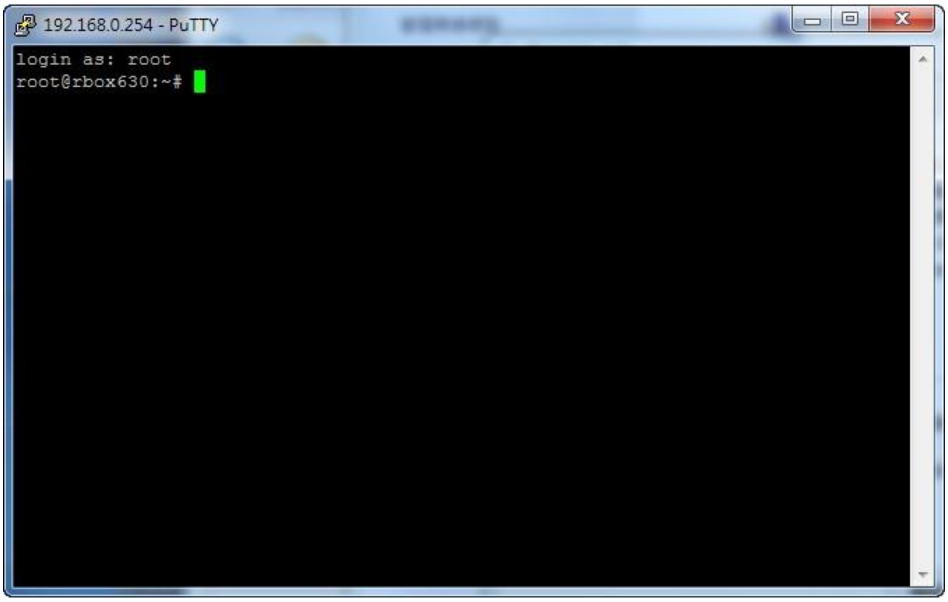
2. If connection is established successfully, you should see the following image.



192.168.0.254 - PuTTY

```
login as:
```

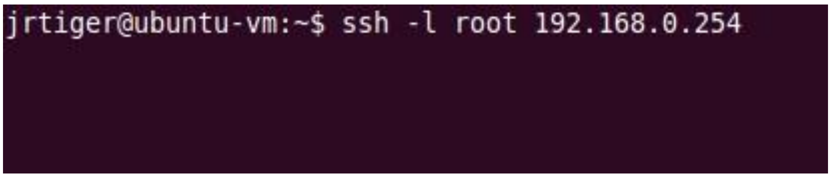
3. To login rBOX630, please enter 'root' (with no password).



```
login as: root
root@rbox630:~#
```

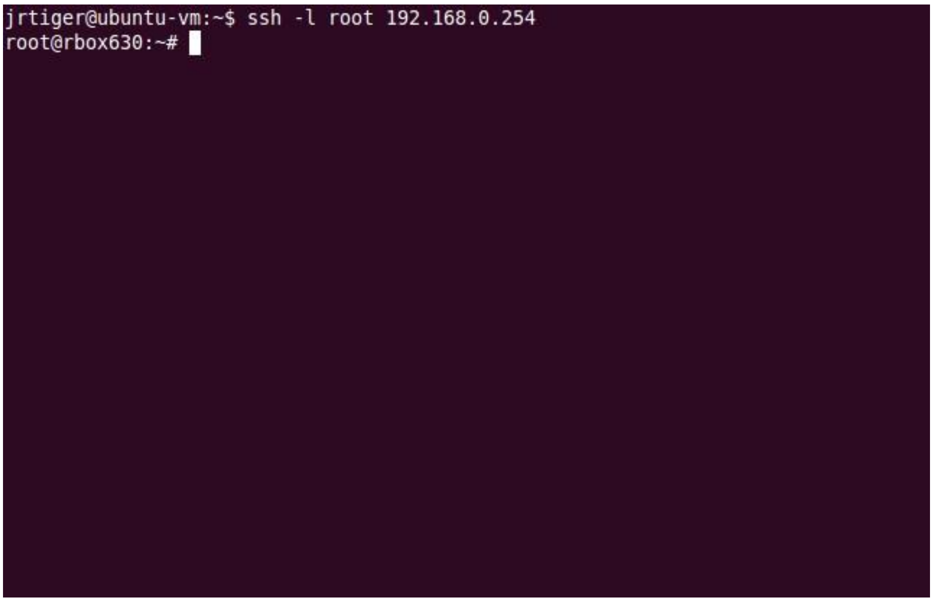
For Linux users:

1. Open terminal and keyin 'ssh' command.



```
jrtiger@ubuntu-vm:~$ ssh -l root 192.168.0.254
```

2. After the connection is established successfully.



```
jrtiger@ubuntu-vm:~$ ssh -l root 192.168.0.254
root@rbox630:~#
```

2.2 How to Develop a Sample Program

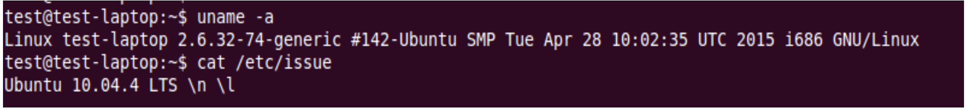
In this section, learn how to develop a sample program for rBOX630 with the following step by step instructions. The sample program is named ‘hello.c’.

2.2.1 Install Yocto Toolchain

Before you develop and compile sample program, you should install Yocto toolchain into development PC. You can follow below step to install Yocto toolchain or refer to Chapter 5 Board Support Package to build the toolchain for rBOX630.

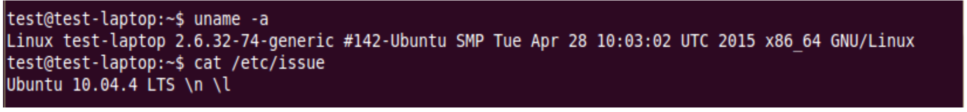
1. Host Ubuntu version.

Ubuntu10.04 **32-bit** (i686):



```
test@test-laptop:~$ uname -a
Linux test-laptop 2.6.32-74-generic #142-Ubuntu SMP Tue Apr 28 10:02:35 UTC 2015 i686 GNU/Linux
test@test-laptop:~$ cat /etc/issue
Ubuntu 10.04.4 LTS \n \l
```

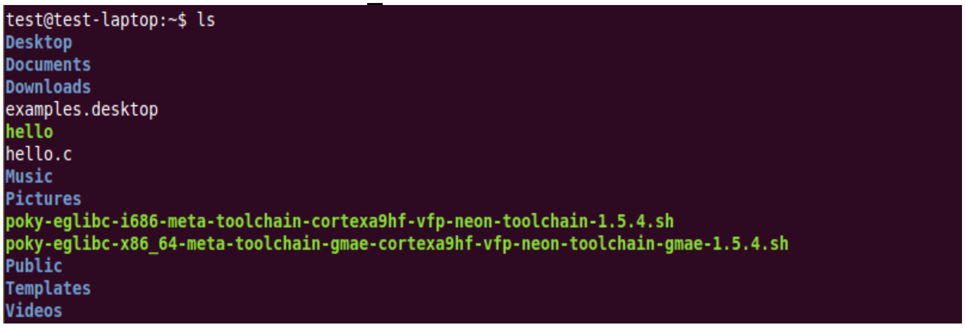
Ubuntu10.04 **64-bit** (x86_64):



```
test@test-laptop:~$ uname -a
Linux test-laptop 2.6.32-74-generic #142-Ubuntu SMP Tue Apr 28 10:03:02 UTC 2015 x86_64 GNU/Linux
test@test-laptop:~$ cat /etc/issue
Ubuntu 10.04.4 LTS \n \l
```

2. Copy the toolchain script to home directory.

i686 for 32-bit machines or x86_64 for 64-bit machines.

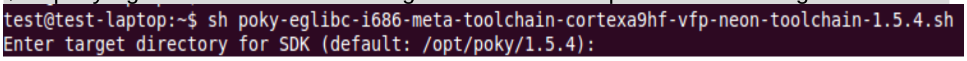


```
test@test-laptop:~$ ls
Desktop
Documents
Downloads
examples.desktop
hello
hello.c
Music
Pictures
poky-eglibc-i686-meta-toolchain-cortexa9hf-vfp-neon-toolchain-1.5.4.sh
poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4.sh
Public
Templates
Videos
```

3 Execute the toolchain script and press Enter to install to default directory.

32-bit machines:

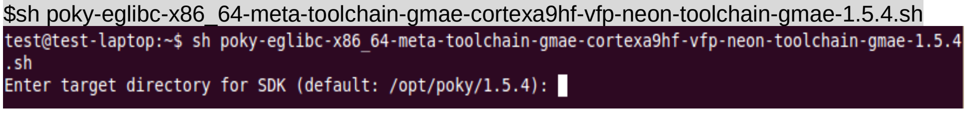
$sh poky-eglibc-i686-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4.sh



```
test@test-laptop:~$ sh poky-eglibc-i686-meta-toolchain-cortexa9hf-vfp-neon-toolchain-1.5.4.sh
Enter target directory for SDK (default: /opt/poky/1.5.4):
```

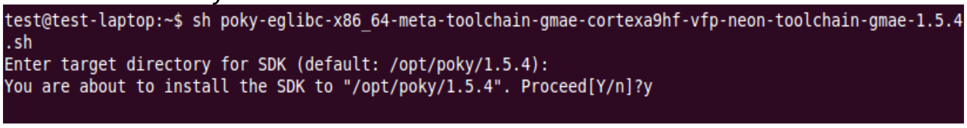
64-bit machines:

$sh poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4.sh



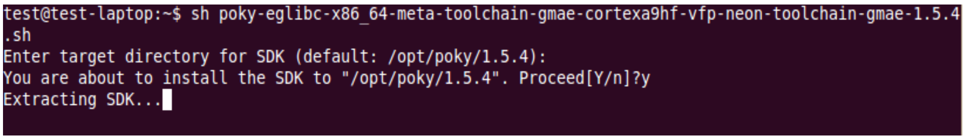
```
test@test-laptop:~$ sh poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4
.sh
Enter target directory for SDK (default: /opt/poky/1.5.4): 
```

4 Check the directory.



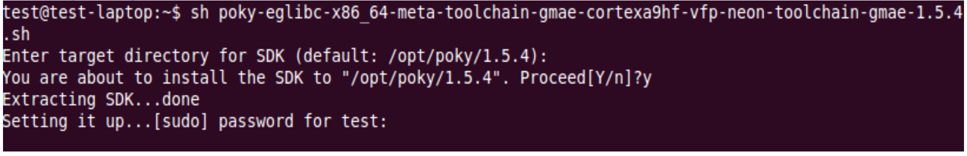
```
test@test-laptop:~$ sh poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4
.sh
Enter target directory for SDK (default: /opt/poky/1.5.4):
You are about to install the SDK to "/opt/poky/1.5.4". Proceed[Y/n]?y
```

5 Wait to installation.



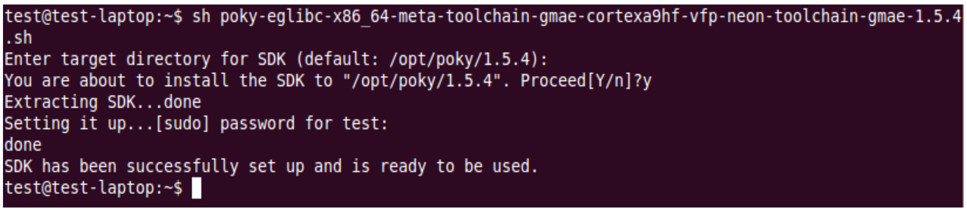
```
test@test-laptop:~$ sh poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4
.sh
Enter target directory for SDK (default: /opt/poky/1.5.4):
You are about to install the SDK to "/opt/poky/1.5.4". Proceed[Y/n]?y
Extracting SDK...
```

6 Press your password.



```
test@test-laptop:~$ sh poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4
.sh
Enter target directory for SDK (default: /opt/poky/1.5.4):
You are about to install the SDK to "/opt/poky/1.5.4". Proceed[Y/n]?y
Extracting SDK...done
Setting it up...[sudo] password for test:
```

7 Install finish.

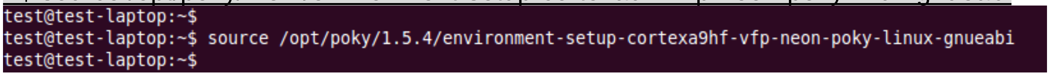


```
test@test-laptop:~$ sh poky-eglibc-x86_64-meta-toolchain-gmae-cortexa9hf-vfp-neon-toolchain-gmae-1.5.4
.sh
Enter target directory for SDK (default: /opt/poky/1.5.4):
You are about to install the SDK to "/opt/poky/1.5.4". Proceed[Y/n]?y
Extracting SDK...done
Setting it up...[sudo] password for test:
done
SDK has been successfully set up and is ready to be used.
test@test-laptop:~$
```

2.2.2 Setting Up the Cross-Development Environment

Before you can develop using the cross-toolchain, you need to set up the cross-development environment, and then you can find this script in the directory you chose for installation.

