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MINI2440 User's Manual

2009—03—03

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Chapter 1 Introduction

1.1 About this Manual

This manual is intended to provide the user with an overview of the MINI2440 board, its benefits, features, specifications, and set up procedures.

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1.2 Benefits

The MINI2440 Development Board is based on the Samsung S3C2440 microprocessor. Its PCB is 4-layer boarded, equipped with professional equal length wiring which ensures signal integrity. All MINI2440 boards are manufactured in mass production and released with strict quality control. On startup it directly boots preinstalled Linux by default. There are no extra setup steps or configuring procedures to start the system. It is easy for users to get started. Anyone with very basic knowledge about the C language can become proficient in its development within two weeks. This package also provides detailed documents on how to configure and boot to alternative operating systems. In addition, our technical support is always available for assistance to our customers. This product delivers high quality with low price.

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1.3 Product Overview

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1.3.1 What a MINI2440 Development Board Looks Like

The MINI2440 development board is a 100 x 100(mm) board equipped with a wide variety of connectors, interfaces and ports.

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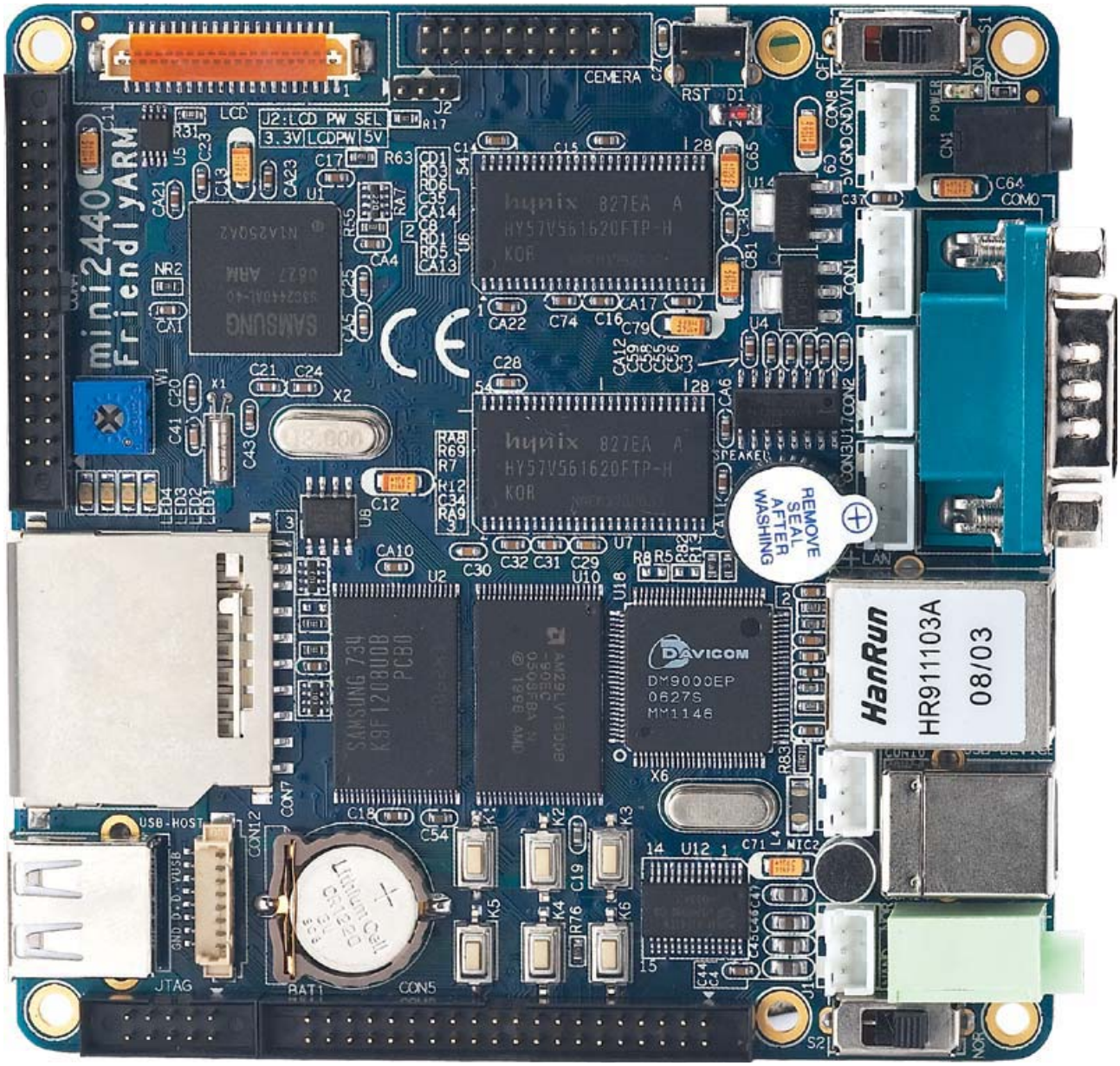

1.3.2 MINI2440 Hardware Features

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- **CPU**
  - Samsung S3C2440A，400MHz，maximum 533Mhz
- **SDRAM**
  - On board 64M SDRAM
  - 32bit Data Bus
  - SDRAM, maximum clock frequency 100MHz
- **FLASH Memory**
  - On board 64M Nand Flash
  - On board 2M Nor Flash with preinstalled BIOS
- **LCD**
  - Four-wire touch screen interface

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- Support black and white, 4 level grayscale, 16 level grayscale, 256-color、4096-color STN LCD, 3.5-inch to 12.1-inch, screen resolution 1024x768;

- Support black and white, 4 level grayscale, 16 level grayscale, 256-color, 64K-color, true color TFT LCD, 3.5-inch to 12.1-inch, screen resolution 1024x768,

- NEC 256K color 240x320/3.5-inch TFT true color touch screen,

- 12 V power supply interface, it is for 12V CCFL backlight modules of big size TFT LCDs

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1.3.3 Interfaces and External Accessories

- **Interfaces and External Accessories**
  - 100M Ethernet RJ-45 port (powered by the DM9000 network chip)
  - 3 serial ports
  - USB Host port
  - USB Slave B port
  - SD card interface
  - Single stereo audio output and single microphone interface
  - 2.0mm 10 pin JTAG interface
  - 4 USER LEDs
  - 6 USER Buttons (with leads to block)
  - PWM buzzer
  - Adjustable resistor, for AD conversion
  - AT24C08 chip with I2C Bus, for I2C Bus test
  - 2.0 mm 20pin video camera interface
  - Onboard real-time clock backup battery
  - 5V power supply interface, with power switch and led
- **System Clock Source**
  - 12M passive crystal oscillator
- **Real-Time Clock**
  - RTC with lithium battery backup
- **Extended Interfaces**
  - 34 pin 2.0mm GPIO port
  - 40 pin 2.0mm system bus interface

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1.3.4 OS Support

The MINI2440 development board currently supports Linux 2.6.29 and WinCE.NET 5.0.

1.3.4.1 Linux Features

- **Kernel Version**
  - Linux 2.6.29
- **File Systems**
  - YAFFS2
  - CRAMFS
  - EXT2
  - FAT32

  - NFS
- **Drivers (all open source)**
  - Drivers for 3 serial ports
  - DM9000 driver
  - Audio driver (UDA1341) (audio recording supported)
  - RTC driver
  - User LED driver
  - USB host driver
  - True color LCD driver (including 1024 x 768 VGA)
  - Touch screen driver
  - USB camera driver
  - Drivers for USB mouse, keyboard, flash drive and portable hard disk
  - SD card driver, supports maximum memory of 32 G
  - I2C-EEPROM driver
  - PWM buzzer driver
  - LCD backlight driver
  - A/D converter driver
  - Watchdog driver (watchdog reset is cold reset)
- **Linux Applications and Utilities**
  - Busybox1.13 (Linux tool kit including basic Linux commands)
  - Telnet, FTP and inetd (remote login tool)
  - BOA (web server)
  - Madplay (console based mp3 player)
  - Snapshot (console based screen print tool)
  - ifconfig, ping, route and so on (basic network commands)
- **Graphic User Interface (Open Source)**
  - Qt/Embedded 2.2 (x86 and arm)
- **Qtopia Test Utilities (developed by FriendlyARM, not open source)**
  - A/D conversion test tool
  - LED test tool
  - User button test tool
  - I2C-EEPROM read/write test tool
  - LCD test tool
  - Ping test tool
  - USB camera live preview and picture taking
  - Audio recorder
  - Web browser
  - Watchdog test tool
  - Network configuration tool
  - Backlight control tool
  - Language setting tool (English and Chinese)
  - Handwriting tool (for touch pen testing)
  - MMC/SD card and flash drive auto mounting and unmounting

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1.3.4.2 WinCE Features

- **Version**
  - Windows CE.net 5.0
- **Features**
  - DM9000 driver source code
  - Drivers for USB keyboard, mouse, flash drive and portable hard disks
  - Drivers for 3 serial ports
  - USB ActiveSync
  - Audio driver
  - SD card driver
  - RTC clock
  - Registry archive
  - Power-down data save in flash drive
  - Screen rotation
- **Default System Options (Simplified Chinese System)**
  - XP screen
  - Windows Media Player 9.0 (supporting mp3, mpeg2, mpeg4, wma, wav and so on)
  - Super player (video player)
  - Picture browser and word pad
  - IE6
  - FTP, TELNET and HTTPD
  - Serial port assistant

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1.3.5 Additional Resources

Please refer to Appendix A for the resources included in the shipped CD and Appendix B for the device schematics.

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Chapter 2 Getting Started

2.1 System Setup and Configurations

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2.1.1 Boot Options

You can select the booting mode by toggling the S2 switch:

When toggling the S2 switch to the "Nor Flash" side the system will boot from on board Nor Flash. When toggling the S2 switch to the "Nand Flash" side the system will boot from on board Nand Flash.

This board is shipped with the switch toggled to the Nand Flash side by default it will boot from Nand Flash. Both its Nor Flash and Nand Flash have been installed an identical BIOS (which supports both types of Flash. The only difference is that the system will have different startup windows).

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2.1.2 Connecting Peripherals

- Connect the MINI2440 board's serial port to a PC's serial port with the shipped serial cable in the package
- Connect the MINI2440 board's Ethernet interface to a PC with the shipped crossover cable
- Connect the shipped 5V power supply adapter to the 5V power supply interface on the board
- Connect a headphone or speaker to the audio input(green) on the board
- Connect an LCD touch panel (if the user has one) to the LCD interface on the board following the data bus' arrow.
- Connect the MINI2440 board to a PC with a USB cable.

