

# Tiny4412 User's Manual



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# **1** Introduction



Tiny4412 CPU Board

The Tiny4412 development board is a Cortex-A9 embedded processing board that

uses the Samsung Exynos4412 Quad-Core System On Chip (SOC).



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The Exynos4412 integrates the Mali-400 MP GPU graphic engine with hardware support for 3D and can drive video playing on screens up to 1080P. These features make it easily and widely used in MID development, Android notepads, auto electronic devices, industrial applications, GPS systems and multimedia systems.

# 1.1 Tiny4412 CPU Board

The Tiny4412 has four 2.0 mm spacing double row pitch headers (P1, P2, P3 and P4) among which P1 and P2 connect the Tiny4412 CPU board to a carrier board and extend most of the CPU's pins. Its standard version integrates 1G DDR3 RAM and 8G eMMC flash memory.



#### 1.1.1 Tiny4412 CPU Board Hardware Feature

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СРИ	• Samsung Quad-Core Exynos 4412, based on Cortex-A9, 1.5GHz
	Integrated ARM Mali-400 Dual-Core GPU
	• Elegent 2D/3D graphic accelaration
	• Up to 1080p@30fps hard decoded video playing, support MPEG4, H.263, H.264 etc
	• Up to 1080p@30fps hard decoded (Mpeg-2/VC1) video input
DDR3 RAM	• 1G
	• 32bit data bus, single channels
	• 400 M Hz
FLASH	• eMMC Flash: 8G, optional 4GB/16GB/32GB
Connector	• 2 x 70 pin 2.0 mm pitch header
	• 2 x 34 pin 2.0 mm pitch header
On Board Hardware	• 4 x LED (Green)
Kesource	• 2 x Power LED (Green)
Power	• 3.7V to 6V (support sleep mode)
PCB Dimension	• Eight layered board
	• Dimension: 74 x 55 x 10(mm)

# 1.1.2 Pin Spec



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#### **1.1.3 Interface and Port**

#### 1.1.3.1 LED

LED is a commonly used status indication device. The Tiny4412 has four programmable LEDs which are directly connected to GPIO and are on at a low level voltage.

	LED1	LED2	LED3	LED4
GPIO Pins	GPJ_0	GPJ_1	GPJ_2	GPJ_3

#### 1.1.3.2 JTag

Currently most of high end ARM chips support booting from SD card the JTAG is not significant to users any more. However there are still users who really like JTAG therefore we extend the JTAG's test points for users.



# **1.2 Tiny4412 Base Board (Extension Board)**

The Tiny4412 has two types of base board: standard version and enhanced version. The Tiny4412SDK 1306 is the enhanced version and the 1308 is the standard version. Below is a 1308 board.



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# 1.2.1 Tiny4412SDK Enhanced Version



The Tiny4412 base board is a double-layer circuit board that demonstrates user-friendly reference designs with all the common interfaces.

#### 1.2.1.1 Tiny4412 Base Board Enhanced Version

LCD	•	LCD1 interface (on the reverse): 45Pin, 0.5mm spacing, compatible with Mini2440/Tiny4412/Mini210S LCD, supports one wire precise touching
	•	LCD3 interface (on the reverse): 40Pin, 0.5mm spacing, compatible with

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	Expertise on Embedded Linux, Android, WindowsCE		
	Mini2440/Mini6410/Mini210S LCD, supports one wire precise touching		
	• LCD4 interface (on the obverse, reserved): 44Pin, compatible with Mini2440/Mini6410 LCD/Mini210S, supports one wire precise touching		
	• HDMI high definition interface (Type A)		
	• LCDs supported from 3.5" to 12.1", HD		
Network	• 10/100M Ethernet interface(RJ45) using DM9621		
Standard Configuration	• 2 x DB9 RS232 serial port		
	• 1 x microUSB Slave-2.0		
	• 1 x 3.5mm stereotype audio output		
	• 1 x integrated microphone		
	• 1 x one speaker port which can drive an $8\Omega$ 1W speaker		
	• 1 x USB Host 2.0		
	• 1 x standard SD card socket		
	• 1 x 5V power input (DC-23B)		
On Board Hardware	• 1 x I2C-EEPROM (256byte) for I2C bus test		
Kesource	• 4 x Interrupt Style Push Button on module		
	• 1 x PWM buzzer		
	• 1 x backup battery for on board real time clock		
	• 1 x gravity sensor chip		
External Resource	• 4 x TTL		
	• 1 x GPIO (including SDIO)		
	• 1 x CMOS camera interface		
PCB Dimension	Two Layered Board		
	• Dimension: 180 x 140(mm)		

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Friend	$\mathbf{r}$	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE
Software	<ul><li>Li</li><li>Ai</li></ul>	nux Kernel 3.5 ndroid 4.2.1

#### 1.2.1.2 Tiny4412 Base Board Enhanced Version Overview



# 1.2.2 Tiny4412SDK Standard Version

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#### 1.2.2.1 Tiny4412 Base Board Standard Version

LCD	•	LCD1 interface (on the reverse): 45Pin, 0.5mm spacing, compatible with Mini2440/Mini6410/Mini210S LCD, supports one wire precise touching	
	•	LCD4 interface (on the obverse, reserved): 44Pin, compatible with Mini2440/Mini6410 LCD/Mini210S, supports one wire precise touching	
	•	HDMI high definition interface (Type A)	
	•	LCDs supported from 3.5" to 12.1", HD	
Network	•	10/100M Ethernet interface(RJ45) using DM9621	
Standard Configuration	•	1 x DB9 RS232 serial port	
	•	1 x 3.5mm stereotype audio output	

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Friend	Complete ARM Solutions Design, Development and Manufacturing
	<ul> <li>Expertise on Embedded Linux, Android, WindowsCE</li> <li>1 x integrated microphone</li> <li>1 x one speaker port which can drive an 8Ω 1W speaker</li> <li>1 x USB Host 2.0</li> <li>1 x standard SD card socket</li> <li>1 x 5V power input (DC-23B)</li> </ul>
On Board Hardware Resource	<ul> <li>4 x Interrupt Style Push Button on module</li> <li>1 x PWM buzzer</li> <li>1 x backup battery for on board real time clock</li> <li>1 x gravity sensor chip</li> </ul>
External Resource	<ul> <li>4 x TTL</li> <li>1 x GPIO (including SDIO)</li> <li>1 x CMOS camera interface</li> </ul>
PCB Dimension	<ul> <li>Two Layered Board</li> <li>Dimension: 180 x 140(mm)</li> </ul>
Software	<ul> <li>Linux Kernel 3.5</li> <li>Android 4.2.2</li> </ul>

# 1.2.2.2 Tiny4412 Base Board Standard Version Overview





# 1.3 Tiny4412SDK Interface and Port

This section introduces the main ports and interfaces of the Tiny4412. You can find detailed schematics from the 4412 DVDs

#### **1.3.1** Power

The SDK base board requires 5V DC and has two power input ports. CN1 is the barrel jack for the 5V PSU included with SDK kits. The 4 pin white CON5 takes a connector with a "click in place" for secure power in enclosures or commercial applications.

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C	)N5	ľ	NO.	Pin	Spec
			1	VDD5V	
			2	GND	
VDD5V			3	GND	
			4	VDDIN	
		Note: this	layout i	s convenient f	or users to
		connect S1	when it is	extended	

#### Power Socket:

#### Type: DC023B



#### **1.3.2 Serial Port**

The Exynos4412 has four serial ports: UART0, 1, 2 and 3. The UART1 is a four wire serial port and UART0, 2 and 3 are two wire serial ports.

For the Tiny4412 the UART0 and 3 are converted to RS232 (COM0 and COM3).

You need to use the shipped cross serial cable to connect the board to a PC.

Details of CON1, CON2, CON3, CON4 are as follows:



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· · · · · · · · · · · · · · · · · · ·	Expertise on	Embedded Linux, A	ndroid, WindowsCE				
CON0 ~ CON4	CON0 ~ CON4Pin Spec(TTL)COM0Pin Spec(RS232)						
1	RTSn	1	NC				
2	CTSn	2	RSRXD				
3	TXD	3	RSTXD				
4	RXD	4	NC				
5	5V	5	GND				
6	GND	6	NC				
		7	NC				
		8	NC				
		9	NC				
Note: NC me	ans no connection	•	•				

COM3	Pin Spec(RS232)		
1	NC		
2	RSRXD		
3	RSTXD		
4	NC		
5	GND		
6	NC		
7	RSCTSn		
8	RSRTSn		
9	NC		

#### 1.3.3 USB

This board has two types of USB interfaces: one USB Host (2.0) and one USB Slave (2.0). The USB Host functions the same as on PC's. You can access USB camera, USB keyboard, USB mouse, USB flash drives and other common USB peripherals. You can also use USB Hub extensions. Each OS has native USB Hub drivers. The USB Slave (microUSB 2.0) is generally used to debug in Android ADB.

microUSB Spec:

miniUSB	Pin Spec
5	GND
4	OTGID
3	D+

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Friendly	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE		
	2	D-	
	1	Vbus	
USB Host Pin Spec			
	USB Host	Pin Spec	
2	1	5V	
E (1) 3(1-	2	D-	
	3	D+	
CON Q TEDS	4	GND	

#### **1.3.4 Network Interface**

The Tiny4412 base board has a DM9621 LAN chip for adaptive 10/100M Ethernet. The RJ45 connector includes the magnetics. You can use ordinary Cat5 with RJ45 to connect to your router or switch.

#### 1.3.5 Audio

The Exynos4412 supports I2S/PCM/AC97 audio interfaces. The Tiny4412 uses the I2S0 interface with the WM8960 CODEC.

The audio output is on the 3.5mm green jack. The board also has a microphone input. When recording we suggest users to move the microphone close to the audio source



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#### **1.3.6 User Button**

The Tiny4412 has four user buttons connected directly to the CPU's interrupt pins.

They trigger low when closed.



Button	K1	K2	K3	K4
Interrupt	EINT26	EINT27	EINT28	EINT29
GPIO	GPH3_2	GPH3_3	GPH3_4	GPH3_5
Notes:				

# **1.3.7 LCD Interface**

For convenience in mounting various displays the Tiny4412 has three LCD

connectors and one of them is 45pin(LCD1) for connecting a capacitive LCD.

The LCD control signals are the same on all connectors with horizontal and vertical scan, clock, enable, disable etc., and 8:8:8 models of RGB data. It has a PWM output and a reset signal (nRESET). LCD\_PWR is the backlight switch signal.

Since we apply the one wire precise touch technology neither LCD interface has the four wire resistor touch pins that the CPU uses by default (LCD1-41, 42, 43 and 44). This way gives us flexibility to connect capacitive screens.

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LCD1	Pin Spec	LCD1	Pin Spec
1	VDD_5V	2	VDD_5V
3	VD0	4	VD1
5	VD2	6	VD3
7	VD4	8	VD5
9	VD6	10	VD7
11	GND	12	VD8
13	VD9	14	VD10
15	VD11	16	VD12
17	VD13	18	VD14
19	VD15	20	GND
21	VD16	22	VD17
23	VD18	24	VD19
25	VD20	26	VD21
27	VD22	28	VD23
29	GND	30	PWM1/GPD0_1
31	XEINT10/GPH1_2	32	nRSTOUT
33	VDEN	34	VSYNC
35	HSYNC	36	VCLK
37	I2CSCL2	38	XEINT14/GPH1_6
39	I2CSDA2	40	XEINT15/GPH1_7
41	GND		

Note: the Exynos4412 has three I2Cs and here we use I2C2.

Please refer to the schematics in the shipped CD for the exact connection details between each pin and CPU. The information provided here is for reference

#### 1.3.8 ADC

The Tiny4412 has 4 ADC channels for different purposes. AINO is connected to a

variable resistor W1 for testing and the remaining AINs are not extended.



#### 1.3.9 PWM Buzzer

The on-board buzzer is controlled by PWM0, the diagram is shown below. PWM0

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corresponds to GPD0\_0 which can be configured as PWM output via software or used

as a GPIO.



### **1.3.10 I2C-EEPROM**

The Tiny4412 has a direct connection to an AT24C08 – an I2C EEPROM which has a

capacity of 256 bytes and is mainly for testing I2C bus.

Note: the Exynos4412 has eight I2Cs and here the Tiny4412 uses I2C0



# 1.3.11 SD Card Socket

The Tiny4412 has two SDIO interfaces. The SDIOO is used for ordinary SD cards. The interface can support SDHC, that is, high-speed large-capacity cards up to 32G bytes.



#### 1.3.12 GPIO/SDIO Interface

The GPIO is a 2.0mm spacing 30 pin header.

# GPIO / SDIO

The first 20 pin is an SDIO which is usually used for SD-WiFi.

CON9	Pin Spec	CON9	Pin Spec	
1	VDD_3.3V	2	GND	
3	TXD2	4	RXD2	
5	I2CSCL	6	I2CSDA	
7	SPIMOSI0	8	SPIMISO0	
9	SPICLK0	10	SPICSn1	
11	EINT13	12	EINT12	
13	SD3_CLK	14	SD3_CMD	
15	SD3_nCD	16	EINT11	
17	SD3_DAT0	18	SD3_DAT1	
19	SD3_DAT2	20	SD3_DAT3	
21	SPIMISO1	22	EINT26	
23	SPIMOSI1	24	EINT27	
25	SPICLK1	26	EINT28	
27	SPICSn1	28	EINT29	
29	VDD5V	30	GND	
Please refer to the schematics in the shipped CD for the exact connection details between each pin and CPU. The				

information provided here is for reference

# 1.3.13 CMOS Camera

The Tiny4412 has one CMOS camera interface which is a 2.0mm spacing 20 pin header. Users can use our CAM130 cameras by connecting it to this header. Actually the



CAM130 doesn't have any circuits and it is a conversion board which applies the ZT130G2 module.

Note: the CAMER interface is a multiplexed port which can be used as a GPIO by setting corresponding registers. The table below shows its GPIO pins.



CAMERA					
CAMERAPin SpecCAMERAPin Spec					
1	I2CSDA0	2	I2CSCL0		
3	XciFIELD	4	CAM_RESET/GPJ3_1		
5	CAM_CLK	6	CAM_HREF		
7	CAM_VSYNC	8	CAM_PCLK		
9	CAM_DATA7	10	CAM_DATA6		
11	CAM_DATA5	12	CAM_DATA4		
13	CAM_DATA3	14	CAM_DATA2		
15	CAM_DATA1	16	CAM_DATA0		
17	VDD_3.3V	18	VDD_2.45-2.8V		
19	VDD_1.8V	20	GND		

Please refer to the schematics in the shipped CD for the exact connection details between each pin and CPU. The information provided here is for reference

# 1.3.14 CPLD-JTAG

This interface is used to flash the CPLD (EPM240T100) with firmware.



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# 1.4 Tiny4412 Software Feature

# 1.4.1 Android 4.2.2 Feature

Cross-compiler	arm-linux-gcc-4.5.1-v6-vfp	Same as Mini6410/Mini210S, by default it
		compiles with armv7 command set. It supports
		hard floating point arithmetic
Bootloader	Two bootloaders: superboot (non-open	
	source) and uboot (open source).	
	It supports SD card system burning and can	
	install (YAFFS2) systems within 1.8 seconds.	
	It supports Android's fastboot USB flash	
	system	
	It supports SD card formatting.	
Android kernel	Kernel version: Linux-3.5	Complete BSP
	It supports EXT3/YAFFS2/CRAMFS/FAT32.	Open source
	Watchdog	
	RTC driver	
	LED driver	
	User button driver	
	SPI driver	
	I2C-EEPROM driver	
	PWM buzzer driver	
	ADC driver (channel: AIN0)	
	Touch screen coontroller driver which comes	
	with CPU by default	
	Capacitive LCD driver	
	LCD back light driver: it allows users to	



2D accelerator	
3D accelerator	
HDMI driver	
MFC multi-media driver	
JPEG driver	
FIMC driver	
Ethernet driver(DM9621)	
amplifier)	
recording and playing, ALSA API and type D	
Audio driver(WM8960: it supports audio	
USB WiFi driver: it supports more types	
can only drive limited types	
USB WiFi driver: it comes with the kernel but	
On board SD WiFi driver(Marvell8686)	
Serial port driver	
SD card driver	
ADB/Fastboot	
USB Device driver: it supports USB	
tooth and so on.	
USB Host driver: it supports flash drives, blue	
LCD)	
LCD driver(common 7" LCD and HD 7"	
levels	
adjust the board's backlight up to 127	

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6	Friendly Complete ARM Sol Design, D Expertise on Embed	utions evelopment and Manufacturing ded Linux, Android, WindowsCE
	WiFi	
	HDMI	Up to 1080p
	Back Light Adjusting up to 127 Levels	

# 1.4.2 Linux Feature

Cross-compiler	arm-linux-gcc-4.5.1-v6-vfp	Same as Mini6410/Mini210S, by default it
		compiles with armv7 command set. It supports
		hard floating point arithmetic
Bootloader	Two bootloaders: superboot (non-open	
	source) and uboot (open source).	
	It supports SD card system burning and can	
	install (YAFFS2) systems within 1.8 seconds.	
	It supports Android's fastboot USB flash	
	system	
	It supports SD card formatting.	
Linux kernel	Kernel version: Linux-3.5	Complete BSP
	It supports EXT3/YAFFS2/CRAMFS/FAT32.	Open source
	Watchdog	
	RTC driver	
	LED driver	
	User button driver	
	SPI driver	
	I2C-EEPROM driver	
	PWM buzzer driver	
	ADC driver (channel: AIN0)	
	Touch screen coontroller driver which is	
	supported by CPU	

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	Capacitive LCD driver	
	LCD back light driver: it allows users to	
	adjust the board's backlight up to 127	
	levels	
	LCD driver(common 7" LCD and HD 7"	
	LCD)	
	USB Host driver: it supports flash drives, blue	
	tooth and so on.	
	USB Device driver: it supports USB ADB	
	SD card driver	
	Serial port driver	
	On board SD WiFi driver(Marvell8686)	
	USB WiFi driver: it comes with the kernel but	
	can only drive limited types	
	USB WiFi driver: it supports more types	
	Audio driver(WM8960: it supports audio	
	recording and playing, ALSA API and type D	
	amplifier)	
	Ethernet driver(DM9621)	
	FIMC driver	
	JPEG driver	
	MFC multi-media driver	
	3D accelerator	
	2D accelerator	
	USB to serial driver	
	3G driver	Open Source
GUI System	Qtopia – 2.2.0	Open Source for x86 and ARM

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	QtEmbedded – 4.7.0	Open Source for ARM
	Qt-Extended-4.4.3	Open Source
Application	ADC utility	
	LED utility	
	Buttons utility	
	I2C-EEPROM	
	LCD Test	
	Ping	
	Audio Recorder	
	Web Browser	
	Watchdog	
	Network Configuration	
	Language Settings	
	Back Light Adjusting up to 127 Levels	
	MMC/SD Card Mount/Umount	
	Qt4 Switcher	
	Qtopia4 Switcher	
	SMPlayer	

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# **2** Getting Started

By default, all our systems have been preinstalled with Android 4.2.1 (located in the shipped CDs' directory /images/Android are zImage, ramdisk-u.img, system.img and so on) therefore you can easily boot the board and play.

# 2.1 System Setup and Configurations

# 2.1.1 Boot Option

The Tiny4412 supports booting from either SD card or eMMC. Users can switch between by toggling the S2 switch:

Screenshot	Operation	Comment
ういた した 技动 开关 、 の 人 修 人 の 人 の 人 の 人 の 人 の 人 の 人 の 人 の 人 の 人 の 人 の 人 の し は 动 一 、 う の し は つ し お の 一 の う し も う い の し し お の 一 の し し お の 一 の し し お の 一 の し し た の 一 の し し た の の 一 の し し た の の 一 の し し た の の 一 の 一 の し し た の の 一 の し し た の の 一 の し に の つ し た の の 一 の し に の つ し に の つ し た の の 一 の し の の 一 の の の 一 、 の の の し の の の の の の の の の の の の の	Toggle S2 to "NAND" and the board will boot from the eMMC	Default and Standard booting.
○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○○	Toggle S2 to "SDBOOT" and the board will boot from SD card	This is for system booting or burning

Usually, S2 is switched to "Nand" unless users need to boot from the SD card or

reflash the system.

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Email for Business and Cooperation:		capbily@163.com	Email for Tech Supp	port: dev_f	riendlyarm@163.com



# 2.1.2 Interface and Port

The Tiny4412SDK has the following interfaces, ports and sockets:



Please follow the steps below to hook up the board:

- Connect the Tiny4412 board's serial port0 (Debug Serial Port) to a PC's serial port with the shipped crossover serial cable (blue one) in the package
- Connect the Tiny4412 board's Ethernet interface to a PC with the shipped crossover cable (this step can be skipped if you don't need to connect to the internet)
- Connect the shipped 5V power supply adapter to the 5V power supply interface on the board (do it with care to prevent damaging the interface)



- Connect a headphone or speaker to the audio input(green) on the board
- Connect an LCD touch screen (if the user has one) to the LCD interface on the board following the data bus' arrow

#### 2.1.3 Setting up HyperTerminal

Note: some users attempt to expand the board's serial ports by using a USB to serial port cable. Sometimes this operation would cause error codes. This might be an indication that the cable doesn't work. Most of our agents have these conversion cables for sale. Users can contact them. In addition we strongly recommend users to use our shipped crossover serial cable. Other serial cables might not work properly.

To connect the Tiny4412 board to a host PC via a serial cable, you should use a simulation terminal. There are many tools available. A most widely used one is the MS-Windows' super terminal. In Windows9x, you need to install it by checking that option during installation. Windows2000 and later

A common Linux desktop version has a similar terminal too and it is minicom. It is a command line utility which may not be easy for beginners. Interested users can search the internet for more resources.

We take WindowsXP's super terminal for instance. You can find it by going to "Start->Programs->Accessories->Communications". After it starts the following dialog will pop up, please click on the "No" button


#### Click on the "Cancel" button on the following dialog

Location Information	? ×
	Before you can make any phone or modern connections, Windows needs the following information about your current location. What country/region are you in now? United States What area code (or city code) are you in now? What area code (or city code) are you in now? If you need to specify a carrier code, what is it? If you need to specify a carrier code, what is it? If you dial a number to access an outside line, what is it? The phone system at this location uses: Tone dialing Pulse dialing
	OK Cancel

Click on the "Yes" button and the "OK" button to the next step

Confirm (	Cancel
1	Windows needs telephone information about the location from which you will be dialing. If you cancel without providing this information, this program may not function correctly when dialing. In addition, some applications respond to your canceling this dialog box by immediately re-posting it. Are you sure you want to cancel?
	Yes No
Hyper	Terminal
į	Before HyperTerminal can dial or make connections, you must provide information about your location.
	ОК

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A popup window will require you to name this connection. In this example we typed "ttyS0". Windows does not accept names like "COM1" that have already been used by the system.

Connection Description	?×
New Connection	
Enter a name and choose an icon for the connection:	
Name:	
ttyS0	
Icon:	
OK Can	cel

After naming this connection another window will require you to select a serial port

that will be used to connect the Tiny4412 board. Here we selected COM1:

Connect To
🧞 tyS0
Enter details for the phone number that you want to dial:
Country/region:
Area code:
Phone number:
Connect using: COM1
OK Cancel

Lastly, also the most important step is to set up the port properties. Note: you must select "No" in the data flow control field otherwise you will only be able to see outputs. In addition the bits per second should be set to 115200.

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Po	rt Settings	
	Bits per second: 115200	-
	Data bits: 8	
	Parity: None	
	Stop bits: 1	<b>-</b>
	Flow control: None	
	Restore	Defaults
	OK Cancel	Apply

After setting up all properties, turn on the board's power supply, if the connection gets set properly, you will see a bootloader startup interface. If everything runs fine please save this connection for later use.

# 2.2 Burning Superboot to SD Card

In order to boot from an SD card, you need to burn BIOS to it. FriendlyARM offers a flashing utility: SD-Flasher.exe which can burn our Bootloader (Tiny4412-Boot.bin) to an SD card.