~$ source /opt/poky/1.5.4/environment-setup-cortexa9hf-vfp-neon-poky-linux-gnueabi



```
test@test-laptop:~$
test@test-laptop:~$ source /opt/poky/1.5.4/environment-setup-cortexa9hf-vfp-neon-poky-linux-gnueabi
test@test-laptop:~$
```

2.2.3 Write and Compile Sample Program

~$ mkdir -p example

~$ cd example

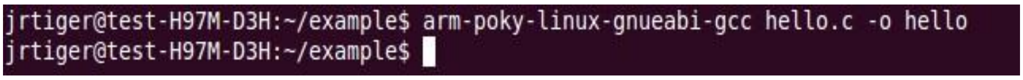
Use vi to edit hello.c.

~$ vi hello.c

```
#include<stdio.h>
int main()
{
    printf(“hello world\n”);
    return 0;
}
```

To compile the program, please do:

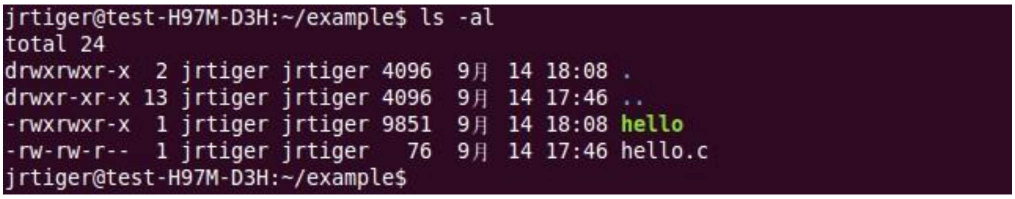
~$ arm-poky-linux-gnueabi-gcc hello.c -o hello



```
jrtiger@test-H97M-D3H:~/example$ arm-poky-linux-gnueabi-gcc hello.c -o hello
jrtiger@test-H97M-D3H:~/example$
```

After compiling, enter the following command and you can see the ‘hello’ execution file.

~$ ls -l



```
jrtiger@test-H97M-D3H:~/example$ ls -al
total 24
drwxrwxr-x  2 jrtiger jrtiger 4096  9月  14 18:08 .
drwxr-xr-x 13 jrtiger jrtiger 4096  9月  14 17:46 ..
-rwxrwxr-x  1 jrtiger jrtiger 9851  9月  14 18:08 hello
-rw-rw-r--  1 jrtiger jrtiger   76  9月  14 17:46 hello.c
jrtiger@test-H97M-D3H:~/example$
```

2.3 How to Put and Run a Sample Program

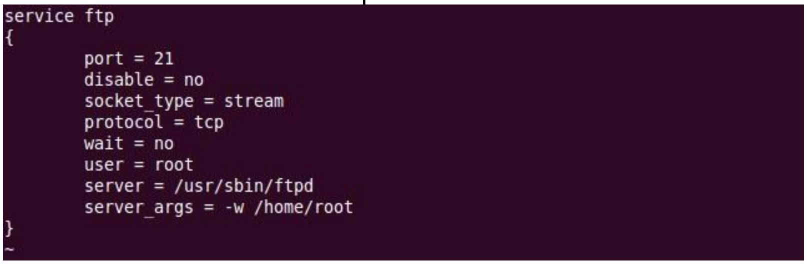
In this section, we provide 3 methods showing how to put the ‘hello’ program into rBOX630 and execute it.

2.3.1 Via FTP (Default disable)

The rBOX630 has a built-in FTP server. Users can put ‘hello’ program to rBOX630 via FTP by following the steps below.

1. Enable FTPD daemon

   Use vi to create /etc/xinetd.d/ftpd file

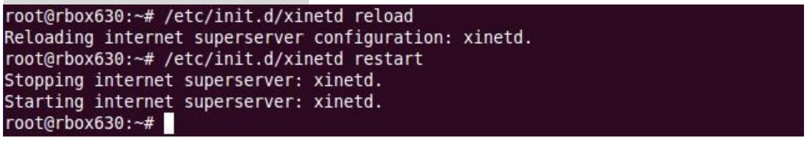


```
service ftp
{
        port = 21
        disable = no
        socket_type = stream
        protocol = tcp
        wait = no
        user = root
        server = /usr/sbin/ftpd
        server_args = -w /home/root
}
~
```

   Restart Internet server

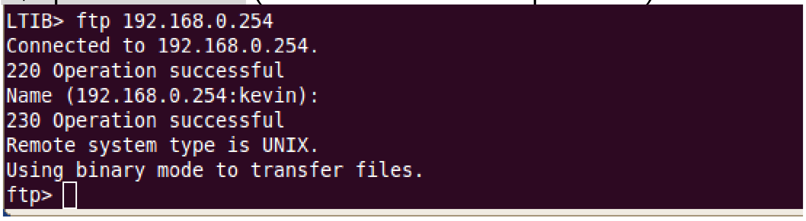
   ~# /etc/init.d/xinetd reload

   ~# /etc/init.d/xinetd restart



```
root@rbox630:~# /etc/init.d/xinetd reload
Reloading internet superserver configuration: xinetd.
root@rbox630:~# /etc/init.d/xinetd restart
Stopping internet superserver: xinetd.
Starting internet superserver: xinetd.
root@rbox630:~# █
```

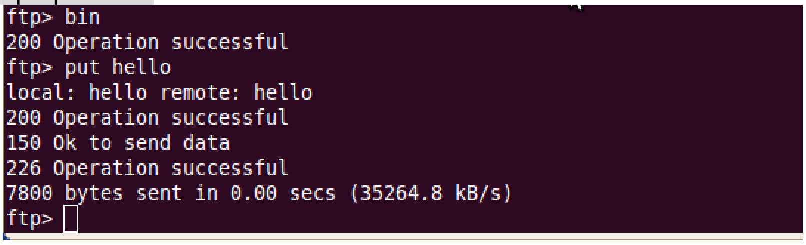
2. ~$ ftp 192.168.0.254 (without username and password)



```
LTIB> ftp 192.168.0.254
Connected to 192.168.0.254.
220 Operation successful
Name (192.168.0.254:kevin):
230 Operation successful
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> 
```

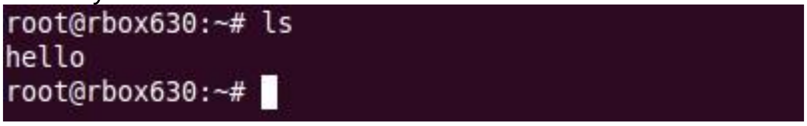
3. ftp> bin

4. ftp> put hello



```
ftp> bin
200 Operation successful
ftp> put hello
local: hello remote: hello
200 Operation successful
150 Ok to send data
226 Operation successful
7800 bytes sent in 0.00 secs (35264.8 kB/s)
ftp> 
```

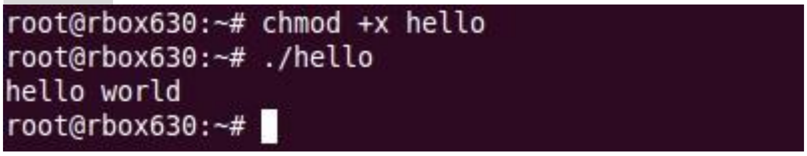
If the operation is successful, you can see 'hello' program at rBOX630's */home/root* directory.



```
root@rbox630:~# ls
hello
root@rbox630:~# 
```

5. ~# chmod +x hello

6. Run the 'hello' program.
~# ./hello



```
root@rbox630:~# chmod +x hello
root@rbox630:~# ./hello
hello world
root@rbox630:~# 
```

2.3.2 Via USB Flash Drive

Another method of putting 'hello' program into rBOX630 is via USB flash drive. Please follow the instructions below.

1. From the PC, copy 'hello' program to USB flash drive.

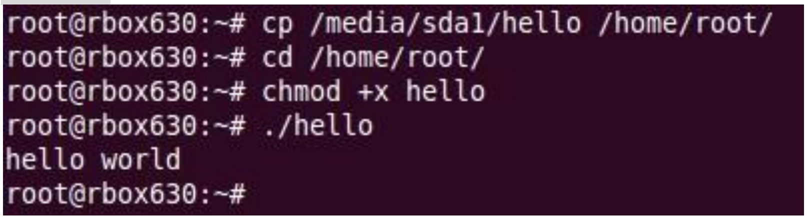
2. Attach USB flash drive to rBOX630.

3. ~# cp /media/sda1/hello /home/root

4. ~# cd /home/root

5. ~# chmod +x hello

6. ~# ./hello

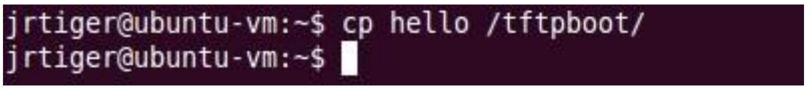


```
root@rbox630:~# cp /media/sda1/hello /home/root/
root@rbox630:~# cd /home/root/
root@rbox630:~# chmod +x hello
root@rbox630:~# ./hello
hello world
root@rbox630:~#
```

2.3.3 Via TFTP

Originally the Host Development System Installation already has TFTP server installed. You can put the ‘hello’ program into rBOX630 via TFTP. Please follow the instructions below.

1. ~$ cp hello /tftpboot

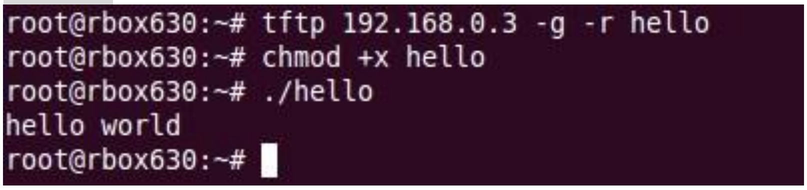


```
jrtiger@ubuntu-vm:~$ cp hello /tftpboot/
jrtiger@ubuntu-vm:~$ █
```

2. ~# tftp -g -r hello 192.168.0.3 (tftp server IP)

3. ~# chmod +x hello

4. Run the ‘hello’ program.
   ~# ./hello

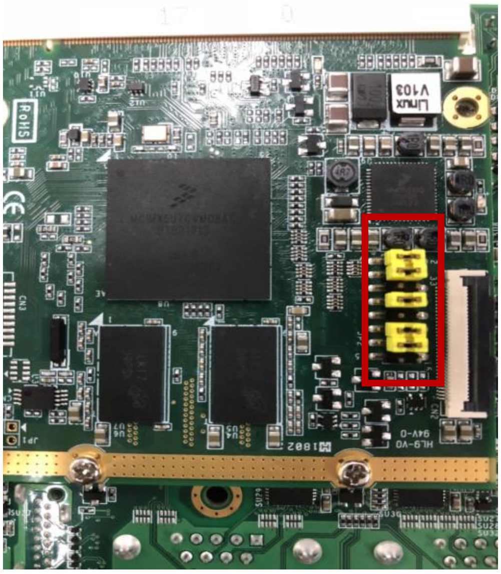


```
root@rbox630:~# tftp 192.168.0.3 -g -r hello
root@rbox630:~# chmod +x hello
root@rbox630:~# ./hello
hello world
root@rbox630:~# █
```

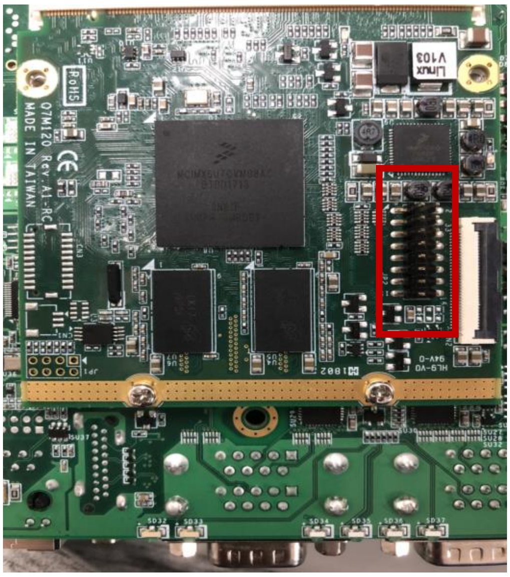
2.4 How to use MFG tool to download image

In this section, we show how to use MFG tool to download image to the rBOX630 System.

