
Ubuntu 9.10 Startup Guide for the i.MX5X EVK board

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1 Introduction

This document will guide through the steps to run Ubuntu 9.10 (aka Karmic) on an i.MX51 EVK and i.MX53 boards.

The first chapter lists the required hardware equipment and cables

The second chapter is a quick start up guide. Your system might come with a pre-installed Ubuntu 9.10 file system on an SD card. Your system is ready to go.

The third chapter focuses on programming the Ubuntu 9.10 root file system to an SD card.

We will use the i.MX5x acronym to refer to either i.MX51 or i.MX53 whenever instruction apply to both systems.

2 Hardware setup

2.1 MX51 EVK setup

The Figure 1 shows an i.MX51 EVK board and its connectors:

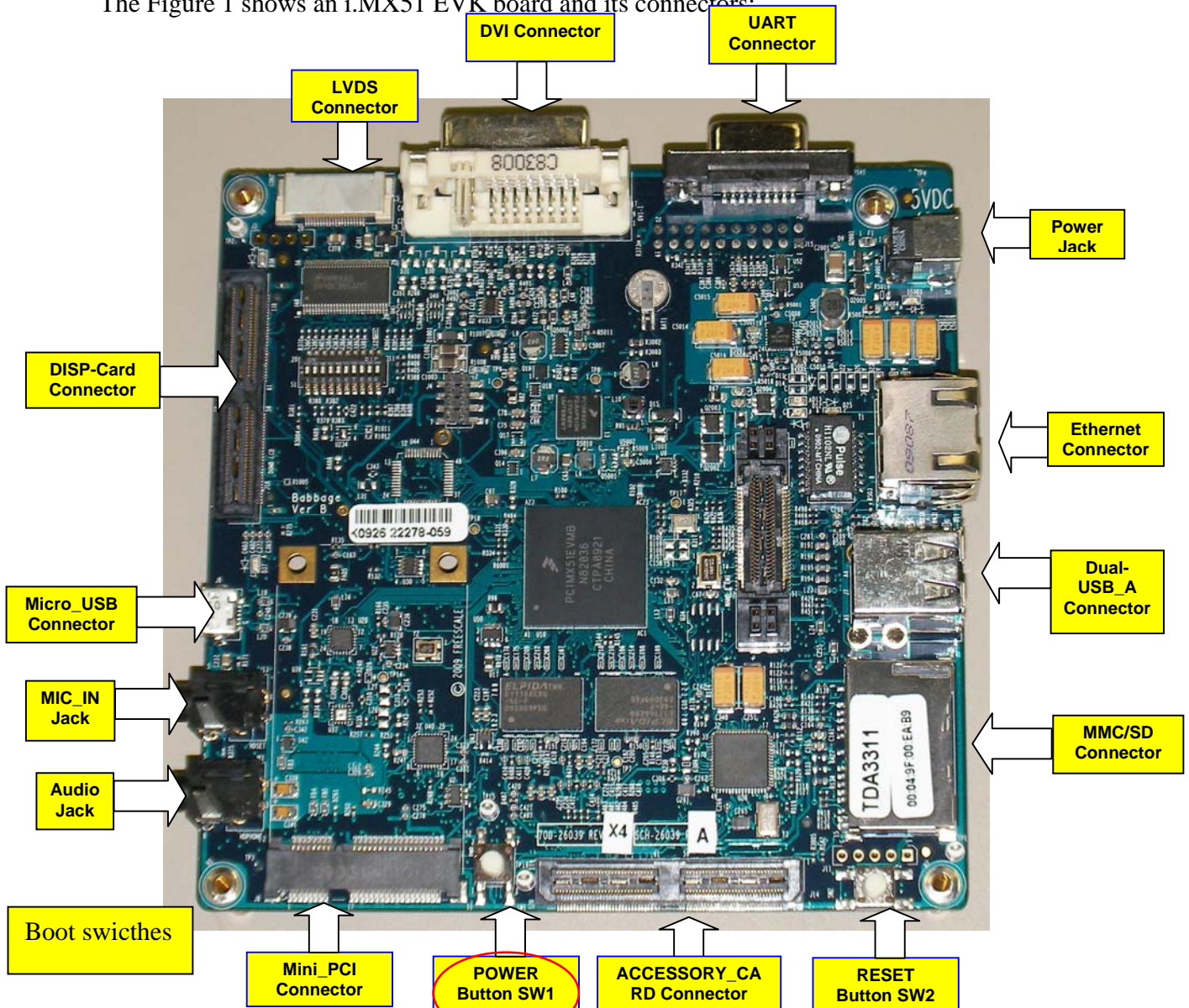