### 2.2.1 Burning Tiny4412-Boot.bin to SD Card

We tested the following steps on Windows7

Note: users complained that some notebook's integrated SD card reader cannot work properly with card burning or reading. So far we haven't encountered this issue and we

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suggest that you should try a common card reader in this case.

Our SD-Flasher.exe formats a 130M space for the bootloader therefore an SD card whose memory is less than 256M cannot work and we recommend using one whose memory is at least 4G

Step1: launch the SD-Flasher.exe in your shipped CD (under "\tools\"). Note: this program should be run as "administrator"



When the utility is launched a message box will pop up "Select your Machine...", please select "Mini4412/Tiny4412":



Below is the dialog you will see after it is started. Note: the "ReLayout" is enabled and we will format the SD card with this function.

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	Expertise on Embedded Linux, Android	l, WindowsCE
4	FriendlyARM SD Memory Card Fusing Tool	
	Image File to Fuse D:\superboot\superboot-20110511.bin	
	SD Drive(s)	
	Name Physical Disk# Size Label Available Result	Scan
	Reports	
		Fuse
	Designed by FriendlyARM         ReFormat!         ReLayout!         Quit	Ver: 1117
click on	to select your bootloader file	
click on	to select your bootloader file	
click on iendlyARM SD M	to select your bootloader file	
click on iendlyARM SD M Image File to Fus C:\Tiny4412-2013	to select your bootloader file	, 
click on iendlyARM SD M Image File to Fus C:\Tiny4412-2013 SD Drive(s)	to select your bootloader file	
click on iendlyARM SD M Image File to Fus C:\Tiny4412-2013 SD Drive(s) Name Physical I: Disk	to select your bootloader file  lemory Card Fusing Tool  se 10706\images Tiny4412-Boot. bin  Disk# Size Label Available Resul  k 3 7584M FRIENDLYARM Yes	t Scan
click on iendlyARM SD M Image File to Fus C:\Tiny4412-2013 SD Drive(s) Name Physical I: Disk	to select your bootloader file lemory Card Fusing Tool se 10706\images Tiny4412-Boot.bin Disk# Size Label Available Resul c 3 7584M FRIENDLYARM Yes	It Scan
click on iendlyARM SD M Image File to Fus C:\Tiny4412-2013 SD Drive(s) Name Physical I: Disk Reports Scenning	to select your bootloader file lemory Card Fusing Tool se 10706\images Tiny4412-Boot. bin Disk# Size Label Available Resul c 3 7584M FRIENDLYARM Yes	t Scan

Step3: insert a FAT32 SD card into your host's SD card socket (you can also use a USB

card reader to connect to a PC), backup your data in the card and click on "Scan", all



recognized SD cards will be listed.

Step4: click on "ReLayout", the following dialog will pop up prompting you that the data in your card will be lost. Just click on "Yes"



After formatting is done you will be directed back to the main menu. Click on "Scan",

you will see that a "FriendlyARM" section available.

SD Drive	(z)					
Name	Physical Disk#	Size	Label	Available	Result	
I:	Disk 3	7584M	FRIENDLYARM	Yes		Scan

Step5: click on "Fuse", Superboot will be safely burned into the SD card. You can burn

this card in WindowsXP without worrying about its FAT32 data being lost or damaged.

D. Decision	4412-20130706\im	ages\Tiny	4412-Boot.bin			
Name I:	Physical Disk# Disk 3	Size 7584M	Label FRIENDLYARM	Available Yes	Result Succeeded	Scan
eports Jusing.	<u>.</u> .					-

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The Tiny4412-Boot.bin in your SD card is invisible. To verify it you can insert your SD card into your board's SD card socket and connect your board to a PC via a serial cable. Switch S2 to the "SDBOOT" mode, reboot your board and if messages pop up from the hyperterminal it is indicating that your SD card is functioning.

If there are no output messages from your serial port it may indicate your burning was not successful. The following cases could result in this failure:

1. You might use a notebook and the notebook's the card reader might not work. We suggest using an external usb card reader.

2. You might use a bad SD card. We suggest using one whose memory is at least 4G or SDHC

3. You might use an SD card. Please use a standard SD card which can be directly connected to your card reader

4. The SD card booting function is integrated in Samsung's chip and the ROM is preinstalled. It might not recognize some cards. In this case we suggest you try some different cards

5. Poor contact might be another reason. In this case you could try a few more times: by unplugging and plugging the core board and the base board (if your board is a tiny board) and unplugging and plugging the SD card

### 2.2.2 Restore SD Card

Note: we tested the following steps on Windows7

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Using SD-Flasher.exe will reserve 130M memory for Tiny4412-Boot.bin. When you no longer need your SD card for system burning you might want to restore your card to what it was. You can do it this way: launch SD-Flasher.exe as an administrator; click on "scan" and "ReFormat" you will see the following dialog

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Image Fi	le to Fuse	ogor\Tipy	1112-Back bin			
c. any	4412 20130100 (IM	ages (TTRy	4412 DOOC. DIII			
SD Drive	(z)					
Name	Physical Disk#	Size	Label	Available	Result	
I:	Disk 3	7584M	FRIENDLYARM	Yes	Succeeded	
Reports Fusing. u-boot : 1 Total, 	 Image , 1 Succeeded, O	Failed,	0 Skipped			Fuse
Reports Fusing. u-boot : 1 Total,  Desig All rig	 Image , 1 Succeeded, 0 <b>gned by Friend</b> hts reserved.   www.a	Failed, IyARM rm9.net	0 Skipped	ReLayout!	Quit	Fuse Ver: 1327

Click on "Yes". A moment later click on "Scan" again, you will find your card

Yes

No

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becomes "no" available and your card is restored successfully.

SD Drive	(z)					
Name	Physical Disk#	Size	Label	Available	Result	
I:	Disk 3	7584M SD	CARD	No		
						Scan
Reports						
-						
3.CGDD1D	Disk(s)					
Found 1						Fuse
Found 1						
Found 1						

### 2.2.3 Notes to Users

Common SD cards are used as storage cards therefore on Vista/Windows7

SD-Flasher automatically formats an SD card to two sections: one is FAT32 (named

"FriendlyARM") and the other (by default 130M) reserved for the bootloader.

In fact, Vista/Windows7's system security policies don't permit unauthorized users to

start auto burning an SD card thus common users need to format the SD card first and

then burn data into it.

To burn Tiny4412-Boot.bin please run the SD-Flasher on Windows7. Running

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SD-Flasher on XP may not work.

# 2.2.4 Copy Images to SD Card

When installing systems with an SD card you need to copy the whole "images"

directory to the root directory of the SD card.



# 2.3 Install Systems with FASTBOOT

With fastboot you can install systems easily.

# 2.3.1 Pre-requisits

Before you start with fastboot you need to do the following things

1) Copy the "android\_tools.tgz" from the "tools" directory of your 4412DVD to the

root directory of Ubuntu. If you download your ISO from the internet you can try the

commands below:

# mkdir -p /mnt/iso

# mount -o loop Tiny4412-20130707.iso /mnt/iso

# cd /

# tar xvzf /mnt/iso/tools/android\_tools.tgz

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- 2) Connect your board to a PC via a serial cable and open a minicom terminal.
- 3) Make a bootable SD card with SD-Flasher (refer to section 2.2)
- 4) Get your system files ready. For Android you need ramdisk-u.bin and system.img which correspond to the root file system and the system section. You can get these two files from the "images/Android" directory of the 4412 DVD.

### 2.3.2 Install Systems with FASTBOOT

The following steps are tested with Ubuntu12.04.2. Theoratically with other Linux versions as long as FASTBOOT is properly installed the following steps should work too.

Step1: connect your board to a PC via a serial cable and open up a hyperterminal or minicom.

Step2: switch S2 to eMMC and power on



Step3: right after hyperterminal or minicom has output messages please press "enter" within 3 seconds you will enter the command line interface

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Step4: type "fastboot" in the command line and enter. Bootloader will enter the USB download mode and wait for download's beginning

Step5: connect your board to a PC via a microUSB cable. On your PC please go to the directory which contains the ramdisk-u.img and system.img files and run "burn-img.sh" and the image files will be burned to the board

### 2.3.3 Update Individual Files

The following steps should be done in the USB download mode

### 2.3.3.1 Update Kernel

Go to the directory which has the zImage file and run the following command # fastboot flash kernel zImage

### 2.3.3.2 Update Root File System

Go to the directory which has the ramdisk-u.img file and run the following command # fastboot flash ramdisk ramdisk-u.img

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### 2.3.3.3 Update System Section

Go to the directory which has the system.img file and run the following command # fastboot flash system system.img

# 2.4 Install Systems with SD Card

Before you start with the following steps please make sure you have your SD card

flashed ready and copied the whole images directory to your SD card.

# 2.4.1 Install Android

Step1: insert the SD card to a PC and open the "images\FriendlyARM.ini" file and

make sure the contents are as follows

```
#This line cannot be removed. by FriendlyARM(www.arm9.net)
CheckOneButton=No
Action = Install
OS = Android
LowFormat = No
VerifyNandWrite = No
LCD-Mode = No
CheckCRC32=No
 StatusType = Beeper | LED
 Android-BootLoader = Superboot4412.bin
 Android-Kernel = Android/zImage
 Android-CommandLine = console=ttySAC0,115200n8 androidboot.console=ttySAC0 ctp=2
 skipcali=y vmalloc=512m
 Android-RamDisk = Android/ramdisk-u.img
 Android-RootFs-InstallImage = Android/system.img
 Android-UserData = Android/userdata.img
```

Note: if you use the Tiny4412 SDK 1308 base board you need to add "uhost0 = y" in



the Android-CommandLine. If you use a resistive LCD you need to add "ctp = 0" and

"skipcali = n"

Step2: make sure the SD card has the following files. If it doesn't please copy those

files from DVDs

File	Comment
images\Superboot4412.bin	Bootloader
images\Android\zImage	Android Kernel(Linux Kernel 3.5)
images\Android\ramdisk-u.img	Andoird root file system
Images\Android\system.img	Android system section
Images\Adroid\userdata.img	Android data section
images\FriendlyARM.ini	Configuration file

Step3: insert the SD card to the board's SD card socket. Switch S2 to "SD" and power

on. If everything works fine hyperterminal/minicom will show system installation messages



Step4: after system installation is done system will enter the command line interface. Switch S2 to "Nand", power on the board and Android will load.



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### 2.4.2 Install Linux

Step1: insert the SD card to a PC and open the "images\FriendlyARM.ini" file and

make sure the contents are as follows

#This line cannot be removed. by FriendlyARM(www.arm9.net)
CheckOneButton=No
Action = Install
OS = Linux
LowFormat = No
VerifyNandWrite = No
LCD-Mode = No
CheckCRC32=No
StatusType = Beeper   LED
######################################
Linux-BootLoader = Superboot4412.bin
Linux-Kernel = Linux/zImage
Linux-CommandLine = root=/dev/mmcblk0p1 rootfstype=ext4 console=ttySAC0,115200
init=/linuxrc ctp=2
Linux-RamDisk = Linux/ramdisk-u.img
Linux-RootFs-InstallImage = Linux/rootfs_qtopia_qt4.img

Note: if you use the Tiny4412 SDK 1308 base board you need to add "uhost0 = y" in

the Android-CommandLine. If you use a resistive LCD you need to add "ctp = 0" and

"skipcali = n"

Step2: make sure the SD card has the following files. If it doesn't please copy those

files from DVDs

File	Comment
images\Superboot4412.bin	Bootloader
images\Linux\zImage	Linux Kernel 3.5
images\Linux\ramdisk-u.img	Linux root file system
Images\Linux\rootfs_qtopia_qt4.img	Linux system section
images\FriendlyARM.ini	Configuration file

Step3: insert the SD card to the board's SD card socket. Switch S2 to "SD" and power



on. If everything works fine hyperterminal/minicom will show system installation

#### messages



Step4: after system installation is done system will enter the command line interface. Switch S2 to "Nand", power on the board and Linux will load.



# **2.5 Install Systems with Minitools**

The Minitools utility is a FriendlyARM developed USB download tool which allows

users to install systems more easily and conveniently. It has the following features:

- Only need a USB cable: with the Minitools users only need a USB cable to install systems
- One key action: no need to type any command.
- Works with both 32/64-bit OS: it can be installed on both 32-bit and 64-bit Windows systems
- Cross platform: it can be installed on both Windows and Linux systems

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### **2.5.1 Install Minitools**

#### 2.5.1.1 Install on Windows

Double click on the "MiniTools-Windows-YYYYMMDD.exe" icon in the tools directory in your shipped DVD and you will be guided to install it. Just follow the prompts and take the default options. When it asks whether you want install the driver please go by "continue anyway". After installation is done please unplug and plug the USB cable and Windows will prompt that it is updating drivers. After Windows' updating is done you can continue

If your installation is successful there will be an icon on your desktop. You can double click on it to run:



The minitools' main window is shown below:

下载烧写	中口助手	<b>父</b> 安用工具	随心利系统,让你爱不转手!	MiniTools	Friendly
我的开发板					
已连接					
📫 Android			欢迎使用Mini'	Tools	
Windows CE		ARM开	发板专用USB烧写工具,让你	的效率极速提升!	
📥 Linux		开发板信息	•		
🍠 裸机程序(No O	S)				
关于		CPU: Exynos4 RAM: 1GB eMMC: 4GB Touch Device: LCD Type: S70	1/2 (1.5GHz) 1-wire 0(Auto)		
		关于"快速原	<b>启动''</b>		
		在USB下载模。 调试开发之用。 注意:启动兵	式下,点"快速启动"即可直接启动NAND flash中已经 。 亏USB连接将会断开	5存在的系统。而无需切换S2开关	;更加方便
快速	启动				
●已连接开发板(Exy	nos4412 1.5GHz / 10	B / 4GB / 1-wire / S70	D(Auto) )		v1.4a build130813

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### 2.5.1.2 Install on Linux

We tested installing the Minitools on Fedora9/Fedora15/Ubuntu12.04 64-bit systems. Please login and execute the installation as root. Please copy the "MiniTools-Linux-YYYYMMDD.tgz" in the "tools" directory from your DVD to your PC and untar the ball and run the "./start.sh" command to the installation.

### 2.5.2 Flash SD Card with Superboot

In order to work with the Minitools you need to get an SD card and flash it with our superboot. Please follow the steps below:

- 1. Please flash the superboot to an SD card with "SD-Flasher"
- Please copy the whole "images" directory from your DVD to the root directory of your SD card
- 3. Open the "images/friendlyARM.ini" and add the following line

USB-Mode = yes

Please follow the steps below to connect your board to your PC

- 1. Switch the S2 on your board to "SD"
- 2. Power on the board and you will see the LCD showing "USB Mode:Waiting" if everything works correctly
- 3. Please connect your board to your PC via a USB cable
- 4. If the connection is successful the LCD will show "USB Mode:Connected"

Now you can start installing systems with the Minitools



To change the installation method back to SD card installation you just need to

change the "USB-Mode = yes" to "USB-Mode=no".

# 2.5.3 Install Systems with Minitools

Please enter the USB download mode and connect your board to your PC which runs

the Minitools via USB



On the left bottom of the window there is a LED which is green indicating the board

is connected successfully. On the left bottom there is a button which can start your



board directly without switching to NAND.

Before install systems please select the system you want to install e.g. Android and

then its configuration will be presented as follows:

下载焼写	中山助手	实用工具	随心刷系统	5,让你爱不释乎!	Min	iTools	Friendly
我的开发板		烧写选项:					
已连接		Low format NAND flash	🗖 跳过校准	🔲 启用HDMI独立输出,	选择分辨率:	HDMI720P60	
Android		请选择要烧写的文件,或从imag	ges目录自动导入:	选择images目录		全选	反选
🚰 Windows CE		Android BootLoader:					_
💍 Linux							
禄机程序(No OS)		Android Kernel:					
关于		Kernel CommandLine:					
		☐ Android Ramdisk:	age:				··· ··· 清空
快速启	动					开始	烧写
已连接开发板 (Exyno	s4412 1.5GHz / 1	.GB / 4GB / 1-wire / S70(Auto) )				v	1.4a build130813

You can just click on the "images" button to select an "images" directory which contains complete installation files for all systems and the Minitools will show all the info listed in the FriendlyARM.ini.

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(Frie	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE
下载说写         単口助手	度べ列系统、让你爱不許行! SymIIA 随べ列系统、让你爱不許行! MiniTools (Friendly)
我的开发板 已连接 Android Windows CE	烧写选项:          ↓ Low format NAND flash       ↓ 跳过校准       ↓ 启用HDMI独立输出,选择分辨率:       HDMI720P60         请选择要旋写的文件,或从images目录自动导入:       选择images目录       全选       反选         ✓ Android BootLoader:
Linux 禄机程序(No OS) 关于	/mnt/fa/yang/4412/iso/Tiny4412/images/Superboot4412.bin          Image: Console = tySAC0,115200n8 android/boot.console = tySAC0
	Android Ramdisk:  /mnt/fa/yang/4412/iso/Tiny4412/images/Android/ramdisk-u.img  Android RootFs/System Image:
	/mnt/fa/yang/4412/iso/Tiny4412/images/Android/system.img 详细信息: 清空
快速启动	开始烧写

With the Minitools utility you can update either the whole system (all image files) or individual image files e.g. the kernel image file. After you are done with your installation configuration please click on "Start installation"





After installation is done you can boot your board and enter your system.

Note: sometime users complain that Minitools shows the board isn't connected to PC. It is very likely that the USB download driver is not properly installed on your PC and you can try manually install the USB download driver which is under the Minitools directory in the shipped DVD

) ♥ 🐌 C:\Program Files (x86)\FriendlyARM MiniTools\usb_drivers									
包含到库中	▼ 共享 ▼ 新建文件夹								
藏夹	名称	修改日期	类型	大小					
Dropbox	퉬 amd64	2012/11/15 13:27	文件夹						
下载	鷆 i386	2012/11/15 13:27	文件夹						
桌面	android_winusb.inf	2012/11/14 11:10	安装信息						
最近访问的位置	iandroidwinusb86.cat	2012/9/11 13:56	安全目录						
mages	🤿 androidwinusba64.cat	2012/9/11 13:56	安全目录						
mages	source.properties	2012/9/11 13:56	PROPERTIES 文件						

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# **3 Android Installation and Navigation**

The Tiny4412 can run Android 4.2.1 (Linux kernel 3.5). We migrated all the utilities

we developed for the Mini6410 and Tiny210 to the Tiny4412. This not only meets most

customers' requirements but also enables users to focus on application development.

# **3.1 Playing with Android**

### **3.1.1 Android Buttons**

#### User button layout:

The Tiny4412 has 4 buttons:

#### Their definitions in Android are as follows

Key	Function
K1	Back
K2	Home
К3	Menu and Screen rotation
K4	ОК

# **3.1.2 Android Commands**

### 3.1.2.1 Enter Android Command Line Mode

Quite often users need to enter the commandline mode to operate the system

Users can do so by connecting the board to a PC via either a USB cable or a serial

cable.

When using a USB cable users need to install Android SDK. Then users can type adb

shell to enter the commandline interface as root.

When using a serial cable users will enter the commandline interface by default. But



this doesn't give users the root's access and you can command "su" to login as root

### 3.1.2.2 Set System Section Read/Write Access

By default Android's system section only has read access. You can type the following

command to make it writable.

# mount -o remount /dev/block/mmcblk0p2 /system

But after system reboots this section will be read only again.

If you want the section writable permenantly you need to change Android's source

code. Please open "device/friendly-arm/tiny4412/fstab.tiny4412".

Change this line

/dev/block/mmcblk0p2 /system ext4 ro

То

/dev/block/mmcblk0p2 /system ext4 rw

### 3.1.2.3 Tansfer Files from PC to Tiny4412

Using Android SDK' adb commands can transfer files from PC to the Tiny4412 via USB. For example to transfer "sensors.tiny4412.so" to "/system/lib/hw" you can type the following command adb push sensors.tiny4412.so /system/lib/hw/ Note: before transferring files to the system directory you need to make the system directory writable (Please refer to the previous section)

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# 3.1.3 Screen Rotation by Gravity Sensor

The Tiny4412 has a gravity sensor and by default it supports automatical screen

rotation. If you want to disable this function you can go to "Settings"-> "Display" and

turn it off.

Settings	
Ethernet configuration	Brightness
8 Bluetooth OFF	Wallpaper
Data usage	Auto-rotate screen
DEVICE	Sleep
<b>ြ</b> •) Sound	TV Mode Choose TV out mode
Display	TV Resolution
E Storage	Choose TV resolution
Battery	TV HDCP Enable HDMI HDCP
🛃 Apps	Font size
PERSONAL	
	1:52 🖊

### **3.1.4 SD Card**

The SD card is mounted at /storage/sd\_external/

### 3.1.5 Play MP3

Android can automatically detect MP3 files in the SD card.

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# 3.1.6 Adjust Volumn

Please go to "Settings" -> "Sound" to adjust the volumn

Settings		
WIRELESS & NETWOR	Volumes	
🗢 Wi-Fi		
Ethernet cont	Music, video, games, & other media	
Bluetooth		
O Data usage	Ringtone & notifications	
More		
DEVICE	Alarms	
🐠 Sound	0	
Display	ок	
Storage		
Battery		
	э ÷	2:06 🖊

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### 3.1.7 Audio Recording

The DroidRecord utility can record and play audio. Double click on the icon to

launch it.



Please follow the screenshots below to start recording and play:



# 3.1.8 Ethernet

As for the Ethernet the Tiny4412 supports plug and play in Android. Before the board

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powers on please connect your board to the internet via an Ethernet cable then powers on and you can surf the internet. Now it only supports DHCP and you don't need to do any configuration.

# 3.1.9 SD WiFi

The Tiny4412 can connect to a USB WiFi module.

<b>P</b>	Se	ttings			SCAN	ADD NETWORK	E
	WIR	ELESS & NETWORKS					
	\$	Wi-Fi	OFF				
	ዊ	Ethernet configura	ation				
	*	Bluetooth	OFF				
	0	Data usage					
		More		To see available networks, turn Wi-Fi on.			
	DEVI	CE					
	•{)·1)	Sound					
	۰	Display					
	-	Storage					
	Ê	Battery					
<u>(</u>	D				Ť	2:15	/ 1

Click on "WiFi" and slide the "ON/OFF" switch to turn it on it will search the nearby

WiFi access points:





Click on the WiFi you want to connect and type the password

Settings	FriendlyARM-P	ub					CAN ADD NET	WORK
WIRELESS & NETWOR	Signal strength Security	Excellent WPA/WPA2	PSK				(þ.	
🗢 WI-FI	Password		•				();*	
Bluetooth	Cance	Show pas	sword	Cor	nnect		¢;	
1 2	3 4	5	6	7	8	9	0	×
#\$	% 8	¥ *	-	+	(	;	)	←
~\{ <	> =	:	;		•	1	?	1
ABC →I	@					Ψ.	<del></del> ic	Ħ
$\sim$ $\Box$	ŋ						÷ 2:2	24 💵

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If the connection is a success you will see the following screenshot

Ϋ́	Settings		SCAN	ADD NETWORK	I
	WIRELESS & NETWORKS	FriendlyARM-Pub Connected		();	
	🗢 Wi-Fi 🛛 🗖 ON	ChinaNet-jnfk Secured with WPA/WPA2 (protected network available)		<b>\$</b>	
	Ethernet configuration	FriendlyADM			
	Bluetooth OFF	Secured with WPA/WPA2 (protected network available)		ŝ.	
	🕚 Data usage	HS Secured with WPA		<b>.</b>	
	More	EK-WIFI-04		Ŧ.	
	DEVICE	Secured with WFA/ WFA2			
	<b>∮</b> ୬ Sound	<b>simeigz</b> Secured with WPA2 (protected network available)		Tr	
	🗘 Display				
	E Storage				
	Battery				
<u> </u>			÷	2:247	1

# 3.1.10 3G Dial-up and Messaging

The Tiny4412 now can work with the ZTE MF210 module (WCDMA). The driver is RIL provided.

In Android 4 you don't need to do any setup and you can just plug the MF210

module and power on then your 3G will be connected and a 3G icon will show up on

the right top of the GUI.