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2.1.3 Setting up Super Terminal

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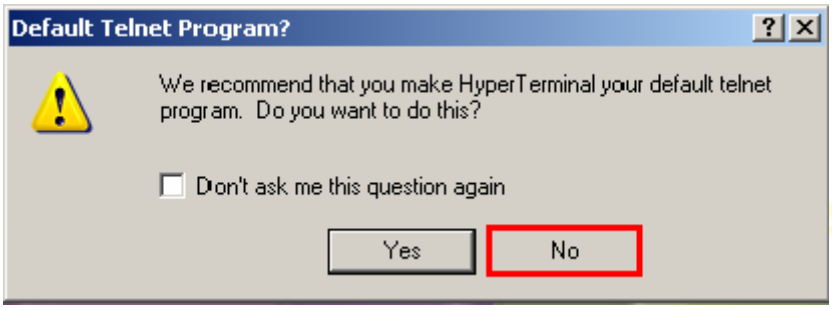
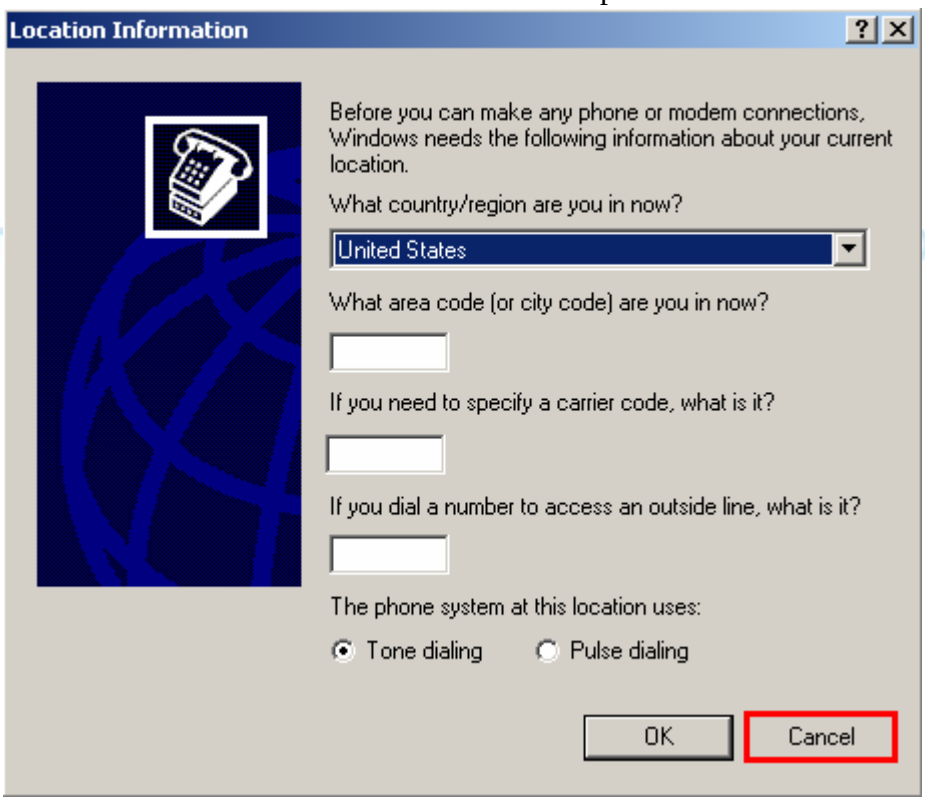
To connect the MINI2440 board to a host PC via a serial cable, you should use a simulated terminal. There are many tools available. A most widely used one is the MS-Windows' super terminal. In Windows9x, you need to install it by checking that option during installation. Windows2000 and later versions already have it installed by default. We used the super terminal in Windows XP in all our examples in this manual (Other versions of super terminal might have different user interfaces). Go to "Start" -> "All Programs" -> "Accessories" -> "Communications".

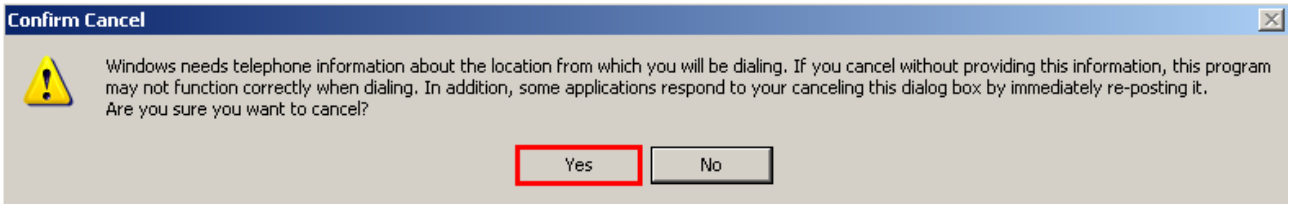
Click on “Hyper Terminal” and a Window will pop up as below. Click on the “No” button

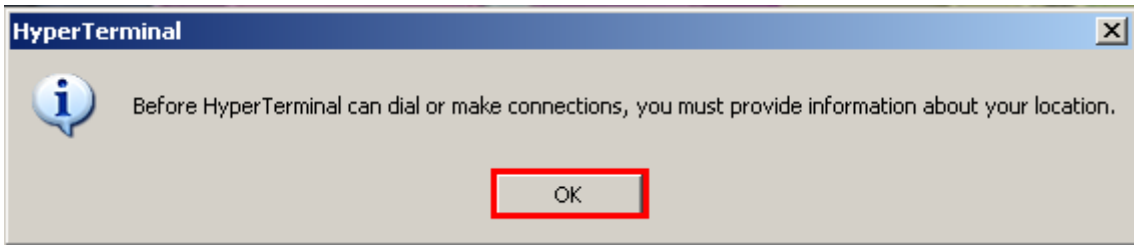


Click on the “Cancel” button on the following window

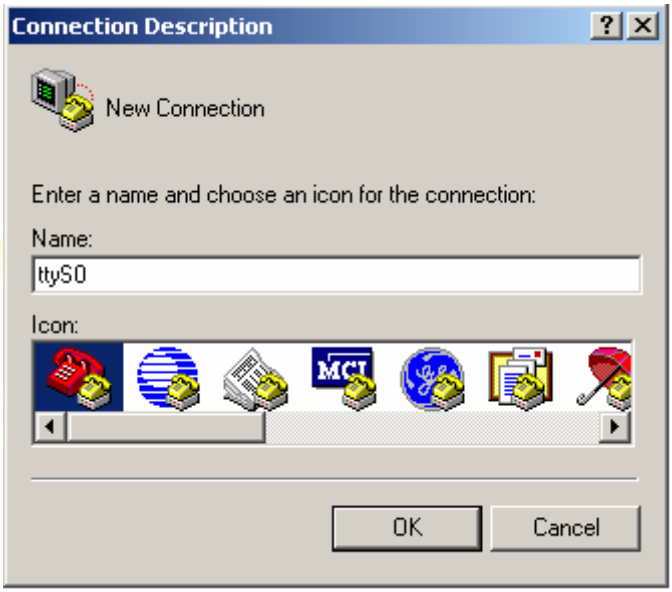
Click on the “Yes” button and the “OK” button to the next step







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.



After naming this connection another window will require you to select a serial port that will be used to connect the MINI2440 board. Here we selected COM1:

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.

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

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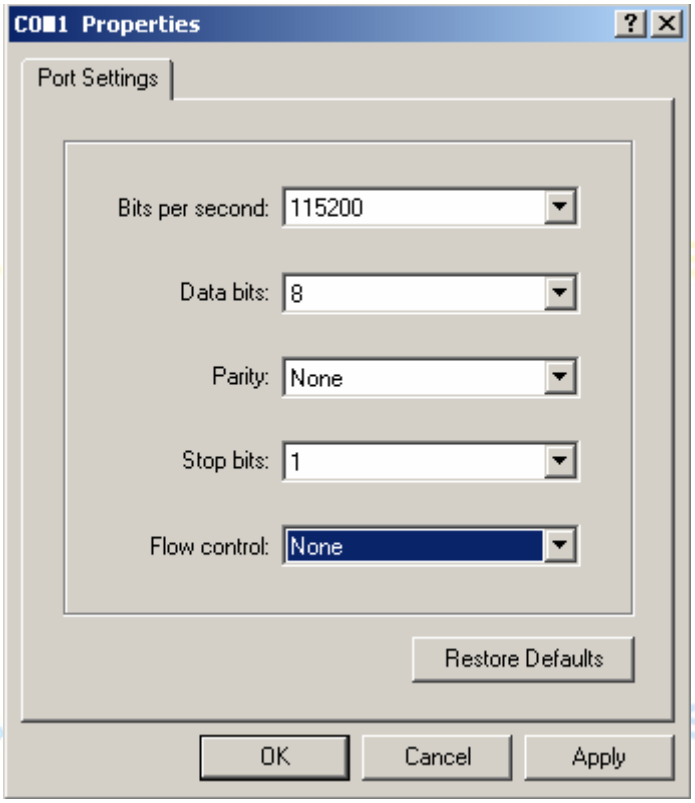

2.2 Power Up

2.2.1 Entering BIOS

The board is shipped with a preinstalled SUPERVIVI in Nor Flash. When the system boots from Nor Flash it will enter the BIOS and in the meantime the green LED1 on the board will be flashing. The startup interface is as below:

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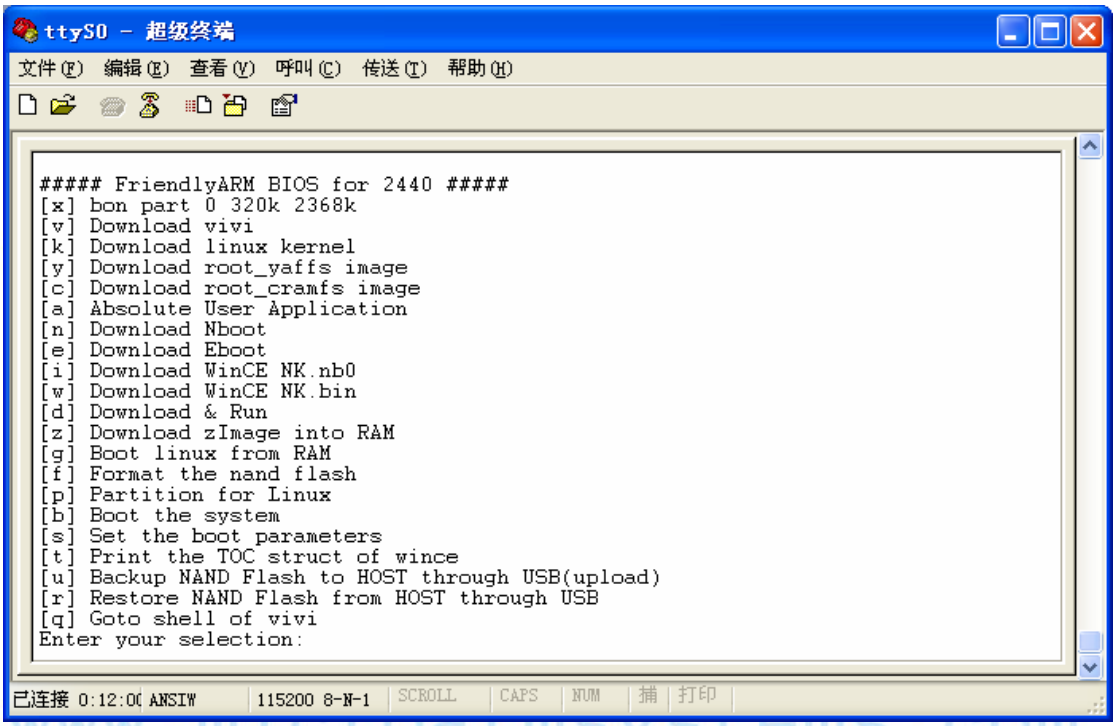

SUPERVIVI is developed and maintained by Friendly Arm, it is based on vivi. It starts with a function menu. And users can switch between supervivi's menu interface and command line.

Supervivi can be burned into the Nor Flash with JTAG or run from the Nand Flash. When it is burned into the Nor Flash and run, users will see its menu. When it is run from the Nand Flash it will start as command line (note: users need to press down and hold the space key in the super terminal on system startup otherwise the system will boot to its installed operating system). Supervivi is mainly for software burning and debugging, and can be used to partition flash drive. It downloads files via USB. It is easy to use and runs fast. When burning supervivi into the Nor Flash, you can easily update your Linux or WinCE system, or any other operating system that supports system boot from the Nand Flash and non OS programs to the Nand Flash such as uCos2, U-boot, Nboot, 2440test and so on, and then reboot system from the Nand Flash to enjoy your programs. When burning supervivi to the Nand Flash, it will self detect your operating system and start it. In addition, with its "Down & Run" function, you can download programs to RAM and run them. This features software debugging such that you don't need a simulator. The 2440test utility in the shipped CD is such a good example.