1. Before using the mfgtool, you have to change the rBOX630 CPU board JP2 boot mode (default emmc boot) to OTG serial downloader mode. Connect the rBOX630 and PC with a USB cable.

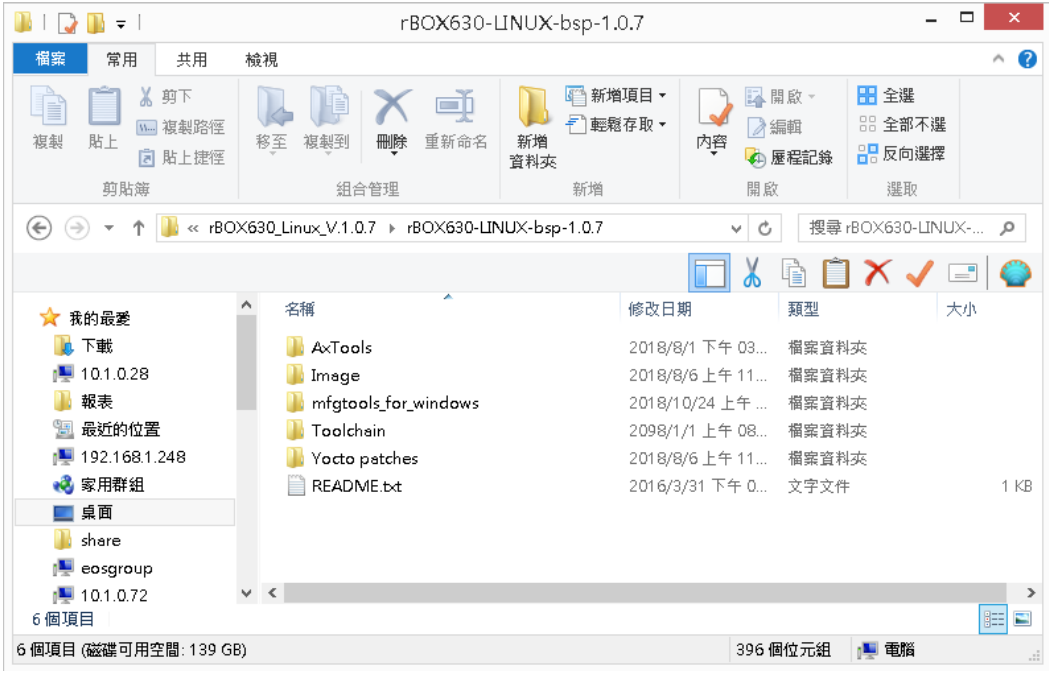


Emmc boot mode



Serial downloader mode

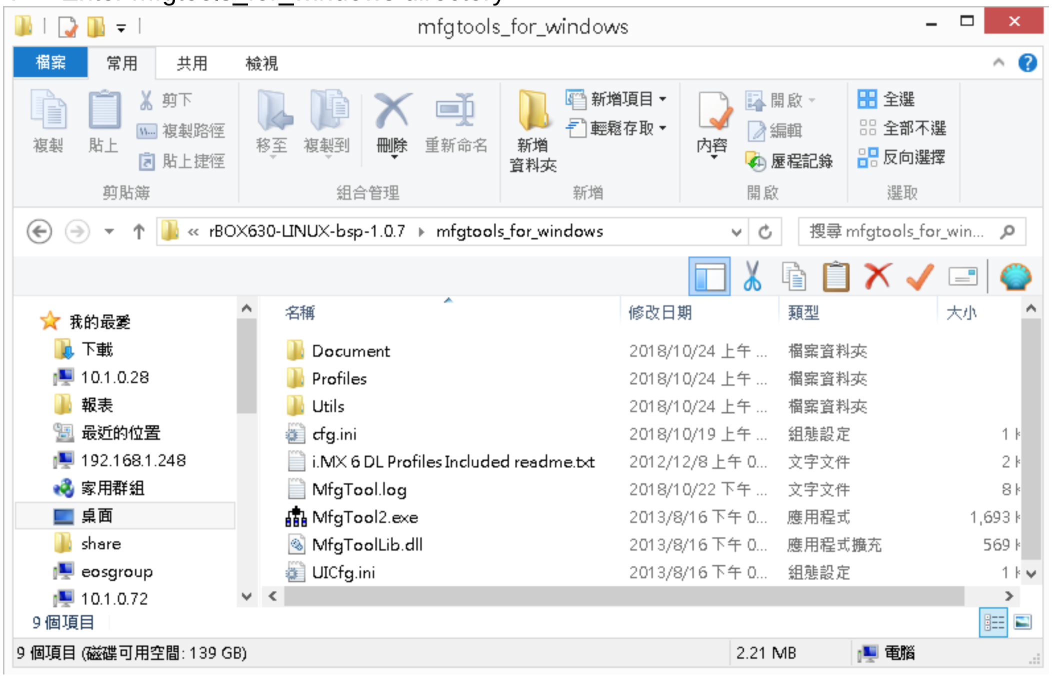
3. Extract Axiomtek's Yocto BSP and you will see mfgtools_for_windows in the Rbox630-LINUX-bsp-x.x.x directory



名稱	修改日期	類型	大小
AxTools	2018/8/1 下午 03...	檔案資料夾	
Image	2018/8/6 上午 11...	檔案資料夾	
mfgtools_for_windows	2018/10/24 上午 ...	檔案資料夾	
Toolchain	2098/1/1 上午 08...	檔案資料夾	
Yocto patches	2018/8/6 上午 11...	檔案資料夾	
README.txt	2016/3/31 下午 0...	文字文件	1 KB

6 個項目 (磁碟可用空間: 139 GB)　396 個位元組　電腦

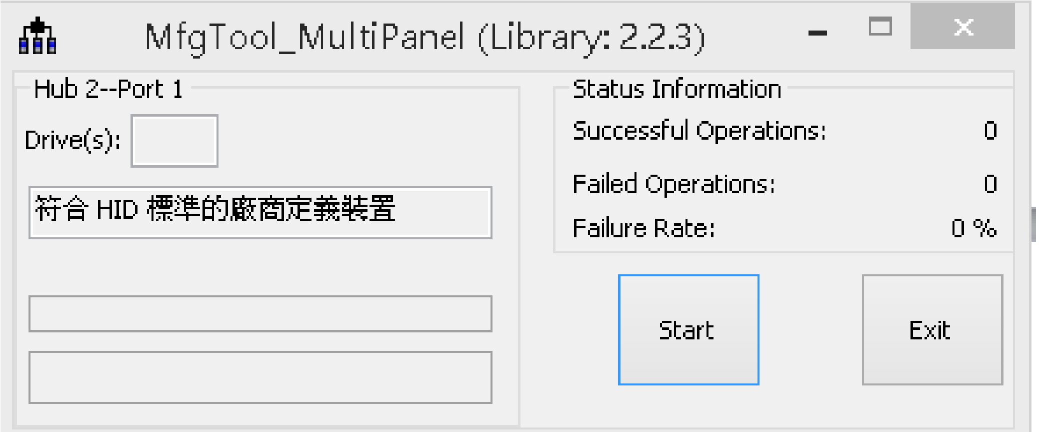
4. Enter mfgtools_for_windows directory



名稱	修改日期	類型	大小
Document	2018/10/24 上午 ...	檔案資料夾	
Profiles	2018/10/24 上午 ...	檔案資料夾	
Utils	2018/10/24 上午 ...	檔案資料夾	
cfg.ini	2018/10/19 上午 ...	組態設定	1 K
i.MX 6 DL Profiles Included readme.txt	2012/12/8 上午 0...	文字文件	2 K
MfgTool.log	2018/10/22 下午 ...	文字文件	8 K
MfgTool2.exe	2013/8/16 下午 0...	應用程式	1,693 K
MfgToolLib.dll	2013/8/16 下午 0...	應用程式擴充	569 K
UICfg.ini	2013/8/16 下午 0...	組態設定	1 K

9 個項目 (磁碟可用空間: 139 GB)　2.21 MB　電腦

5. Double clicking MfgTool2.exe, click "Start" to start burning.



MfgTool_MultiPanel (Library: 2.2.3)

Hub 2--Port 1

Drive(s):

符合 HID 標準的廠商定義裝置

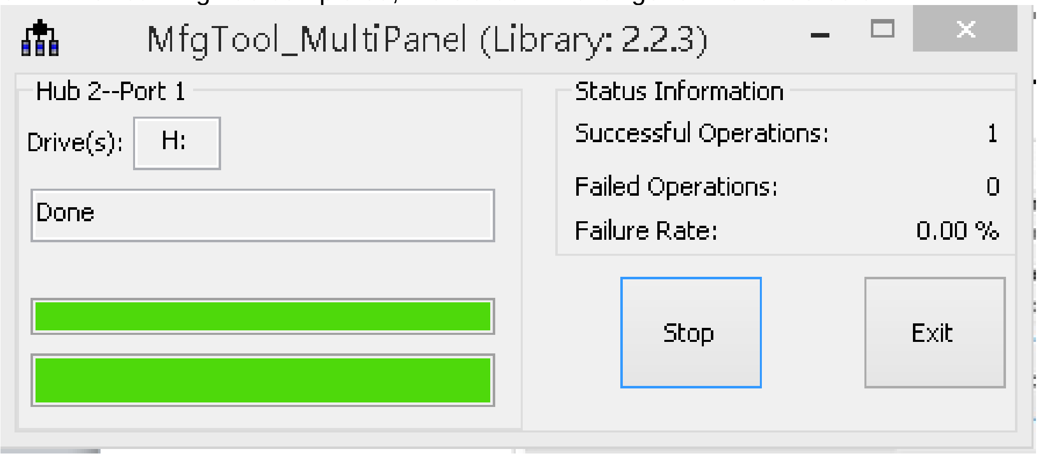
Status Information

Successful Operations: 0

Failed Operations: 0

Failure Rate: 0 %

6. After burning has completed, the status will change to "Done" as below.



MfgTool_MultiPanel (Library: 2.2.3)

Hub 2--Port 1

Drive(s): H:

Done

Status Information

Successful Operations: 1

Failed Operations: 0

Failure Rate: 0.00 %

7. Change rBOX630 CPU board JP2 boot mode as emmc mode, success.

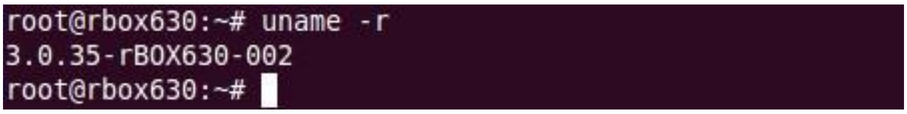
Chapter 3
The Embedded Linux

3.1 Embedded Linux Image Managing

3.1.1 System Version

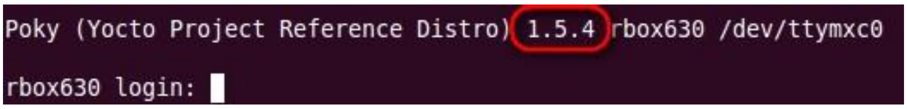
This section describes how to determine system version information including kernel and root filesystem version.