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Now you can open a browser and surf the internet or send short messages.

Note: we found several MF210 models. The ones we tested and their device IDs are the

following two:

VID: 19d2 PID: 0117VID: 19d2 PID: 2003



In addition the MF210 module needs to be hooked up to the miniPCIe interface

which doesn't exist on the Tiny4412. FriendlyARM has developed a convertion board

for this application.



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Its internal design is as follows:



### 3.1.11 HDMI Output

Copy your video files to an SD card (note: they must be mp4 whose audio data is in "aac" format. We provide some test files in the "Test Video" directory) and go to your "Gallery" directory:



The Gallery will list all the available video files

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Click on a video file it will be played. The max resolution is 1080p.

When connecting your board to a TV with an HDMI cable the audio and video output will be simultaneously output to your TV.

### **3.1.12 Play High Definition Video**

Copy your video files to an SD card (note: they must be mp4 files in "aac" format.

We provide some test files in the "Test Video" directory) and open "Gallery":

	APPS WI	IDGETS					Б знор
			8		- =		
	3G Dial-up	AutoStart	Bluetooth Fil	Browser	Calculator	Calendar	Camera
	Clock	Dev Tools	Downloads	DroidRecord	Email	ES File Explor	ES Task Man
		<b>**</b>	:)			Sough Keun	
	Gallery	iTest	Messaging	Movie Studio	Music	News & Weat	People
	<		Q	8	٩ ٩	1	
	Phone	Play Store	Search	Search	Settings	Speech Recor	Superuser
<u></u>		57					3:037/

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"Gallery" lists all the available video files:



Click on a video file and play. The max resolution is 1080p.

### **3.1.13 Backlight Control**

Maybe you have noticed that after the system boots the backlight will turn off gradually if the touch screen doesn't receive any touch. This is manipulated by the backlight control. Please go to "Settings" -> "Display" -> "Brightness".

Settings						
WIRELESS & NETWORKS	Brightness					
🗢 Wi-Fi OFF	Wallpaper					
Ethernet configuration						
Bluetooth OFF	Auto-rotate screen					
O Data usage	Sleep					
More	TV Mode					
DEVICE						
🜗 Sound	TV Resolution Choose TV resolution					
Display	TV HDCP Enable HDMI HDCP					
E Storage	Font size					
Battery	Normal					
	· 5:39 ⁄ 🏚					

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Click on "Brightness", open the backlight control window and you will be able to set

#### the backlight's brightness

Settings			
💝 Wi-Fi		Wallpaper	
G Ethernet conf			
Bluetooth	Brightness		
🕓 Data usage 👘			
More			
	Cancel	ок	
الله Sound		TV Resolution Choose TV resolution	
Display			
Storage		Font size	
Battery			
			·· 5:41/

Go to "Display" -> "Sleep" to set its turn off time

Settings		
	Sleep	
S Wi-Fi	15 seconds	
G Ethernet or	30 seconds	
Bluetooth	1 minute	
🕚 Data usagi	2 minutes	
More	5 minutes	
	10 minutes	
📢 Sound	30 minutes	
Display	Never	
	Cancel	
Battery		
		5:48

# 3.1.14 Serial Port Assistant

To launch our serial port assistant utility, you can click on the "iTest" icon

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Click on "Serial Port Assistant" and you can set its parameters as follows:

Serial Port Assistant				
Serial line to connect to: /dev/ 115200 bps	Connect Back			
Data bits:				
Stop bits:				
	Designed by FriendlyARM All rights reserved.   www.amt/pret			
	🐦 5:58 📣			

After setup is done, click on "Connect" and if the connection is successful you will

see the following messages from the serial port

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Friendly	Complete ARM Solutions Design, Development and Manufacturing
	Expertise on Embedded Linux, Android, WindowsCE
Serial Port Assistant - ttyUSB2	
>>> at at	Clean
	Pause
	Back
	Send
	6:29 🗸 🚺

To send data to the serial port, you can type your messages in the left text box and click on "send". Clicking on "Pause" pauses message sending and "Clean" removes all the received messages

Note:

- If a serial port cannot be accessed please try "fuser" to check if it is occupied by other applications
- 2) If this serial port still cannot be opened please command "ls -l" to check its access right and then try "chmod 777" to change its right and try again
- 3) By default "s3c2410\_serial0" is associated with COM0 which is for debugging therefore it is not commended to use this serial port

### 3.1.15 LED Testing

To test LEDs, please click on the "iTest" icon. Click on "LED Testing" and you will



see the following window and be able to test LEDs by clicking on those buttons:

	Testing: /d	ev/leds	
LED1 On	LED1 Off	LED2 On	LED2 Off
LED3 On	LED3 Off	LED4 On	LED4 Off
	Ba	ack	
$\leftarrow$		_	

### 3.1.16 PWM Buzzer

To test PWM, please click on the iTest icon. Click on "PWM Testing" you will see the following window. On the window you can type a frequency and "start" or adjust the frequency by clicking on "+" and "-". To stop it you can click on "stop".

PWM Testing: /dev/pwm		
- 1000		+
	Start	
	Stop	
	Back	
	6:39	1

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## 3.1.17 ADC Testing

To test ADC, please click on the "iTest" icon. Click on "A/D Convert" you will see

the following window

ADC	Testing:	/dev/adc	c						
[AIN0] 2	033 [	[AIN1]	3627						
[AIN6] 2	582 [	[AIN7]	3791						
[AIN8] 2	385 [	[AIN9]	3588						
					Back				
					Duon				
Û	$\Box$							6:	40 🖊 📕

## 3.1.18 I2C-EEPROM Testing

To test "I2C-EEPROM" please click on the "iTest" icon. Click on "IIC/EEPROM

Testing" you will see the following window

IIC/EEPROM Testing: /dev/i	i2c-0		
	Write Data below into	Read EEPROM Data via	
	One day he asked an artist to draw him a beautiful horse. The artist said	One day he asked an artist to draw him a beautiful horse. The artist said	
	Status	:: Done	
	Ba	ack	
			6:41/1

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Click on "Write Data below into EEPROM" to write your data on the left to "EEPROM" and then clickon "Read EEPROM Data via IIC" to read it from EEPROM to the right area

## **3.2 Set up Android Development Environment**

What we mean by "set up Android Development Environment" includes the following three steps:

Step1: install Ubuntu 12.04.2 (64bit)

Step2: install Android SDK on Ubuntu12.04.2

Step3: install Android source code, kernel code and cross compiler

Step4: install fastboot

### 3.2.1 Install Ubuntu12.04.2 64bit

Please download a Ubuntu12.04.2 64bit installation image. Its official website is:

http://releases.ubuntu.com/precise/.

The file name is ubuntu-12.04.2-desktop-amd64.iso. Then you can install it on your

PC.

## 3.2.2 Configure Ubuntu

### 3.2.3 Login as Root

We recommend users to login Ubuntu as root. Please follow the steps below to do

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#### that in a commandline terminal.

终端 UXTerm XTerm	
	a state and
终端 🔤 🖾 🛇 🌗	12:07 👤 friendlyarm 🖏
Regional Antipart Control of the Antipart Control	
[friendlyarm ~]\$	
[friendlyarm ~]\$	
[friendlyarm ~]\$ [friendlyarm ~]\$	
[friendlyarm ~]\$ [friendlyarm ~]\$	
[friendlyarm ~]\$ [friendlyarm ~]\$	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [internet of the second se</pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [internet of the second se</pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [friendlyarm ~]\$ [internet internet internet</pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [internet of the second se</pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [internet of the second se</pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [friendlyarm ~]\$ ] </pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ [friendlyarm ~]\$ [if i endlyarm ~]\$ [if i endlyarm</pre>	
<pre>[friendlyarm ~]\$ [friendlyarm ~]\$ ] </pre>	
Ifriendlyarm     Ifriendlyarm     Image: Comparison of the second seco	
Intendiyarm ~]\$     [friendlyarm ~]\$     Image: Comparison of the second seco	

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Firstly you need to set up a password for root. Please run "sudo passwd root" and

type a password twice



to login as root. Run "cp -p /etc/lightdm/lightdm.conf Run "su root" /etc/lightdm/lightdm.conf.bak" to back up your lightdm file. Then run "vi /etc/lightdm/lightdm.conf" to open it

> [root friendlyarm]\$ root friendlyarm]\$ vi /etc/lightdm/lightdm.conf

Add one line at the end of the file "greeter-show-manual-login=true"



Save the file, reboot the system and click on "login"



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Then type "root", enter and type the password.

## **3.2.4 Install Android Tools**

By default Ubuntu's default installation doesn't have software development tools

therefore users need to install them

Firstly please copy the "\tools\ubuntu" directory from the 4412DVD to "tmp". If you

already have an iso file please follow the steps below

# mkdir -p /mnt/iso
# mount -o loop Tiny4412-20130707.iso /mnt/iso
# cp /mnt/iso/tools/ubuntu /tmp/ -a

Secondly please install jdk6

# cd /tmp/ubuntu/jdk6/
# chmod 755 install-sun-java6.sh
# ./install-sun-java6.sh

Lastly please run the install-devel-packages.sh script and install necessary software

### components

# cd /tmp/ubuntu/
# chmod 755 install-devel-packages.sh
# ./ install-devel-packages.sh

## 3.2.5 Setup Android Compiler

We used arm-linux-gcc-4.5.1 and it by defauly supports armv7 command sets. The

following steps will introduce how to build a compile environment.

Step 1: copy the compressed file "arm-linux-gcc-4.5.1-v6-vfp-yyyymmdd.tgz" in the shipped CD into a system's directory, e.g "/tmp", enter this directory and execute the following commands:



#gedit ~/.bashrc

This is to edit the "~/.bashrc" file (there is a "." before "bashrc"). Update the last line

with "export PATH=\$PATH:/opt/FriendlyARM/toolschain/4.5.1/bin" in the opened

file, save and exit the file



Logout and login the system again (no need to reboot the system, just go to "start"-> "logout"), the above settings will take into effect. Type "arm-linux-gcc -v", if the messages depicted in the screen shot below appear, it indicates the compile environment has been set up successfully.

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## 3.2.6 Uncompress Android Source Code and Install Application Utilities

Firstly, create a working directory: "/opt/FriendlyARM/tiny4412/android" by running

the following command

#### #mkdir -p /opt/FriendlyARM/4412/android

All the source code in the following steps will be uncompressed in this working

directory

#### (1) Get a Copy of Android Souce Code Package

Please copy the Android directory from your 4412 DVD to the tmp directory of

your system. If you already have an iso file please run the commands below

# mkdir -p /mnt/iso # mount -o loop Tiny4412-20130707.iso /mnt/iso # cp /mnt/iso/Android /tmp/ -a

#### (2) Uncompress Android Kernel

Execute the commands below in "/opt/FriendlyARM/tiny4412/android"

#cd /opt/FriendlyARM/tiny4412/android #tar xvzf /tmp/android/ linux-3.5-yyyymmdd.tgz

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This will create a "linux-3.5" directory which contains a complete copy of source

code

Note: yyyymmdd is the date when we released it

### (3) Uncompress Android 4.2.1 System

Execute the commands below in "/opt/FriendlyARM/tiny4412/android"

```
#cd /opt/FriendlyARM/tiny4412/android
#tar xvzf /tmp/android/android-4.2.1_r1-fs-YYYYMMDD.tar.gz
```

This will create an "Android-4.2.1\_r1" directory

Note: yyyymmdd is the date when we released it.

# 3.3 Configure and Compile Linux Kernel

To compile a Linux3.5 kernel please follow the steps below

```
#cd /opt/FriendlyARM/tiny4412/android/linux-3.5
#cp tiny4412_android_defconfig .config ; note: there is a "." before "config"
```

You can run "make menuconfig" to configure the kernel and run "make" to compile":

#make

This will generate a zImage under "arch/arm/boot".

# 3.4 Create Android

Compiling Android may not be an easy task for beginners. Therefore we have a

Script	Comment	Code Example
setenv	Set Android environment variables	. setenv ; note: there is a space
		after "."
gen-img.sh	Generates a system.img and a ramdisk-u.bin	./gen-img.sh
	which are used with fastboot and SD card	
	for flashing systems	

complete copy of the source code and three compiling scripts.

CH-	nt and Manufacturing Android, WindowsCE	
burn-img.sh	Flashes the board with image files. When the Tiny4412 works in the fastboot mode and connected to a PC via USB running this script will flash the board with "system.img" and "ramdisk-u.bin".	./burn-img.sh

To compile the Android source code (Android 4.2.1\_r1) please run the following

commands:

#### #cd /opt/FriendlyARM/tiny4412/android/ android-4.2.1\_r1

#. setenv ;note: there is a space after "."
# make

Tips: you can add a "-j" parameter after "make" to speed up your compilation if your

PC is multi-core. For example if your PC is quad-core you can try "make –j4"

## 3.5 Create and Run File System

Please run the command below to generate a system.img and a ramdisk-u.img:

#### #./gen-img.sh

Running gen-img.sh will create a system.img and a ramdisk-u.img in Android's

source code directory.

[root androi /opt/Friendl [root androi [root androi	d-4.2.1_r1]\$ yARM/tiny4412 d-4.2.1_r1]\$ d-4.2.1 r1]\$	pwd /android-4.2 ls	.1_r1		
abi bionic bootable build burn-img.sh froot androi	cts dalvik development device docs d-4.2.1 r115	external frameworks gdk gen-img.sh hardware	libcore libnativehelper Makefile ndk out	<pre>packages pdk prebuilts ramdisk-u.img sdk</pre>	setenv system system.img tools vendor

# 3.6 Access Hardware in Andorid

For users to fully use and acces the Tiny4412 hardware resources FriendlyARM

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developed a library named "libfriendlyarm-hardware.so" which can be used to access and operate the hardware resources on the Tiny4412 including serial port, buzzer, EEPROM and ADC.

The iTest utility is based on this library and you can run the iTest utility to learn this library.

In this section we will describe how to use the libfriendlyarm-hardware.so library.

### 3.6.1 How to Use "libfriendlyarm-hardware.so"

FriendlyARM has included the libfriendlyarm-hardware.so library in Android. It is in

the following directory:

vendor/friendly-arm/exynos4412/rootdir/system/lib/libfriendlyarm-hardware.so

On the Tiny4412 it is in the "/system/lib/libfriendlyarm-hardware.so" directory.

If you develop Android applications with Eclipse you can follow the steps below to

call libfriendlyarm-hardware.so APIs:

- Go to your Android program's directory, create a "libs" directory, enter it and create an "armeabi" directory and copy "libfriendlyrm-hardware.so" to this directory.
- Go back to your program's directory, enter the "src" directory and create a "com\friendlyarm\AndroidSDK" directory and create a "HardwareControler.java"

file and type the following code:

package com.friendlyarm.AndroidSDK;
import android.util.Log;



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Start Eclipse and select your project list and "Refresh" it now you will see the following information:



To use the HardwareControler APIs you need to add the following line to your code

which introduces the HardwareControler class:

import com.friendlyarm.AndroidSDK.HardwareControler;

Now you will be able to call HardwareControler APIS and we will show you some

examples in the following sections

### 3.6.2 libfriendlyarm-hardware.so APIs

We will list some HardwareControler APIs here.

### 3.6.2.1 Serial Port API

#### Serial Port APIs:

APIs	Parameters and Return Value	Comment
int openSerialPort(	devName: device name, the following	Open a serial device and return its file
String devName,	devices are available:	descriptor.
long baud,	/dev/s3c2410_serial1	
int dataBits,	/dev/s3c2410_serial2	
int stopBits )	/dev/s3c2410_serial3	

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Friendl	Complete ARM Solutions Design, Developm	ent and Manufacturing
C/#RN	Expertise on Embedded Linux	x, Android, WindowsCE
	/dev/ttyUSB0 /dev/ttyUSB1 /dev/ttyUSB2	
	/dev/ttyUSB3	
	dataBits: in general we use 8	
	stopBits: in general we use 1	
	Return Value:	
	When the device is opened successfully it	
	will return a file descriptor which can be	
	used to read, write and select the device	
int write(	fd: file descriptor	Write data to an opened device
int write(	data: data to write to the device	write data to an opened device.
byte[] data)	data. data to write to the device	
	Return Value:	
	When the operation succeeds it will	
	return the number of characters written	
	otherwise it will return -1.	
int read(	fd: file descriptor	Read data from an opened device.
int fd,	buf: data buffer	
byte[] but, int len)	len: number of characters to read	
	Return Value:	
	When the operation succeeds it will	
	return the number of characters read	
	read function is called the file pointer	
	already reaches the end of the device it	
	will return 0	
int select(	fd: file descriptor	Query whether an opened device has
int fd,	sec: seconds allowed to wait	data for reading.
int sec,	usec: useconds allowed to wait(1ms =	
int usec)	1000us)	
	Return Value:	
	If the device has data it will return 1	
	otherwise it will return 0. If this operation	
	fails it will return -1.	
void close(int fd)	td: file descriptor	Close a device
	Return Value: No	

#### Notes:

Firstly you need to open a serial device with "openSerialPort", then your can call "select" to query if is has available data. When it has data you can call "read" to read data.



To write data to a device you can call "write". If you don't need to use a device

remember to "close" it.

### 3.6.2.2 LED APIs

#### LED APIs:

APIs	Parameters and Return Value	Comment
int setLedState(	ledID: LED you want to access (0~3)	Open an LED
int ledID,	ledState: 1 is on, 0 is off	
int ledState )	Return Value:	
	If this operation succeeds it will return 0	
	otherwise it will return -1	

### 3.6.2.3 PWM APIs

#### **PWM Buzzer APIs:**

APIs	Parameters and Return Value	Comment				
<pre>int PWMPlay(int frequency);</pre>	frequency: frequency of sound	Play a Buzzer with the specified				
	Return Value:	frequency				
	If this operation succeeds it will return 0					
	otherwise it will return -1					
int PWMStop():	Return Value:	Stop a buzzer				
1 (7)	If this operation succeeds it will return 0					
	otherwise it will return -1					

### **3.6.2.4 ADC APIs**

#### ADC APIs:

APIs	Parameters and Return Value	Comment				
int readADC()	Return Value:	Read an ADC conversion result				
	If this operation succeeds it will return the					
	conversion result otherwise it will return -1					
int readADCWithChannel(int	Channel: specified channel number: 0, 1, 4	Read a specified ADC conversion				
channel)	and 5	result				
channer)	Return Value:					
	If this operation succeeds it will return the					
	conversion result otherwise it will return -1					
int	Channel: an array of specified channel	Read multiple specified ADC				
read ADCWithChannel(int[]	numbers	conversion results				
	Return Value:					
channels)	If this operation succeeds it will return					
	multiple conversion results otherwise it will					

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### 3.6.2.5 EEPROM APIs

#### EEPROM APIs:

APIs	Parameters and Return Value	Comment
int openI2CDevice();	Return Value:	Open an IIC device and return a file
1 07	If this operation succeeds it will return an	descriptor. After an IIC device is opened
	IIC file descriptor otherwise it will return	successfully you can call
	-1.	"writeByteDataToI2C" and
		"readByteDataFromI2C" to operator the
		EEPROM.
int writeByteDataToI2C(	fd: file descriptor	Write data to EEPROM (one byte on each
int fd,	pos: position where data to be written	write operaration).
int pos,	(0~255)	
<b>byte</b> byteData);	byteData: data to be written	Note: this operation is time consuming. It
		costs about 10 ms.
	Return Value:	
	If this operation succeeds it will return the	
	number of characters written otherwise it	
	will return -1.	
int	fd: file descriptor	Read data from EEPROM.
readByteDataFromI2C(	pos: position where data to be read $(0~255)$	
int fd,		Note: this operation is time consuming. It
int pos);	Return Value:	costs about 10 ms.
	If this operation succeeds it will return data	
	it reads otherwise it will return -1. If before	
	this function is called the file pointer has	
	reached the end of the device it will return	
	0. The return value's type is int you need to	
	convert it to a byte value.	
void close(int fd)	fd: file descriptor	Close a device
	Return Value:No	

#### Notes:

First you need to open a serial device with "openI2CDevice", then your can call "writeByteDataToI2C" to write data and "readByteDataFromI2C" to read data. These operations are time consuming and will usually cost 10ms therefore it is better to call them in a new thread.

The EEPROM device can store 256 bytes data so the position parameter's value

ranges from 0 to 255 and each time it can only read/write one byte





If you don't need to operate the device you need to "close" it.

### 3.6.3 Examples

In the "Android" directory in the shipped DVD there is a LED Demo program you can open it in Eclipse and learn how to use the libfriendlyarm-hardware.so library.You can debug, download and run it on the board via the shipped miniUSB cable.

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# 4. Linux Navigation

# 4.1 Linux GUIs

The Linux image we prepare for the Tiny4412 includes Qtopia2.2.0, QtE4.7 and Qt

Extended 4.4.3. Users can switch among all these three GUIs freely. By default the

Linux GUI is Qtopia 2.2.0.

To get the latest QtE, please go to <u>http://qt.nokia.com/</u>.

### 4.1.1 Linux Main Window

After Linux loads you will see the following main window



## 4.1.2 Play MP3

Go to the "Application" page, click on the "music" icon, select an mp3 and click on "play".

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### 4.1.3 Play Video

Go to the "Application" page, click on the "video" icon, select a video file and click on "play". This player can fluently play H.264/H.263/Mpeg4 files.



### 4.1.4 Image Viewer

Go to the Application page, click on the "pictures" icon and you will be able to

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browse pictures

Pictures	
Image View	1 🗑 🛜 🚯 🖆
mini2440 sunflow	ar
All	-
💶 abc 🥒 🔺 🐯	🔾 🛱 垫 🛚 00:43

### 4.1.5 Calculator

Go to "Applications" and click on the calculator icon. You can select "Simple", "Fraction", "Scientific" and "Conversion".

🕐 Calcula	ator						-1 <b>(X</b> )		
Scientific									
Conversio	on								
Fraction									
Scientific									
Simple									
Sin	Cos	Tan	MC	7	8	9			
0111				4	5	6	+		
Log	Ln	<u>1</u> 	M+	1	2	3			
× <sup>2</sup>	×y	n!	MR	0		+/-	=		
🛂 abc 🖉 🔺	🔽 obc// 🔺 🗱 💦 👘 01:39								

### 4.1.6 Terminal

Go to "Applications", click on the terminal icon and you will be able to type Linux

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#### commands.

Terr	minal																	۲.	X
Font	Opti	ons					1	<b>&gt;_</b>	Ę	) =)	10	₽	Ē	) Is	3				•
" # 1s bin dev etc hone lib linuxrc nnt " # I			8144444 1	ot lopia- lopia- lopia- lopia- lopia-	calc. fa.pn main. mp3.p	png g png .png	444C N N N	topic topic topic bin dcard tart.	a-sd. a-sd. a-vio	∙info png leo.p	•png	sys tap touc usr uar uuu	h.pn: h2.pi	eng					=
ESC	•	1		2	3	4		5	6		7	8	9		0	-	=	+	
Tab	9		w	e	1	·	t	у		u	i	6	,	р	] [		1		
Cap	s	a		s	d	f		g	h		j	k	İ		;	'		Ret	
sł	nift		z	х	0	:	v	b		n	m	,			/	′	S	hift	
Ctrl		Alt														A	lt	Ctrl	I
<mark></mark> 🛱	罰▲	>_														9	1 🗐	01	:41

## 4.1.7 File Manager

Go to "FriendlyARM", click on the file manager icon and you will see your system's

file structure:

File Manager	2. ×
Dir Sort	(- 🔶 🟹 🗶 🗗 🛍
Name.	1000 2010-01-03
Sopt	288B 2010-05-26
Sproc	0B 1970-01-01
🔄 root	576B 2000-01-01
Sbin	2.8K 2010-04-08 ≡
Sdcard	4.0K 1970-01-01
Sys	0B 1970-01-01
Saturb	0B 2000-01-01
Susr	416B 2010-05-26
🧠 var	0B 2000-01-01
Samme	664B 2010-04-08
2 linuxrc	635.4K 2010-04-20 🚔
	R 🖓 🖻 垫 🛚 01:42

### 4.1.8 Network Setting

Go to "FriendlyARM", click on the network setting and you will be able to see the

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#### following screenshot

Network Setting	
Ethernet Device: dm9000	
Static IP: 192.168.1.230	Save
Mask: 255.255.255.0	
Gateway: 192.168.1.1	Close
DNS: 192.168.1.1	Designed by FriendlyARM
MAC: 08:90:90:90:90:90	All rights reserved.   www.arm9.net
	🧱 🔍 🛱 垫 🛚 01:44

You can set your network parameters and "save" it to the "/etc/eth0-setting".