Figure 1: i.MX51 EVK board connectors and switches

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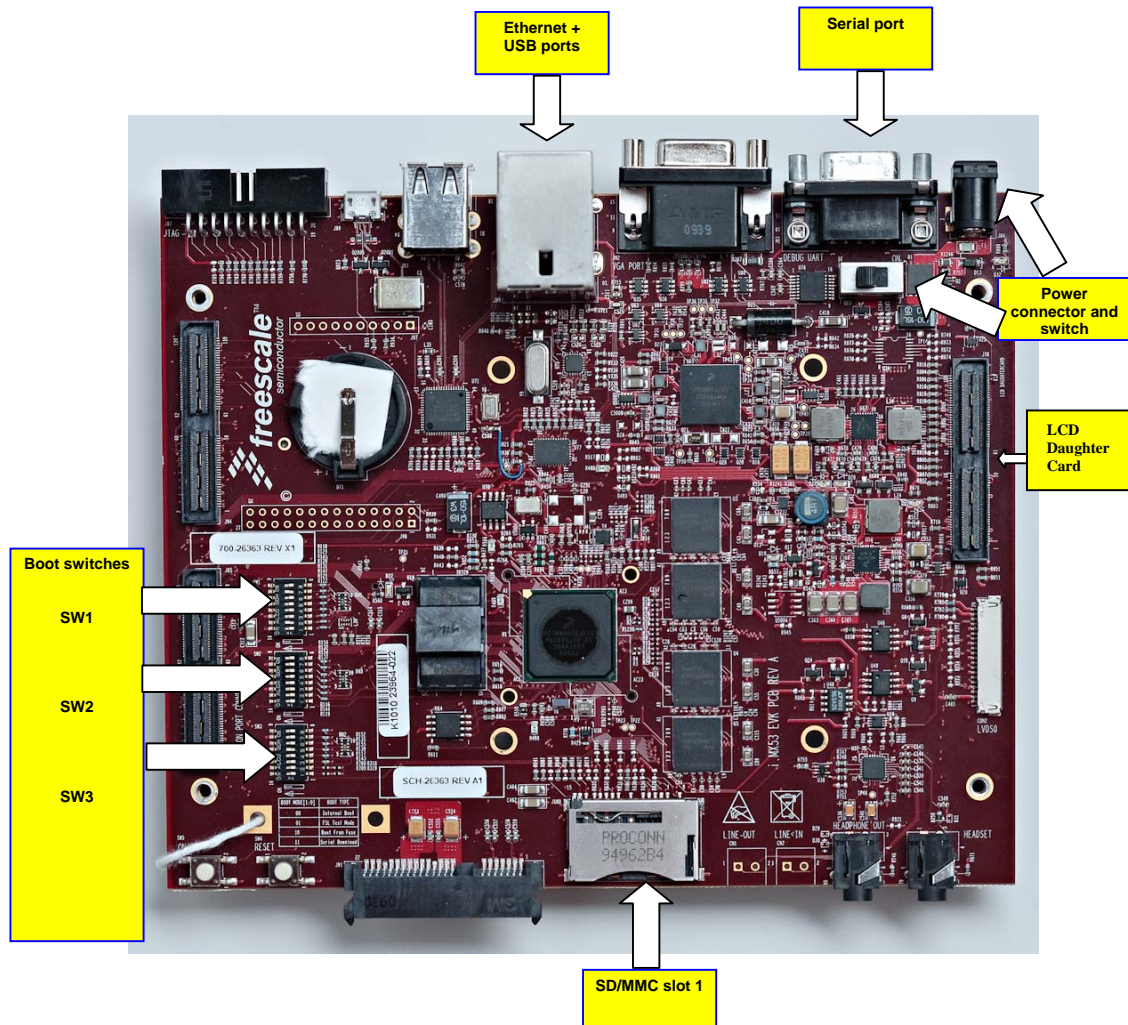
The following cables and equipment are required:

- + A DVI cable
- + A monitor with a DVI input. Minimum supported resolution must be 800x600.
- + A DB9 cable for the serial console
- + A USB mouse and keyboard (connect them to the Dual USB connector shown above)
- + Speakers or headphones with a 3.5 mm stereo jack
- + An Ethernet cable
- + A 5V power supply
- + A PC running Windows or Linux (we do recommend this PC runs Ubuntu 9.04)

Configure the i.MX51 EVK board to boot off of an SD card by setting the boot switches SW7 and SW8 to ON and by setting the other boot switches to off. For the switches settings of other boot modes, see [i.MX51_EVK_Linux_BSP_UserGuide.pdf](#).