With supervivi, you can download the Linux kernel image zImage into RAM and run it. You can even start your system via network by setting up the network boot parameters in supervivi. Similarly, you can download the WinCE kernel image NK.nb0 to RAM and run it too.

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2.2.2 Installing USB Driver

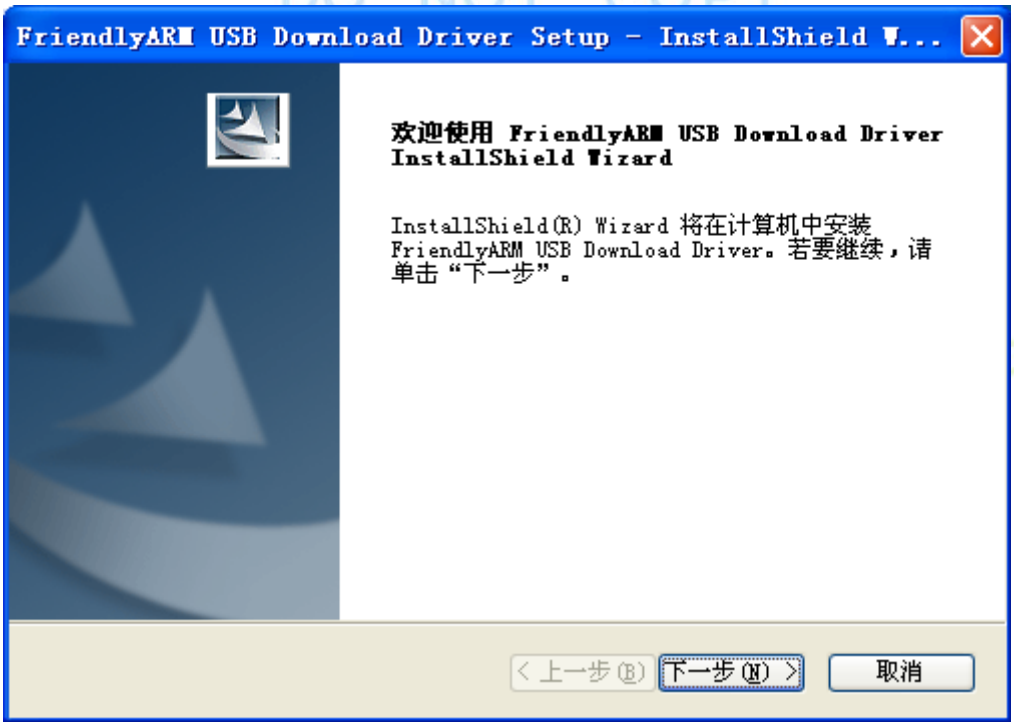
Note: the driver installed here can only work for a USB connection in the BIOS mode. It should work in conjunction with the dnw.exe executable. After the system enters Linux or WinCE, the

driver will no longer be used.

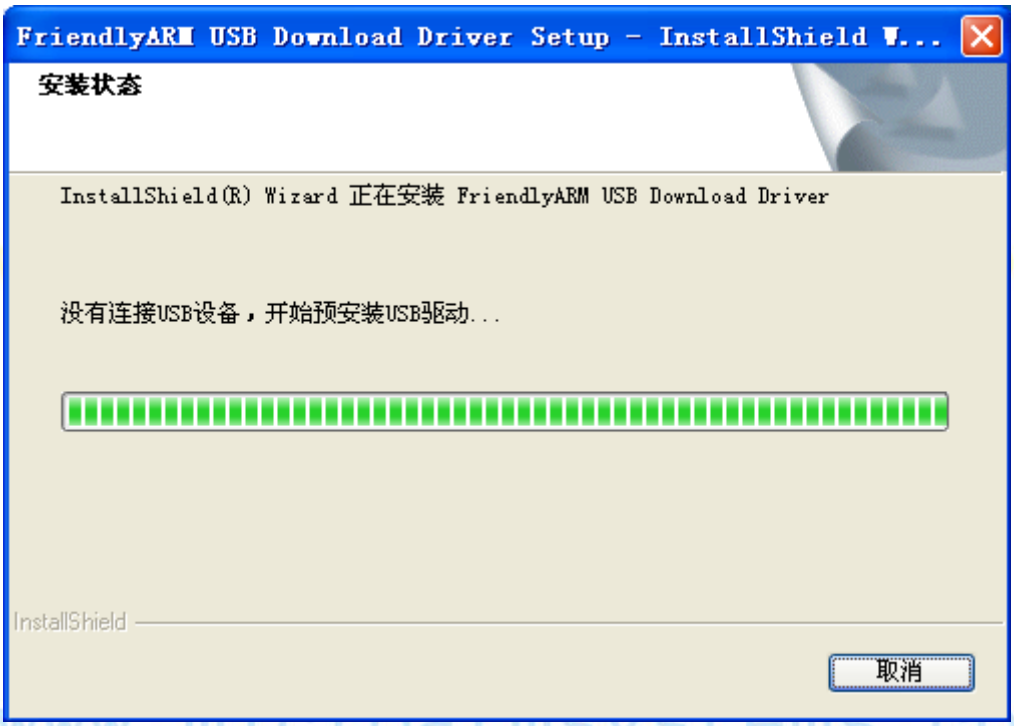
Installing this USB driver doesn't need to connect to a board. It is just for the PC system.

Open the shipped CD, double click on "**windows 平台工具\usb 下载驱动\ FriendlyARM USB Download Driver Setup_20090421.exe**" to start installing.

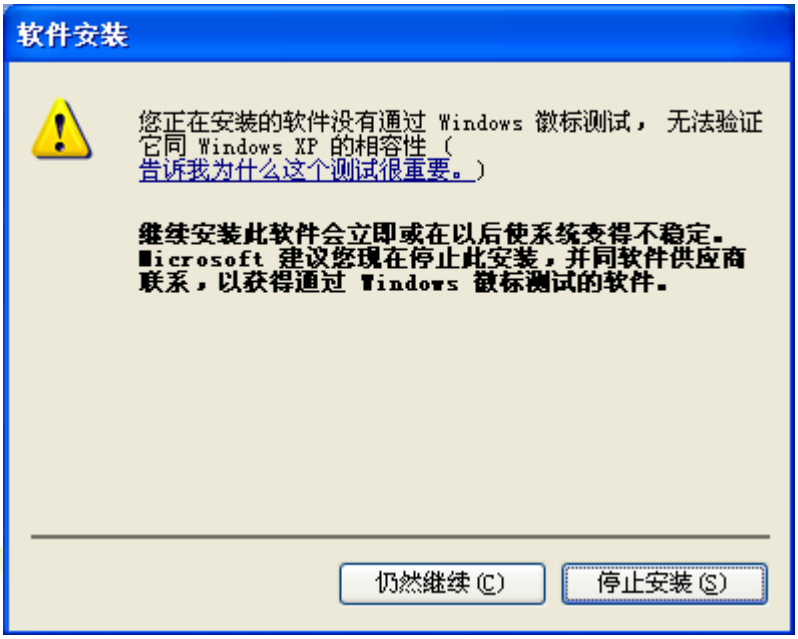
The following window will show up:



Click on ("Next")the middle button.



A warning message will pop up



Click on the (“continue anyway”) the left button to finish the installation.

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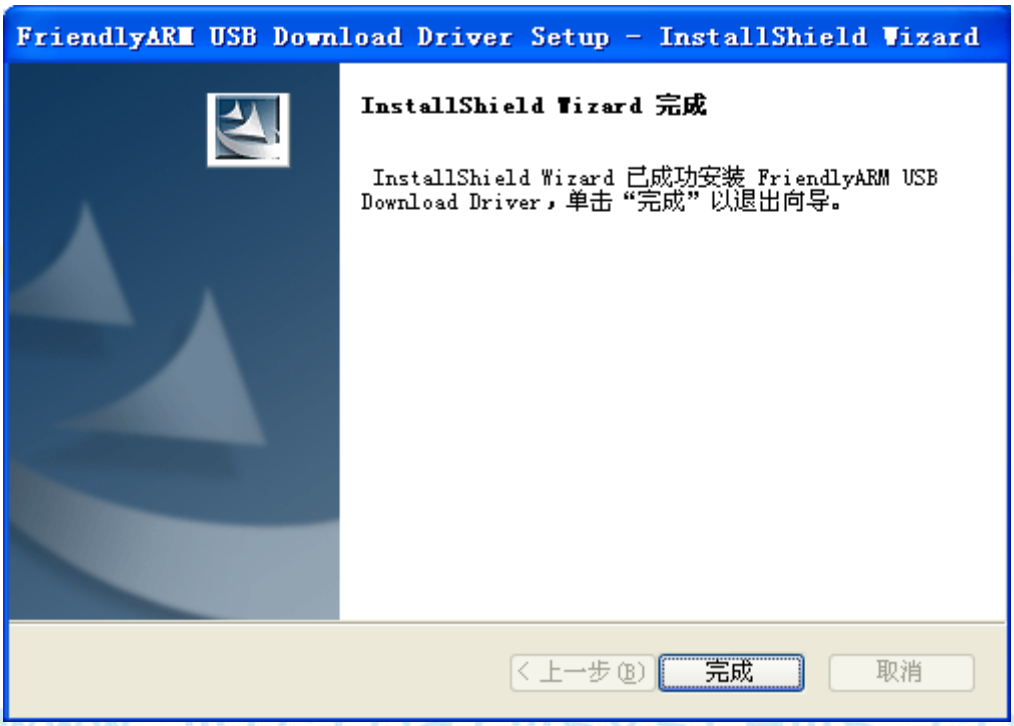
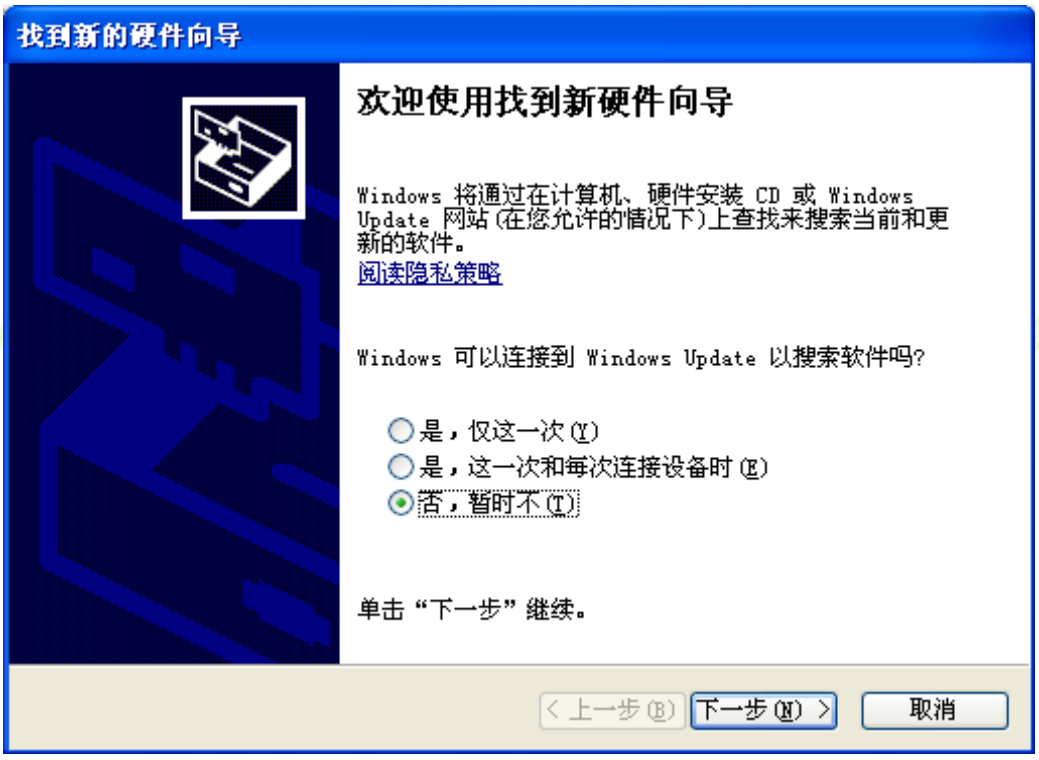