### **4.1.9 Wireless Network**

This section will introduce how to configure the SD WiFi and USB WiFi.

### 4.1.9.1 Wireless Utility

Go to the "FriendlyARM" page, click on the wireless setting icon



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### 4.1.9.2 Wireless AP

After launching the setting utility it will automatically search for an AP and list all

SSIDs and their signal strengths.

WLAN Setting (IP v	via DHCP)		<u>- (x</u>
Device: [wlan0:liberta:	s_sdio:sdio]		
ESSID	Status	Sca	
FRIENDLY-ARM	.all	Disconnect	
ChinaNet-nh7P	-11	Configure IP	
lmf	-11		
luluit	110	Net Detail	
FCARD01	-11		
TP-LINK_5D02EE		Close	
Designed by Frid All rights reserved.   w	endlyARM ww.arm9.net		
🛂 abc 🥒 🔺 察			🔜 🖓 🗃 🙅 🛚 11:59

After an AP is found to connect to it you can click on its ESSID and input its

#### password

WLAN Setting (IP v	ia DHCP)	-\[X
Device: [wlan0:libertas	_sdio:sdio]	
ESSID	Connect to AP XOK	
FRIENDLY-ARM	ESSID: FRIENDLY-ARM	
ChinaNet-nh7P	MAC: 00:21:27:BB:2D:1E	
lmf	Security: WPA2 v1	
	Wireless password:	
luluit		
FCARD01	Show password	
TP-LINK_5D02EE	Connect	
Designed by Frie	Connect	
All rights reserved.   w	vw.arm9.net	
💶 abc 🥒 🔺 🛜		黒 🔍 🖻 肈 🔒 12:00

Click on "connect"

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Friendly Des Expertise on E	RM Solutions ign, Development and Manufacturing Embedded Linux, Android, WindowsCE
WLAN Setting – Connecting	
Device: [wlan0:libertas_sdio:sdio]	
ESSID Status	Scan
FRIENDLY-ARM	Disconnect
ChinaNet-nh7P	Configure ID
Imf all	Conligure IP
luluit 🚮	Net Detail
FCARD01	
TP-LINK_5D02EE	Close
Designed by FriendlyARM All rights reserved.   www.arm9.net	
	🔜 🖓 🗃 🙅 👔 12:00

If the connection is successful it will show "Connected"

WLAN Setting (IP	via DHCP)		-L <b>X</b>
Device: [wlan0:liberta	us_sdio:sdio]		
ESSID	Status	Scan	
FRIENDLY-ARM	Connected	Disconnect	
ChinaNet-nh7P		Configure ID	
Imf		Configure IP	
luluit	100	Net Detail	
FCARD01			
TP-LINK_5D02EE		Close	
Designed by Fri All rights reserved.   v	endlyARM www.arm9.net		
<mark></mark> 🛲 🔺 察			2:01 💼 🔁 📕

If you started the Ethernet before you start the wireless you will see the following

dialog which prompts you to close the Ethernet. You need to close the Ethernet.

WLAN Settir	ng – Connecting				-\ <b>X</b>
Device: [wlan0:	libertas_sdio:sdio]				
ESSID	Statu	s	Scan		
смее	lin.		Disconnect		
FRIENDLY-AF	Multi-Network			×	
ChinaNet-nh7	🚺 Do you w	ant to tur	n off Ethernet t	o use WiFi?	
Imf		[			
luluit		Yes	NO		
FCARD01	-41	5	Close		
Designed I All rights reser	by FriendlyARM wed.   www.arm9.net	hs.			
<mark>!-</mark> ▲ 🛜				Ç	<b>) 🖻 坐 </b> 08:30

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Click on "Net Detail" you will see the wireless network's details



After your connection is successful, click on "close" to minimize the utility



Now you can surf the internet



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### 4.1.9.3 Disconnect Wireless Network

To disconnect the wireless network you can just click on "Disconnect"

WLAN Setting - Dis	connecting		×
Device: [wlan0:libertas_	sdio:sdio]		
ESSID	Status	Scan	
Disconnecting		Disconnect	
		Configure IP	
		Net Detail	
		Close	
Designed by Frier All rights reserved.   www	ndlyARM w.arm9.net		
<mark>!</mark> ===== ▲ 🔍 🛜			2:04 🗟 🙅 📲 🖳

### **4.1.9.4 IP Configuration**

On the wireless utility window click on "Configure IP" you will see the following dialog:

WLAN Setting (IP v Device: (wlan0:liberta:	ia DHCP)	
ESSID	IP Setting IP via DHCP	X OK
FRIENDLY-ARM	IP Address	
ChinaNet-nh7P	Subnet Mask 255.255.255.9	
Imf	Gateway	
luluit	First DNS	
FCARD01	Second DNS	
TP-LINK_5D02EE	Sava Cance	
Designed by Frie All rights reserved.   w		51
<mark></mark> =====		R 🖓 🖻 🙅 🛚 12:04

Click on the "IP Setting" pull-down list you will be able to select "DHCP" or

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"Configure IP Manually"

WLAN Setting (IP v	/ia DHCP)		×
Device: [wlan0:liberta:	IP Setting	X OK	
ESSID	IP via DHCP	-	
FRIENDLY-ARM	IP via DHCP	R	
ChinaNet-nh7P	Configure IP manu	ally	
Imf	Gateway		
luluit			
FCARD01	First DNS		
TP-LINK_5D02EE	Second DNS		
Designed by Frid	Save	Cancel	
All rights reserved.   w			
			800 🖻 🙅 🛚 12:04
WLAN Setting (IP v	via DHCP)		
WLAN Setting (IP v Device: [wlan0:liberta:	via DHCP)	Roya	
WLAN Setting (IP Device: [wlan0:liberta: ESSID	IP Setting	ХОК	
WLAN Setting (IP v Device: [wlan0:liberta: ESSID FRIENDLY-ARM	via DHCP) <sup>S</sup> IP Setting IP via DHCP IP via DHCP	ХОК	
WLAN Setting (IP Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P	IP Setting IP Setting IP via DHCP IP via DHCP Configure IP manu	X OK	
WLAN Setting (IP Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P Imf	Via DHCP) P Setting IP via DHCP IP via DHCP Configure IP manu Submet Mask 200 Gataway	ally	
WLAN Setting (IP v Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P Imf Iuluit	Via DHCP) IP Setting IP via DHCP IP via DHCP Configure IP manu Submer Iviask	ally	
WLAN Setting (IP v Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P Imf Iuluit FCARD01	via DHCP) P Setting IP via DHCP IP via DHCP Configure IP manu Submet Mask 200 Gateway First DNS	ally	
WLAN Setting (IP v Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P Imf Iuluit FCARD01 TP-LINK_5D02EE	via DHCP) IP Setting IP via DHCP Configure IP manu Submer Wrask 200 Gateway First DNS Second DNS	ally	
WLAN Setting (IP v Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P Imf Iuluit FCARD01 TP-LINK_5D02EE Designed by Eric	Via DHCP) IP via DHCP IP via DHCP Configure IP manu Submet Mask 200 Gateway First DNS Second DNS Save	ally Cancel	
WLAN Setting (IP v Device: [wlan0:liberta: ESSID FRIENDLY-ARM ChinaNet-nh7P Imf Iuluit FCARD01 TP-LINK_5D02EE Designed by Frie All rights reserved.   w	via DHCP) IP via DHCP IP via DHCP Configure IP manu Submert Wask 200 Gateway First DNS Second DNS Save	Ally Cancel	

### 4.1.10 WiFi AP

To start the WIFI AP function you need to use the RT8192 WiFi module.

Note: the router function hasn't been implemented.

Go to "FriendlyARM", click on the network setting and you will be able to see the

following screenshot



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Click on the the icon you will see the following window:
WiFiAP (for RTL8192)
IP: 192.168.2.1 + -
SSID: arm9.net
Password: arm12345
Security mode: WPA2
Channel: 8 + –
Opt Mode: IEEE 802.11g ▼
Auto start at boot
Status: Working (192.168.2.1)
Apply 🔀 Stop
Config files: /etc/hostapd.conf /etc/rc.d/init.d/wifiapd /etc/udhcpd.con1
Designed by FriendlyARM All rights reserved.   www.arm9.net
The fields on the window are defined as follows:

IP	IP Address
SSID	Access point
Password	Password, at least 8 digits with WPA2 encoding
Channel	The default value is 8. Note: if your working area has a wireless
	router this value cannot be the same as the router's. Usually most
	popular routers such as D-LINK's value is 6.
Opt Mode	WiFi protocol. The default is 802.11g
Auto start at boot	Whether to set auto start the WiFi AP

After configuration is done click on "Apply" to save. Click on "Start" to start the

WiFi AP. When it shows "Working" it means the board is now working under the WiFi

AP mode. In our example the IP was 192.168.2.1

Status: Working (192.168.2.1)

Now you can find the board from your mobile phone. In our example the SSID was



"arm9.net" we could find it on our mobile phone. Click on it and input the password to

#### connect.



After the connection is successful you will find similar information shown as below

Wi-Fi 网络	arm9.net	
IP 地址		
DHCP	BootP	静态
IP 地址		192.168.2.2
子网掩码	25	5.255.255.0
路由器		192.168.2.1
DNS	192.168.2.1, 8	8.8.8.8, 129

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In our example the board's IP was 192.168.2.1 we could browse <u>http://192.168.2.1</u> on

#### our mobile phone.



WiFi AP Setting will save WiFi's configuration data to the following files:

Configuration File	Comment
/etc/hostapd.conf	WiFi parameters
/etc/hostcpd.conf	DHCP service parameters
/etc/rc.d/init.d/wifiapd	Start/Stop WiFi AP service
/etc/init.d/rcS	If you want to auto start WiFi AP service you can
	add "/etc/rc.d/init.d/wifiapd start"

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### 4.1.11 Ping Test

After configure your network please go to "FriendlyARM" and click on "Ping

### Testing"

Ping Testing	L X
IP Address: 192.168.1.1	✓ ping forever
Pinging PING 192.168.1.1 (192.168.1.1): 56 dat 64 bytes from 192.168.1.1: seq=0 ttl=€	Stop
64 bytes from 192,168,1,1; seq=1 ttl=6	Close
	Designed by FriendlyARM All rights reserved.   www.arm9.net
<mark></mark>	<b>₽</b> \$ 🛱 🗐 1:48 zł

### 4.1.12 Browser

Go to "FriendlyARM", click on "Browser", open the soft keypad on the left bottom

and you can type a website in the address bar.

有道手机版	-1 ( <b>X</b>
🎟 💠 👌 🍜 📀 👌 🔍 🖏	
http://m.youdao.com/?keyfrom=web.index	-
有道youdao	_
搜索	=
<u>图片 音乐 新闻 博客</u>	
<u>购物 餐饮 阅读 快贴</u>	
<u>词典   翻译   影讯   天气</u>	
输入" <u>广州天气</u> "直接搜天气。	
看 <u>热闻</u> * <u>小说</u> * <u>新歌榜</u>	
■手机词典Ⅰ购物助手	▲ ▼
	📃 🔍 🖻 垫 📋 02:00
	₽\$\$ 🖻 📽 👖 02:00

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### 4.1.13 LED Test

Go to "FriendlyARM" and click on "LED Testing"

LED Testing		<b>2</b>	×
	All On	Stop led-player	
	All Off	Close	
LED 3		Designed by FriendlyARM All rights reserved.   www.arm9.net	
<mark></mark> ===== - []		n 🔜 🖓 🛱 垫 👖 02:	01

### 4.1.14 EEPROM Reading and Writing

Go to "FriendlyARM" and click on "I2C-EEPROM". Click on "Write Data below

into EEPROM via IIC" you will see the writing process

IIC/EEPROM Testing	2) X
Long, long ago there lived a king. He loved horses. One day he asked an artist to draw him a beautiful horse. The artist said	
EV	Read EEBBOM Date via IIC
3%	Reau EEFROM Data Via IIC
Writing	
About	Close
<mark></mark>	📕 🔍 🛱 🙅 👔 02:04

Click on "Read EEPROM Data via IIC" you will see the reading process

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### 4.1.15 PWM Buzzer Test

Go to "FriendlyARM" and click on "PWM Buzzer" you will see the writing process.

PWM/Buzzer Testing	1. X
PWM and Buzzer Testing	
1130Hz +	Stop
Designed by FriendlyARM	<b>0</b> 144
All rights reserved.   www.arm9.net	Close
	🔜 💭 💼 🔜 🔜 02:07

### 4.1.16 Serial Port

Note: before start this program please connect the serial port your want to test to your

board.

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The on board CON1, 2, 3 and 4 are CPU UART0, 1, 2 and 3. UART0 has been converted to RS232, and extended to COM0 via DB9. On system startup it has been set to the console terminal, so it cannot be tested via this utility. The other three ports CON2, 3 and 4 must be converted to RS232 before they can communicate with a PC serial port. (FriendlyARM has a "OneCom" RS232 conversion module) When connect the ports to a PC, please make sure to use a correct serial cable (cross serial line or direct serial line).
This program also supports common USB to Serial cables. Now most laptops don't have serial ports. For the sake of users most of our agents provide those conversion cables. Connecting a USB to Serial cable to your board, you can extend your serial ports. Its device name generally is "/dev/ttyUSB0, 1, 2 and 3", which implies you can use a USB hub to extend your serial ports.



Connect your serial port extension board to the Tiny4412's CON2/3/4 and connect to

a PC via a crossover serial cable.

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Go to the "FriendlyARM" tab and click on the "serial port assistant" icon to open the interface.

/dev/ttySAC1 115200 8N1 [C]	-1( <b>x</b> )
	Setting
	Connect
	Clean
1	Close
	Send

The title bar of the utility shows the default setting is "**ttySAC1 115200 8N1** [**C**]", and it implies the default port is:

- Serial Port Deivce: /dev/ttySAC1, it corresponds to the second port UART1
- Bits Per Second: 115200
- Data Bits: 8
- Flow Control: None
- Stop Bits: 1
- [C]: stands for the character mode; [H] stands for Hex

There are two edit areas in the interface, the top one shows received data which cannot be edited; the bottom one shows sent data which can be edited via a USB keyboard or a soft keyboard.
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Click on the "Connect" button to open "/dev/ttySAC1", type some characters in the edit area, click on the "Send" button and it will send data to the connected serial port device. The screenshot below shows what a Windows super terminal receives (Note: the settings for this super terminal should be 115200 8N1)

/dev/ttySAC2 115200 8N1 [C]	U X	D 🖨 🍘 🕉 🗈 🎦 😭
	Setting	[
	Disconnect	www.arm9.net
	Clean	
www.arm9.net	Close	
	Send	
<mark>.</mark>	📕 🖓 🖻 🙅 🛚 21:58	

Click on "Disconnect" to disconnect the connection. Click on "Setting..." to enter the

parameter setting interface which lists some basic serial port parameters:

Comm Port: you can choose "/dev/ttySAC0,1,2" or the USB to Serial

"/dev/ttyUSB0,1,2,3". Note: in this utility, SAC0 corresponds to CON1, SAC1

corresponds to CON2 and etc.

Speed: bits per second

Data: data bits, 8 or 7, usually 8.

Hex: input and output data in Hex format

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## **4.1.17 Com Ping**

FriendlyARM developed another serial port utility "Com Ping" which is used to test

multiple serial ports



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- 1) "Send Text" is the text that will be sent to the specified port
- 2) "Invalidate" is the time span between two text sending
- 3) Supports hex bytes

After setting these parameters click on "Start" you will be able to communicate with serial ports.

### 4.1.18 Audio Recording

Go to the "FriendlyARM" tab and click on the "recorder" icon:

Recorder
00:00
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Click on the "REC" button to start recording. When you speak to the microphone on the board, you will see audio waves shown on the screen. Click on the "STOP" button to stop recording.

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RCORDING	PRESS PLAY TO PLAY	
<b>**10)+){{                                  </b>		
00:13	00:21 New REC Play Close	
Designed by FriendlyARM All rights reserved.   www.arm9.net	Designed by FriendlyARM All rights reserved.   www.arm9.net	
<mark></mark> ▲ 🙀 🛛 💀 💼 坐 🛔 04:00-	🔽 🎫 🔺 🔢 🛛 🔜 📲 📫 04:01	

Click on the "PLAY" button to play what you recorded and you can see what you recorded has been saved as "WAV" files in the "Documents" directory.

Recorder	8		Documents	C
PLAYING	<b>K</b>	<b>K</b>	(CP	
	girl	mini2440	New Soul	
,	4	Q7	<b>K</b>	
	panda	Sun Jan 14	sunflower	=
00:14		04:00:42		
New REC Step Close		2024		
Designed by FriendlyARM All rights reserved.   www.arm9.net				4
	All types	✓ All		Ŧ
🛂 🎫 🔺 🔢 🛛 🔍 🛱 望 👖 04:03			🔍 🖻 坐 🚺 04	:05

Note: Qtopia 2.2.0 has a recorder utility by itself. But it cannot record audio. We leave it

as what it is.

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### 4.1.19 LCD Test

Go to the "FriendlyARM" tab, click on the "LCD" icon you will see the following dialog pop up:

LCD Testing	<b>Z</b> ( <b>X</b> )
Display different color at full screen	Designed by FriendlyARM All rights reserved.   www.arm9.net
Auto-loop	Manual-control
CI	ose
🔽 abc 🖉 🔺 🐢	n 🔁 🗐 🔁 🖉 🛛 🛛

This utility has two modes: auto and manual

Auto-loop loops automatically. Executing it presents "red", "yellow", "white", "sky blue", "dark blue", "green", "pink" and "black". During the loop clicking on any place on the screen will return

## 4.1.20 Backlight Control

Note: this feature requires an LCD driven by the 1-wire precise touch driver.

If you already played our 4412 system you may notice that after power on the board will turn "dark" without being touched for a period. This is a default system action controlled by the backlight management. In the "Settings" tab clicking on "Power Management" will start this utility



Here the default setting is 25 seconds you can click on the "Up" or "down" arrow to adjust it. If you uncheck "Light off", the backlight will be on as long as the system is powered on. An LCD driven by the 1-wire precise touch driver integrates the function of adjusting the backlight therefore you can slide the slider to get your desired backlight. When you check "Dim light" you will observe that the light is off gradually. Actually adjusting the backlight in our software is pretty straightforward. You can refer to 2.10 for more details on how to adjust it via the command line utility.



#### 4.1.20 A/D Conversion

The Samsung 4412 chip has 8 A/D conversion channels but only one converter. In general, AIN4, AIN5, AIN6 and AIN7 are used as YM, YP, XM and XP channels via a four wire resistor. We extended AINs 1-3 which reside on CON6. For easier testing, AIN0 is directly connected to an adjustable resistor W1. How do they share a common converter? The following screenshots will show you:

Click on the "ADC Testing" icon in the "FriendlyARM" tab:



Turning the W1 adjustable resistor, you will see the conversion changes. It has 10 digit precision, therefore the minimum value is close to 0 and the maximum value is close to

1024.

ADC Testing	₩ <b>₩</b>
Designed by FriendlyARM All rights reserved.   www.arm9.net	Close
<mark></mark> abc 🖋 🔺 🎆	27 05:27

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When you click on the touch screen, the A/D converter will take the touch screen as the

channel, you will see the result "-1"; when you move your touch pen away from the

screen, the A/D converter will take AIN0 as the channel again.

ADC Testing	-1	×
Vcc         AIN0         w1         Twist resistor W1, Get the RESULT         Tap screen, Drop off AIN0 Converting	- 1	
Designed by FriendlyARM All rights reserved.   www.arm9.net	Close	
2 abc 🖉 🔺 🎆	<b>2</b> 🖓 💼 🙅 👖 05:2	27

### **4.1.21 User Button Test**

Note: the user buttons don't have dedicated functions and they are just for testing low level drivers. Click on the "Buttons" icon in the "FriendlyARM" tab. Press down any buttons on the board, the corresponding button icons will change to blue, release them, their icons will change back to grey.



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### 4.1.22 Touch Pen Test

To test whether or not a touch pen works properly, you can draw a line on the LCD, check if there is any offset or vibration. This can be done via the "penpad" utility. Click on the "penpad" icon in the "FriendlyARM" tab.

The "penpad" utility is an easy to use program developed by FriendlyARM. Start it, a yellow drawing area will show up. Draw whatever you like in the area (the pen color is black, its width is 1 pixel), go to "File" -> "Save", you will save what you draw to a png file(in the "Documents" tab, the /Documents/image/png/ directory). The file name begins with 001. The maximum number of files that can be saved is 999. The following screenshot shows that our writing was smooth which meant our pen was accurate.



## 4.1.23 Barcode Scanning

Our system supports USB barcode scanners which are actually a HID device very similar to a USB keyboard. Therefore a barcode scanner can work any where a USB



keyboard works.

Note: before start this utility, please make sure to plug in your scanner.

Click on the "text editor" icon in the "Application Programs" subgroup, scan a code

with your scanner, then you will see the code number displayed in the editor.



### 4.1.24 Language Setting

Qtopia 2.2.0 has a language setting utility which is different from the one in Qtopia 1.7.0. It only supports English. Therefore we developed a new utility located in the "FriendlyARM" tab (the icon is a waving flag).

Language Setting	
<ul> <li>English</li> <li>Chinese</li> <li>Japanese</li> </ul>	Designed by FriendlyARM All rights reserved.   www.arm9.net
ок	Close
	n 12:48 🗟 😒 🔒 02:48

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Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE It now supports three languages: English, Chinese and Japanese. When you select "English", then click on "OK", a message will popup asking you if you want to change your language setting. Clicking on "Yes" Qtopia will reboot; clicking on "No" it will

return. (Note: the Chinese and Japanese versions only have file names translated).



## 4.1.25 Set up Time Zone, Date, Time and Alarm Clock

When you get our system, the date and time usually might not be accurate. You can

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adjust them by yourself. Because the CPU has its own RTC and the board has a backup battery, after you adjust the date and time, they will be saved. To adjust them, click on the time zone area at the right bottom of the screen, a menu will show up, please select "Set time..", open the setting interface where you can set parameters such as time zone, date, time and so on

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Select "Clock" from the menu.



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Besides you can set the alarm clock. When it is triggered, you will hear a beeping sound which lasts about one minute and the following popup window will show up. Click on "OK" to close the alarm clock.

\lambda 🖹 垫 🚺 02:54

20

#### 4.1.26 Rotate Screen

/ 🔺 🧭 🕑

Click on the "rotation" icon in the "settings" tab to enter its interface. You can rotate the screen in four directions.



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Select the direction you want, click on "OK" you will see the screen rotate. Note: sometimes you need to reboot Qtopia to see the rotation. It is a Qtopia utility and we hasn't made any change to it. In addition the rotation effect is implemented via Qtopia software and has nothing to do with LCD drivers.

After rotation you will notice that all "FriendlyARM" utilities get rotated too. We implemented this feature to make our utilities displayed properly with different LCDs



## 4.1.27 Setup Auto Run Program

By setting "auto run" you can make Qtopia launch its own or your programs after it

boots up. It is very similar to what you see in Windows "Programs -> Startup".

Click on the "Auto Start Setting" icon in the "FriendlyARM" tab.