The serial port is configured as follows: 115200 BPS, 8 bits, no parity, 1 stop bit and no flow control. Make sure the serial port terminal running on the PC is configured accordingly.

2.2 MX53 EVK setup



Above figure takes MX53 EVK RevA board (Red color) as the example. MX53 EVK RevB board (Blue color) is similar with RevA board. Please refer to Hardware documentations to know the detailed difference between RevA and RevB boards.

The following cables and equipment are required:

- + A 4 + GB SD card (we recommend SanDisk's)
- + A DB9 cable for the serial console
- + A USB mouse and keyboard (connect them to the Dual USB connector shown above)
- + a WVGA LCD display or DVI daughter board which connects to J78.
- + An Ethernet cable
- + A 5V power supply
- + A PC running Linux, equipped with an SD card reader

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Configure the i.MX53 EVK board to boot off of an SD card in upper slot by setting the switches on:

- + SW1 's switches 7 ON. All others set to off
- + All SW2's switches set to off
- + SW3's switch 6 set to on (4-bit)/off (1-bit), all others set to off.

For the switches settings of other boot modes, see [i.MX53_EVK_Linux_BSP_UserGuide.pdf](#).

The serial port is configured as follows: 115200 BPS, 8 bits, no parity, 1 stop bit and no flow control. Make sure the serial port terminal running on the PC is configured accordingly.

3 Quick start up

Your system might come with a pre-installed Ubuntu 9.10 file system on an SD card.

3.1 MX51 Start up

To start the i.MX51 off that SD card, please insert the SD card into the SD/MMC slot 1 located at the bottom of the board (two ports are available). Press the power button SW1 for at least 3 seconds. Messages will be printed out to the serial port, and will show up on the terminal.

3.2 MX53 Start up

To start the i.MX53 off that SD card, please insert the SD card into the SD/MMC slot 1 located at the top side of the board (two ports are available). Put power switch as On. Messages will be printed out to the serial port, and will show up on the terminal.

4 Build Root File System

Starting from the FSL tar file:

Untar the FSL Ubuntu demo image (for example, the package name is karmic.tar.gz) file onto an SD card (4GB or larger) using a Linux host with an SD interface or using a target Linux system. The instructions below assume an i.MX5x EVK board, running the Freescale Linux BSP.

Copying the boot loader image:

Use dd command in linux server to perform the copying. At first you can run following command to identify the device node assigned to the SD card:

```
$ cat /proc/partitions
major minor #blocks name
8 0 78125000 sda
8 1 75095811 sda1
8 2 1 sda2
8 5 3028221 sda5
8 32 488386584 sdc
8 33 488386552 sdc1
8 16 3921920 mmcblk0
```

In this case, the device node assigned by kernel is /dev/mmcblk0. Then run the following command to copy the u-boot image to the SD card (pick the command that matches the platform you want to use):

```
sudo dd if=u-boot-bbg.bin of=/dev/mmcblk0 bs=512 && sync && sync
sudo dd if=u-boot-mx53.bin of=/dev/mmcblk0 bs=512 && sync && sync
```

Please note this operation will delete the partition table present on the medium. If want to update uboot to another version, may run the following command instead:

```
sudo dd if=u-boot-bbg.bin of=/dev/mmcblk0 bs=512 skip=2 seek=2 && sync && sync
sudo dd if=u-boot-mx53.bin of=/dev/mmcblk0 bs=512 skip=2 seek=2 && sync && sync
```

The first 1kB, which includes the partition table, will be preserved.

Copying the kernel image:

The following command will copy the kernel image to the SD card (i.MX5x).