Check kernel version with the following command:
~# uname -r



```
root@rbox630:~# uname -r
3.0.35-rBOX630-002
root@rbox630:~# █
```

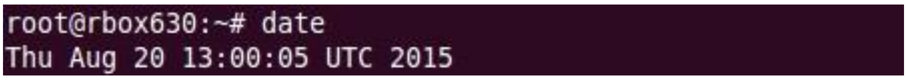
Check root filesystem with the login screen:



```
Poky (Yocto Project Reference Distro) 1.5.4 rbox630 /dev/ttymxc0

rbox630 login: █
```

3.1.2 System Time

System time is the time value loaded from RTC each time the system boots up. Read system time with the following command:
~# date

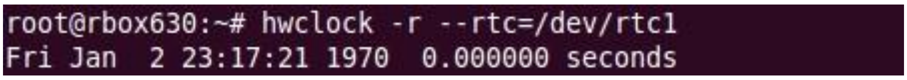


```
root@rbox630:~# date
Thu Aug 20 13:00:05 UTC 2015
```

3.1.3 Internal RTC Time

The internal RTC time is read from i.MX processor internal RTC. Note that this time value is not saved, when system power is removed.

Read internal RTC time with the following command:
~# hwclock -r --rtc=/dev/rtc1

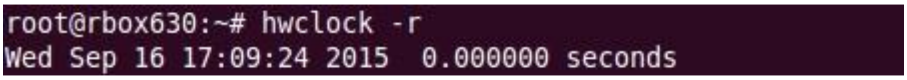


```
root@rbox630:~# hwclock -r --rtc=/dev/rtc1
Fri Jan  2 23:17:21 1970  0.000000 seconds
```

3.1.4 External RTC Time

The external RTC time is read from RS5C372 external RTC. When system power is removed, this time value is kept as RS5C372 is powered by battery.

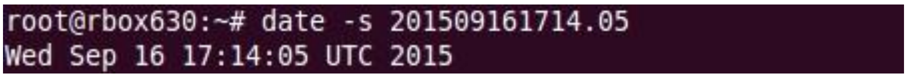
Read external RTC time with the following command:
~# hwclock -r



```
root@rbox630:~# hwclock -r
Wed Sep 16 17:09:24 2015  0.000000 seconds
```

3.1.5 Adjusting System Time

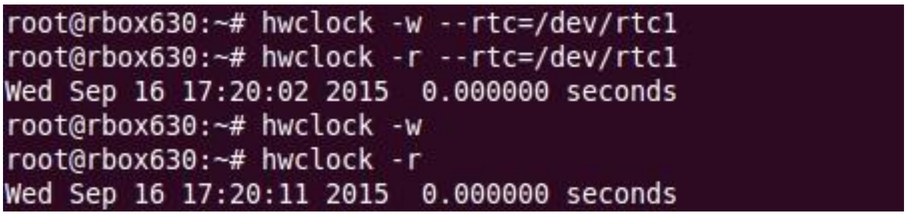
Manually setting up the system time.
~# date -s YYYYMMDDHHmm.SS



```
root@rbox630:~# date -s 201509161714.05
Wed Sep 16 17:14:05 UTC 2015
```

Write sync time to internal RTC
$ hwclock -w --rtc=/dev/rtc1

Write sync time to external RTC
$ hwclock -w



```
root@rbox630:~# hwclock -w --rtc=/dev/rtc1
root@rbox630:~# hwclock -r --rtc=/dev/rtc1
Wed Sep 16 17:20:02 2015  0.000000 seconds
root@rbox630:~# hwclock -w
root@rbox630:~# hwclock -r
Wed Sep 16 17:20:11 2015  0.000000 seconds
```

3.2 Networking

3.2.1 FTP – File Transfer Protocol

FTP is a standard network protocol used to transfer files from one host to another host over TCP-based network.

The rBOX630 comes with a built-in FTP server. Section 2.1 shows the steps to put ‘hello’ program to rBOX630 via FTP.

3.2.2 TFTP – Trivial File Transfer Protocol

TFTP is a lightweight protocol of transfer files between a TFTP server and TFTP client over Ethernet. To support TFTP, this embedded Linux image has built-in TFTP client, so does its accompanying bootloader U-boot.

In Chapter 5, there are descriptions of TFTP server installation and kernel boot up process via TFTP. Section 2.3.3 shows you how to transfer file between server and client.

3.2.3 NFS – Network File System

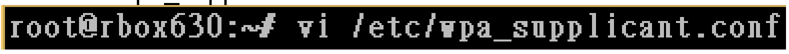
NFS enables you to export a directory on an NFS server and mount that directory on remote client machine as if it were a local file system. Using NFS on target machine, we can have access to a huge number of files, libraries, and utilities during development and debugging, as well as booting up kernel.

This embedded Linux kernel is compiled with support for NFS, including server-side, client-side functionality and ‘Root file system on NFS’. Section 5.1 and 5.2.1 show how to boot up embedded Linux with an NFS support.

3.2.4 How to use a Wi-Fi module (Optional)

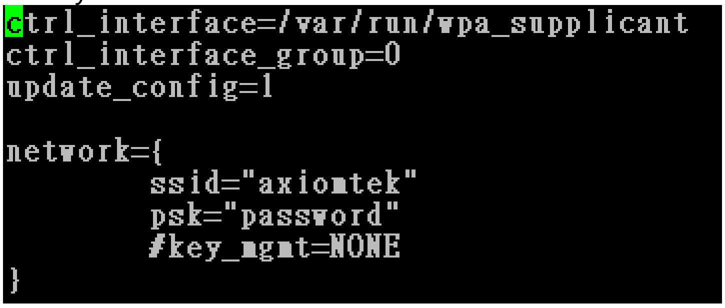
If your Wi-Fi module is WPEA-121NW, follow the instructions below.

Editor /etc/wpa_supplicant.conf file
~# vi /etc/wpa_supplicant.conf



```
root@rbox630:~# vi /etc/wpa_supplicant.conf
```

Enter your router’s SSID and Password

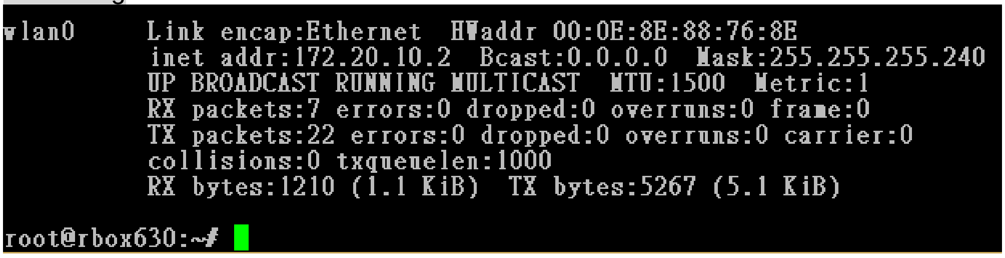


```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=0
update_config=1

network={
        ssid="axiomtek"
        psk="password"
        #key_mgmt=NONE
}
```

If the setting is successful, it will automatically connect after reboot.

You can execute command” **ifconfig”** to check connection.

```
~# ifconfig
```



```
wlan0     Link encap:Ethernet  HWaddr 00:0E:8E:88:76:8E
          inet addr:172.20.10.2  Bcast:0.0.0.0  Mask:255.255.255.240
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7 errors:0 dropped:0 overruns:0 frame:0
          TX packets:22 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1210 (1.1 KiB)  TX bytes:5267 (5.1 KiB)

root@rbox630:~#
```

Chapter 4
Programming Guide

We release a set of application programming interface (API) functions for users to access/control hardware. With these API functions, users can more easily design their own software. This chapter includes detailed description of each API function and step-by-step code samples showing how it works.

4.1 librb217 API Functions

The rBOX630 BSP includes ‘librb217.so’ shared library for users to access I/O and read back system information. This shared library is kept in BSP, you can find it in rBOX630-rb_lib-x.x.x.tar.bz2 of AxTools. Extract the compressed file, then besides the shared library you can also see a *demo* folder containing API header file and example programs.

Summary table of available API functions

No.	Function	Description
1	Get_BoardID()	Get board ID.
2	Get_PowerStatus()	Get power status.
3	Set_LEDStatus()	Set ACT/RDY LED status.
4	Set_ALARMLED()	Set ALARM LED status
5	Get_COMType()	Get COM port communication mode type.
6	Set_COMType()	Set COM port communication mode type.
7	Set_COMTermination()	Set termination of specified COM port.
8	CPLD_Get_WDTCounter()	Get watchdog timer counter value.
9	CPLD_WDT_Enable()	Enable watchdog timer. Also used it to reset WDT counter.
10	CPLD_WDT_Disable()	Disable watchdog timer.
11	CPLD_WDTStatus()	Detect watchdog timer status.
12	Get_DI()	Read high or low state on digital input channels.
13	Get_DO()	Read high or low state on digital output channels.
14	Set_DO()	Set digital output channels to high or low state.
15	Set_CANTermination()	Set termination of specified CAN port.

Function: Get_BoardID()

Function	**__u16 Get_BoardID(void);**
Description	Get board ID.
Arguments	None.
Return	Board ID (in 2 bytes pattern).
Others	None.

Function: Get_PowerStatus()

Function	**int Get_PowerStatus(int number);**
Description	Get power status.
Arguments	number: Power number. 0: Power1. 1: Power2.
Return	0: Power fails. 1: Power is OK.
Others	None.

Function: Set_LEDStatus()

Function	**int Set_LEDStatus(int onoff);**
Description	Set ACT/RDY LED status.
Arguments	onoff: System LED status. 1: On. 0: Blink.
Return	0: No error. 1: Function fails.
Others	None.

Function: Set_ALARMLED ()

Function	**int Set_ALARMLED(int onoff);**
Description	Set ALARM LED status.
Arguments	onoff: Alarm LED status. 1: On. 0: Off.
Return	0: No error. 1: Function fails.
Others	None.

Function: Get_COMType()

Function	**int Get_COMType(int number);**
Description	Get COM port communication mode type.
Arguments	number: COM port number. 1: COM1. 2: COM2. 3: COM3. 4: COM4.
Return	0: Reserved. 1: RS232 Enable. 2: RS422/RS485_4W Enable. 3: RS485_2W Enable.
Others	None.

Function: Set_COMType()

Function	**int Set_COMType(int number, int type);**
Description	Set COM port communication mode type.
Arguments	number: COM port number. 1: COM1. 2: COM2. 3: COM3. 4: COM4. type: COM port mode type 0: Reserved. 1: RS232 Enable. 2: RS422/RS485_4W Enable. 3: RS485_2W Enable.
Return	0: No error. 1: Function fails.
Others	None.

Function: Set_COMTermination()

Function	**int Set_COMTermination(int number, int onoff);**
Description	Set termination of specified COM port.
Arguments	number: COM port number. 1: COM1. 2: COM2. 3: COM3. 4: COM4. onoff: Enable or disable termination. 1: Enable termination. 0: Disable termination.
Return	0: No error. 1: Function fails.
Others	None.

Function: CPLD_Get_WDTCounter()

Function	**__u8 CPLD_Get_WDTCounter(void);**
Description	Get watchdog timer counter value.
Arguments	None
Return	0~255 where 1 unit ~= 250ms.
Others	None.

Function: CPLD_WDT_Enable()

Function	**int CPLD_WDT_Enable(__u8 timeout);**
Description	Enable watchdog timer. Also use it to reset WDT counter.
Arguments	timeout: Timeout value. The range is from 0 to 255 where 1 unit ~= 250ms.
Return	0: No error. 1: Function fails.
Others	None.

Function: CPLD_WDT_Disable()

Function	**int CPLD_WDT_Disable(void);**
Description	Disable watchdog timer.
Arguments	None.
Return	0: No error. 1: Function fails.
Others	None.

Function: CPLD_WDTStatus()

Function	**__u8 CPLD_WDTStatus(void);**
Description	Detect watchdog timer status.
Arguments	None.
Return	0: If watchdog timer has not been triggered, return value = 0. 1: If watchdog timer has been triggered, return value = 1.
Others	None.