Now let’s test the USB connection:

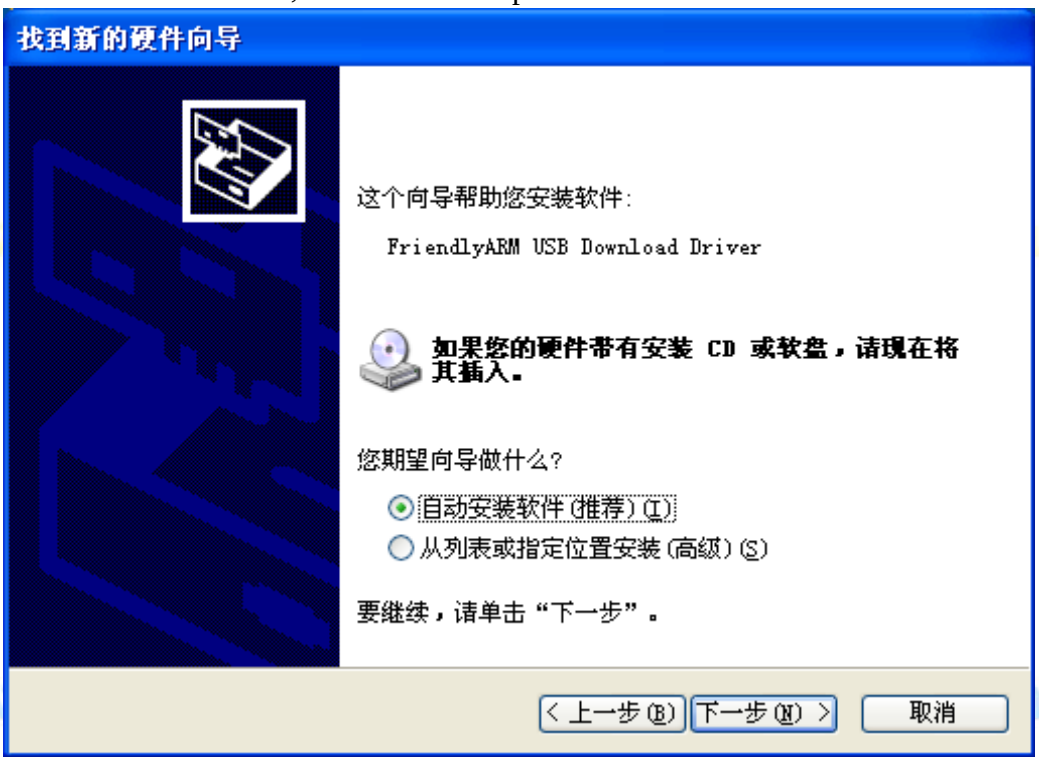
Connect the MINI2440 board to a host PC via a USB cable. Toggle the S2 switch to the “Nor Flash” side.

Turn on the S1 switch, if this is the first time you connect, Windows XP will prompt that a new USB device is found. Follow the steps below to install a USB driver:

(1) After the following window pops up, check the third option and click on the “Next” button



(2) On the window shown below, check the first option and click on the “Next” button



On the following popup window, click on the left button (“Continue anyway”).

So far, our installation is done.

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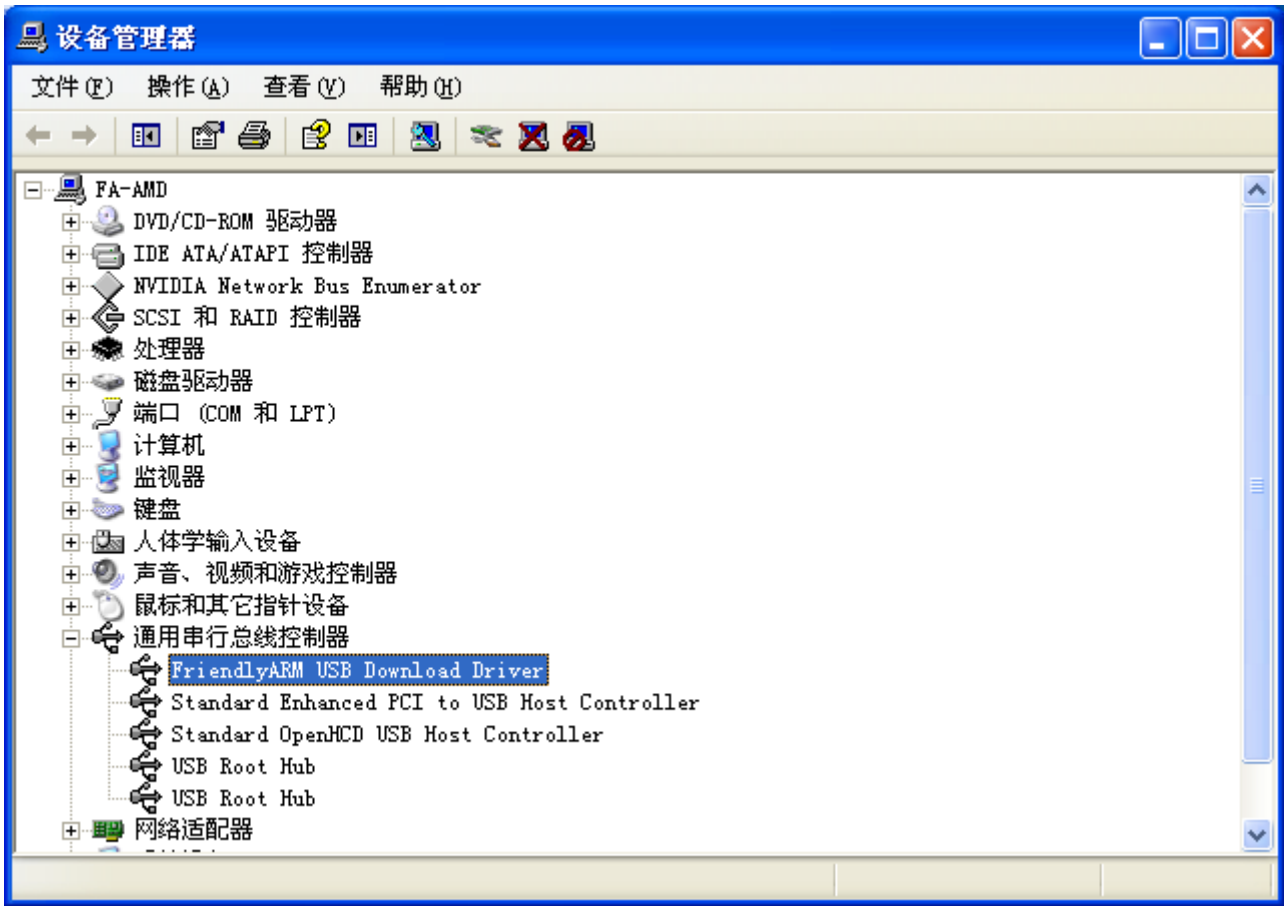
Open the shipped CD, click on the dnw.exe, if you can see “USB:OK”, this means the installation is a success.

In the device manager, you will see the installed USB driver information:



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2.2.3 Entering Main Menu

Note: the following programs that are downloaded via USB need to run together with the DNW application.

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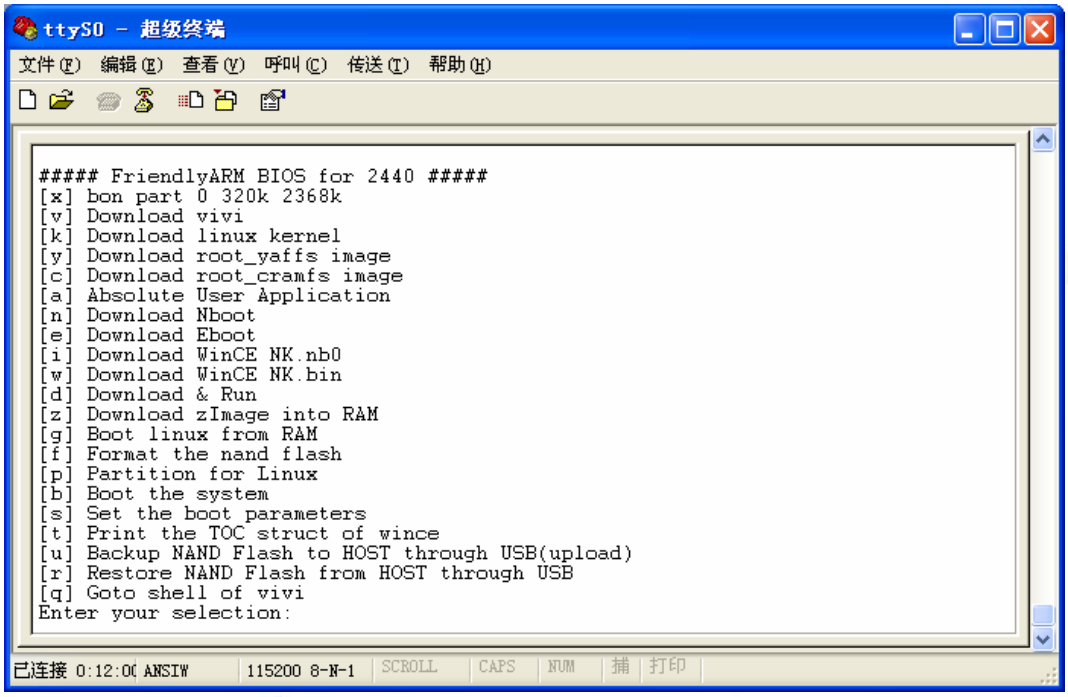

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Item**[x]:** Partition Nand Flash with a default setting, it is the same as executing command: bon part 0 320k 2368k

Item**[v]:** Download a linux bootloader vivi to the vivi partition of Nand Flash via USB

Item**[k]:** Download a linux kernel to the kernel partition of Nand Flash via USB

Item**[y]:** Download an image of the yaffs file system to the root partition of Nand Flash via USB

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Item**[c]:** Download an image of the cramfs file system to the root partition of Nand Flash via USB

Item**[a]:** Download a user application to Nand Flash via USB, usually it is a bin file, such as “2440test”, uCos2(our shipped uCos2 supports booting from Nand Flash), U-Boot and other bin programs.

Item**[n]:** Download a WinCE’s bootloader Nboot to block0 of Nand Flash via USB

Item**[e]:** Download a WinCE’s bootloader Eboot to the Eboot partition of Nand Flash via USB

Item**[i]:** Download an image of WinCE NK.nb0 to Nand Flash via USB

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Item**[w]:** Download an image of WinCE NK.bin to Nand Flash via USB

Item**[d]:** Download a program to a user defined address(via the DNW’s “Configuration” -> “Option” to define a download address) and run. The SDRAM’s physical address in this board is from 0x30000000 to 0x34000000, 64Mbytes. The BIOS takes all the address space above 0x33DE8000, so the user defined address should be between **0x30000000 and 0x33DE8000**.

Item**[z]:** Download a linux kernel zImage to RAM via USB. The download address is 0x30008000.

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Item**[g]:** Boot linux from RAM. Item [z] should be executed before this.