Con Friendly Expe	nplete ARM Design ertise on Eml	Solutions a, Development and Manufacturing bedded Linux, Android, WindowsCE
Select Auto Start program	O to to to	
	Status	_
U 🧐 Calendar		
		Save
		Clean
		Close
Tasks		
Clock	<b></b>	Designed by Friendly&RM
Camera	<b>▼</b>	All rights reserved.   www.arm9.net
- 🔽 abc 🥒 🔺 🎆		<b>R</b> 🖓 🛱 垫 🔒 16:17

Those program listed are available programs which include all Qtopia programs, the status column indicates whether a program is set to auto start. The status is unique. For instance, if the "Serial Port Assistant" is checked, its status will show "Auto Start", click on "Save", a message box will pop up prompting that the net setting has been successfully saved. Close this utility, reboot the system you will see the "Serial Port Assistant" is auto run.



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To disable auto run for a program, just click on "Clean" and "Close", a message box

will pop up, click on "Yes" the auto run for that program will be disabled.

Select Auto Start	program	
Program list	Status	
🗹 💀 Calendar	Auto Star	
🗖 🚳 World Time		te
🗖 🔮 Voice Notes	Auto Start Program se	etting
🗖 🕼 Music	Do you want to s	save the change?
🗖 💆 Notes	<u>••</u>	
🗖 🖉 Pictures	Yes	No
🗖 🕜 Help		ie i
🗖 🖉 Tasks		~~~
Clock		Designed by FriendlyARM
mera		All rights reserved.   www.arm9.net
h		
🔽 abc 🥒 🔺 🎆		🔜 🖓 💼 🙅 👖 16:19

### 4.1.28 System Shutdown

In the "Settings" tab, click on the "shutdown" icon you will see four options on the shutdown window.

**Shutdown:** Press this button, Linux will end all the programs and services to shutdown the whole system. After the whole system is shutdown, the CPU will not be running and the system consumes lest power. However since our system doesn't have a hardware power down circuit you still can see the power LED on the board is on.

**Reboot:** This is a "hot" reboot button. If your system boots from the Nor Flash, after you press this button, the system will shutdown, reboot and enter the supervivi main menu. If your system boots from the Nand Flash, after you press this button, the system will shutdown, reboot and enter the Qtopia interface.

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Note: **Reboot** is different from the "Watchdog" function we will introduce. The

"Watchdog" is "cold" reboot and doesn't end programs or services but reset the system instead.

Restart Server: it restarts the Qtopia system only. It doesn't interrupt the running

Linux.

Terminate Server: it shuts down the Qtopia system. After press this button, the Qtopia

interface will be disabled. What is left on the screen is the left data in RAM and it is not

an active graphic interface.

? Shutdown			
_ Terminate			
Shutdown	Restart Server		
Reboot	Terminate Server		
These termination options are provided primarily for use while developing and testing the Qtopia system. In a normal environment, these concepts are unnecessary.			
Cancel			
	23:07 🖻 🚽 📔 🖓		

Note: the original Qtopia 2.2.0 system doesn't "shutdown" or "reboot" effectively, we

changed its code to make it work.

## 4.1.29 Watchdog

The "Watchdog" is a very basic utility in embedded systems. The 4412 chip already

has a watchdog. The latest Linux kernel has drivers for it.



Note: before take any action, please read the notes in the red area: once start, no way out,

#### feed the dog, or else reboot!

Here we set a countdown time 15 seconds. To feed the dog, click on the "Feed"

button. Keep feeding, it will always have bones and the system will not reboot.

Watchdog Testing		×
III Caution: Once START , NO WAY OUT FEED the dog, or else REBOOT		
E	Feed	
Designed by FriendlyARM All rights reserved.   www.arm9.net		
	R_ 🛱 🕾 🛙	03:09

### 4.1.30 Start QtE-4.7.0

In order for users to switch freely and smoothly between different systems we

implemented a feature that allows Qtopia-2.2.0 and QtE-4.7.0 to co-exist in the same

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file system. In Qtopia-2.2.0, by clicking on a common application icon users will be able to start QtE-4.7.0. After close the QtE-4.7.0 utility, users will be able to return to Qtopia-2.2.0.



QtE-4.7.0 runs as follows. It is a program manager that display a CoverFlow effect. You can drag it left and right and run it by clicking on one of the Covers.



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You can exit QtE-4.7.0 by clicking on "Exit Embedded Demo" and return to Qtopia-2.2.0



## 4.1.31 Start Qtopia4

In order for users to switch freely and smoothly between different systems we

implemented a feature that allows Qtopia-2.2.0 and Qtopia4(Qt Extended 4.4.3 Phone)

to co-exist in the same file system. In Qtopia-2.2.0, by clicking on a common



application icon users will be able to start Qtopia4. After close the Qtopia4 utility,

users will be able to return to Qtopia-2.2.0



If you have never run Qtopia4 on the system you will see the following GUI after

#### start it



Click on the screen you will be directed to a configuration window where you can set

up your date and time. You can ignore it here and click on "Finish" to continue.

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After a while you will enter Qtopia4 and the title is "Qt Extended"



There are three buttons "Options", "Menu" and "Quit". "Quit" is implemented by FriendlyARM to allow users easily returning to Qtopia2. You can add your own features too in the source code. Here please click on "Menu" to enter the main function menu.



Qtopia4's applications are very limited which we will not talk too much about here.

Click on "Back" to return to the main menu and click on "Quit" to return to Qtopia2.



Note: when quitting users will see a flash which doesn't exist in Qtopia and is

implemented by FriendlyARM. It is open source and users can check it.

So far, we have introduced most of the GUI utilities that will be used to manipulate hardware. There are other utilities you can try by yourself.



# 4.2 Play Tiny4412 via Command Line

Note: every Linux fan may need to get familiar with the command line utility. All Linux

commands are very similar (99% of them are identical) across different versions. Before

step in this section, please set up your super terminal properly.

Below is a screenshot of system login via super terminal. Just press "Enter" as

prompted to continue.



## 4.2.1 Play MP3

This section will give a brief introduction on how to run Linux commands and

various application programs in Linux via a super terminal. Before move forward,

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please connect your board with a PC and start a super terminal. The following

screenshot is what you might see after you set up your super terminal and connection

#### with your board

The madplay utility is an mp3 player migrated by FriendlyARM. It can be run in

various ways and the most straightforward one is this:

#### #madplay your.mp3

This command will play "your.mp3" in its default way. You can get help by running

"madplay -h". Below is a screenshot of how it works.

```
FAT: utf8 is not a recommended IO charset for FAT filesystems, filesystem will b
e case sensitive!
[01/Jan/2000:11:32:48 +0000] boa: server version Boa/0.94.13
[01/Jan/2000:11:32:48 +0000] boa: server built Apr 8 2010 at 15:40:06.
[01/Jan/2000:11:32:48 +0000] boa: starting server pid=657, port 80
Try to bring eth0 interface up.....eth0: link down
Done
Please press Enter to activate this console. eth0: link up, 100Mbps, full-duplex
 lpa 0x45E1
[root@FriendlyARM /]#
[root@FriendlyARM /]# madplay /root/Documents/viva-la-vida.mp3
MPEG Audio Decoder 0.15.2 (beta) - Copyright (C) 2000-2004 Robert Leslie et al.
           Title: Viva La Vida
         Artist: Coldplay
           Album: Viva La Vida Or Death And All His Friends
           Track:
            Year: 2008
           Genre: Rock
        Encoder: iTunes v7.6
        Comment: Rip & Rls by Team COC
```

In the latest Linux kernel, we integrated a driver for ALSA audio interface. The madplay utility plays audio files via this interface too and related ALSA libraries are also integrated into the system.



### **4.2.2 Terminate Program**

To terminate a running program you can press Ctrl + C in a terminal. For instance, if you are running madplay you can press Ctrl + C to terminate it. If a program runs in the background you need to issue the "kill" command to terminate it.

## 4.2.3 File Transfer To and From PC via Serial Port

Note: some users may not get file transfers done successfully via a USB to Serial

#### connector it could result from the cable's bad quality

After login into the Tiny4412 system via a serial port, you can transfer files to and from a host PC by using command "**rz**" or "**sz**" as follows:

#### (1) Transfering files by using "sz"

Open a super terminal, click on the mouse's right button, then click on "Receive files" to set up the destination directory and the protocol this transfer will use, see the screenshot below:

🗖 接收文件 🛛 💽 🔀
在下列文件夹中放置收到的文件 (P):
①:\data 浏览 @
使用接收协议 (U): Receive Files
Znodem 与崩溃恢复
援收 (B) 关闭 (C) 取消

Type "**sz** /**root/Documents/viva-la-vida.mp3**" in the shell to transfer the "viva-la-vida.mp3" file under the "/root/Documents" directory to the host PC. It took a while to transfer this big file. After it is done, the system will save it in the directory you



set in the previous step. Please see the screen-shot below:

为 ttys0	接收 Zmodem 与崩溃恢复 文件	
正在接收:	VIVA-LA-VIDA. MP3	
存储为:	D:\data\VIVA-LA-VIDA.MP3	文件数: 1 / 1
上次事件:	正在接收	重试次数:
状态:	正在接收	
文件:		978K / 4720K
己用:	00:01:33 剩余: 00:05:56	吞吐量: 10733 eps
	取消 跳	过文件 (S)   cps/bps (C)

#### (2) Transfering files by using "rz"

In your Tiny4412 system, type "rz" to receive files from a host PC.

Open a super terminal, click on the mouse's right button, select "Send file", set up the

file being sent and the protocol the transfer will use. Then send the file:

■ 发送文件	? 🛛
文件夹: D:\data	Send File
文件名 (g):	
D:\data\I-See-You.mp3	浏览 图
协议(E):	
Zmodem 与崩溃恢复	
发送	⑤ 关闭(C) 取消

Click on "Send" and the board will begin to receive your file



(Friend	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE
为 tty	s0 发送 Zmodem 与崩溃恢复 文件
正在发达	≚: D:\data\I-See-You.mp3
上次事件	+: 正在发送 文件: 1 / 1
状态:	正在发送 重试次数: 0
文件:	822K / 6114K
己用:	00:01:15 剩余: 00:08:02 吞吐量: 11223 cps
	取消 Cps/bps(C)

After the transfer is done, the current directory will get this file. You can verify it by using "md5sum" to check whether this file is the same as the original one.

#### 4.2.4 LED Test

#### (1) LED Server

After the system starts up it will automatically start a LED service

(/etc/rc.d/init.d/leds), it actually runs a led-player script. After the led-player script is run

a pipe file led-control will be created in the /tmp directory.

Users can change an LED's flashing by setting its parameters

#echo 0 0.2 > /tmp/led-control

After this command is executed each of the 4 LEDs will be flashing one by one with

a 0.2 second in between.

#echo 1 0.2 >/tmp/led-control

After this command is executed 4 LEDs will be running the accumulator one by one

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with a 0.2 second in between.

#/etc/rc.d/init.d/leds stop

After this command is executed all 4 LEDs will be turned off.

#/etc/rc.d/init.d/leds start

After this command is executed all 4 LEDs will be turned on.

#### (2) Manipulating a Single LED

The /bin/leds utility can be used to manipulate a single led. To launch this utility

users need to stop the led-player service first:

#/etc/rc.d/init.d/leds stop

This command will stop the led-player service. To get more information for the usage

of "led" you can type the following command:

[root@fa /]# led

Usage: leds led\_no 0|1

led\_no: the LED you want to manipulate (0/1/2/3). "0" and "1" represents "turn off"

and "turn on" respectively

#led 2 1

This will turn on LED3

## 4.2.5 User Button Test

Type the "**buttons**" command, press a user button and you will see the following scenario



[root@FriendlyARM /]# buttons key 1 is down key 1 is up is down key 1 is down kev 2 key 2 is up kev 1 is up key 3 is down key 3 is up is down kev l kev is up is down key 1 key 5 is down key 5 is up

#### 4.2.6 Serial Port Test

key 1 is up

Note: the armcomtest utility is a straightforward and easy to use program developed by

FriendlyARM for Linux. It doesn't rely on system calls or hardware. After Linux is

loaded Serial Ports1, 2, 3 and 4 correspond to /dev/ttySAC0, 1, 2 and 3.

To test Serial Port 2 you need a PC with a serial port. Please connect CON2 to the PC

via our extension board. Type the following command:

#### #armcomtest -d /dev/ttySAC1 -o

Now if you type characters (in Serial Port Assistant) on your board they will be

output to your PC's super terminal simultaneously and vice versa

To test Serial Port 3 you need to connect CON3 via our extension board and type the command below:



#armcomtest -d /dev/ttySAC2 -o

Here is a screenshot

```
RPC: Registered udp transport module.
RPC: Registered tcp transport module.
s3c2410-rtc s3c2410-rtc: setting system clock to 2080-02-10 11:43:18 UTC (347479
0998)
yaffs: dev is 32505858 name is "mtdblock2"
yaffs: passed flags ""
yaffs: Attempting MTD mount on 31.2, "mtdblock2"
yaffs_read_super: isCheckpointed 0
VFS: Mounted root (yaffs filesystem) on device 31:2.
Freeing init memory: 144K
hvclock: settimeofday() failed: Invalid argument
[05/Jan/1944:05:15:09 +0000] boa: server version Boa/0.94.13
[05/Jan/1944:05:15:09 +0000] boa: server built Feb 28 2004 at 21:47:23.
[05/Jan/1944:05:15:09 +0000] boa: starting server pid=496, port 80
Try to bring eth0 interface up.....eth0: link down
Done
Please press Enter to activate this console. eth0: link up, 100Mbps, full-duplex
, lpa 0x45E1
[root@FriendlyARM /]#
[root@FriendlyARM /]# armcomtest -d /dev/ttySAC1 -o
jjjjjjjjxxxxxxxxx_
```

### 4.2.7 PWM Buzzer Test

Type "pwm\_test" in a terminal and you will be able to hear beeps. Press "+" or "-"

you can turn up or down. Press "ESC" to exit.

```
[root@FriendlyARM /]#
  [root@FriendlyARM /]#
  [root@FriendlyARM /]# pw
  pvd
               pwm_test
  [root@FriendlyARM /]# pwm_test
  BUZZER TEST ( PWM Control )
  Press +/- to increase/reduce the frequency of BUZZER !
Press 'ESC' key to Exit this program !
             Freq = 1010
             Freq = 1020
             Freq = 1030
             Freq = 1020
             Freq = 1010
             Freq = 1000
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                                          Tech Support: +86-13719442657
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                                                                                        Fax:
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                                                                                                    第 - 139 - 页
```



## 4.2.8 Backligh Control

Note: the device file for the LCD backlight is /dev/backlight-1wire.

We also implement the feature of adjusting backlight for 1-wire precise touch LCDs.

It supports up to 127 levels of adjustment. To turn off the backlight you can feed "0" to

the device file as follows:

Type the command: echo 0 > /dev/backlight

When feed 1-127 to the device file you will observe different levels of light. 127 is

the highest.In general 15 will begin to show some light. 1-15 makes the screen

completely dark. Values higher than 127 will be treated as 127.

Try: echo 15 > /dev/backlight you will be able to see some light.

### 4.2.9 I2C-EEPROM Test

Type "i2c –w" in a terminal you will be able to write data (0x00-0xff) to 24C08.

[root@Frie [root@Frie Open /dev/ Writing	endlyAR endlyAR indlyAR i2c/0 0x00-0	M /]# M /]# M /]# i2c with 8bit xff into	-w mode 24C08			
0000  00 0010  10 0020  20 0030  30 0040  40 0050  50 0060  60 0070  70 0080  80 0090  90 0080  80 0090  90 0080  80 0090  90 0080  80 0080  80 000	0 01 02 11 12 21 22 31 32 41 42 51 52 61 62 0 71 72 0 81 82 0 91 92 0 1 62 0 91 92 0 1 62 0 1 62	03 04 05 13 14 15 23 24 29 33 34 35 43 44 45 53 54 55 63 64 65 73 74 75 83 84 85 93 94 95 a3 a4 b5 c3 c4 c5 c3 c4 c5 c4 c5 c5 c3 c4 c5 c4 c5 c5 c5 c5 c5 c5 c5 c5 c5 c5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	08 09 0 18 19 1 28 29 2 38 39 3 48 49 4 58 59 5 68 69 6 78 79 7 88 89 8 98 99 9 a8 a9 a b8 b9 b c8 c9 c d8 d9 d e8 f9 f	a Ob Oc Od a 1b 1c 1d a 2b 2c 2d a 3b 3c 3d a 4b 4c 4d a 5b 5c 5d a 6b 6c 6d a 7b 7c 7d a 8b 8c 8d a 9b 9c 9d a ab ac ad a bb bc bd a cb cc cd a 6b 6c 6d a bb fc fd	Oe Of 1e 1f 2e 2f 3e 3f 4e 4f 5e 5f 6e 6f 7e 7f 8e 8f 9e 9f ae af be bf ce cf de df fe ff

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Type "i2c -r" in a terminal you will be able to read data from 24C08.

```
00f0|
         f0 f1 f2 f3 f4 f5 f6 f7
                                          f8 f9 fa fb fc fd fe ff
[root@FriendlyARM /]# i2c -r
Open /dev/i2c/0 with 8bit mode
  Reading 256 bytes from 0x0
             01 02
11 12
21 22
31 32
                                                  Oa Ob Oc Od Oe Of
                                          08 09
 0000
          00
                    03 04 05 06
                                   07
                                              19
29
                    13 14
23 24
33 34
                            15
25
                                    17
27
 0010
         10
                                16
                                          18
                                                  1a
                                                      1Ь
                                                         1c
                                                             ^{1d}
                                                                 1e
                                                                     1f
                                          28
 0020
          20
                                26
                                                  2a.
                                                      2Ъ
                                                          2c
                                                              2d
                                                                 2e
                                                                     2f
                                                                     3f
 0030
          30
                            35
                                36
                                    37
                                          38
                                              39
                                                  3a
                                                      3b 3c
                                                             3d
                                                                 3e
                     43
53
 0040
          40
                 42
52
62
72
82
                         44
                             45
                                46
                                    47
                                          48
                                              49
             41
                                                  4a
                                                      4Ь
                                                         4c
                                                              4d
                                                                 4e
                                                                     4f
                                    57
                            55
                                              59
         50
             51
                                56
                                                         5c
                                                                 5e
 0050
                        54
                                          58
                                                  5a
                                                      5Ъ
                                                             5d
                                                                     5f
                                    67
77
                     63 64
                                              69
 0060
         60
             61
                            65
                                66
                                          68
                                                  6a
                                                      6Ь
                                                         6c
                                                             6d
                                                                 6e
                                                                     6f
                                              79
 0070
          70
             71
                     73
                         74
                            75
                                76
                                          78
                                                  7a.
                                                      7Ь
                                                          7c
                                                                     7f
                                                             7d
                                                                 7e
                                                      8Ъ
                                                         8c
 0080
             81
                     83 84
                            85
                                86
                                    87
                                          88
                                              89
                                                  8a.
                                                                     8f
         80
                                                             8d
                                                                 8e
                 92
a2
 0090
         90
             91
                     93 94
                            95
                                96 97
                                          98
                                              99
                                                  9a
                                                      9b 9c
                                                             9d
                                                                 9e
                                                                     9f
                                   a7
                                              a.9
 00a0
         aO
                    a3
                            a5
             a1
                        a4
                                a.6
                                          a.8
                                                  aa.
                                                     ab ac
                                                             ad
                                                                 ae
                                                                     af
 00Ъ0
         b0 b1 b2 b3 b4 b5 b6 b7
                                          b8 b9 ba bb bc bd be bf
         c0 c1 c2 c3 c4 c5 c6 c7
d0 d1 d2 d3 d4 d5 d6 d7
 00c0
                                          c8 c9
                                                  ca cb cc cd
                                                                 ce cf
                                          d8 d9 da db dc dd de df
 00d0
         e0 e1 e2
f0 f1 f2
                    e3 e4
f3 f4
                           e5 e6
f5 f6
                                   e7
f7
                                          e8 e9
 00e0
                                                  ea eb
                                                         ec
                                                             ed
                                                                 ee
                                                                     ef
                                          f8 f9 fa
 00f0|
                                                     fЬ
                                                         fc fd
                                                                 fe
                                                                     ff
[root@FriendlyARM /]#
```

#### 4.2.10 A/D Conversion Test

Type "adc-test" in a terminal, you will be able to test AD conversion. By adjusting

the W1 resistor you will observe the output.

[root@FriendlyARM /]# adc-test
press Ctrl-C to stop
ADC Value: Ø
ADC Value: 0
ADC Value: Ø
ADC Value: 152
ADC Value: 295
ADC Value: 559
ADC Value: 800
ADC Value: 882
ADC Value: 890
ADC Value: 891
ADC Value: 892

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### 4.2.11 WiFi

For users to utilize USB WiFi or SD WiFi cards we originally developed a command set:USB WiFi kits for the Mini2440 system. This command set supports up to one thousand various USB WiFi cards (most of which utilize similar chips). We also integrated this command set into our Tiny4412 system and also integrated the SD WiFi driver.

This command set includes a WiFi driver and three commands:

- scan-wifi scans nearby wireless networks
- start-wifi starts connecting to a wireless network
- stop-wifi closes a wireless connection

All of them are under the "/usr/sbin" directory

#### 1. Scanning Nearby Wireless Networks

Connect your USB WiFi card to your board you will see the following screenshot



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Execute the scan command to search for a network: #scan-wifi

In our example it found three networks and "63%" indicated the strength of the

signals. Those that need passwords will be noted by "Security".

#### 2. Start Connection

"start-wifi" will connect your board to a specified netowork. After execute "start-wifi"

you will see the following information:

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mode – security type, such as "wpa", "wpa2", "wep" or "none". "None" means that network doesn't require a password

ssid - network name such as "FriendlyARM4", "NETGEAR" shown above.

password – password to log in the network.

We will present two examples: one for a network that doesn't require a password and

the other for a network that does require a password

#### 2.1 Connecting to an Open Network that Doesn't Require a Password

Step1: Command "scan-wifi" to scan your nearby networks. Here we found

"FriendlyARM-Test" which was dedicated for this testing

[root@FriendlyARM /]# scan-wifi cfg80211: Calling CRDA to update world regulatory domain
Registered led device: rt73usb-phy0::radio Registered led device: rt73usb-phy0::assoc
Registered led device: rt73usb-phy0::quality usbcore: registered new interface driver rt73usb
usbcore: registered new interface driver ath9k_hif_usb 63% Friend1vARM4(Securitv)
37% TP-LINK_65FC92 34% NETGEAR
3 Access Point Found [root@Friend]vARM /]# start-
start-stop-daemon start-wifi [root@FriendlyARM /]# start-wifi
Usage: start-wifi mode ssid [password] mode: wpa, wpa2, wep or none
no password needed if mode is none [root@FriendlyARM /]# scan-wifi
54% FriendlyARM4 (Security) 34% TP-LINK_65FC92
37% test engineers(Security) 100% FriendlyARM-Test
4 Access Point Found [root@Friend]yARM /]# _

Step2: Command "start-wifi none FriendlyARM-Test" to connect to this network

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Moments later you will notice that your board will be allocated an IP. Here we got

"192.168.3.100". "Ping" this network to test your connection.

Or you can try this IP in your PC's web browser.

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#### 2.2 Connect to a Network That Requires a Password

This procedure is very similar to the previous one but you need to know the network's security type and its password:

**Step1**: Select your network's security type. (The router we used in this example was TL-WR740N.) Open its web page.



Friendly	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE	
<ul> <li>⑦ TL-WR740N - Windows Internet Explorer</li> <li>③ ○ ● http://192.168.3.1/</li> <li>文件(日) 編編(日) 音音(公) 改融夫(白) 工具(日) 得助</li> <li>※ (改融夫) ● 第(公) (公融夫(白) 工具(日) 得助</li> </ul>	・ 2 + × 2 Google 出 出 2 ・ 2 ・ ○ ● ・ 页面()・ 辛介()・ I具()・	× م •••
<ul> <li>- 运行状态</li> <li>- 设运商导</li> <li>- 经济金设置</li> <li>- 网络香酸</li> <li>- 无线设置</li> <li>- 无线设置</li> <li>- 无线安全设置</li> <li>- 无线密路设置</li> <li>- 无线磁路设置</li> <li>- 主机状态</li> <li>- 四环桥器</li> <li>- 单机状态</li> <li>- 四环桥器</li> <li>- 韩大校和</li> <li>- 生风状态</li> <li>- 建机状态</li> <li>- 如木桥</li> <li>- 四石</li> <li>- 李安功能</li> <li>- 家长控制</li> <li>- 上网运取</li> <li>- 新会立取</li> <li>- 新会工具</li> </ul>		

You can choose from the following three:

- WPA-PSK/WPA2-PSK
- WPA/WPA2
- WEP

In our example we selected "WPA" and the password was "test1234". After that click on "Save" and reboot your router. Note: on how to configure your router you need to refer to your router's manual.