Function: Get_DI()

Function	**int Get_DI(__u8 *data);**
Description	Read high or low state on digital input channels.
Arguments	data: This function will store digital input data in this argument.
Return	0: No error. 1: Function fails.
Others	None.

Function: Get_DO()

Function	**int Get_DO(__u8 *data);**
Description	Read high or low state on digital output channels.
Arguments	data: This function will store digital output data in this argument.
Return	0: No error. 1: Function fails.
Others	None.

Function: Set_DO()

Function	**int Set_DO(__u8 data);**
Description	Set digital output channels to high or low state.
Arguments	data: Data to be written to digital output channels.
Return	0: No error. 1: Function fails.
Others	None.

Function: Set_CANTermination()

Function	**int Set_CANTermination(int number, int onoff);**
Description	Set termination of specified CAN port.
Arguments	number: CAN port number. 0: CAN0. 1: CAN1. onoff: Enable or disable termination. 1: Enable termination. 0: Disable termination.
Return	0: No error. 1: Function fails.
Others	None.

4.2 librb217 API Examples

Note

Before using the API functions, remember to include header file librb217.h.

4.2.1 Get Board ID and Power Status

Use these system API functions to read boardID, check power status, and etc.

```
printf("This Board Device ID: %x\n\n", Get_BoardID());
printf("Check Power 1 status: ");
if(Get_PowerStatus(1) == 1) printf("Good!!\n\n");
else printf("Fail!!\n\n");

printf("Check Power 2 status: ");
if(Get_PowerStatus(2) == 1) printf("Good!!\n\n");
else printf("Fail!!\n\n");
```

4.2.2 COM Port Configuration

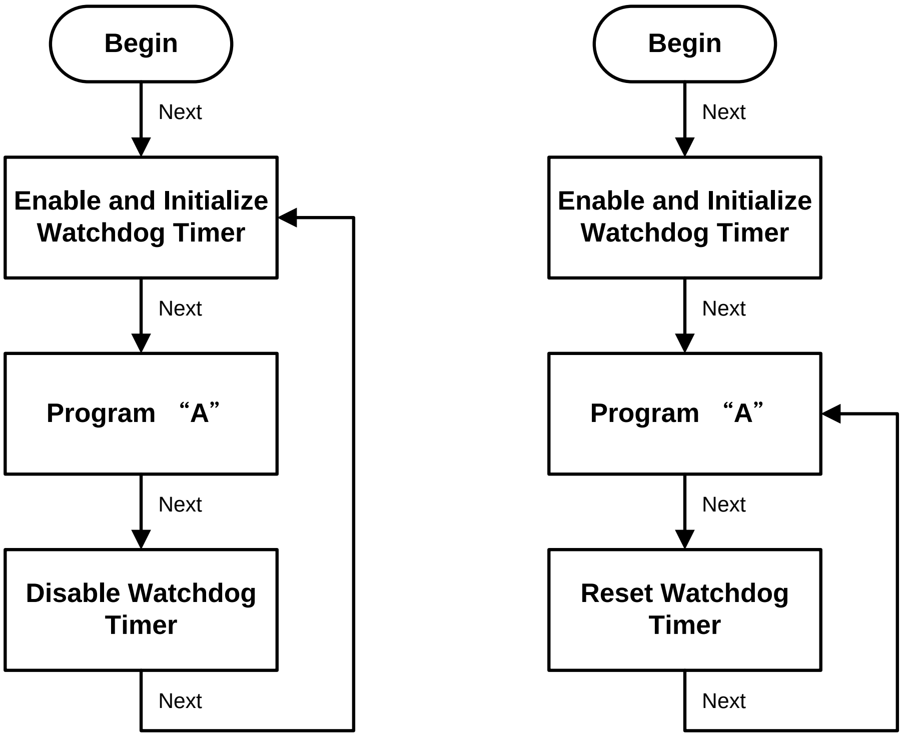
The COM port related API functions enable users to configure specified COM port communication mode to RS-232, 4-wired RS-422/485 and 2-wired RS-485.

```
printf("Read COM1 type: ");
if(Get_COMType(1) == 1) printf(" RS232\n\n");
else if(Get_COMType(1) == 2) printf(" RS422\n\n");
else if(Get_COMType(1) == 3) printf(" RS485\n\n");
else printf(" RSVD\n\n");

printf("Set COM2 to RS485..\n");

Set_COMType(2, 3);
printf("Read COM2 type: ");
if(Get_COMType(2) == 1) printf(" RS232\n\n");
else if(Get_COMType(2) == 2) printf(" RS422\n\n");
else if(Get_COMType(2) == 3) printf(" RS485\n\n");
else printf(" RSVD\n\n")
```

4.2.3 Watchdog Timer

Software stability is major issue in most application. Some embedded systems are not watched by human for 24 hours. It is usually too slow to wait for someone to reboot when system hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solution.

The watchdog timer is a counter that triggers a system reset when it counts down to zero from a preset value. The software starts counter with an initial value and must reset it periodically. If the counter ever reaches zero which means the software has crashed, the system will reboot. With these API functions, you can enable, disable, set watchdog timer value to 0 from 255 where 1 unit ~= 250ms, and etc..



```
printf("Enable CPLD WDT 30 sec..\n");
CPLD_WDT_Enable(120);
printf("CPLD WDT Counter: [%.2f] sec\n\n",(float)
CPLD_Get_WDTCounter()/4);
printf("Delay 5 sec..\n");
sleep(5);

printf("CPLD WDT Counter: [%.2f] sec\n\n",(float)
CPLD_Get_WDTCounter()/4);
printf("Disable CPLD WDT..\n");
CPLD_WDT_Disable();
```

4.2.4 Digital Input and Output

The digital related API functions allow users to set digital output signals to high or low and detect signal state from each digital channel.

```
unsigned char xch;
Get_DI(&xch);
printf("Current Digital-Input Data is %2X\n",xch);
Set_DO(0xAA);
Get_DO(&xch);
printf("Current Digital-Output Data is %2X\n",xch);
```

4.2.5 LEDs Control

Four different LEDs are supported by rBOX630: ACT/RDY LED, ALARM LED and Minicard strength, linked LED. Use the LED API functions to control LED on/off state.

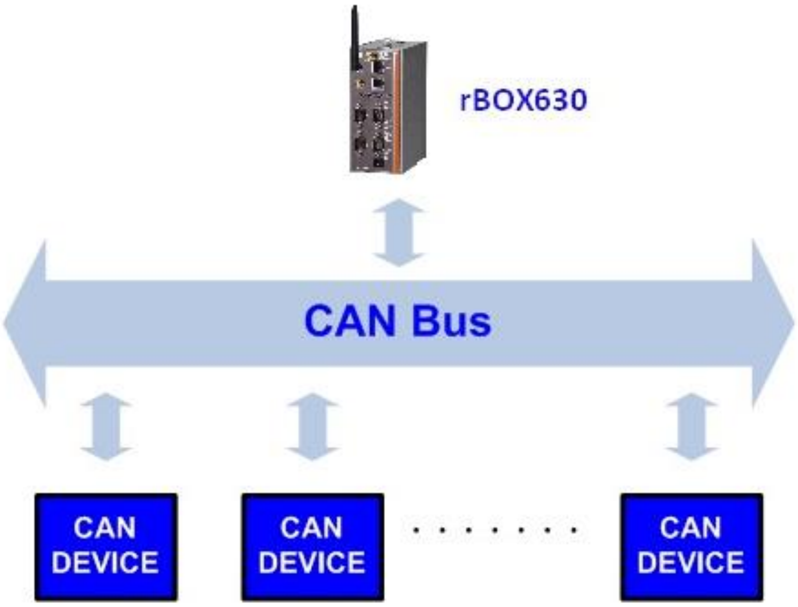
```
printf("Turn on ACT/RDY LED ..\n");
Set_LEDStatus(1);
sleep(2);
printf("Turn off(blinking) ACT/RDY LED ..\n");
Set_LEDStatus(0)
printf("Turn on ALARM LED ..\n");
Set_ALARMLED(1);
Set_3GSLEDGreen();
sleep(2);
printf("Turn off ALARM LED ..\n");
Set_ALARMLED(0);
```

Use sysfs filesystem to control Minicard LED on/off state.

Turn on linked LED
```
~# echo 0 > /sys/class/leds/card1-link/brightness
```
Turn off linked LED
```
~# echo 255 > /sys/class/leds/card1-link/brightness
```
Turn on strength LED Green
```
~# echo 0 > /sys/class/leds/card1-good/brightness
```
Turn off strength LED Green
```
~# echo 255 > /sys/class/leds/card1-good/brightness
```
Turn on strength LED Amber
```
~# echo 0 > /sys/class/leds/card1-poor/brightness
```
Turn off strength LED Amber
```
~# echo 255 > /sys/class/leds/card1-poor/brightness
```

4.3 CAN Bus

The Controller Area Network (CAN) bus is a serial bus protocol that usually used in connecting intelligent industrial device networks and building smart automatic control systems. Use the SocketCAN API to read and write to CAN bus on rBOX630. An example program showing how it works is provided below.



```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h>
#include <net/if.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <sys/ioctl.h>
#include <linux/can.h>
#include <linux/can/raw.h>

#define SIOCSCANBAUDRATE        0x89F0

int main(void)
{
            int s,s1;
            int nbytes;
            struct sockaddr_can addr,addr1;
            struct can_frame frame,frame1;
            struct ifreq ifr,ifr1;
              int xBitRate=500000;
```

```
        char *ifname = "can0";
          char *ifname1 = "can1";

        if((s = socket(PF_CAN, SOCK_RAW, CAN_RAW)) < 0) {
                perror("Error while opening socket");
                return -1;
        }
          if((s1 = socket(PF_CAN, SOCK_RAW, CAN_RAW)) < 0) {
                perror("Error while opening socket");
                return -1;
        }

        strcpy(ifr.ifr_name, ifname);
          strcpy(ifr1.ifr_name,ifname1);
        ioctl(s, SIOCGIFINDEX, &ifr);
          ioctl(s1,SIOCGIFINDEX, &ifr1);

        addr.can_family   = AF_CAN;
        addr.can_ifindex = ifr.ifr_ifindex;
          ifr.ifr_ifru.ifru_ivalue = xBitRate;
          ioctl(s, SIOCSCANBAUDRATE, &ifr);

          addr1.can_family = AF_CAN;
          addr1.can_ifindex = ifr1.ifr_ifindex;
          ifr.ifr_ifru.ifru_ivalue = xBitRate;
          ioctl(s1, SIOCSCANBAUDRATE, &ifr1);

        printf("%s at index %d\n", ifname, ifr.ifr_ifindex);
          printf("%s at index %d\n", ifname1, ifr1.ifr_ifindex);

        if(bind(s, (struct sockaddr *)&addr, sizeof(addr)) < 0) {
                perror("Error in socket bind");
                return -2;
        }
          if(bind(s1, (struct sockaddr *)&addr1, sizeof(addr1)) < 0) {
                perror("Error in socket bind");
                return -2;
        }

        frame.can_id   = 0x123;
        frame.can_dlc = 2;
        frame.data[0] = 0x11;
        frame.data[1] = 0x22;

        write(s, &frame, sizeof(struct can_frame));
          printf("Wrote data[0]:%2x,data[1]:%2x\n",frame.data[0],frame.data[1]);
          read(s1, &frame1, sizeof(struct can_frame));
          printf("Read data[0]:%2x,data[1]:%2x\n",frame1.data[0],frame1.data[1]);

        return 0;
}
```

4.4 Compile Demo Program

4.4.1 Install Yocto Toolchain

Before you develop and compile sample program, you should install Yocto toolchain into development PC. To do so, refer to Chapter 5 Board Support Package.