Item**[f]:** Format Nand Flash. This command will format the specified address space of Nand Flash. The on board Nand Flash is 64Mbytes. Its address space is 0-0x4000000. You can format one partition or the whole Nand Flash. The partition table is as follows:

Partition Table

Type “f”, you will be prompted to type a starting address and a end address, this table presents the address space of each partition		
	Srarting Address	End Address
vivi partitions(block0-13)	0x0	0x50000
linux kernel partitions(block14-93)	0x50000	0x250000
file system partitions(block94-4095)	0x250000	0x4000000
complete address space of the Nand Flash(block0-4095)	0x0	0x4000000

Note：The on board Nand Flash has 4096 blocks，each block has 32 pages，each page has 512 bytes，the total size is: 4096 x 32 x 512 = 64M bytes

Item**[p]:** Partition Nand Flash, this is for Linux

Item**[b]:** Boot OS (either a Linux or a WinCE).

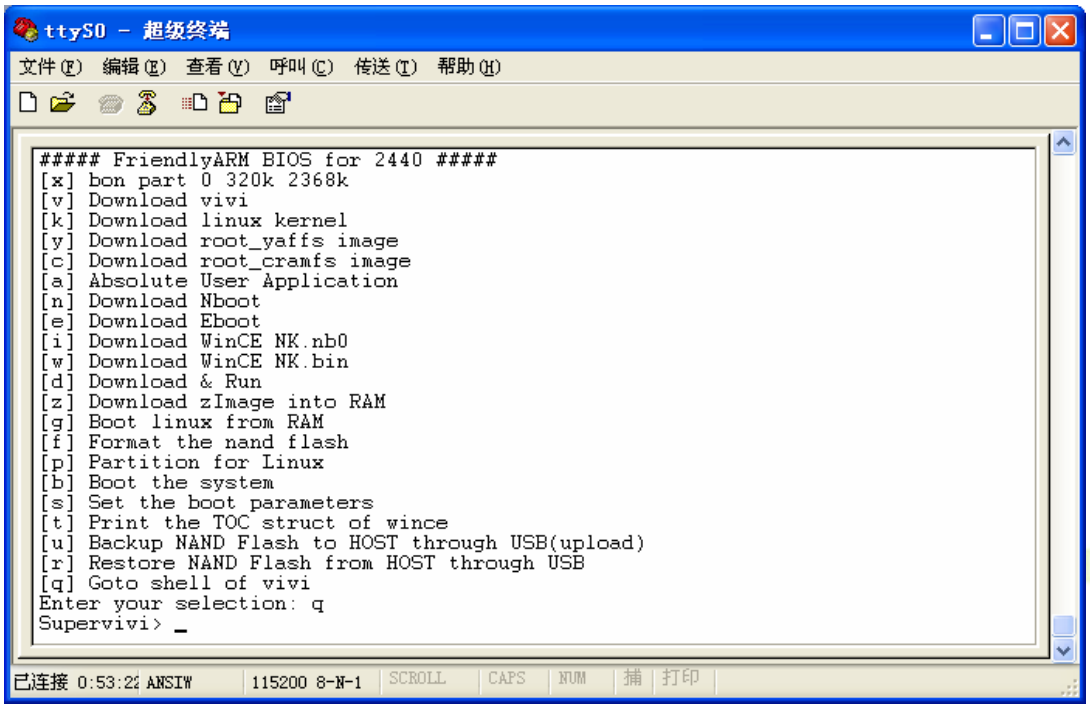
Item**[s]:** Set up Linux startup parameters

Item**[t]:** Print the TOC structure of WinCE (rarely used)

Item**[u]:** Backup Nand Flash data to a host PC via USB. This is similar to a Ghost tool commonly used in PCs.

Item**[r]:** Restore Nand Flash from a host via USB.

Item**[q]:** Return to the vivi shell



In the vivi shell, typing “menu” can return to the main menu.

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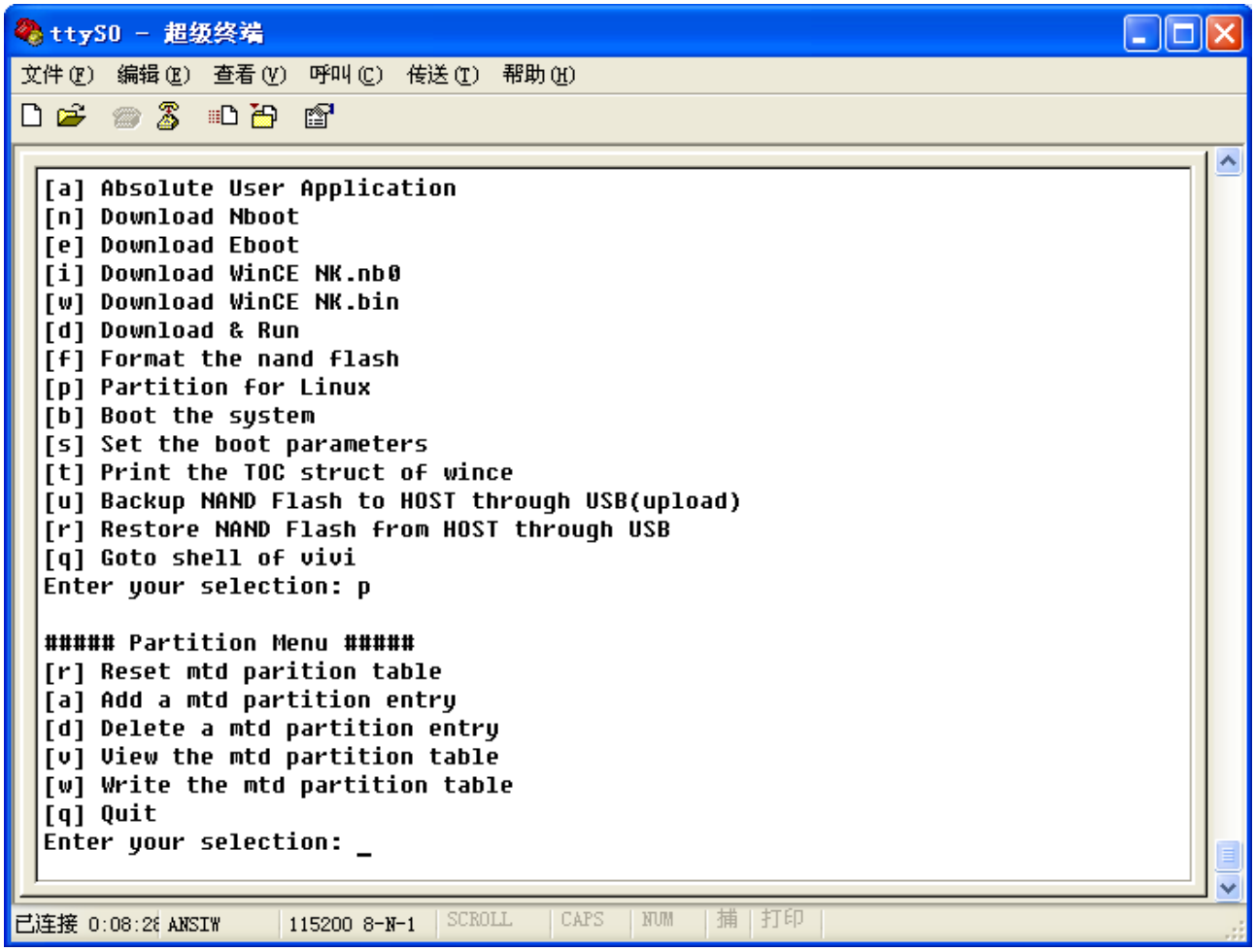
2.2.4 Sub Menus

This section will briefly introduces some submenu functions

Type “p” to enter the interface shown below:



(1) browsing partitions

Type “v” to browse the current partition table, which is stored in the Nand Flash. If the Nand Flash has no data, it will show the default BIOS partition table.

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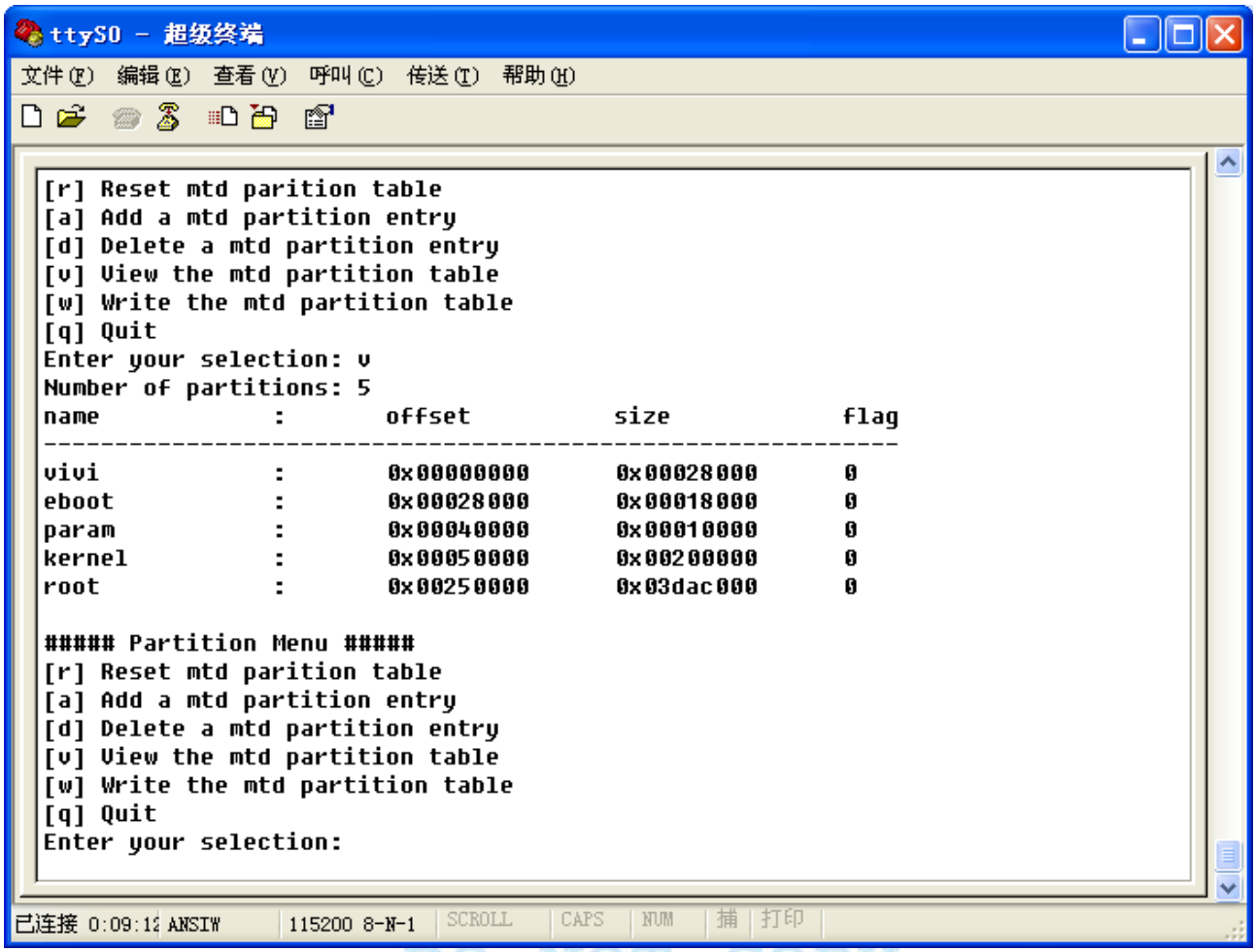

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(2) deleting partitions

Type “d”, it will prompt you to enter the partition’s name you want to delete, e.g. “vivi” if you want to delete the vivi partition