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```
sudo dd if=uImage of=/dev/mmcbk0 bs=512 seek=2048 && sync && sync
```

This will copy the uImage to the medium at offset 1MB.

Create the partition table:

```
sudo fdisk /dev/mmcbk0
```

Use the p, d, n, and w commands to delete any existing partition and to create a new partition. The partition for root file system should be located after kernel image. So the first 4M bytes (8192 sectors of 512 bytes) can be reserved for MBR, boot loader and kernel sections.

Create the ext3 or ext4 file system

```
sudo mkfs.ext3 /dev/mmcbk0p1  
# or  
sudo mkfs.ext4 /dev/mmcbk0p1
```

Mount the SD card and uncompress the root file system files:

```
sudo mount /dev/mmcbk0p1 /mnt/hd  
cd /mnt/hd  
sudo tar --numeric-owner -xvzf /<path>/karmic.tar.gz
```

Note the option “--numeric-owner” may not be available if you are using busybox. Using this option is mandatory though, so please make sure you use the full blown version of tar.

U-Boot needs to be configured. Please refer to BSP user guide. For example, check whether the MAC address of FEC is configured in fuse by “iim read fecmac”. If it’s the invalid value, “iim blow fecmac” can be used to blow right MAC address. Please note fuse operation is one-time operation. Or you can use “ethaddr” environment variable to set MAC address.

```
## Set MAC address ###  
EVK U-Boot > setenv ethaddr 00:04:9f:00:ea:d3  
....
```

The kernel programmed at the offset 1MB can be read using the ‘mmc read’ command

```
u-boot> mmc read 0 ${loadaddr} <offset> <kernel size in blocks>
```

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4.1 Boot with Karmic rootfs:

The U-Boot configurations for **MX51 EVK** booting from SD with **DVI monitor (1024x768 resolution)**:

```
u-boot> setenv bootargs_mmc 'setenv bootargs ${bootargs} console=tty1 root=/dev/mmcblk0p1
rootwait rw'
u-boot> setenv loadk 'mmc read 0 ${loadaddr} 0x800 0x1800'
u-boot> setenv bootcmd_mmc 'run bootargs_base bootargs_mmc; run loadk; bootm'
u-boot> setenv bootcmd 'run bootcmd_mmc'
u-boot> saveenv
```

If using **WVGA panel** for **MX51 EVK**, change the boot command as the following:

```
u-boot> setenv bootargs_mmc 'setenv bootargs ${bootargs} console=tty1
video=mxcdi1fb:RGB565,CLAA-WVGA di1_primary root=/dev/mmcblk0p1 rootwait rw'
```

The U-Boot configurations for **MX53 EVK** booting from SD with **WVGA panel**:

```
u-boot> setenv bootargs_mmc 'setenv bootargs ${bootargs} console=tty1 root=/dev/mmcblk0p1
rootwait rw'
u-boot> setenv loadk 'mmc read 0 ${loadaddr} 0x800 0x1800'
u-boot> setenv bootcmd_mmc 'run bootargs_base bootargs_mmc; run loadk; bootm'
u-boot> setenv bootcmd 'run bootcmd_mmc'
u-boot> saveenv
```

If using **DVI monitor** for **MX53 EVK**, change the boot command as the following:

```
u-boot> setenv bootargs_mmc 'setenv bootargs ${bootargs} console=tty1 video=mxcdi0fb:RGB24,
1024x768M-16@60 root=/dev/mmcblk0p1 rootwait rw'
```

Log in as **ubuntu** (not root), the **password** is **ubuntu123**

Ensure the below changes are conducted in RFS for the usages.

/etc/init/ttymxc0.conf is created just like the following:

```
# ttymxc0 - getty
#
# This service maintains a getty on ttymxc0 from the point the system is
# started until it is shut down again.

start on stopped rc RUNLEVEL=[2345]
stop on runlevel [!2345]

respawn
exec /sbin/getty -L 115200 ttymxc0
```

The following configurations are added to /etc/rc.local (before the exit 0 line):

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```
echo 16000 > /proc/sys/vm/min_free_kbytes
echo 1 1 > /proc/sys/vm/lowmem_reserve_ratio
#echo 2 > /proc/cpu/alignment
chmod -R o+w /sys/class/graphics/
# enable usb auto-suspend
echo auto > /sys/bus/usb/devices/1-1/power/level
echo auto > /sys/bus/usb/devices/2-1/power/level
echo auto > /sys/bus/usb/devices/3-1/power/level
echo auto > /sys/bus/usb/devices/2-1.1/power/level
```

/usr/sbin/flash-kernel is modified as the following:

```
#!/bin/sh
echo okay
```

Check /etc/udev/rules.d/10-imx.rules and ensure the device modes are changed to grant permission for different users. For example,

```
# Miscellaneous devices
KERNEL=="mxc_iim", MODE="0444", SYMLINK+="mxc_mem"
KERNEL=="mxc_viiim", MODE="0444", SYMLINK+="mxc_mem"
KERNEL=="mxc_ipu", MODE="0666"
KERNEL=="fb0", MODE="0666"
KERNEL=="fb1", MODE="0666"
KERNEL=="fb2", MODE="0666"
KERNEL=="mxc_vpu", MODE="0666"
SUBSYSTEM=="video", MODE="0666"
KERNEL=="gsl_kmod", MODE="0666"...
```