To compile and build demo program for rBOX630, please do:
Change to *your project* directory.

```
~$ cd ~/Project
```

Set up the cross-development environment.

```
~$ source /opt/poky/1.5.4/environment-setup-cortexa9hf-vfp-neon-poky-linux-gnueabi
```

Extract driver source to *your project* directory.

```
~$ tar jxf rBOX630-rb_lib-x.x.x.tar.bz2 -C ~/Project
```

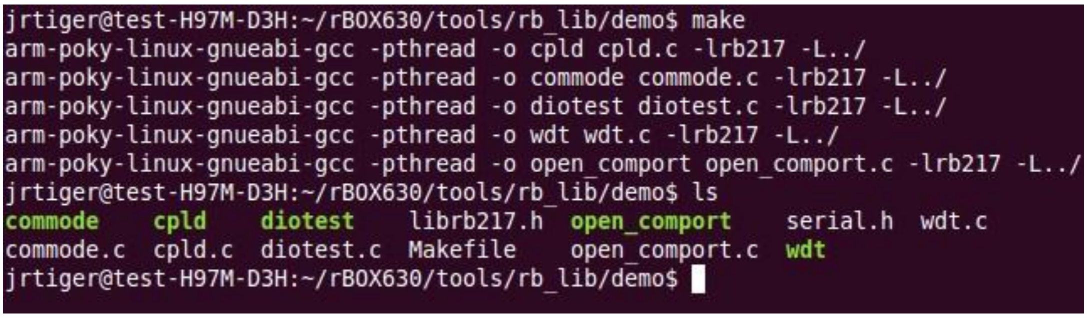
Change to *rb_lib/demo* directory.

```
~$ cd ~/Project/rb_lib/demo
```

Build the demo program.

```
~$ make
```

Then you should have example programs such as open_comport, wdt, cpld, diotest, and commode.



```
jrtiger@test-H97M-D3H:~/rBOX630/tools/rb_lib/demo$ make
arm-poky-linux-gnueabi-gcc -pthread -o cpld cpld.c -lrb217 -L../
arm-poky-linux-gnueabi-gcc -pthread -o commode commode.c -lrb217 -L../
arm-poky-linux-gnueabi-gcc -pthread -o diotest diotest.c -lrb217 -L../
arm-poky-linux-gnueabi-gcc -pthread -o wdt wdt.c -lrb217 -L../
arm-poky-linux-gnueabi-gcc -pthread -o open_comport open_comport.c -lrb217 -L../
jrtiger@test-H97M-D3H:~/rBOX630/tools/rb_lib/demo$ ls
commode    cpld    diotest    librb217.h  open_comport    serial.h  wdt.c
commode.c  cpld.c  diotest.c  Makefile    open_comport.c  wdt
jrtiger@test-H97M-D3H:~/rBOX630/tools/rb_lib/demo$ 
```

4.4.2 Run demo program

Refer to section 2.3 for detailed information.

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Chapter 5
Board Support Package (BSP)

5.1 Host Development System Installation

5.1.1 Install Host System

1. Download Ubuntu 14.04 LTS iso image.

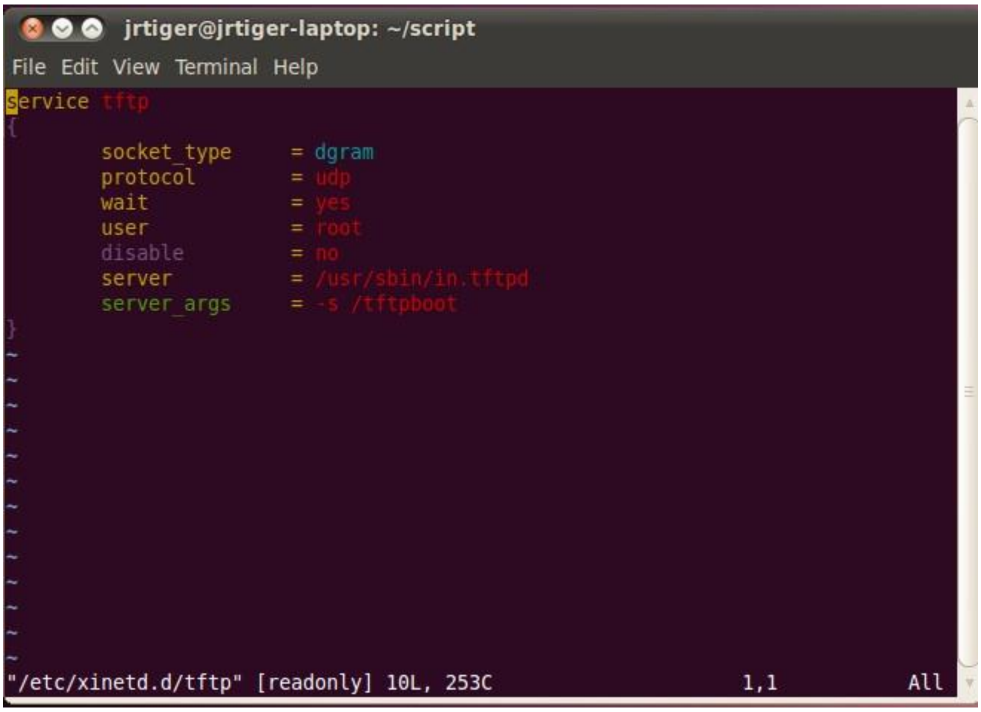
2. Install Ubuntu 14.04.

3. Install host packages needed by Yocto development as follows:

```
~$ sudo apt-get install wget git-core unzip texinfo libsdl1.2-dev gawk diffstat
~$ sudo apt-get install build-essential chrpath sed cvs subversion coreutils
~$ sudo apt-get install texi2html docbook-utils python-pysqlite2 help2man
~$ sudo apt-get install make gcc g++ desktop-file-utils libgl1-mesa-dev
~$ sudo apt-get install libglu1-mesa-dev mercurial autoconf
~$ sudo apt-get install automake groff curl lzop asciidoc xterm
```

4. Install and configure TFTP server:
After tftpd is installed, configure it by editing */etc/xinetd.d/tftp*. Change the default export path (it is either */usr/var/tftpboot* or */var/lib/tftpboot*) to */*. Or change the default export path to whatever directory you want to download from. Then reboot the hardware.

```
$ sudo aptitude -y install tftp tftpd xinetd
$ sudo vi /etc/xinetd.d/tftp
```


jrtiger@jrtiger-laptop: ~/script
File Edit View Terminal Help

```
service tftp
{
        socket_type     = dgram
        protocol        = udp
        wait            = yes
        user            = root
        disable         = no
        server          = /usr/sbin/in.tftpd
        server_args     = -s /tftpboot
}
~
~
~
~
~
~
~
~
~
~
~
~
~
"/etc/xinetd.d/tftp" [readonly] 10L, 253C                    1,1           All
```

Then restart the TFTP server.

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

5. Install and configure NFS server:

   ```
   $ sudo aptitude -y install nfs-common nfs-kernel-server portmap
   ```

   To configure nfs server, add lines to */etc/exports* as follows:
   */tools/rootfs *(rw,sync,no_root_squash)*

   ```
   $ sudo vi /etc/exports
   ```

   Create a symbolic link to root filesystem which your build.

   ```
   $ sudo mkdir /tools
   $ sudo ln -s ~/Project/rootfs /tools/rootfs
   ```

   Then restart the NFS server.

   ```
   $ sudo /etc/init.d/nfs-kernel-server restart
   ```

5.1.2 Install Yocto development

1. Setting up the repo utility.
   Create a bin folder in the home directory.

   ```
   ~$ mkdir ~/bin (this step may not be needed if the bin folder already exists)
   ~$ curl http://commondatastorage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
   ~$ chmod a+x ~/bin/repo
   ```

   Add the following line to the .bashrcfile to ensure that the ~/binfolder is in your PATH variable.

   ```
   export PATH=~/bin:$PATH
   ```

2. Setting up the Git environment

   ```
   ~$ git config --global user.name “Your Name”
   ~$ git config --global user.email “Your Email”
   ```

3. Download the Freescale’s Yocto BSP source

   ```
   ~$ mkdir fsl-community-bsp
   ~$ cd fsl-community-bsp
   ~$ repo init -u https://github.com/Freescale/fsl-community-bsp-platform -b dora
   ~$ repo sync
   ```

4. Extract Axiomtek’s Yocto BSP source

   ```
   ~$ tar zxvf meta-axiomtek-x.x.x.tar.gz -C fsl-community-bsp/sources
   ```

5. Update bblayers.conf

   ```
   ~$ vi fsl-community-bsp/sources/base/conf/bblayers.conf
   ```

   And add this line after *${BSPDIR}/sources/meta-fsl-demos \*
   ${BSPDIR}/sources/meta-axiomtek \

6. First build
   Change to fsl-community-bsp directory

   ```
   ~$ cd fsl-community-bsp
   ```

   Create your local branch

   ```
   ~$ repo start <new branch name> --all
   ```

   Choose your board

   ```
   ~$ MACHINE=rbox630 source setup-environment build
   ```

   Start to build image

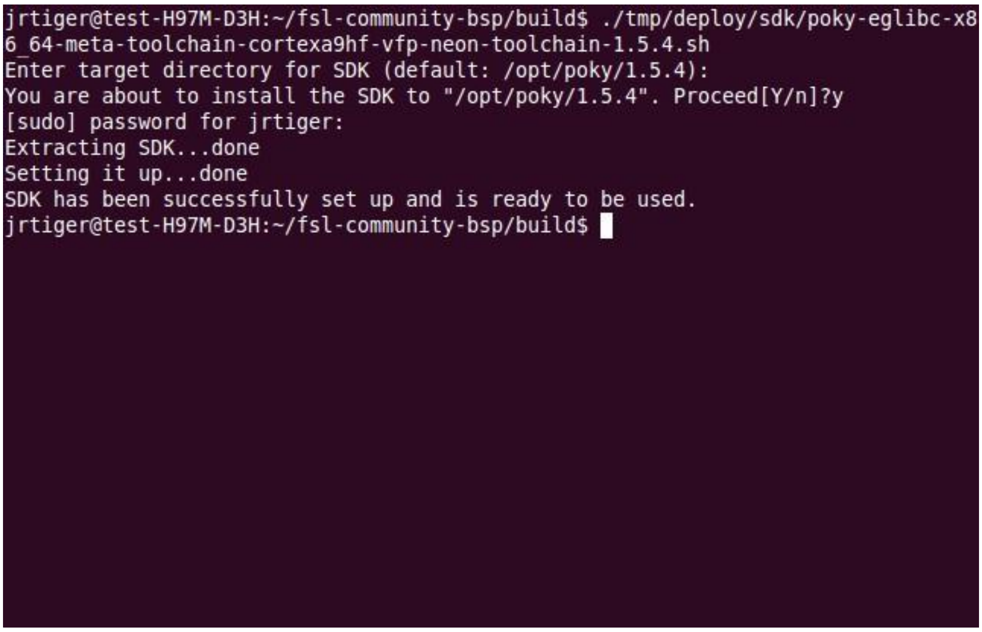
   ```
   ~$ bitbake rbox-image-test
   ```

5.1.3 Build and Install Yocto toolchain

1. Build the toolchain for rBOX630 from Yocto development.
   Change to *Yocto development* directory.
   ~$ cd fsl-community-bsp
   ~$ source setup-environment build
   ~$ bitbake meta-toolchain-sdk

   After these steps to generate the toolchain into the Build Directory.