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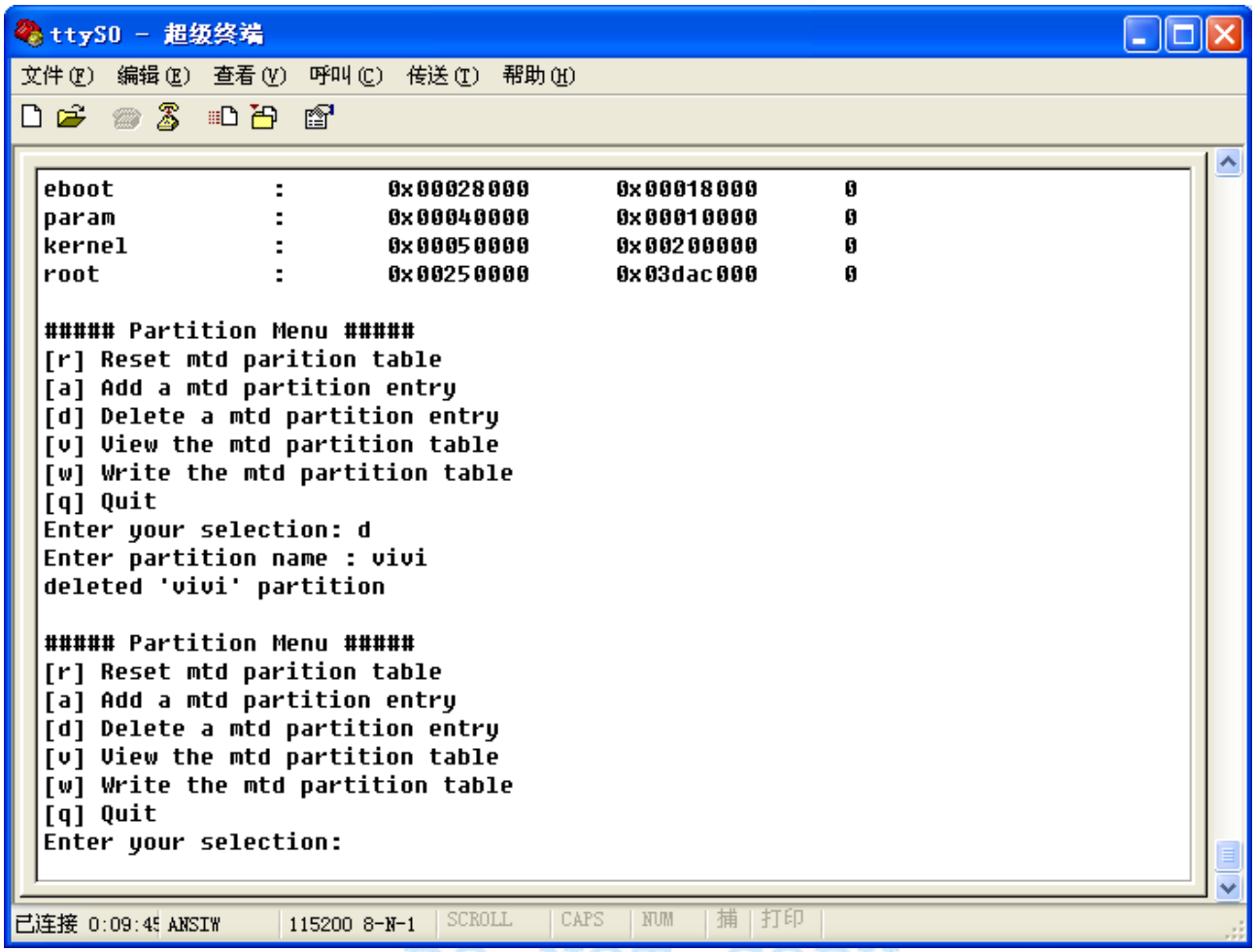

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(3) saving configurations

Type “w” to save the current configuration. For instance, if you just deleted the vivi partition without saving it, next time when you browse the partition, it will still exist.

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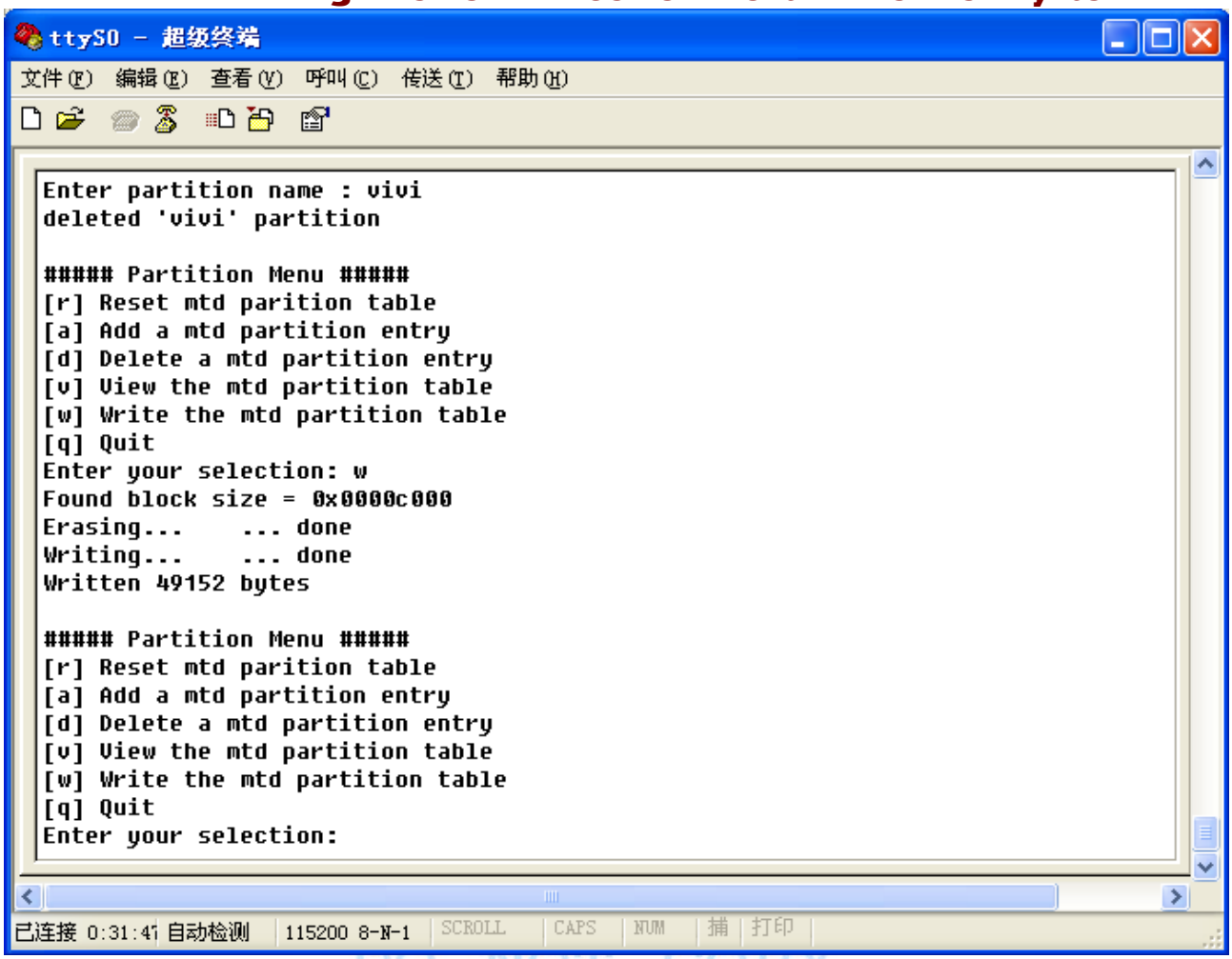

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(4) adding partitions

Type “a”, it will prompt you to enter some basic information (such as name, offset, size and so on) of the partition you want to add. You can just follow its default options.

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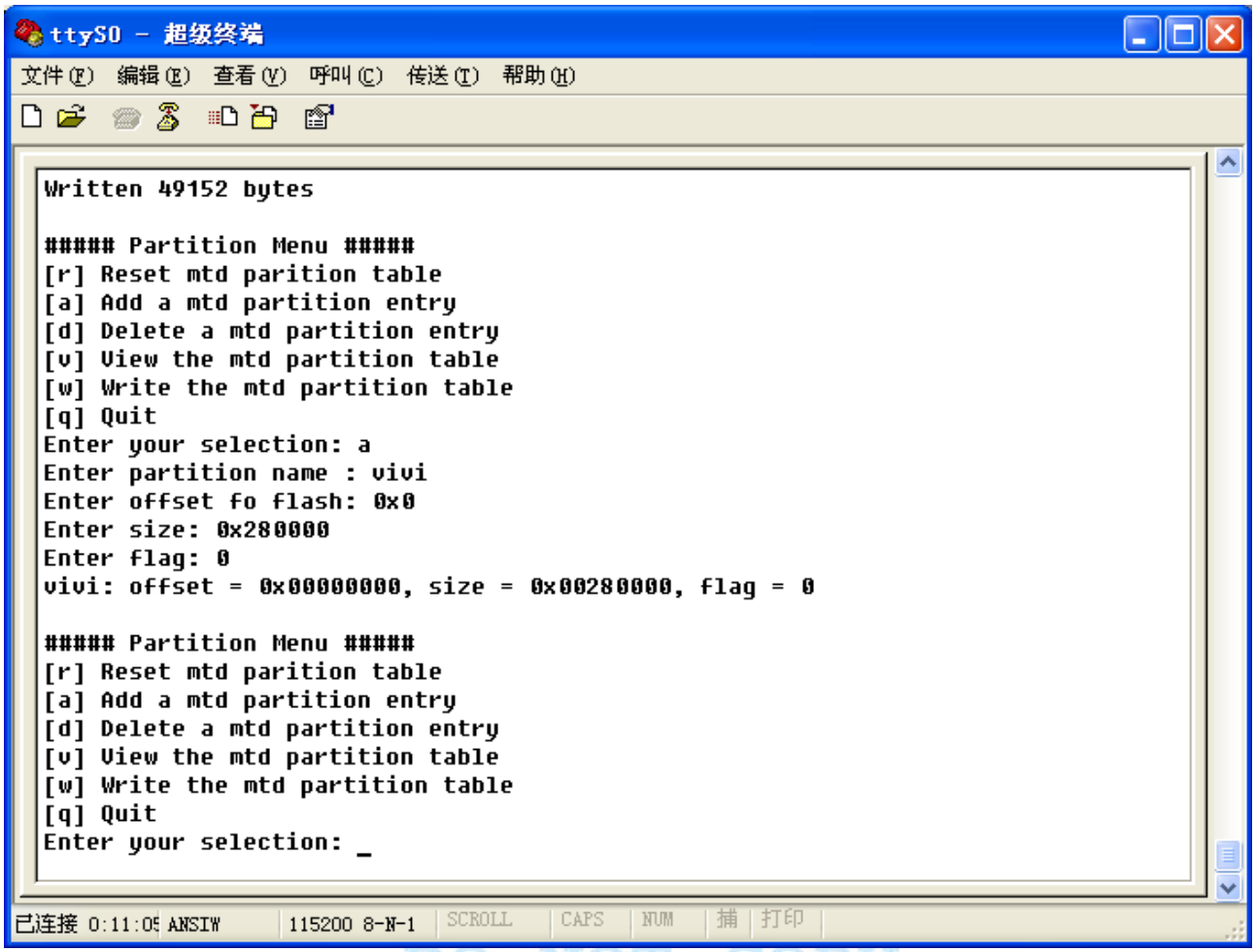

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(5) resetting partition table

Type “r” to import the BIOS partition table and the current table will be overwritten. When you delete your Linux partition table by mistake, this command will restore it. After restoring our Linux partition you need to enter “w” to save this result.