Step2: Command "scan-wifi" to scan your nearby networks. Here we found

"FriendlyARM-Test" which was dedicated for this testing



Step3: Command "start-wifi wpa FriendlyARM-Test test1234" to connect to this

network.

```
[root@Friend]yARM /]# scan-wifi
		74% Friend]yARM4(Security)
		100% Friend]yARM-Test(Security)
2 Access Point Found
[root@Friend]yARM /]# start-wifi wpa Friend]yARM-Test test1234
sh: cannot kill pid 794: No such process
cfg80211: Calling CRDA to update world regulatory domain
udhcpc (v1.13.3) started
Sending discover...
Sending discover...
Sending select for 192.168.3.100...
Lease of 192.168.3.100 obtained, lease time 7200
deleting routers
route: SIQCDELRT: No such process
adding dns 192.168.3.1
[root@Friend]yARM /]# _
```

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Moments later you will notice that your board will be allocated an IP. Here we got

"192.168.3.100". "Ping" this network to test your connection

[root@Friend]yARM /]# scan-wifi
/4% FriendlyARM4 (Security)
2 Access Point Found
[root@Friend]vARM /]# start-wifi wpa Friend]vARM-Test test1234
sh: cannot kill pid 794: No such process
cfg80211: Calling CRDA to update world regulatory domain
udhcpc (v1.13.3) started
Sending discover
Sending discover
Lesse of 192 168 3 100 obtained lesse time 7200
deleting routers
route: SIOCDELRT: No such process
adding dns 192.168.3.1
[root@FriendlyARM /]# ping_192.168.3.1
PING 192.168.3.1 (192.168.3.1): 56 data bytes
64 bytes from 192,168.3.1: seq=0 ttl=64 time=31.8/0 ms
64 bytes from 192,106.3.1; seq=1 ttl=04 time=/0.10/ ms
04 bytes from 192.108.3.1. seq=4 ttr=04 thme=42.121 hs

Or you can try this IP in your PC's web browser



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### 3. Close USB WiFi Connection

Command "stop-wifi" to close your USB WiFi connection

# 4.2.12 Telnet

"Telnet" is a popular utility. If your board is connected to the internet you can telnet a

bbs.

First make sure your board's IP is 192.168.1.230 and your board is communicating

with other machines.



Then configure your router's IP: route add default gw 192.168.1.1

Now you can telnet a BBS. Here we visited "bbs.scut.edu.cn".

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# 4.2.13 Ethernet Configuration

Connect your board to the internet, write down your gateway IP(the one in our

example was 192.168.1.1) and configure your router:

### # route add default gw 192.168.1.1

Now you can visit an IP address on the internet e.g. you can ping bbs.scut.edu.cn (IP:

202.112.17.137):

### #ping 202.112.17.137

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If it is a success you will see the following output

```
[root@FriendlyARM /]# route add default gw 192.168.1.1
[root@FriendlyARM /]# ping 202.112.17.137
PING 202.112.17.137 (202.112.17.137): 56 data bytes
64 bytes from 202.112.17.137: icmp_seq=0 ttl=52 time=1509.6 ms
64 bytes from 202.112.17.137: icmp_seq=1 ttl=52 time=1426.0 ms
64 bytes from 202.112.17.137: icmp_seq=2 ttl=52 time=1446.8 ms
-
```

To ping through an outside website you also need to configure your DNS. You may

get it from your network manager

Internet Protocol Version 4 (TCP/IPv4)	Properties ? X
General	
You can get IP settings assigned auton this capability. Otherwise, you need to for the appropriate IP settings.	natically if your network supports ask your network administrator
Obtain an IP address automatical	у
Ouse the following IP address:	
IP address:	192 . 168 . 1 . 166
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	192 . 168 . 1 . 1
Obtain DNS server address autom	atically
Ouse the following DNS server add	resses:
Preferred DNS server:	202 . 96 . 128 . 86
Alternate DNS server:	· · ·
Validate settings upon exit	Advanced
	OK Cancel

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The one in our example was "202.96.128.86". Therefore we set our board as follows:

#rm /etc/resolv.conf; This is to remove the existing configuration file.

#touch /etc/resolv.conf; This is to generate a resolv.conf file

#echo nameserver 202.96.128.86 >> /etc/resolv.conf; Set up the DNS configuration file

resolv.conf with your DNS IP or you can edit it with vi.

```
[root@FriendlyARM /]# rm /etc/resolv.conf
[root@FriendlyARM /]# touch /etc/resolv.conf
[root@FriendlyARM /]# echo nameserver 202.96.128.86 >> /etc/resolv.conf
[root@FriendlyARM /]# cat /etc/resolv.conf
nameserver 202.96.128.86
[root@FriendlyARM /]# ping www.163.com
PING www.cache.split.netease.com (220.181.28.54): 56 data bytes
64 bytes from 220.181.28.54: icmp_seq=0 ttl=53 time=1353.8 ms
64 bytes from 220.181.28.54: icmp_seq=1 ttl=53 time=1378.0 ms
64 bytes from 220.181.28.54: icmp_seq=2 ttl=53 time=1398.1 ms
64 bytes from 220.181.28.54: icmp_seq=4 ttl=53 time=1356.0 ms
64 bytes from 220.181.28.54: icmp_seq=5 ttl=53 time=1314.9 ms
--- www.cache.split.netease.com ping statistics ---
7 packets transmitted, 5 packets received, 28% packet loss
round-trip min/avg/max = 1314.9/1360.1/1398.1 ms
[root@FriendlyARM /]# _
```

### 4.2.14 Configure MAC Address

The MAC address in the Tiny4412 is "soft" therefore you can change it via

"ifconfig".

First check your current MAC address via "ifconfig":

#ifconfig ;

(	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE
Destinati 192.168.1 default [root@Fri nameserve [root@Fri eth0	<pre>on Gateway Genmask Flags Metric Ref Use Iface 0 * 255.255.255.0 U 0 0 0 0 eth0 192.168.1.1 0.0.0.0 UG 0 0 0 eth0 endlyARM /]# cat /etc/resolv.conf 192.168.1.1 endlyARM /]# ifconfig Link encap:Ethernet HWaddr 08:90:90:90:90:90 inet addr:192.168.1.230 Bcast:192.168.1.255 Mask:255.255.255.0 UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1 RX packets:34 errors:0 dropped:0 overruns:0 frame:0 TX packets:15 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:1000 RX bytes:5236 (5.1 KiB) TX bytes:977 (977.0 B) Interrupt:51</pre>
lo	Link encap:Local Loopback inet addr:127.0.0.1 Mask:255.0.0.0 UP LOOPBACK RUNNING MTU:16436 Metric:1 RX packets:0 errors:0 dropped:0 overruns:0 frame:0 TX packets:0 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:0 RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
[root@Fri	endlyARM /]#

In our example the MAC was "08: 90: 90: 90: 90?, this is the default MAC address and has been hard-coded in the kernel. If you want to update it you have to recompile the kernel. In order to change the MAC dynamically you need to close your network connection and then fill your new MAC: #ifconfig eth0 down

#ifconfig eth0 hw ether 00:11:AA:BB:CC:DD; note: **a,b,c,d,e,f...** could be lower case

Restart the network, check your MAC via "ifconfig" and verify your network via

"ping":

#ifconfig eth0 up

#ifconfig

#ping 192.168.1.1





### 4.2.15 Telnet Tiny4412

If the system reboots normally it will automatically start a telnet service therefore

users can telnet the board too. You can try typing "telnet 192.168.1.230" from a

command line, type "root" and you will be able to login.

🖼 Telnet 192.1	68.1.230		- 🗆 🗙
Kernel 2.6.29 of FriendlyARM log	n (/dev/pts/0) in: root		
LrooterrienalyH 1.png 5.png bin dev etc home [root@FriendlyA]	<pre>KM / J# IS     infinity 2008.mp3     lib     linuxrc     lost+found     mnt     opt RM / J#</pre>	proc root sbin sys test.mp3 tmp	<b>•</b>

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# 4.2.16 FTP

After the system boots normally, it will automatically start a telnet service. Users can

ftp a remote host via "ftp" in the command line utility in both Linux and Windows.

Users can transfer files to the board from a host PC.

Note: please make sure you have a file ready in your FTP directory. Here we had

"test.mp3".The account for login is plg and the password is plg.

After file transfer is doen you will see a test.mp3 file in your target board's /home/plg

directory.

C:\WINDOWS\system32\cmd.exe - ftp 192.168.1.230	- 🗆	×
C:\mini2440>ftp 192.168.1.230		
Connected to 192.168.1.230.		
220 FriendlyARM FTP server (Version 6.4/OpenBSD/Linux-ftpd-0.17) ready.		
User <192.168.1.230: <none>&gt;: plg</none>		
331 Password required for plg.		
Password:		
230 User plg logged in.		
ftp> bin		
200 Type set to I.		
ftp> ls		
200 PORT command successful.		
150 Opening ASCII mode data connection for 'file list'.		
.ash_history		
226 Transfer complete.		
ftp: 收到 14 字节,用时 0.00Seconds 14000.00Kbytes/sec.		
ftp> put test.mp3		
200 PORT command successful.		
150 Opening BINARY mode data connection for 'TEST.MP3'.		
226 Transfer complete.		
ftp: 发送 1804924 字节,用时 1.64Seconds 1099.89Kbytes/sec.		
ftp> ls		
200 PORT command successful.		
150 Opening ASCII mode data connection for 'file list'.		
TEST_MP3		
.ash_history		
226 Transfer complete.		
ftp: 收到 24 字节,用时 0.00Seconds 24000.00Kbytes/sec.		
ftp>		-
		1

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# 4.2.17 LED Control via Web

Click on "Manipulating LEDs via HTML" on the test page of our web server, the

following page will be loaded



You can test each of these items. The "LED Test" will manipulate the LEDs via CGI

programs and it includes two display modes and three display rates

To stop the web service you need to type the following commands:

### #/etc/rc.d/init.d/httpd stop

Then restart the service

### #/etc/rc.d/init.d/httpd start





# 4.2.18 Configure System Clock

The Linux command for updating time is "**date**", to synchronize the S3C6420 time with Linux's system time you can use "**hwclock**":

(1) date -s 042916352007 #set time to 2007-04-29 16:34

(2) hwclock -w # save your setting to 4412's RTC

(3) Command "hwclock -s" to update Linux's system time with RTC. Usually this

command will be included in "/etc/init.d/rcS" for auto run

Note: our system's "/etc/init.d/rcS" includes "hwclock -s" already.

# 4.2.19 Save Date to Flash Permenantly

The Tiny4412 system applies yaffs2 thus can save data dynamically and will not lose any even when the system is powered off. After the system boots, please try the following command:

# #cp / shanghaitan.mp3 /home/plg

This will create a duplicate file under "/home/plg". Power off and on you will observe that the file still exists.

# 4.2.20 Setup Auto Run Program

Users can set up programs that will be automatically run on system startup in the boot script. It is similar to Window's Autobat. It is under the /etc/init.d/rcS directory, the contents are as follows (they may be different in differed systems)

<sup>#! /</sup>bin/sh



PATH=/sbin:/usr/sbin:/usr/bin:/usr/local/bin: runlevel=S prevlevel=N umask 022 export PATH runlevel prevlevel # # Trap CTRL-C &c only in this shell so we can interrupt subprocesses. # trap ":" INT QUIT TSTP /bin/hostname FriendlyARM [ -e /proc/1 ] || /bin/mount -n -t proc none /proc [ -e /sys/class ] || /bin/mount -n -t sysfs none /sys [ -e /dev/tty ] || /bin/mount -t ramfs none /dev /bin/mount -n -t usbfs none /proc/bus/usb echo /sbin/mdev > /proc/sys/kernel/hotplug /sbin/mdev -s /bin/hotplug # mounting file system specified in /etc/fstab mkdir -p /dev/pts mkdir -p /dev/shm /bin/mount -n -t devpts none /dev/pts -o mode=0622 /bin/mount -n -t tmpfs tmpfs /dev/shm /bin/mount -n -t ramfs none /tmp /bin/mount -n -t ramfs none /var mkdir -p /var/empty mkdir -p /var/log mkdir -p /var/lock mkdir -p /var/run mkdir -p /var/tmp /sbin/hwclock -s syslogd /etc/rc.d/init.d/netd start echo " " > /dev/tty1 echo "Starting networking..." > /dev/tty1 sleep 1 /etc/rc.d/init.d/httpd start echo " " > /dev/tty1 echo "Starting web server..." > /dev/tty1 sleep 1 /etc/rc.d/init.d/leds start echo " " > /dev/tty1 echo "Starting leds service..." > /dev/tty1

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echo " "
sleep 1
echo " " > /dev/tty1
/etc/rc.d/init.d/alsaconf start
echo "Loading sound card config..." > /dev/tty1
echo " "
/sbin/ifconfig lo 127.0.0.1
/etc/init.d/ifconfig-eth0
/bin/qtopia &
echo " " > /dev/tty1
echo "Starting Qtopia, please waiting..." > /dev/tty1

# 4.2.21 Take Screenshot with Snapshot

Users can take screenshots with "snapshot" and save them as png files

#### #snapshot pic.png

Executing this command will take a screenshot of the current LCD display and save it as "pic.png".

# 4.2.22 Check RAM Info

The Tiny4412 system incorporates a 1G DDR3 RAM. Some users complained that

they can only find less than 1G available this is because the multi-media driver takes

quite a lot. In general users can check the RAM info by commanding "cat

/proc/meminfo", however this only shows the amount available to the system.

# 4.3 Setup Fedora9 Development Environment

This section will guide you through the steps on how to install Fedora 9.0 on a PC and set up your Linux development environment. All our software development and



testing for the Tiny4412 were based on Fedora 9.0. We didn't test it on other platforms. We strongly suggest you use this platform as we do, which you can download from its website

(ftp://download.fedora.redhat.com/pub/fedora/linux/releases/9/Fedora/i386/iso/Fedora-9

-i386-DVD.iso).

The reason why we chose Fedora 9.0 is that it is easy to be installed and set up.

Fedora 10 and later versions are more complicated and therefore may not be easy for

beginners and Fedora 8 and earlier versions are a little bit obsolete. Please follow the

steps below to install.

### 4.3.1 Install Fedora 9.0

Step1: Insert the first disk in the CDROM/DVD, set the boot sequence to CDROM in the BIOS. After reboot the system it will prompt the user to the following interface, just press "enter"



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Step2: The system will check the installation disk. It can be ignored, just press "Skip" to

#### the next step



Step3: it enters the graphic interface, click on the "Next" button.



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Step4: set the installation language. In this example, we chose the simplified English.

fedora. <sup>f</sup> .	
What language would you like to use during the installation process?	
Chinese(Simplified) (简体中文)	
Chinese(Traditional) (繁體中文)	
Croatian (Hrvatski)	
Czech (Čeština)	
Danish (Dansk)	
Dutch (Nederlands)	
English (English)	
Estonian (eesti keel)	
Finnish (suomi)	
French (Français)	
German (Deutsch)	
Greek (Ελληνικά)	
Gujarati (ગુજરાતી)	
	🔶 📴 Back 🛛 📦 <u>N</u> ext

Step5: set the keyboard, in this example, we chose the U.S. key board.

Swedish Swiss French Swiss French (latin1) Swiss German Swiss German (latin1) Tamil (Inscript) Tamil (Typewriter) Turkish U.S. English U.S. International Ukrainian United Kingdom	
Swiss French Swiss French (latin1) Swiss German Swiss German (latin1) Tamil (Inscript) Tamil (Typewriter) Turkish U.S. English U.S. International Ukrainian United Kingdom	
Swiss German Swiss German (latin1) Tamil (Inscript) Tamil (Typewriter) Turkish U.S. English U.S. International Ukrainian United Kingdom	
Swiss German (latin1) Tamil (Inscript) Tamil (Typewriter) Turkish U.S. English U.S. International Ukrainian United Kingdom	
Tamil (Inscript) Tamil (Typewriter) Turkish U.S. English U.S. International Ukrainian United Kingdom	
Tamil (Typewriter) Turkish U.S. English U.S. International Ukrainian United Kingdom	
Turkish U.S. English U.S. International Ukrainian United Kingdom	
U.S. English U.S. International Ukrainian United Kingdom	
U.S. International Ukrainian United Kingdom	
Ukrainian United Kingdom	
United Kingdom	
	))
e Back	<u>N</u> ext



Step 6: configure the network.

Active on Boot Device   IPv4/Netmask   IPv6/Prefix   Edit  Edit Hostname Set the hostname:	fedora				557		424
Active on Boot Device IPv4/Netmask IPv6/Prefix Edit  Active on Boot Device IPv4/Netmask IPv6/Prefix Edit  Hostname Set the ODHCP Auto  Hostname:  automatically via DHCP  manually localhost.localdomain (e.g., host.domain.com)  Miscellaneous Settings Gateway: Primary DNS: Secondary DNS:	Network Dev	ices					
Image: Constraint of the state of	Active on Boo	t Device	IPv4/Netmask	IPv6/Prefix	Edit		
Hostname Set the hostname: automatically via DHCP manually localhost.localdomain (e.g., host.domain.com)  Miscellaneous Settings Gateway: Primary DNS: Secondary DNS:	<b>v</b>	eth0	DHCP	Auto			
Hostname         Set the hostname:							
Set the hostname: automatically via DHCP manually localhost.localdomain (e.g., host.domain.com) Miscellaneous Settings Gateway: Primary DNS: Secondary DNS: Secondary DNS:	Hostname				1		
<ul> <li>_ <u>automatically via DHCP</u></li> <li>● <u>manually</u> <u>localhost.localdomain</u> (e.g., host.domain.com)</li> </ul> Miscellaneous Settings <u>Gateway:</u> Primary DNS: <u>Secondary DNS:</u> <u>Secondary DNS:</u>	Set the hostna	ame:					
• manually localhost.localdomain (e.g., host.domain.com)   Miscellaneous Settings   Gateway:   Primary DNS:   Secondary DNS:     Secondary DNS:	<ul> <li><u>a</u>utomatica</li> </ul>	lly via DHC	CP				
Miscellaneous Settings Gateway: Primary DNS: Secondary DNS: ▲ Back ▲ Next	• manually	ocalhost.lo	caldomain		(e.g., host.domain.com)		
Gateway:	Miscellaneou	s Setting	s				
Primary DNS: Secondary DNS:	<u>G</u> ateway:						
Secondary DNS:	Primary DNS:	1					
Back Next	Secondary DNS	5:					
Back Next							
Back Next							
A Back Next							
der Back en Next							
						e Back	▶ <u>N</u> ext

In our example, we didn't set it as "DHCP", we used a static IP instead, and

### typed the IP and subnet mask as follows.

letwork Dev	E	Edit Interface
Active on Boc	Advanced Micro Devices [Al	MD] 79c970 [PCnet32 LANCE]
	Hardware address: 00:0c:29	9:27:87:51
	Enable IPv4 support     Dynamic IB configuration	
	Manual configuration	(DHCP)
	IP Address	Prefix (Netmask)
lostname	192.168.1.108	/ 255.255.255.0
set the hostna	Cashla IDuG summert	
<u>a</u> utomatica	Automatic neighbor disco	Verv
• <u>m</u> anually	Dynamic IP configuration	(DHCPv6)
liscellaneou	O Manual configuration	
iscenaneou	IP Address	Prefix
ateway:		
rimary DNS:		
econdary DN:		<mark>⊗ c</mark> ancel <u><i>₹</i></u> <u>O</u> K
		<u>■</u> Back <u>■</u> Nex

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Click on the OK button and go on to set the machine name, gateway and DNS.

Active on Boot Device IPv4/Netmask IPv6/Prefix Edit	
Hostname Set the hostname:	
Hostname Set the hostname:	
Hostname Set the hostname:	
Set the hostname:	
<u>a</u> utomatically via DHCP	
manually tom     (e.g., host.domain.com)	
Miscellaneous Settings	
Gateway: 192,168,1,1	
Primary DNS: 192.168.1.1	
Secondary DNS:	

Step 7: set the time zone. We chose "Asia/Shanghai".

fedora. <sup>f</sup>
Please select the nearest city in your time zone:
☑ <u>S</u> ystem clock uses UTC ▲ Back
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Step 8: set up the administrator's password, i.e. the root's password. "root" is the super

user. It should be at least 6 characters

fedora		
The root account is used for administering the system. Enter a password for the root user.		
Root <u>P</u> assword: •••••		
<u>C</u> onfirm: ••••••		
	👍 Back 📄	Next

Step 9: disk partition. We followed the default option. Before do this, please back up

disk data.

Encrypt		
ect th	: system e drive(s) to use for this installation.	
<b>S</b>	a 15359 MB VMware, VMware Virtual S	
	dvanced storage configuration	
at dri	ve would you like to boot this installation from?	
sda	15359 MB VMware, VMware Virtual S	_
Re <u>v</u> iew	and modify partitioning layout	
	ack	<u>•</u> <u>N</u> e



Click on "Next", it will warn the user that all the data will be deleted. Usually we would do this installation in VMWARE, so we chose "Write changes to disk" and disk format would begin.

move Linux partitions on se	elected drives and create default layout	
ncrypt system		
EX cda 15359 Mg	Writing partitioning to disk	
	The partitioning options you have selected will now be written to disk. Any data on deleted or reformatted partitions will be lost	
- Advanced storage	Go <u>b</u> ack <u>W</u> rite changes to disk	
at drive would you I		
sda 15359 MB VMware.	VMware Virtual S	

#### Here is the format process:

	second anticipate default layout	× )
ncrypt system		
ect the drive(s) to use fo	or this installation.	
ISDA 15359 MB VM	Ware, VMware Virtual S	
	Formatting / file system	
Advanced storage conf	iguration	
at drive would vou like t	o boot this installation from?	
sda 15359 MB VMware, V	'Mware Virtual S	
eview and modify partitionin	g lavout	·

		Expertise	on Embedded	Linux, Android,	WindowsC	E
p 11:	select the installation	on type, in	this example	, we chose " <mark>cu</mark>	istomize"	
fedo	ora. <sup>f.</sup>				$\leq$	
The def	ault installation of Fedora ir t usage. What additional ta	ncludes a set o sks would you l	f software applical ike your system to	ble for general include support for	?	
☐ Offi ☑ Soft	ce and Productivity tware Development					
Please :	select any additional reposi	tories that you	ı want to use for s	oftware installation	¥.	
□ Add ☑ Fed	litional Fedora Software ora					
Ad	ld additional software repos	itories	Modify rep	oository		
You can manage O Cust	further customize the soft ement application. comize later OCustomi	tware selection	n now, or after inst	all via the software		

Step 12: configure the "server" item as follows:

Development	ETP Server
Servers	Legacy Network Server
Base System	Mail Server
Languages	🕒 🗆 MySQL Database
	🖶 🗆 Network Servers
	Optional packages.

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20 of 1148 packages completed

Installing evolution-data-server-doc-2.22.1-2.fc9.i386 (4 MB) Documentation files for evolution-data-server

### Step14: installation complete.



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Back

Next



Step15: after installation completed, click on the reboot button on the page shown in

step 14



### Step16: skip this license page and go "forward"



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### Step17: create new users. We ignored user creation and went to the next step.

Welcome License Information > Create User Date and Time Hardware Profile	Create User         It is recommended that you create a 'username' for regular (non-administrative) use of your system. To create a system 'username,' please provide the information requested below.         Username:         Full Name:         Password:         Confirm Password:
	If you need to use network authentication, such as Kerberos or NIS, please click the Use Network Login button. Use Network Login Use Network Login

#### Press "continue" to go on.

Welcome License Information • Create User Date and Time Hardware Profile	Create User         It is recommended that you create a 'username' for regular (non-administrative) use of your system. To create a system 'username,' please provide the information requested below.         Username:         Full Name:         Password:         Confirm Password:
	It is highly recommended that a personal user account be created. If you continue without an account, you can only log in with the root account, which is reserved for administrative use only. <u>Continue</u> Create <u>a</u> ccount
d f.	<b>Eorward</b>

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endlyarm@163.com **第 - 171 - 页** 



Step18: setup date and time. We ignored this and went to the next step.