2. Install the toolchain into your host system /opt directory.
   ~$ ./tmp/deploy/sdk/poky-eglibc-x86_64-meta-toolchain-cortexa9hf-vfp-neon-toolchain-1.5.4.sh

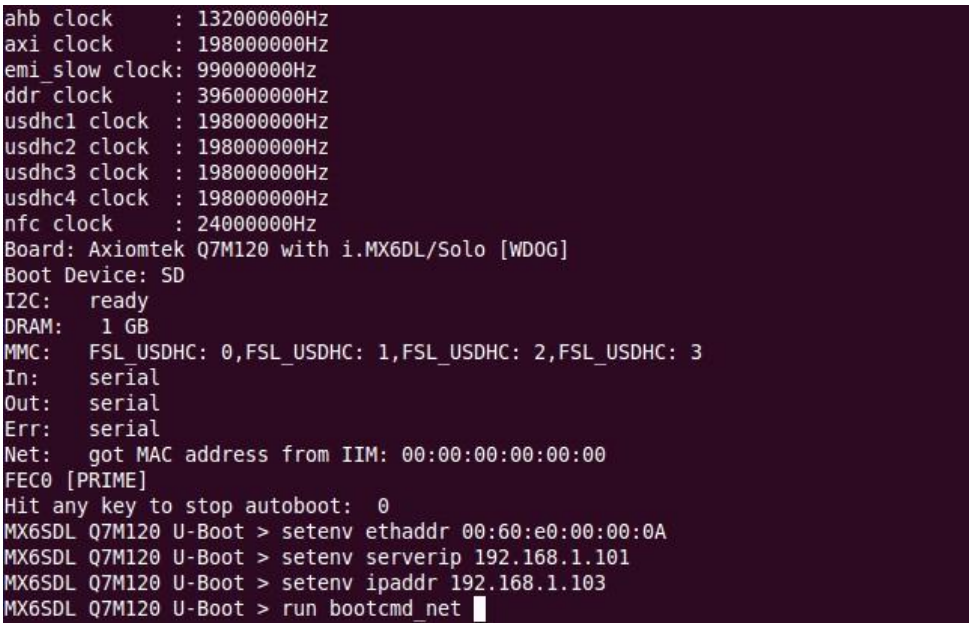


```
jrtiger@test-H97M-D3H:~/fsl-community-bsp/build$ ./tmp/deploy/sdk/poky-eglibc-x8
6_64-meta-toolchain-cortexa9hf-vfp-neon-toolchain-1.5.4.sh
Enter target directory for SDK (default: /opt/poky/1.5.4):
You are about to install the SDK to "/opt/poky/1.5.4". Proceed[Y/n]?y
[sudo] password for jrtiger:
Extracting SDK...done
Setting it up...done
SDK has been successfully set up and is ready to be used.
jrtiger@test-H97M-D3H:~/fsl-community-bsp/build$
```

5.2 U-Boot for rBOX630

5.2.1 Booting the System with an NFS Filesystem

By default, U-Boot is configured to boot from SD CARD. To boot from NFS, first you must set some configurations. Press any key to break from the boot progress and set configurations.



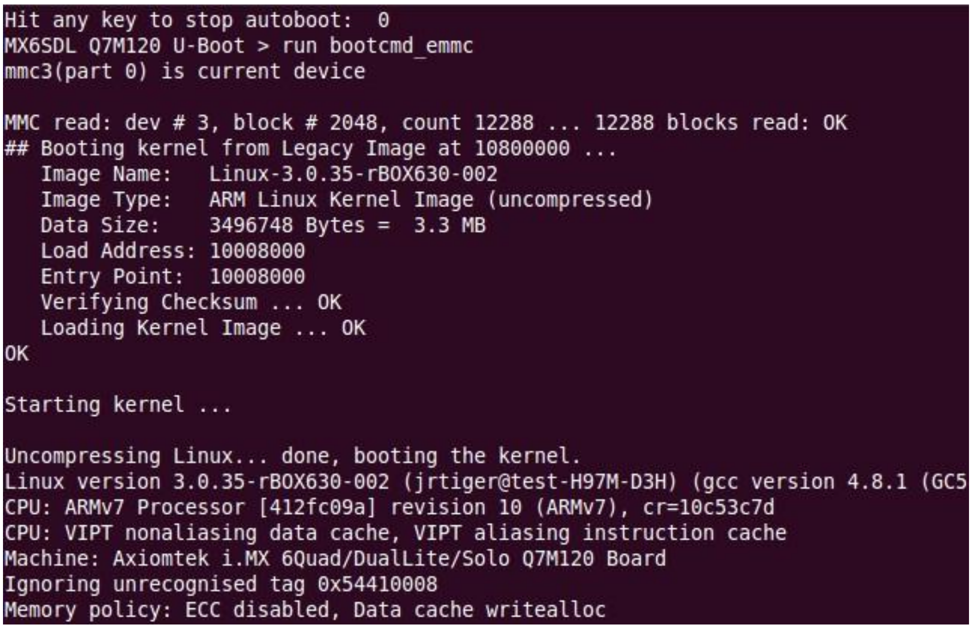
```
ahb clock     : 132000000Hz
axi clock     : 198000000Hz
emi_slow clock: 99000000Hz
ddr clock     : 396000000Hz
usdhc1 clock  : 198000000Hz
usdhc2 clock  : 198000000Hz
usdhc3 clock  : 198000000Hz
usdhc4 clock  : 198000000Hz
nfc clock     : 24000000Hz
Board: Axiomtek Q7M120 with i.MX6DL/Solo [WDOG]
Boot Device: SD
I2C:   ready
DRAM:   1 GB
MMC:   FSL_USDHC: 0,FSL_USDHC: 1,FSL_USDHC: 2,FSL_USDHC: 3
In:    serial
Out:   serial
Err:   serial
Net:   got MAC address from IIM: 00:00:00:00:00:00
FEC0 [PRIME]
Hit any key to stop autoboot:  0
MX6SDL Q7M120 U-Boot > setenv ethaddr 00:60:e0:00:00:0A
MX6SDL Q7M120 U-Boot > setenv serverip 192.168.1.101
MX6SDL Q7M120 U-Boot > setenv ipaddr 192.168.1.103
MX6SDL Q7M120 U-Boot > run bootcmd_net
```

Setup TFTP server IP:
MX6SDL Q7M120 U-Boot > setenv serverip 192.168.1.101
Setup board IP address:
MX6SDL Q7M120 U-Boot > setenv ipaddr 192.168.1.103
Run boot from NFS server:
MX6SDL Q7M120 U-Boot > run bootcmd_net

NOTE: If the MAC address has not burned into fuse, you must set the MAC address to use network in U-Boot.
MX6SDL Q7M120 U-Boot > setenv ethaddr xx:xx:xx:xx:xx:xx

5.2.2 Booting the System from eMMC (rBOX630 default)

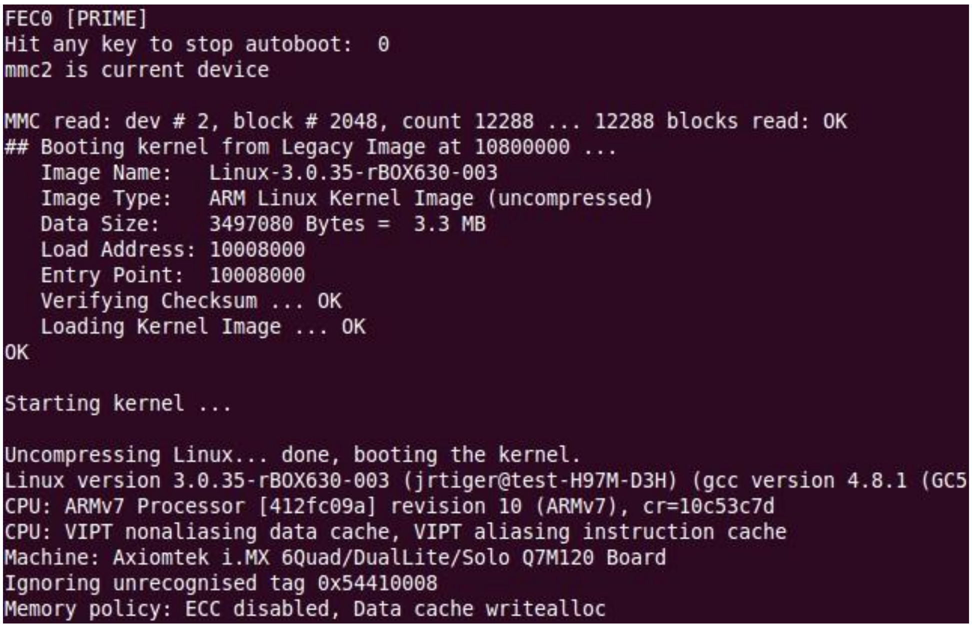
MX6SDL Q7M120 U-Boot > run bootcmd_emmc



```
Hit any key to stop autoboot:  0
MX6SDL Q7M120 U-Boot > run bootcmd_emmc
mmc3(part 0) is current device

MMC read: dev # 3, block # 2048, count 12288 ... 12288 blocks read: OK
## Booting kernel from Legacy Image at 10800000 ...
   Image Name:   Linux-3.0.35-rBOX630-002
   Image Type:   ARM Linux Kernel Image (uncompressed)
   Data Size:    3496748 Bytes =  3.3 MB
   Load Address: 10008000
   Entry Point:  10008000
   Verifying Checksum ... OK
   Loading Kernel Image ... OK
OK

Starting kernel ...

Uncompressing Linux... done, booting the kernel.
Linux version 3.0.35-rBOX630-002 (jrtiger@test-H97M-D3H) (gcc version 4.8.1 (GC5
CPU: ARMv7 Processor [412fc09a] revision 10 (ARMv7), cr=10c53c7d
CPU: VIPT nonaliasing data cache, VIPT aliasing instruction cache
Machine: Axiomtek i.MX 6Quad/DualLite/Solo Q7M120 Board
Ignoring unrecognised tag 0x54410008
Memory policy: ECC disabled, Data cache writealloc
```

5.2.3 Booting the System from SD CARD

MX6SDL Q7M120 U-Boot > run bootcmd_sd



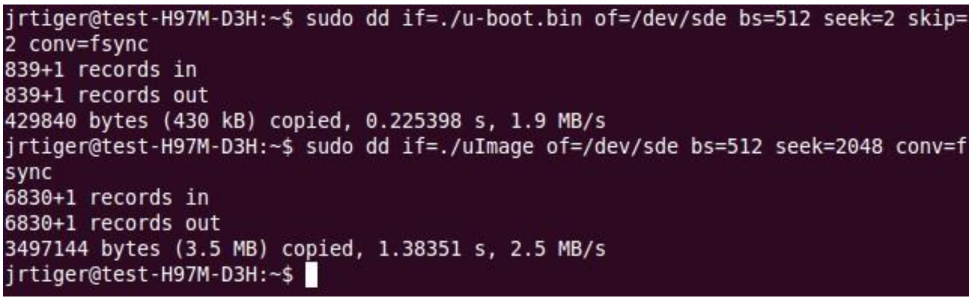
```
FEC0 [PRIME]
Hit any key to stop autoboot:  0
mmc2 is current device

MMC read: dev # 2, block # 2048, count 12288 ... 12288 blocks read: OK
## Booting kernel from Legacy Image at 10800000 ...
   Image Name:   Linux-3.0.35-rBOX630-003
   Image Type:   ARM Linux Kernel Image (uncompressed)
   Data Size:    3497080 Bytes =  3.3 MB
   Load Address: 10008000
   Entry Point:  10008000
   Verifying Checksum ... OK
   Loading Kernel Image ... OK
OK

Starting kernel ...

Uncompressing Linux... done, booting the kernel.
Linux version 3.0.35-rBOX630-003 (jrtiger@test-H97M-D3H) (gcc version 4.8.1 (GC5
CPU: ARMv7 Processor [412fc09a] revision 10 (ARMv7), cr=10c53c7d
CPU: VIPT nonaliasing data cache, VIPT aliasing instruction cache
Machine: Axiomtek i.MX 6Quad/DualLite/Solo Q7M120 Board
Ignoring unrecognised tag 0x54410008
Memory policy: ECC disabled, Data cache writealloc
```

5.3 Additional Information

5.3.1 Create a Bootable SD CARD for rBOX630

1. Copying the Boot Loader image.
   ~$ sudo dd if=./u-boot.bin of=/dev/sdb bs=512 seek=2 skip=2 conv=fsync
   The first 1KB of the SD card, that includes the partition table, will be preserved

2. Copying the Kernel image.
   ~$ sudo dd if=./uImage of=/dev/sdb bs=512 seek=2048 conv=fsync
   This will copy uImage to the media at offset 1MB