(6) returning to the main menu

Type “q” to return to the main menu

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2.2.5 Setting Linux Booting Parameters

Item [s] allows users to configure how Linux should be booted. Type [s] to enter its interface:

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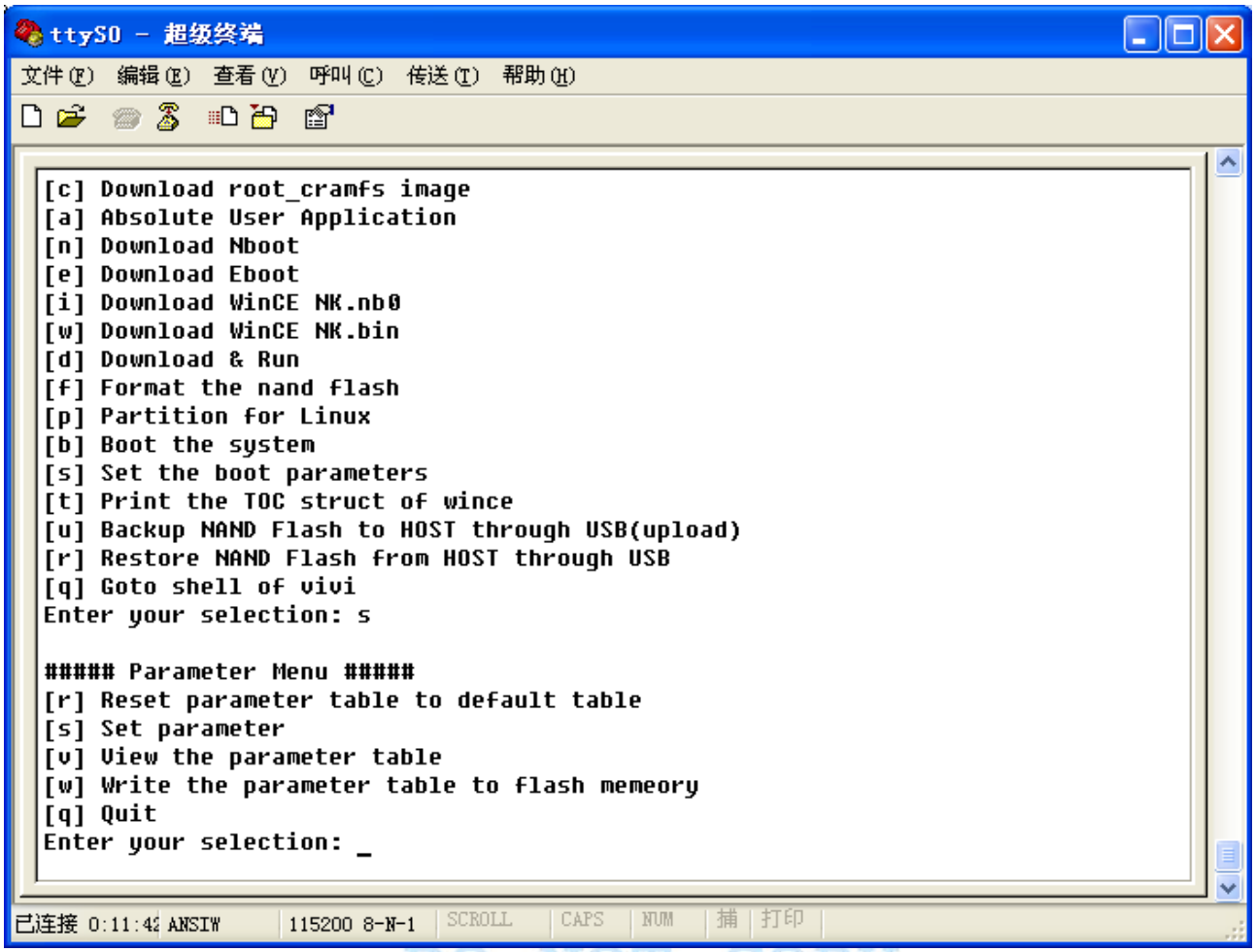

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(1) browsing current configuration

Type “v” to browse the current configuration:

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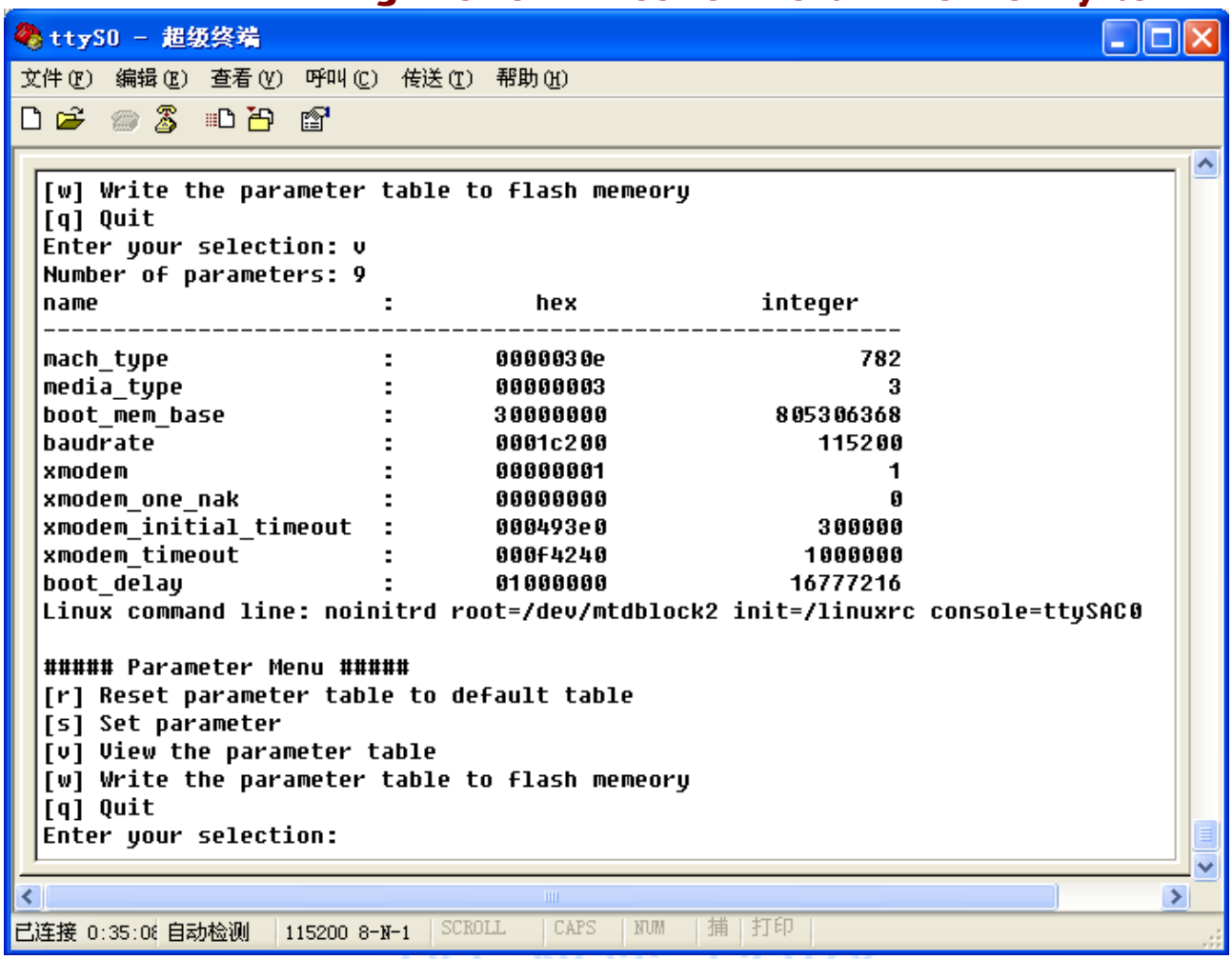

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(2) setting parameters

Type “s” to set parameters. There are two basic parameters (we don’t recommend to change other parameters):

- Match_type
- Linux command line

The default value for MACH_TYPE is 782. For instance, if your compiled kernel’s MACH_TYPE is 867, you can change this value to boot your kernel. Firstly you need to type the parameter name “mach_type”, then type the value “867”, and finally, type “w” to save your change.

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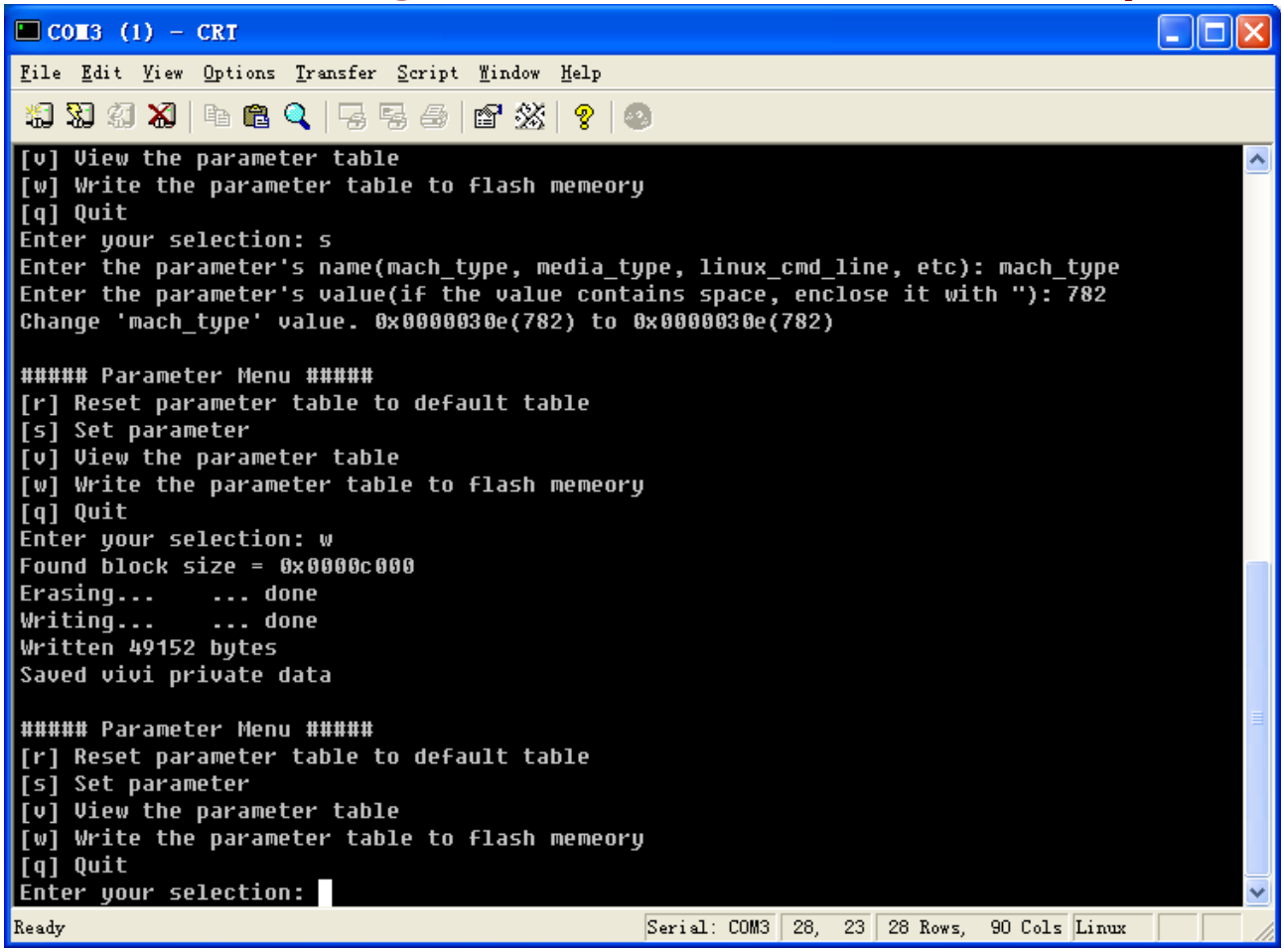