Step19: confirm hardware information. We just clicked on "Finish".

Welcome License Information Create User Date and Time → Hardware Profile	Smolt is a hardware profiler for The Fedora Project. Submitting your profile is a great way to give back to the community as this information is used to help focus our efforts on popular hardware and platforms. Submissions are anonymous. Sending your profile will enable a monthly update.
	UUID: 0895b853-99d0-47d7-85dc-07c9815d24eb OS: Fedora release 9 (Sulphur) Default run level: 5 Language: en_US.UTF-8 Platform: i686 BogoMIPS: 3330.46 CPU Vendor: GenuineIntel CPU Model: Intel(R) Core(TM)2 CPU T5500 @ 1.66GHz Number of CPUs: 1 CPU Speed: 1661 System Memory: 1038 System Swap: 1983 Vendor: VMware, Inc. System: VMware, Inc. System: VMware Virtual Platform None Form factor: unknown Kernel: 2.6.25-14.fc9.i686 SELinux Enabled: True SELinux Policy: targeted
	<ul> <li>Send Profile</li> <li>Do not send profile</li> <li>Eack Finish</li> </ul>

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Website: <u>http://www.arm9.net</u> Fax: +86-20-85261505

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#### Step 20: on the login page, login as "root"

	0	
	tom Other Username: root Cancel 😭 Log In	
B		Wed Mar 25, 5:38 AM

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Input the password we just created for "root"

	<b>F</b>	
	Other Password: •••••	
	Cancel 🚰 Log In	
&		Mon Mar 23, 11:08 AM

When login as "root", the following popup window will show up, just click on "Continue"



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Below is the interface the user will see after a successful login.



# 4.3.2 Add User Account

To create a new user (not root) account, here are the steps:

Step 1: go to "Users and Groups"



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Step 2: open the "Users Manager" window

<sup>1</sup>		User M	anager		- + X
<u>F</u> ile <u>E</u> dit <u>F</u>	<u>l</u> elp				
Add User A	dd Group Prop	erties Dele	ete Refr	resh He	lp
		<u>S</u> earch	i filter:		Apply filter
U <u>s</u> ers Gr <u>c</u> ups					
User Name	User ID 🗸 🛛 Pri	mary Group	Full Name	Login Shell	Home Directory

Step 3: click on the "Add User" button, type the user name and password

👌 Create	New User	الجرير فسيت	+ X
<u>U</u> ser Name:	plg		
<u>F</u> ull Name:	plg		
<u>P</u> assword	*****		
C <u>o</u> nfirm Password:	*****		
<u>L</u> cgin Shell:	/bin/bas	h	~
☑ Create <u>h</u> ome dire	ctory		
Home <u>D</u> irectory:	/home/plg		
🗹 Create a private g	group for th	e user	
Specify user ID m	anually:	501	1
□ Specify <u>gr</u> oup ID r	nanually:	501	() ()
	<u>8</u> <u>C</u> an	cel 🥥	<u>о</u> к

Click on "OK", you will see that a new "plg" user has been created, and a "plg" directory has been created in the "/home" directory too.

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		Expense on Em		, Anarola, Wi	IdowsCE
ð		User M	anager		
<u>File Edit H</u>	<u>H</u> elp				
	B		3 6	3 🛛 🎘	
Add User	Add Group	Properties Del	ete Refr	resh He	lp
		Connel	Che		
		<u>S</u> earcr	i filter:		Appl
Users Groups	5				
User Name	User ID ~	Primary Group	Full Name	Login Shell	Home Dire
pla	501	501	plg	/bin/bash	/home/plg
pig					
hið					
pig				root@tom:	~

## 4.3.3 Access Windows Files

You can easily access shared files in Windows from either a virtual machine or a real Fedora9 system as long as they can communicate. To connect to a Windows from a virtual machine, the easiest way is to set "Guest" to "Bridge" in the network configuration.

Virtual Lachine	Settings	
Device Memory Hard Disk (SCSI) CD/DVD (IDE) Floppy Network Adapter Sound Card Display Processors	Summary 916 MB 20 GB Using file C:\Pr Auto detect Bridged Present Auto detect Auto detect 1 Auto detect 1 <u>A</u> dd	<ul> <li>Device status</li> <li>Connected</li> <li>Connect at power on</li> <li>Network connection</li> <li>Bridged: Connected directly to the physical network</li> <li>Replicate physical network connection state</li> <li>MAT: Used to share the host's IP address</li> <li>Host-only: A private network shared with the host</li> <li>Custom: Specific virtual network</li> <li>VMnet0 (default Bridged)</li> </ul>
		OK Cancel Help

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To access shared files in Windows, please following the steps below:

Step 1: set a shared directory in Windows. Here we set a "share\_f9"

10 C	hare_19 Properties	d
	General Sharing Customize	1 1 1 1 1
re_f9	You can share this folder with other users on your network. To enable sharing for this folder, click Share this folder.	. MINE2440 MINE2440 MINE2440 MINE24
2	Do not share this folder     Share this folder	
HO	Share name: share_19	- Park24405c mini2440-0 untemplate
	Conmert	
	User limit 🕫 Maximum allowed	
	C Allow this number of users:	
	To set permissions for users who access this	
	To configure settings for offline access, clickCaching	
_	New Share	
s select	Windows Finewall is configured to allow this folder to be shared	S My Comput

#### Step 2: set Fedora9



Open the window below:

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Friend	Complete ARM Solutions Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE
	Connect to Server
	Service type: Public FTP
	Server:
	Optional information:
	Port:
	<u>F</u> older:
	Add <u>b</u> ookmark
	Bookmark <u>n</u> ame:
	Image: Melp     Image: Cancel     Connect

Select "Windows share" in the "service type" field

C (	onnect to Server	×
Service <u>t</u> ype:	Windows share	~
<u>S</u> erver:		
Optional inf	formation:	
<u>S</u> hare:		
<u>F</u> older:		
User Name	:	
<u>D</u> omain Na	me:	
🔲 Add <u>b</u> ool	kmark	
Bookmark <u>r</u>	<u>n</u> ame:	
Help	Cancel C <u>o</u> nne	ect

Input the shared file's name and its windows machine IP

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Friendly Design, Development and Manufacturing Expertise on Embedded Linux, Android, WindowsCE
Connect to Server
Service <u>type</u> : Windows share
<u>S</u> erver: 192.168.1.23
Optional information:
Share: share_f9
<u>F</u> older:
<u>U</u> ser Name:
Domain Name:
☑ Add <u>b</u> ookmark
Bookmark <u>n</u> ame: share_f9
Image: Market Backware     Image: Connect       Image: Connect     Connect

Click on "connect", the following window will show up:

Q	Password requ	ured for share share_f9 on 192	.168.1.12
	<u>U</u> sername:	root	
	<u>D</u> omain:	MYGROUP	
	Password:		
	Eorget pas	ssword immediately	
	O <u>R</u> emember	r password until you logout	
	O <u>R</u> emember	r forever	

Go ahead and "connect" again, you will see the shared files you just set in your

### windows system.

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If you want to access this directory from the command line utility, you can do it by

hitting the TAB key.

	root@tom:~	_ + X
<u>File Edit View Terminal Tab</u>	os <u>H</u> elp	
<pre>[root@tom ~]# ls /root/.gvfs, mini2440 on 192.168.1.123/ sl [root@tom ~]# ls /root/.gvfs, arm-linux-gcc-2 95 3 toz</pre>	/ hare_f9 on 192.168.1.123/ /share_f9\ on\ 192.168.1.123/	<u>^</u>
arm-linux-gcc-3.3.2.tgz arm-linux-gcc-3.4.1.tgz arm-qtopia.tgz busybox-1.2.0.tgz examples.tgz ipaq-qtopia.tgz jflash2440.tgz kernel-2.6.13-mini2440-20081 mkyaffsimage.tgz [rool@lom ~]#	readme.txt root_default.tgz root_mizi.tgz root_nfs.tgz root_qtopia_mouse.tgz root_qtopia_tp.tgz vivi.tgz 127.tgz x86-qtopia.tgz	

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To disconnect the shared directory, right click on the shared directory and following the

operations in the screenshot below:



## 4.3.4 Set Up Cross Compile Environment

To compile kernels, Qtopia/Qt4, bootloader and other programs in Linux you need a cross compile environment. We used arm-linux-gcc-4.5.1 and its by defauly supports armv6 command sets. The following steps will introduce how to build a compile environment.

Step 1: copy the compressed file "arm-linux-gcc-4.5.1-v6-vfp-20101103.tgz" in the shipped CD into a system's directory, e.g "tmp\", enter this directory and execute the following commands:

#cd \tmp

#tar xvzf arm-linux-gcc-4.5.1-v6-vfp-20101103.tgz \_\_C /

Note: there is a space after "C" and "C" is a capital letter.



### "/opt/FriendlyARM/toolschain/4.5.1"

Step 2: run the command below to add the compiler's path to system variables:

#### #gedit /root/.bashrc

This is to edit the "/root/.bashrc" file. Update the last line with "export

PATH=\$PATH:/opt/FriendlyARM/toolschain/4.5.1/bin" in the opened file, save and

exit the file.

root@tom:/opt/FriendlyARM/toolschain/4.5.1	-	+ X
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>T</u> erminal Ta <u>b</u> s <u>H</u> elp		
# .bashrc		~
# User specific aliases and functions		
alias rm='rm -i' alias cp='cp -i' alias mv='mv -i'		
<pre># Source global definitions if [ -f /etc/bashrc ]; then</pre>		
<pre>export PATH=\$PATH:/opt/FriendlyARM/toolschain/4.5.1/bin ~</pre>		
~		**
~		
~		
~		
~		
~		
~		
~		
~		
~		
~		
~	1 1	A11 U
	1,1	ALL 🖂

Logout and login the system again (no need to reboot the system, just go to "start"-> "logout"), the above settings will take into effect. Type "arm-linux-gcc -v", if the



messages depicted in the screen shot below appear, it indicates the compile environment

has been set up successfully.

root@tom:/opt/FriendlyARM/toolschain/4.5.1	_ + ×
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>T</u> erminal Ta <u>b</u> s <u>H</u> elp	
<pre>File Edit View Terminal Tabs Help [root@tom 4.5.1]# arm-linux-gcc -v Using built-in specs. COLLECT GCC=arm-linux-gcc COLLECT_LTO_WRAPPER=/opt/FriendlyARM/toolschain/4.5.1/libexec/gcc/arm-none-linux-gnueabi/4.5. rapper Target: arm-none-linux-gnueabi Configured with: /work/toolchain/build/src/gcc-4.5.1/configurebuild=i686-build_pc-linux-gnueabi/4.5with-sysroot=/opt/FriendlyARM/toolschain/4.5.1/arm-none-linux-gnueabi/sys-rootenable-la =c,C++disable-multilibwith-cpu=arm1176jzf-swith-tune=arm1176jzf-swith-fpu=vfpw at=softfpwith-pkgversion=ctng-1.8.1-FAwith-bugurl=http://www.arm9.net/disable-sjlj-e nsenablecxa atexitdisable-libmudflapwith-host-libstdcxx='-static-libgcc -Wl,-Bstat tdc++,-Bdynamic -Im'with-gmp=/work/toolchain/build/staticwith-ppl=/work/toolchain/build/staticwith-host-libstdixwith-libelf=/work/tool collain/build/arm-none-linux-gnueabi/build/staticwith-libelf=/work/tool collain/build/arm-none-linux-gnueabi/build/staticwith-local-prefix=/opt/Fried /toolschain/4.5.1/arm-none-linux-gnueabi/sys-rootdisable-nlsenable-symvers=gnuenable /toolschain/4.5.1/arm-none-linux-gnueabi/sys-rootdisable-nlsenable-symvers=gnuenable /toolschain/4.5.1/arm-none-linux-gnueabi/sys-rootdisable-nlsenable-symvers=gnuenable /toolschain/4.5.1/ctng-1.8.1-FA) /root@tom 4.5.1]# //ord@tom 4.5.1]#</pre>	1/lto-w uhos n/4.5.1 nguages tith-flo xceptio tic,-ls tith-mpf arm-non static chain/b ndlyARM c99

## 4.4 Uncompress Source Code and Install Application Utilities

This section will introduce how to uncompress all the source code that users may

need and install some application utilities including:

- Linux kernel source code
- Qtopia-2.2.0 source code (for x86 and arm)
- arm-qt-extended-4.4.3 source code (i.e. Qtopia4, for x86 and arm)
- QtE-4.7.0 (for ARM)

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- Busybox-1.17 source code
- Sample programs code (developed by FriendlyArm)
- Target file system directory
- File system image maker (for YAFFS2)
- Linux logo maker: logo\_maker

Note: all source code and utilities should be uncompressed and compiled with arm-linux-gcc-4.4.1

## 4.4.1 Uncompress Source Code

Firstly, create a working directory: /opt/FriendlyARM/tiny4412/linux

After execute command "mkdir -p /opt/FriendlyARM/tiny4412/linux", all the source

code in the following steps will be uncompressed in this work directory

(1) Get Linux source code ready

In Fedora9, create a temporary director "/tmp/linux" by running the following

command

#mkdir /tmp/linux

Copy all the files in the linux directory in the shipped CD to "/tmp/linux"

(2) Uncompress the Linux kernel source code

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/linux-3.5-20131010.tar.gz





A linux-3.5 directory is created and it will include a complete copy of linux kernel source code.

Note: 20131010 is the date when FriendlyARM released the new version, the file name

in the shipped CD may be different.

(3) Uncompress and Install the target file system

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/rootfs\_qtopia\_qt4-20131010.tgz

A rootfs\_qtopia-qt4 directory is created it will include a complete copy of linux

kernel source code.

Note: 20131010 is the date when FriendlyARM released the new version, the file name

in the shipped CD may be different.

(4) Uncompress and install Qtopia source code

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/x86-qtopia-20100420.tar.gz

#tar xvzf /tmp/linux/arm-qtopia-20101105.tar.gz

An x86-qtopia directory and an arm-qtopia directory will be created, and their source code will be uncompressed into these two directories.

Note: in this release, supports for mouse and tp are all included in one package. And the source code for the embedded browser konquor is included too.



(5) Uncompress and install qt-extended-4.4.3 source code

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/x86-qt-extended-4.4.3-20101003.tgz

#tar xvzf /tmp/linux/arm-qt-extended-4.4.3-20101105.tgz

An x86-qt-extended-4.4.3 and an arm-qt-extended-4.4.3 are created their source code

will be uncompressed into these two directories.

(6) Uncompress and install QtE-4.7.0 source code

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/x86-qte-4.6.1-20100516.tar.gz

#tar xvzf /tmp/linux/arm-qte-4.7.0-20101105.tar.gz

An x86-qte-4.6.1 and an arm-qte-4.7.0 are created their source code will be

uncompressed into these two directories.

(7) Uncompress and install busybox source code

The Busybox is a compact Linux tool kit. Here we used busybox-1.17.2. Users can

download its latest version from http://www.busybox.net

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/busybox-1.17.2-20101120.tgz

A busybox-1.17.2 directory is created its source code will be extracted into this



### directory.

Note: for the sake of users, we have made a default configuration file: fa.config.

(8) Uncompress and install Linux sample programs

In the work directory /opt/FriendlyARM/tiny4412/linux, run the commands below:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/examples-tiny4412-20131010.tgz

An examples directory is all the source code will be extracted into this directory.

Note: all these sample programs are developed by FriendlyARM.

## 4.4.2 Create Target File System

We offered the following two packages:

• rootfs\_qtopia\_qt4-20131010.tgz

Execute the following commands:

#cd /opt/FriendlyARM/tiny4412/linux

#tar xvzf /tmp/linux/ rootfs\_qtopia\_qt4-20131010.tgz

A rootfs\_qtopia\_qt4 will be created.

This package includes qtopia-2.2.0, Qtopia4 and QtE-4.7.0, busybox and some

command line utilities. It has the following excellent features:

- auto detection of touch screen and launching the calibration utility if necessary. If no

touch screen is connected system will enable the mouse.

- auto detection of command or high speed SD cards (up to maximum memory of 32G)



and flash drives

- auto detection of USB mouse or touch screen

- support co-existence of a USB mouse and a touch screen (since Linux-2.6.36)

## 4.4.3 Install Logo Maker

LogoMaker is developed by FriendlyARM for making linux logos. There are many resources describing how to convert image files such as bmp, jpg, png and so on to linux logos using command line tools. We created this graphic version which is based on Fedora9.Execute the command below:

## #tar xvzf /tmp/linux/logomaker.tgz -C /

Note: "C" is capitalized and means "change".

After executing the above commands, LogoMaker will be installed in the /usr/sbin directory. It only has one file. After installing it, type "logomake" in a command line window, you will see the following screenshot



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# 4.5 Configure and Compile Kernel

Type the following command to compile:

#cp /opt/FriendlyARM/tiny4412/android/linux-3.5

#cp tiny4412\_linux\_defconfig .config : there is a space after "defconfig" and a "."

**#make**; begins to compile

After the compilation is done, an image file **zImage** will be generated under

"arch/arm/boot".

# 4.6 Make File System Image

Please make sure you have installed "mktools" tools and have an image directory

ready before continue.

Enter "/opt/FriendlyARM/tiny4412/linux" and execute the following command:

#make\_ext4fs -s -l 314572800 -a root -L linux rootfs\_qtopia\_qt4.img

rootfs\_qtopia\_qt4

This will compress the whole "rootfs\_qtopia\_qt4" into a yaffs2

rootfs\_qtopia\_qt4.img file. It is the same as the one in "/images/Linux/" in the shipped

CD. Download it to your board's NAND Flash.

# 4.7 Sample Linux Programs

This section lists some sample Linux programs for users' reference.

You can find those programs under "/opt/FriendlyARM/tiny4412/examples".All

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### the following programs are compiled with arm-linux-gcc-4.5.1-v6-vfp. We don't

guarantee they can be compiled and run with other corss compilers.

			root	<pre>@tom:/opt/FriendlyARM/toolschain/4.5.1</pre>	_ + ×
<u>F</u> ile <u>E</u> dit	<u>V</u> iew	<u>T</u> erminal	Ta <u>b</u> s	<u>H</u> elp	
[root@tom Using buil COLLECT_GC COLLECT_LT rapper Target: an Configured t=i686-bui with-sy =c,c++C at=softfp nsenabl tdc++,-Bdy r=/work/td e-linux-gr with-mpd uild/arm-r /toolschai enable-lor Thread mod gcc versid [root@tom	4.5.1] t-in s C=arm- O_WRAP m-none with: ld_pc- sroot= lisable with ecx namic isable with ecx namic solchai ueabi/ c=/work ione-li n/4.5. g-long lel: po n 4.5.1]	<pre># arm-lin pecs. linux-gcc PER=/opt/ -linux-gnu /work/to linux-gnu /opt/Frie -multilib -pkgversi a_atexit a_texit in/build/a build/sta /toolchai nux-gnuea l/arm-non six 1 (ctng-1 # ■</pre>	Friend ueabi olchai tar ndlyAR wit on=ctn disa th-gmp rm-non tic n/buil bi/bui e-linu .8.1-F	<pre>is -V llyARM/toolschain/4.5.1/libexec/gcc/arm-none-linux-gnueabi/4.5. n/build/src/gcc-4.5.1/configurebuild=i686-build_pc-linux-gr get=arm-none-linux-gnueabiprefix=/opt/FriendlyARM/toolschai M/toolschain/4.5.1/arm-none-linux-gnueabi/sys-rootenable-la h-cpu=arm1176jzf-swith-tune=arm1176jzf-swith-fpu=vfpv g-1.8.1-FAwith-bugurl=http://www.arm9.net/disable-sjlj-e ble-libmudflapwith-host-libstdcxx='-static-libgcc -Wl,-Bsta =/work/toolchain/build/arm-none-linux-gnueabi/build/staticv e-linux-gnueabi/build/staticwith-ppl=/work/toolchain/build/ with-cloog=/work/toolchain/build/arm-none-linux-gnueabi/build/ d/arm-none-linux-gnueabi/build/staticwith-libelf=/work/tool ld/staticenable-threads=posixwith-local-prefix=/opt/Frie x-gnueabi/sys-rootdisable-nlsenable-symvers=gnuenable</pre>	1/lto-w nuhos n/4.5.1 anguages vith-flo atic,-ls vith-mpf 'arm-non 'static Lchain/b andlyARM 2-c99

## 4.7.1 "Hello, World!"

The source code of "Hello, World" is under

"/opt/FriendlyARM/tiny4412/linux/examples/hello". Its contents are as follows:

#include <stdio.h>

int main(void) {

#### printf("hello, FriendlyARM!\n");

}





### Step1: Compile Hello,World

Enter the directory where the source code is located and execute "make":

#### #cd /opt/FriendlyARM/tiny4412/linux/examples/hello

#### #make

A "hello" executable will be generated and you can check whether it is for ARM by

commanding "file":

### Step2: Download "Hello,World" to Board

You can download your executable to the board in any of the following ways:

- FTP file transfer (recommended)
- Copy to a media (such as flash drives)
- File transfer via serial port

## (1) FTP File Transfer

Note: login your board via FTP, transfer your executable to it and change its file

#### property to executable.

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First, execute your commands in PC

root@tom:/opt/FriendlyARM/mini2440/examples/hello	_ + ×
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>T</u> erminal Ta <u>b</u> s <u>H</u> elp	
[root@tom hello]# ls	^
hello hello.c Makefile	
[root@tom nello]# Ttp 192.168.1.230 1. Login	
220 EriendlyARM ETP server (Version 6 4/OpenBSD/Linux-ftnd-0 17) ready	
Name (192,168,1,230:root): plg	
331 Password required for plg. 2. Type name and password	
Password:	
230 User plg logged in.	
Remote system type is UNIX.	
Using binary mode to transfer files.	
Ttp> bin 3. Set file transfer format	
ftps put hello 4. Upload hello	
local: hello remote: hello	
227 Entering Passive Mode (192.168.1.230.171.47)	
150 Opening BINARY mode data connection for 'hello'.	
226 Transfer complete.	
5061 bytes sent in 0.000144 secs (35145.83 Kbytes/sec)	
ftp> by 5. Logout	
221 Goodbye.	
[root@tom nello]#	

Go to your board and execute the following commands:

COM1 (1) - CRT			
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>O</u> ptions <u>T</u> ransfer	Script Window Help		
13 33 43 X In C Q IZ I	5 😂   🗗 💥   💡   🔍		
			^
[root@FriendlyARM pig]# co			
bin lib			
dev linuxrc			
etc lost+Found			
hone nnt	shanghaitan.mp3		
[root@FriendlyARM /]# cd /h	ome/plg/ enter/home	/plg	
[root@FriendlyARM plg]# 1s	hello transfe	red	
[root@FriendluARM pla]# chm	od +x hello 🛑 chan	ae mode	
[root@FriendlyARM plg]# 1s		gamoaa	
hello	mode changed		
[root@FriendlyARM plg]# ./h	ello		
hello, FriendlyARM! 🛛 🗕	execute hello		
[root@FriendlyARM plg]#			
			~
Ready	Serial: COM1 4, 25 1	8 Rows, 75 Cols Linux	

### (2) Copy to Flash Drive

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Note: copy your executable to a flash drive, mount it to your board and copy the file to "/bin"

1. Copy to Flash Drive

Connect your flash drive to your PC and execute the following commands

#mount /dev/sda1 /mnt ; mount your drive

#cp hello /mnt ; copy your file to the drive

#umount /mnt ; unmount your drive

2. Copy to Board

Insert your drive to your board's USB host, it will be automatically mounted under