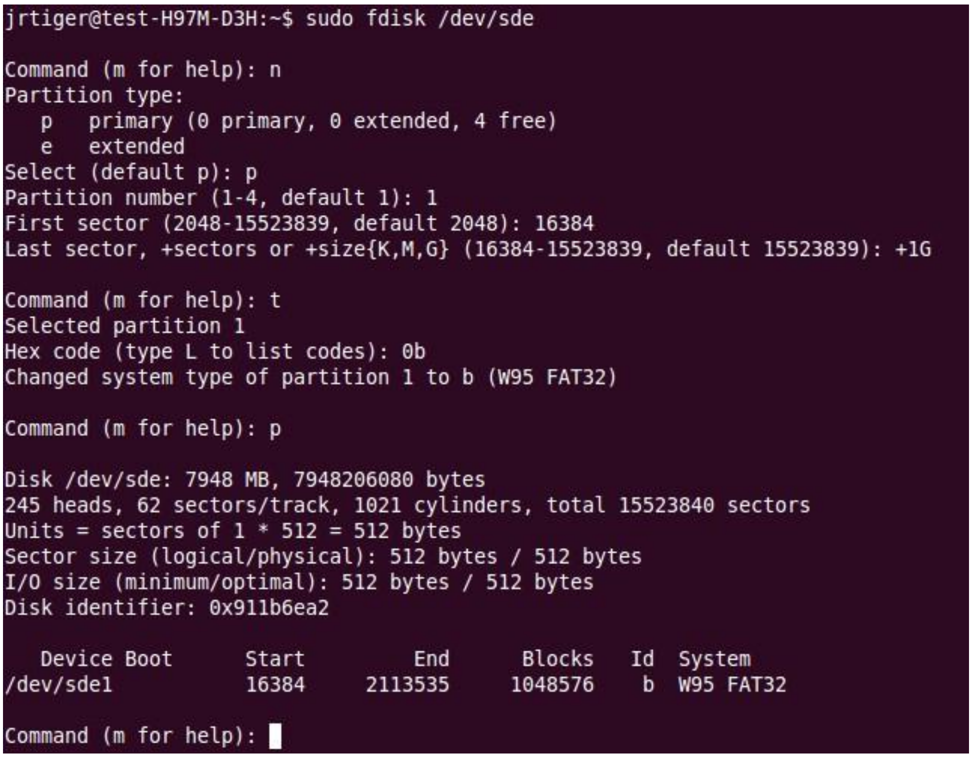
```
jrtiger@test-H97M-D3H:~$ sudo dd if=./u-boot.bin of=/dev/sde bs=512 seek=2 skip=
2 conv=fsync
839+1 records in
839+1 records out
429840 bytes (430 kB) copied, 0.225398 s, 1.9 MB/s
jrtiger@test-H97M-D3H:~$ sudo dd if=./uImage of=/dev/sde bs=512 seek=2048 conv=f
sync
6830+1 records in
6830+1 records out
3497144 bytes (3.5 MB) copied, 1.38351 s, 2.5 MB/s
jrtiger@test-H97M-D3H:~$ 
```

3. Copying the Root File System (rootfs).
   First, a partition table must be created.

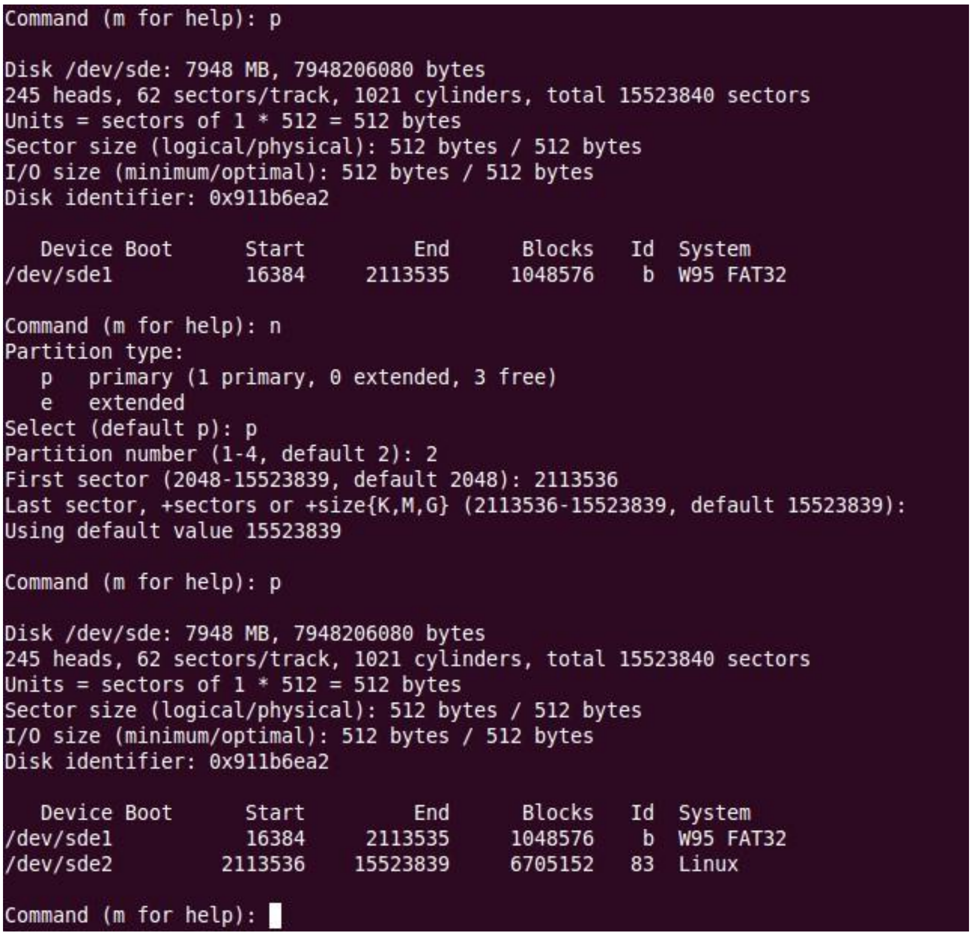
   To create a first partition FAT32 format for Windows PC easy access, after offset 16384 (in sectors of 512 bytes) , and Second partition Linux format for Root filesystem enter the following command:
   ~$ sudo fdisk /dev/sdb

   Type the following parameters (each followed by <Enter>):

u	[switch the unit to sectors instead of cylinders]
d	[repeat this until no partition is reported by the 'p' command]
n	[create a new partition]
p	[create a primary partition]
1	[the first partition]
16384	[starting at offset sector #16384, i.e. 8MB, which leaves enough space for the kernel, the boot loader and its configuration data]
+1G	[create 1G size for FAT32]
t	[change a partition's system id]
b	[choice W95 FAT32 type]
n	[create a new partition]
p	[create a primary partition]
2	[the second partition]
2113536	[starting after offset sector #2113536]
<enter>	[using the default value will create a partition that spans to the last sector of the medium]
w	[this writes the partition table to the medium and fdisk exits]



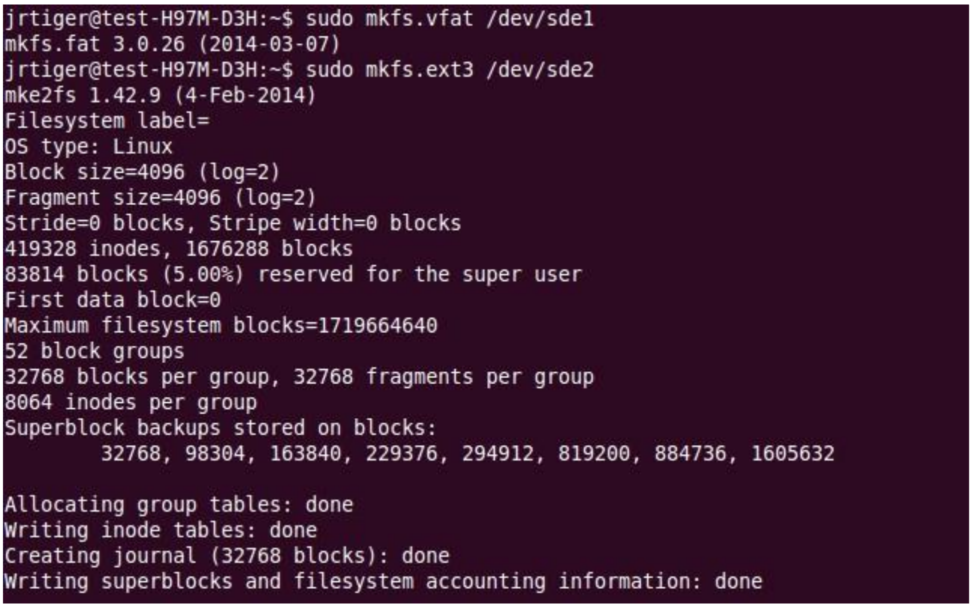
```
jrtiger@test-H97M-D3H:~$ sudo fdisk /dev/sde

Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-15523839, default 2048): 16384
Last sector, +sectors or +size{K,M,G} (16384-15523839, default 15523839): +1G

Command (m for help): t
Selected partition 1
Hex code (type L to list codes): 0b
Changed system type of partition 1 to b (W95 FAT32)

Command (m for help): p

Disk /dev/sde: 7948 MB, 7948206080 bytes
245 heads, 62 sectors/track, 1021 cylinders, total 15523840 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x911b6ea2

   Device Boot      Start         End      Blocks   Id  System
/dev/sde1           16384     2113535     1048576    b  W95 FAT32

Command (m for help):
```



```
Command (m for help): p

Disk /dev/sde: 7948 MB, 7948206080 bytes
245 heads, 62 sectors/track, 1021 cylinders, total 15523840 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x911b6ea2

   Device Boot      Start         End      Blocks   Id  System
/dev/sde1           16384     2113535     1048576    b  W95 FAT32

Command (m for help): n
Partition type:
   p   primary (1 primary, 0 extended, 3 free)
   e   extended
Select (default p): p
Partition number (1-4, default 2): 2
First sector (2048-15523839, default 2048): 2113536
Last sector, +sectors or +size{K,M,G} (2113536-15523839, default 15523839):
Using default value 15523839

Command (m for help): p

Disk /dev/sde: 7948 MB, 7948206080 bytes
245 heads, 62 sectors/track, 1021 cylinders, total 15523840 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x911b6ea2

   Device Boot      Start         End      Blocks   Id  System
/dev/sde1           16384     2113535     1048576    b  W95 FAT32
/dev/sde2         2113536    15523839     6705152   83  Linux

Command (m for help):
```

Run the following command to format the partition

```
~$ sudo mkfs.vfat /dev/sdb1
~$ sudo mkfs.ext3 /dev/sdb2
```



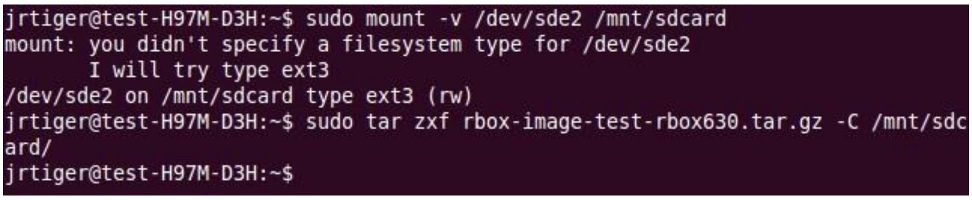
```
jrtiger@test-H97M-D3H:~$ sudo mkfs.vfat /dev/sde1
mkfs.fat 3.0.26 (2014-03-07)
jrtiger@test-H97M-D3H:~$ sudo mkfs.ext3 /dev/sde2
mke2fs 1.42.9 (4-Feb-2014)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
419328 inodes, 1676288 blocks
83814 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1719664640
52 block groups
32768 blocks per group, 32768 fragments per group
8064 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
```

Copy the target file system to the partition

```
 ~$ mkdir /home/user/mountpoint
 ~$ sudo mount /dev/sdb2 /home/user/mountpoint
```

Extract rootfs package to certain directory

```
 ~$ sudo tar zxf rootfs.tar.gz -C /home/user/mountpoint
```



```
jrtiger@test-H97M-D3H:~$ sudo mount -v /dev/sde2 /mnt/sdcard
mount: you didn't specify a filesystem type for /dev/sde2
       I will try type ext3
/dev/sde2 on /mnt/sdcard type ext3 (rw)
jrtiger@test-H97M-D3H:~$ sudo tar zxf rbox-image-test-rbox630.tar.gz -C /mnt/sdc
ard/
jrtiger@test-H97M-D3H:~$
```

Note

Make sure that the device node is correct for the SD CARD. i.e. sdb or sdc