Add Ubuntu to user groups:

```
sudo usermod -a -G audio,video ubuntu
```

Fix audio (pulse audio appears to be broken):

```
kill pulseaudio
sudo aptitude -y purge pulseaudio
sudo aptitude -y remove gstreamer0.10-pulseaudio
sudo aptitude -y install xfce4-mixer
sudo aptitude -y install aumix-gtk
```

Note if you remove the pulse audio, some features will not work normally. For example, the “System->Preference->Sound” entry and the Volume Control applet. When entering the applications, there will pop up “waiting for sound system to respond” and then

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nothing happened. The user can use the applications under “Applications -> Sound & Video -> aumix/mixer” for audio settings.

Configure ntp by editing /etc/ntp.conf to define the NTP server of your choice.

```
server 10.208.0.120
```

Change the configuration to enable X-EGL. Modify the file ‘/etc/modules’ to specify the kernel modules to load at boot time. These kernel modules support the OpenGL-ES rendering. The following entries need to be added to the file, one per line, in the order listed:

```
gpu
```

Since GPU is binary release, if the customer uses different kernel version, they need to modify ‘/lib/modules/<version>/modules.dep’ to reflect the change in module dependencies.

Select v4l2 as default gstreamer sink (Note, do not run with sudo).

```
gconftool -s -t string /system/gstreamer/0.10/default/videosink mfw_v4lsink
```

Flush data to SD card and reboot:

```
sync  
sudo halt
```

Your system is ready to go. The following Freescale debian packages have been installed (available with this release) to allow Ubuntu to operate the i.MX5x specific features like video and graphics acceleration. Please install the version built with gcc4.3.3 for Ubuntu 9.10.

Debian package name	Description
imx-lib_<version>_armel.deb	Package name: imx-lib This debian package includes specific libraries for

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	imx platform such as VPU, IPU libraries etc.
Imx-test-<version>-armel.deddb	This debian package provides test routines
kernel_2.6.31- imx_<version>_armel.deb	Package name: kernel This debian package includes kernel image, kernel modules and relative kernel header files.
firmware- imx_<version>_armel.deb	This debian package includes the firmwares such as VPU, Atheros.
modeps_<version>_armel.deb	Module dependencies
amd-gpu-x11-bin- mx51_<version>_armel.deb	Package name: amd-gpu-x11-bin-mx51 This debian package includes GPU user space library and the applications for x11 on mx5 parts.
libz160-bin_<version>_armel.deb	Package name: libz160-bin This debian package include AMD GPU Z160 2D driver
xserver-xorg-video- imx_<version>_armel.deb	Package name: xserver-xorg-video-imx This debian package includes i.MX accelerated video driver for X11.
udev-fsl- rules_<version>_armel.deb	Debian package for i.mx udev rule
atheros-wifi_<version>_armel.deb	The Wifi driver to run the AR6102 chip.
Multimedia Debian packages	See release note of Multimedia debian packages

Verify execution of EGL running in an X window by running either 'simple_draw' or 'es11ex' sample applications, both OpenGL-ES samples':

```
simple_draw -f <number of iterations>  
es11ex
```

To verify that X is being accelerated if uio_pdrv_genirq module is loaded, open the file '/var/log/Xorg.0.log' (read-only) after X loads and verify by observing the presence of the following entries:

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```
(II) EXA(0): Driver registered support for the following operations:
(II)     Solid
(II)     Copy
(II)     Composite (RENDER acceleration)
(II)     UploadToScreen
(II)     DownloadFromScreen
(II) EXA(0): Using custom EXA
(II) IMX(0): IMX EXA acceleration setup successful
```

5 Known Issues

5.1 Flash support

- Flash 10 packages are not in default delivery release. Contact Product Marketing to get relative packages.

5.2 GPU support

- OpenVG is not supported when X-Acceleration is enabled.
- The 'tiger' sample is for OpenVG and should not be run.
- The 'simple_draw' and 'es11ex' are OpenGL-ES samples which demonstrate the EGL in an X window and so must be run when X is running.

5.3 Audio suspend/resume

- **Issue description:** (ENGR00119077) Play the audio. Then the system enters suspend. After resume, no audio sound can be heard.
- **Analysis:** The audio codec has been resumed firstly. The user can hear the sound once. Then it appears that `dam_mux_put` is called by the application which causes the codec power to enter standby again. Still investigating.

6 FAQ

6.1 How to support Touch screen in Ubuntu

- Add BTN_TOUCH event support in kernel. See `drivers/input/touchscreen/mxc_ts.c`
- If you are using MC13892 Touch screen via SPI interface and finding that the touch screen response is slow, please add the patch “ENGR00122465-Workaround.zip” temporally to change PMIC access mode from interrupt as polling:
- Download xserver-xorg-input-evtouch (0.8.8-ubuntu3 version) from http://launchpadlibrarian.net/24760784/xserver-xorg-input-evtouch_0.8.8-0ubuntu3_armel.deb. X crash is found if using latest 0.8.8-ubuntu6.1 version. For the details. See <https://bugs.launchpad.net/ubuntu/+source/xf86-input-evtouch/+bug/511491>
- In MX51 EVK board, run “`sudo dpkg -i xserver-xorg-input-evtouch_0.8.8-0ubuntu3_armel.deb`” to install debian package.
- Add fdi file by “`sudo vi /usr/share/xf86-config/20thirdparty/50-mxc-ts.fdi`”:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<deviceinfo version="0.2">
  <device>
    <match key="info.product" contains="mxc_ts">
      <merge key="input.x11_driver" type="string">evtouch</merge>
    </match>
  </device>
</deviceinfo>
```

- Save above configuration. Reboot the board. Use USB mouse to select calibration menu firstly. Select "System-> Administration -> Calibrate Touchscreen", do the operations according to the tip. Type USB keypad, ensure the red-cross appears. Then press points. See `/usr/share/doc/xserver-xorg-input-evtouch/README.calibration` for the details.
- After the calibration is done, reboot the board to use touch screen.

6.2 How to test Bluetooth in Ubuntu

The following instructions demonstrate how to test Bluetooth via USB BT dongle (Model: BU_2073-J) in Ubuntu with MX51 EVK board. Please note the below configuration is setup when pulseaudio package is installed.

- Run the system. Then `vi ~/.asoundrc`

```
pcm.btheadset {
  type bluetooth
```

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```
device 00:07:A4:F3:19:D4 #modify the address as your headset address
profile "auto"
}
```

- Write a script “autorun_bt.headset” to run BT automatically:

```
echo "Kill PulseAudio"
clear
pkill pulseaudio
sleep 1

echo "Start PulseAudio"
clear
pulseaudio &
sleep 1

echo "Enable sound drivers by typing the following into a terminal"
clear
gksudo hciconfig hci0 voice 0x0060
sleep 1

echo "Now we n tell PulseAudio that your Bluetooth headset exists"
pactl load-module module-alsa-sink device=btheadset
sleep 8
pactl load-module module-alsa-source device=btheadset
sleep 2

echo "Ready"
sleep 2
```

- Run

```
chmod a+x autorun_bt.headset
```
- Insert USB dongle.
- Type “System -> Preferences-> Bluetooth”. If USB dongle can not be found, do as follows:

```
/etc/init.d/bluetooth stop
```
- Insert USB dongle again, run:

```
/etc/init.d/bluetooth start
```
- See whether USB dongle is found and connected. If not, connect it manually.
- Run

```
sh autorun_bt.headset
aplay -D btheadset -f s16_le /usr/share/sounds/alsa/Front_Left.wav
```
- The audio can be heard clearly.

6.3 How to test AR6102 WiFi in Ubuntu

- FSL delivery includes two sets of WiFi codes. The driver code of AR6003 is located under kernel folder drivers/net/wireless/ath6kl/. The driver code of AR6102 is located under pkgs/atheros-wifi-<version>.tar.gz. AR6003 is enabled by default.
- Install Atheros WiFi debian package.

```
sudo apt-get install atheros-wifi-<version>_armel.deb
```
- If you don't want to use the default debian package for AR6102, you can build above atheros-wifi-<version>.tar.gz by yourself. For example,

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```
tar -xvzf atheros-wifi-<version>.tar.gz
cd atheros-wifi-<version>/
cd 2.2.1.83/AR6K_ANDROID_SDK.2.2.1.83/host
#build
./comp.sh 1 <kernel_folder>
#install to one folder
./comp.sh 4 <output_folder> <kernel_version>
```

- Modify /etc/modules to load atheros module automatically:

```
....
ar6000
```

- Click network-manager applet. Connect Wireless network.

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