"/udisk". Please execute the following command

### #cd /udisk

**#./hello** ; execute "hello"

Note: if you take out your drive directly you need to go back to the root directory and

execute "umount /udisk" for the next mount

ÃA0A0BF1AC8C1155A0318 iguration from 1 choice for lass Storage devices Kingston DataTraveler USB Ma emulation Dire 2.0 1.00 ANSI: (4.00 GB/3 byte hardware sectors: sda sda t is off ive cache: write through -byte hardware sectors: (4.00 GB/3.72 GiB) ive off Protect is ssuming drive cache: write through [sda] Attached SCSI removable disk not\_a recommended IO charset for FAT filesystems, filesystem will b 0 utf8 sensitive! oot@FriendlyARM /]# cd /udisk/ oot@FriendlyARM /udisk]# ls ot@FriendlyARM /udisk]# ./hello lo, FriendlyARM! endlvÁRM ⁄udisk]#

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### (1) File Transfer via Serial Port

Download your file to the board via serial port and change its property to executable

#### #chmod +x hello

Note: some users do this via a USB to Serial connector. This may not be successful due

to the connector's quality issues therefore we recommend file transfer via FTP

## 4.7.2 LED Test Program

The source code of "Hello, World" is under

#### "/opt/FriendlyARM/tiny4412/linux/examples/hello". Its contents are as follows:

Program Description:		
Source Code Location	/opt/FriendlyARM/tiny4412/linux/linux-xxx/drivers/char	
Driver	tiny4412_leds.c	
Device Type	misc	
Device Name	/dev/leds	
Test Program Source Code Location	/opt/FriendlyARM/tiny4412/linux/examples/leds	
Test Program Name	led.c	
Executable Name	led	
Test Program's Location in Board		
Note: the LED driver has been compiled into the kernel by default and you cannot load it via insmod		
Program:		
<pre>#include <stdio.h></stdio.h></pre>		
<pre>#include <stdlib.h></stdlib.h></pre>		
#include <unistd.h></unistd.h>		
#include <sys ioctl.h=""></sys>		
int main(int argc, char **argv)		
{		
int on;		
int led_no;		
int fd;		
/* Check parameters */		
if (argc != 3    sscanf(argv[1], "%d", &led_no) != 1    sscanf(argv[2], "%d", &on) != 1		
$on < 0 \parallel on > 1 \parallel led_no < 0 \parallel led_no > 3) $		

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perror("open device leds"); exit(1); } /\*Manipulate led via ioctl and input parameters \*/ ioctl(fd, on, led\_no); /\*Close device\*/ close(fd); return 0;

if (fd < 0) {

You can compile the program, download it and run

## 4.7.3 User Button Test Program

Program Description:		
Source Code Location	/opt/FriendlyARM/tiny4412/linux/linux-xxx/drivers/char	
Driver	tiny4412_buttons.c	
Device Type	misc	
Device Name	/dev/buttons	
Test Program Source Code Location	/opt/FriendlyARM/tiny4412/linux/examples/buttons	
Test Program Name	Button_test.c	
Executable Name	buttons	
Test Program's Location in Board		
Note: the button driver has been compiled	into the kernel by default and you cannot load it via insmod	
Program:		
<pre>#include <stdio.h></stdio.h></pre>		
<pre>#include <stdlib.h></stdlib.h></pre>		
<pre>#include <unistd.h></unistd.h></pre>		
<pre>#include <sys ioctl.h=""></sys></pre>		
<pre>#include <sys types.h=""></sys></pre>		
<pre>#include <sys stat.h=""></sys></pre>		
<pre>#include <fcntl.h></fcntl.h></pre>		

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#include <sys/select.h> #include <sys/time.h> #include <errno.h> int main(void) int buttons\_fd; char buttons[6] =  $\{ 0', 0', 0', 0', 0', 0', 0' \}$ ; buttons\_fd = open("/dev/buttons", 0); if (buttons\_fd < 0) { perror("open device buttons"); exit(1);} for (;;) { char current\_buttons[6]; int count\_of\_changed\_key; int i; if (read(buttons\_fd, current\_buttons, sizeof current\_buttons) != sizeof current\_buttons) { perror("read buttons:"); exit(1); } for (i = 0, count\_of\_changed\_key = 0; i < size of buttons / size of buttons[0]; i++) { if (buttons[i] != current\_buttons[i]) { buttons[i] = current\_buttons[i]; printf("%skey %d is %s", count\_of\_changed\_key? ", ": "", i+1, buttons[i] == '0' ? "up" : "down"); count\_of\_changed\_key++; } } if (count\_of\_changed\_key) { printf("\n"); } } close(buttons fd); return 0;

You can compile the program, download it and run

## 4.7.4 PWM Buzzer Program

Program Description:

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Source Code Location	/opt/FriendlyARM/tiny4412/linux/linux-xxx/drivers/char
Driver	tiny4412_pwm.c
Device Type	misc
Device Name	/dev/pwm
Test Program Source Code Location	/opt/FriendlyARM/tiny4412/linux/examples/pwm
Test Program Name	pwm_test.c
Executable Name	Pwm_test
Test Program's Location in Board	
Note: the pwm driver has been compiled in	to the kernel by default and you cannot load it via insmod
Program:	
<pre>#include <stdio.h></stdio.h></pre>	
<pre>#include <termios.h></termios.h></pre>	
<pre>#include <unistd.h></unistd.h></pre>	
<pre>#include <stdlib.h></stdlib.h></pre>	
#define PWM_IOCTL_SET_FREQ 1	
#define PWM_IOCTL_STOP 2	
#define ESC_KEY 0x1b	
static int getch(void)	
{	
struct termios oldt, newt;	
int ch;	
if (!isatty(STDIN_FILENO)) {	
fprintf(stderr, "this problem should be i	run at a terminal\n");
exit(1);	
}	
// save terminal setting	
if(tcgetattr(STDIN_FILENO, &oldt) <	0) {
perror("save the terminal setting");	
exit(1);	
}	
// set terminal as need	
newt = oldt;	
newt.c_lflag &= ~( ICANON   ECHO )	);
if(tcsetattr(STDIN_FILENO,TCSANO	W, & newt) < 0) {
perror("set terminal");	
exit(1);	
}	
ch = getchar();	
// restore termial setting	
if(tcsetattr(STDIN_FILENO,TCSANO	$W,\&oldt) < 0) \{$
perror("restore the termial setting");	
- /·	

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```
exit(1);
}
return ch;
}
static int fd = -1;
static void close_buzzer(void);
static void open_buzzer(void)
fd = open("/dev/pwm", 0);
if (fd < 0) {
perror("open pwm_buzzer device");
exit(1);
}
// any function exit call will stop the buzzer
atexit(close_buzzer);
}
static void close_buzzer(void)
{
if (fd \ge 0) {
ioctl(fd, PWM IOCTL STOP);
close(fd);
fd = -1;
}
}
static void set_buzzer_freq(int freq)
// this IOCTL command is the key to set frequency
int ret = ioctl(fd, PWM_IOCTL_SET_FREQ, freq);
if(ret < 0) \{
perror("set the frequency of the buzzer");
exit(1);
}
}
static void stop_buzzer(void)
{
int ret = ioctl(fd, PWM_IOCTL_STOP);
if(ret < 0) {
perror("stop the buzzer");
exit(1);
}
```





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```
int main(int argc, char **argv)
{
int freq = 1000;
open_buzzer();
printf( "\nBUZZER TEST ( PWM Control )\n" );
printf( "Press +/- to increase/reduce the frequency of the BUZZER\n" );
printf( "Press 'ESC' key to Exit this program\n\n" );
while(1)
{
int key;
set_buzzer_freq(freq);
printf( "\tFreq = %d \mid n", freq );
key = getch();
switch(key) {
case '+':
if( freq < 20000 )
freq += 10;
break;
case '-':
if (freq > 11)
freq -= 10;
break;
case ESC_KEY:
case EOF:
stop_buzzer();
exit(0);
default:
break;
}
}
```

You can compile the program, download it and run

## 4.7.5 I2C-EEPROM Program

Program Description:	
Source Code Location	/opt/FriendlyARM/tiny4412/linux/linux-xxx/drivers/i2c/busses
Driver	I2c-s3c2410c
Device Type	Char

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Device Name	/dev/i2c/0		
Test Program Source Code	/opt/FriendlyARM/tiny4412/linux/examples/i2c		
Location	, op i Friend J Fried and Fried State press (20		
Test Program Name	Eeprog.c 24cxx.c		
Executable Name	I2c		
Test Program's Location in			
Board			
Note: the i2c driver has been comp	viled into the kernel by default and you cannot load it via insmod		
Program:			
Note: the following program de	pends on "24cxx.c" in the same directory.		
<pre>#include <stdio.h></stdio.h></pre>			
#include <fcntl.h></fcntl.h>			
<pre>#include <getopt.h></getopt.h></pre>			
<pre>#include <unistd.h></unistd.h></pre>			
<pre>#include <stdlib.h></stdlib.h></pre>			
<pre>#include <errno.h></errno.h></pre>			
<pre>#include <string.h></string.h></pre>			
<pre>#include <sys types.h=""></sys></pre>			
<pre>#include <sys stat.h=""></sys></pre>			
#include "24cXX.h"			
<pre>#define usage_if(a) do { do_usage</pre>	_if( a ,LINE); } while(0);		
void do_usage_if(int b, int line)			
{			
const static char *eeprog_usage =			
"I2C-24C08(256 bytes) Read/Writ	e Program, ONLY FOR TEST!\n"		
"FriendlyARM Computer Tech. 20	009\n";		
if(!b)	if(!b)		
return;			
fprintf(stderr, "%s\n[line %d]\n", e	peprog_usage, line);		
exit(1);			
}			
#define die_if(a, msg) do { do_die	_if( a , msg,LINE); } while(0);		
void do_die_if(int b, char* msg, int line)			
{			
if(!b)			
return;			
fprintf(stderr, "Error at line %d: %	s\n", line, msg);		
fprintf(stderr, " sysmsg: %s\n", str	error(errno));		
exit(1);			
}	}		
static int read_from_eeprom(struct	eeprom *e, int addr, int size)		

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{

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```
int ch, i;
for(i = 0; i < size; ++i, ++addr)
{
die_if((ch = eeprom_read_byte(e, addr)) < 0, "read error");
if( (i % 16) == 0 )
printf("n \%.4x| ", addr);
else if((i \% 8) == 0)
printf(" ");
printf("%.2x ", ch);
fflush(stdout);
}
fprintf(stderr, "\n\n");
return 0;
}
static int write_to_eeprom(struct eeprom *e, int addr)
{
int i;
for(i=0, addr=0; i<256; i++, addr++)
{
if( (i % 16) == 0 )
printf("n \%.4x| ", addr);
else if((i \% 8) == 0)
printf(" ");
printf("%.2x ", i);
fflush(stdout);
die_if(eeprom_write_byte(e, addr, i), "write error");
}
fprintf(stderr, "\n\n");
return 0;
}
int main(int argc, char** argv)
{
struct eeprom e;
int op;
op = 0;
usage_if(argc != 2 || argv[1][0] != '-' || argv[1][2] != '\0');
op = argv[1][1];
fprintf(stderr, "Open /dev/i2c/0 with 8bit mode\n");
die_if(eeprom_open("/dev/i2c/0", 0x50, EEPROM_TYPE_8BIT_ADDR, &e) < 0,
"unable to open eeprom device file "
```

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"(check that the file exists and that it's readable)");
switch(op)
{
case 'r':
fprintf(stderr, " Reading 256 bytes from 0x0\n");
read_from_eeprom(&e, 0, 256);
break;
case 'w':
fprintf(stderr, " Writing 0x00-0xff into 24C08 $n$ ");
write_to_eeprom(&e, 0);
break;
default:
usage_if(1);
exit(1);
}
eeprom_close(&e);
return 0;
}

You can compile the program, download it and run

## 4.7.6 Pipe Program – Manipulating LED via Web

Program Description:		
Source Code Location		
Driver		
Device Type		
Device Name		
Test Program Source Code Location	/opt/FriendlyARM/tiny4412/linux/examples/led-player	
Test Program Name	led-player.c	
Executable Name	led-player	
Test Program's Location in Board		
Note: to utilize math libraries you need to include its header file "pthread.h" and add an compile option		
libpthread		
Program:		
<pre>#include <stdio.h></stdio.h></pre>		
<pre>#include <stdlib.h></stdlib.h></pre>		
<pre>#include <unistd.h></unistd.h></pre>		
<pre>#include <sys ioctl.h=""></sys></pre>		
<pre>#include <sys types.h=""></sys></pre>		

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#include <sys/stat.h> #include <fcntl.h> #include <sys/select.h> #include <sys/time.h> #include <string.h> static int led\_fd; static int type = 1; static void push\_leds(void) { static unsigned step; unsigned led\_bitmap; int i; switch(type) { case 0: if (step  $\geq = 6$ ) { step = 0; } if (step < 3) { led\_bitmap = 1 << step;</pre> } else {  $led_bitmap = 1 \ll (6 - step);$ } break; case 1: if (step > 255) { step = 0; } led\_bitmap = step; break; default:  $led_bitmap = 0;$ } step++; for (i = 0; i < 4; i++) { ioctl(led\_fd, led\_bitmap & 1, i);  $led_bitmap >>= 1;$ } } int main(void) { int led\_control\_pipe;

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int null\_writer\_fd; // for read endpoint not blocking when control process exit double period = 0.5;  $led_fd = open("/dev/leds0", 0);$ if (led\_fd < 0) {  $led_fd = open("/dev/leds", 0);$ } if  $(led_fd < 0)$  { perror("open device leds"); exit(1);} unlink("/tmp/led-control"); mkfifo("/tmp/led-control", 0666); led\_control\_pipe = open("/tmp/led-control", O\_RDONLY | O\_NONBLOCK); if (led\_control\_pipe < 0) { perror("open control pipe for read"); exit(1);} null\_writer\_fd = open("/tmp/led-control", O\_WRONLY | O\_NONBLOCK); if (null\_writer\_fd < 0) { perror("open control pipe for write"); exit(1);} for (;;) { fd\_set rds; struct timeval step; int ret; FD ZERO(&rds); FD\_SET(led\_control\_pipe, &rds); step.tv\_sec = period; step.tv\_usec = (period - step.tv\_sec) \* 1000000L; ret = select(led\_control\_pipe + 1, &rds, NULL, NULL, &step); if (ret < 0) { perror("select"); exit(1);} if (ret == 0) { push\_leds(); } else if (FD\_ISSET(led\_control\_pipe, &rds)) { static char buffer[200]; for (;;) { char c;

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```
int len = strlen(buffer);
if (len \ge size of buffer - 1) {
memset(buffer, 0, sizeof buffer);
break:
if (read(led_control_pipe, &c, 1) != 1) {
break;
ł
if (c == '\r') {
continue;
}
if (c == '\n') \{
int tmp_type;
double tmp_period;
if (sscanf(buffer, "%d%lf", &tmp_type, &tmp_period) == 2) {
type = tmp_type;
period = tmp_period;
fprintf(stderr, "type is %d, period is %lf\n", type, period);
memset(buffer, 0, sizeof buffer);
break;
}
buffer[len] = c;
}
}
}
close(led fd);
return 0;
}
```

"make" will generate a led-player executable which is run as a server under "/sbin".

The leds.cgi gateway source code is under "/www/leds.cgi" on the board. It is a shell

script and can be invoked by leds.html as an action. Here is the shell file

eds.cgi:	
!/bin/sh	
vpe=0	
eriod=1	



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case \$QUERY\_STRING in \*ping\*) type=0 ;; \*counter\*) type=1 ;; \*stop\*) type=2 ;; esac case \$QUERY\_STRING in \*slow\*) period=0.25 ;; \*normal\*) period=0.125 ;; \*fast\*) period=0.0625 ;; esac /bin/echo \$type \$period > /tmp/led-control echo "Content-type: text/html; charset=gb2312" echo /bin/cat led-result.template exit 0

# 4.8 Compile Qtopia-2.2.0

To make it easy for users we compile all the steps into one build script. Executing this script will compile thewhole qtopia platform and its utilities. You can start them by commanding "**run**". The compiling scripts for x86 and arm are a little bit different.

# 4.8.1 Compile and Run Qtopia-2.2.0 for X86

All our programs have been verified on Fedora9. We didn't try them on other

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platforms. We strongly recommend our users to use Fedora9 and download it from

ftp://download.fedora.redhat.com/pub/fedora/linux/releases/9/Fedora/i386/iso/Fedora-9-

#### i386-DVD.iso.

Enter the working directory and run the following command

### #cd /opt/FriendlyARM/tiny4412/linux/x86-qtopia

**#./build-all** (this process takes about 30 minutes)

Note: ./build-all will automatically compile the complete Qtopia and its embedded web

browser. You can execute "./build" first and then "./build-konq" to compile them

separately. To run your qtopia you can type the command below:

#### #./**run**

You will see the following screen

🔲 root@tom:/opt/FriendlyARM/mini6410/x86-qtopia 📃 🔸 🕷	٤
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>T</u> erminal Ta <u>b</u> s <u>H</u> elp	
root@tom:/opt/FriendlyARM/mini6410/x86-qtopia 🛛 🗶 root@tom:/opt/FriendlyARM/mini6410/x86-qtopia 🔊	~
<pre>root@tom:/opt/FriendlyARM/mini6410/x86-qtopia  roo@tom:/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed/src' make[3]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed/src' make[3]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed' make[3]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed' make[3]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed' make[3]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed' make[2]: Entering directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq/konq-embed' make[2]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq' make[2]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq' make[2]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/konq' make[1]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/cong' make[1]: Leaving directory '/opt/FriendlyARM/mini6410/x86-qtopia/qtopia-2.2.0-FriendlyARM/qtopia/image/opt/Qtop ia/i18n/en_US/liape.qm Warning: loading /opt/FriendlyARM/mini6410/x86-qtopia/qtopia-2.2.0-FriendlyARM/qtopia/image/opt/Qtop ia/i18n/en_US/liappe.qm Warning: loading /opt/FriendlyARM/mini6410/x86-qtopia/qtopia-2.2.0-FriendlyARM/qtopia/image/opt/Qtop ia/i18n/en_US/liappe.qm Warning: loading /opt/FriendlyARM/mini6410/x86-qtopia/qtopia-2.2.0-FriendlyARM/qtopia/image/opt/Qtop ia/i18n/en_US/liapquage.qm Warning: loading /opt/FriendlyARM/mini6410/x86-qtopia/qtopia-2.2.0</pre>	

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Follow the default options to continue and you will see the following screen



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## 4.8.2 Compile and Run Qtopia-2.2.0 for ARM86

Please make sure your compiler is arm-linux-gcc-4.5.1 and platform is Fedora 9.

Enter the working directory and type the command below

### #cd /opt/FriendlyARM/tiny4412/linux/arm-qtopia

**#./build-all** (this process takes about 30 minutes)

#./mktarget (this makes a file system image and will generate

## "target-qtopia-konq.tgz")

Note: "./build-all" will automatically compile a complete Qtopia system and the web browser and generate Jpeg, GIF, PNG image files. You can execute "./build" first and then "./build-konq" to compile them separately.

To remove your old Qtopia system you just need to delete all the files under "/opt".

Then you can uncompress your target-qtopia-konq.tgz to the board's root directory via a

flash drive. In our example we had it under /home/plg. Please run the command below:

## #tar xvzf /home/plg/target-qtopia-konq.tgz –C /

"C" means "Change" and "/" after "C" means it will be uncompressed to the root directory. Afteryouare done, reboot your board and you will see that all your GUI components are in English now and there is a browser under the "FriendlyARM" tag. This is your own Qtopia.

Note: your new system may load parameters from "/etc/pointercal", you can delete that file too and will be directed to the calibration screen after reboot.

Friendly	Complete A De	RM Solutions sign, Developn	nent and Manufactur
<u>/#RM /</u>	Expertise on	Embedded Linu	ux, Android, WindowsC
🔠 Applications 📄	FriendlyARM	🙆 Games 🛃 S	Settings 🗋 Documents
\$ <b>-</b>	09	6	<b>())</b>
Calculator	Calendar	Camera	Clock
8	(?)		=
Contacts	Help	Music	Notes
<b>S</b>	(i)	R	>_
Pictures	System Info	Tasks	Terminal
~	4		٩
Today	Videos	VNC	Voice Notes
Applications 🖻	FriendlyARM	😇 Games 🛃 S	Settings 🗋 Documents
Web Browser			
			🔍 🖻 📣 🖡 n2·19

The above procedure is a simplied one. We hide all technical details in the build-all

script you can look into it for more details

# 4.9 Compile QtE-4.7.0

## 4.9.1 Compile and Run QtE-4.7.0 for ARM

Note: please use our arm-linux-gcc-4.5.1 and Fedora9 to compile. We offered a

build-all script for users to easily compile QtE-4.7.0. Please enter the source code



directory and type the following command:

#### #cd /opt/FriendlyARM/tiny4412/linux/arm-qte-4.7.0

#### #./build-all

The build process takes a while. And after it is done, please run the mktarget script

and a **target-qte-4.7.0.tgz** will be generated. Please follow the command below:

#### #tar xvzf target-qte-4.7.0.tgz –C /

A Trolltech directory will be generated under "/usr/local/", which includes all needed

libraries and executables. Since our shipped Linux already includes QtE-4.7.0, to test

your build you can delete the one on your board by "rm" the whole

### "/usr/local/Trolltech" directory.

Before running QtE-4.6.3, please stop the current running Qtopia-2.2.0. Go to "Settings" -> "Shutdown" and you will see the following screen. Click on "Terminate Server" to shut down Qtopia-2.2.0.



Or you can shut it down: either by commenting out the qtopia option in the init script

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"/etc/init.d/rcS" and rebooting the system or commanding "kill all" to terminate related process (there are many options: you can even delete the whole "/opt", shut down qtopia-2.2.0 and run "qt4"



# 4.10 Compile Qtopia4(Qt-Extended-4.4.3)

## 4.10.1 Compile and Run Qt-Extended-4.4.3 for X86

Note: please use our arm-linux-gcc-4.5.1 and Fedora9 to compile. We offered a

build-all script for users to easily compile Qt-Extened-4.4.3. Please enter the source

code directory and type the following command:

## #cd /opt/FriendlyARM/tiny4412/linux/x86-qt-extended-4.4.3

### #./build

The build process takes a while. To run your compiled system please type the command below:

### #**./run**

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## 4.10.2 Compile and Run Qt-Extended-4.4.3 for ARM

3 de

continue.

0t

2 ab 5 jkl

8

Note: please use our arm-linux-gcc-4.5.1 and Fedora9 to compile. We offered a build

0t

5 jkl

3 de

script for users to easily compile Qt-Extened-4.4.3. Please enter the source code

directory and type the following command:

#### #cd /opt/FriendlyARM/tiny4412/linux/arm-qt-extended-4.4.3

#### #./build

The build process takes a while. To run your compiled system please type the command below:

#### #./**run**

And after it is done, please run the mktarget script and a target-qtopia4.tgz will be

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generated. Please follow the command below:

### #tar xvzf target-qtopia4.tgz –C /

A Qtopia4.4.3 directory will be generated under "/opt", which includes all needed libraries and executables. Since our shipped Linux already includes QtE-4.7.0, to test your build you can delete the one on your board by "rm" the whole "/**opt/Qtopia4.4.3**" directory.

Before running Qtopia4, please stop the current running Qtopia-2.2.0. Go to "Settings" -> "Shutdown" and you will see the following screen. Click on "Terminate Server" to shut down Qtopia-2.2.0.

Shutdown	2.3		
Shutdown	Restart Server		
Reboot	Terminate Server		
These termination options are provided primarily for use while developing and testing the Qtopia system. In a normal environment, these concepts are unnecessary.			
Cancel			
abell A	R 🖓 🗐 🗐 1:54		

Or you can shut it down: either by commenting out the qtopia option in the init script "/etc/init.d/rcS" and rebooting the system or commanding "kill all" to terminate related process (there are many options: you can even delete the whole "/opt", shut down qtopia-2.2.0 and run "qtopia4 &"



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## **5** Linux Application Development

We have another document which has very detailed information about how to do

Linux development applications.

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