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Linux_cmd_line is another very important parameter, for example, to change the kernel boot information and change the login port to serial port 1 (the default serial port is 0), you can do it this way:

Linux_cmd_line：**noinitrd root=/dev/mtdblock2 init=/linuxrc console=ttySAC0**

Type “s”, then the name of the parameter “linux_cmd_line”, enter and then type the new value. Because the parameter string has spaces, it should be quoted:

“**noinitrd root=/dev/mtdblock2 init=/linuxrc console=ttySAC1,115200**”

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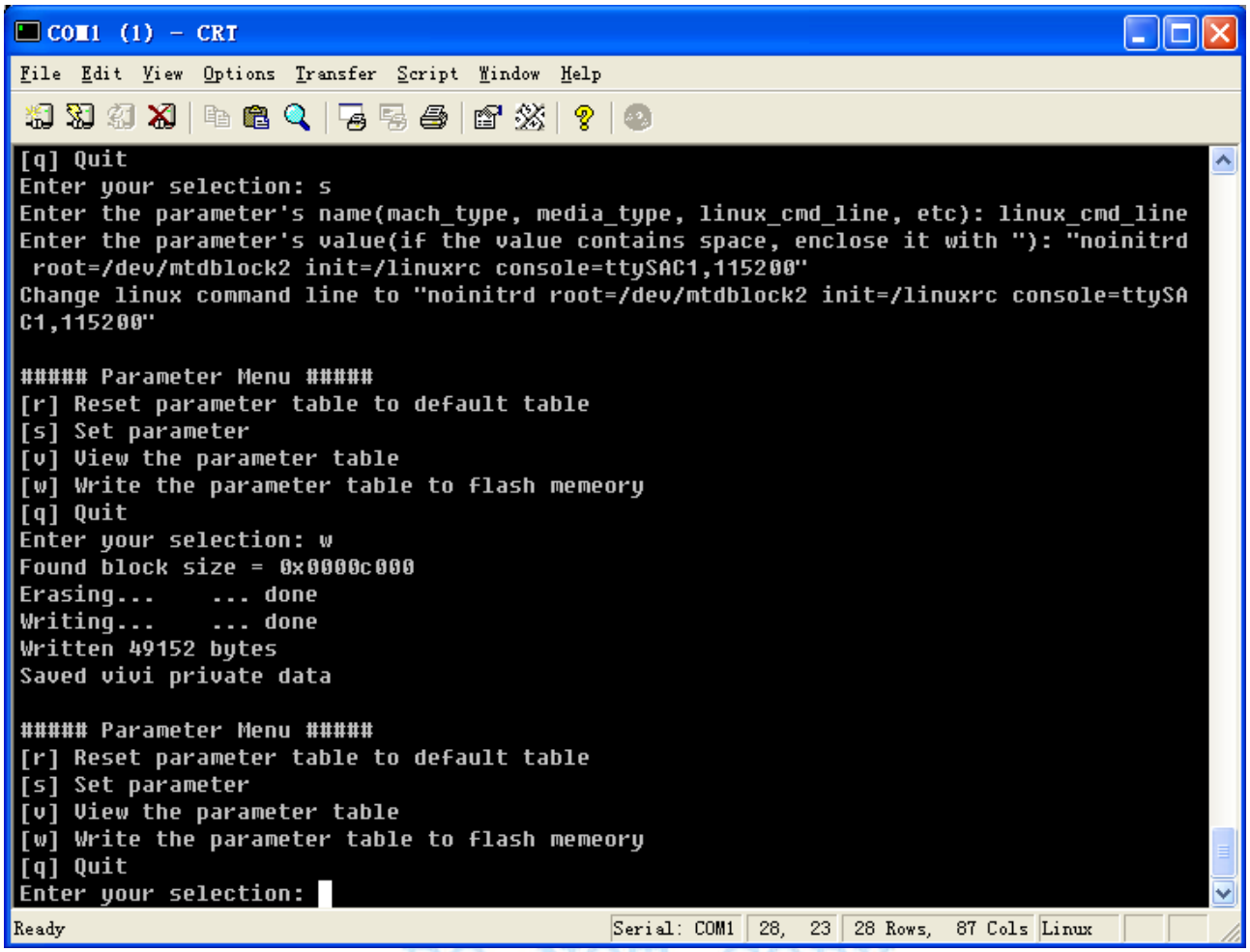

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Now when the system reboots, the booting and login messages will be output at serial port 1 and vivi's messages will still be output at serial port 0.

(3) Saving configuration

Type "w" to save the new setting.

(4) Restoring default value

Type "r" to restore the default kernel setting.

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(5) Returning to main menu

Type "q" to return to the BIOS main menu.

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2.3 Board Device Testing

This section basically tells how to test some external devices without entering the operating system.

Those devices include PWM buzzer, RTC real time clock, AD conversion, user test keys, touch screen, LCD, Infrared function, I2C bus, audio input/output and SD card.

2.3.1 Downloading Testing Utilities

The 2440test program is an independent utility. It is based on Samsung's 2440test utility. We just made some changes for easier use and better experience. In addition we compiled different executables for varied LCDs. Users can download it to RAM via USB and run it. The only difference among those executables is the default LCD output. But they all were compiled from the same source code, we just changed the setting "LCD_TYPE" in the header file "2440test\inc\Option.h".

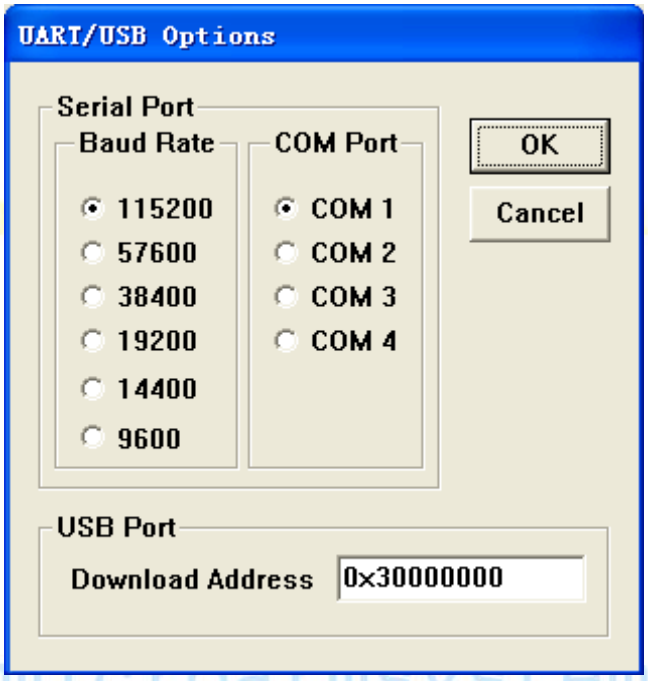
File Name	Notes	Memo
2440test_N35.bin	The default output is NEC3.5 inch LCD	But they all are compiled from the same source code, we give them a uniform name " 2440test.bin".
2440test_A70.bin	The default output is Innolux 7 inch LCD	
2440test_VGA1024x768.bin	The default output is VGA (resolution 1024 x 768 @ 70 Hz)	

In the "images\" directory of the shipped CD, you will find a "2440test.bin" and download it from the BIOS interface.

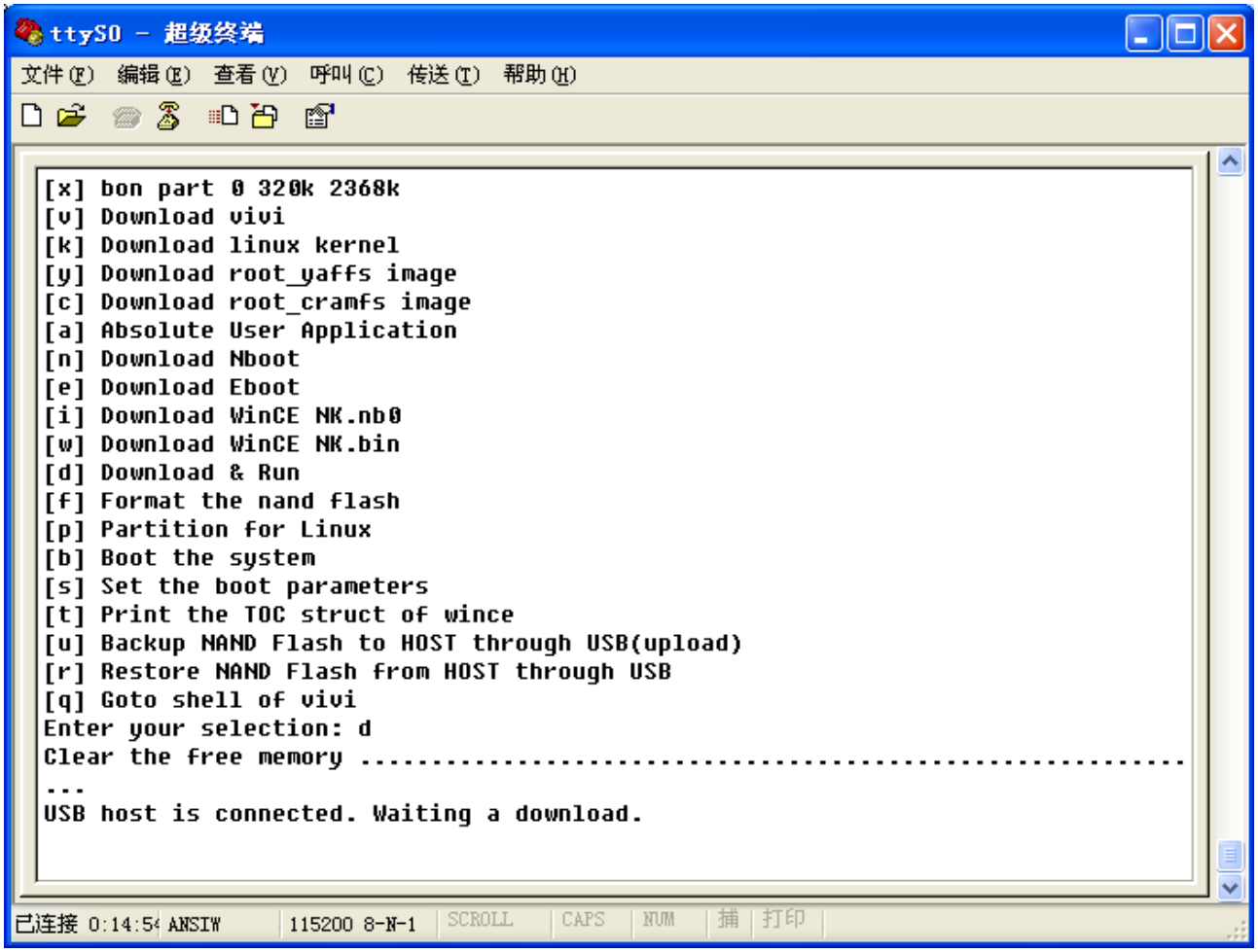
(1) Connect the target board to a power supply, a serial port cable, a USB cable and switch the S2 switch to the Nor Flash boot mode. Start a super terminal and the DNW, power on the board.

(2) Ensure the USB driver is installed, if so you will see [USB: OK] in the title bar of the DNW otherwise it will show [USB: x]

(3) Click on the “Configuration” menu, set the download address to “0x30000000”.

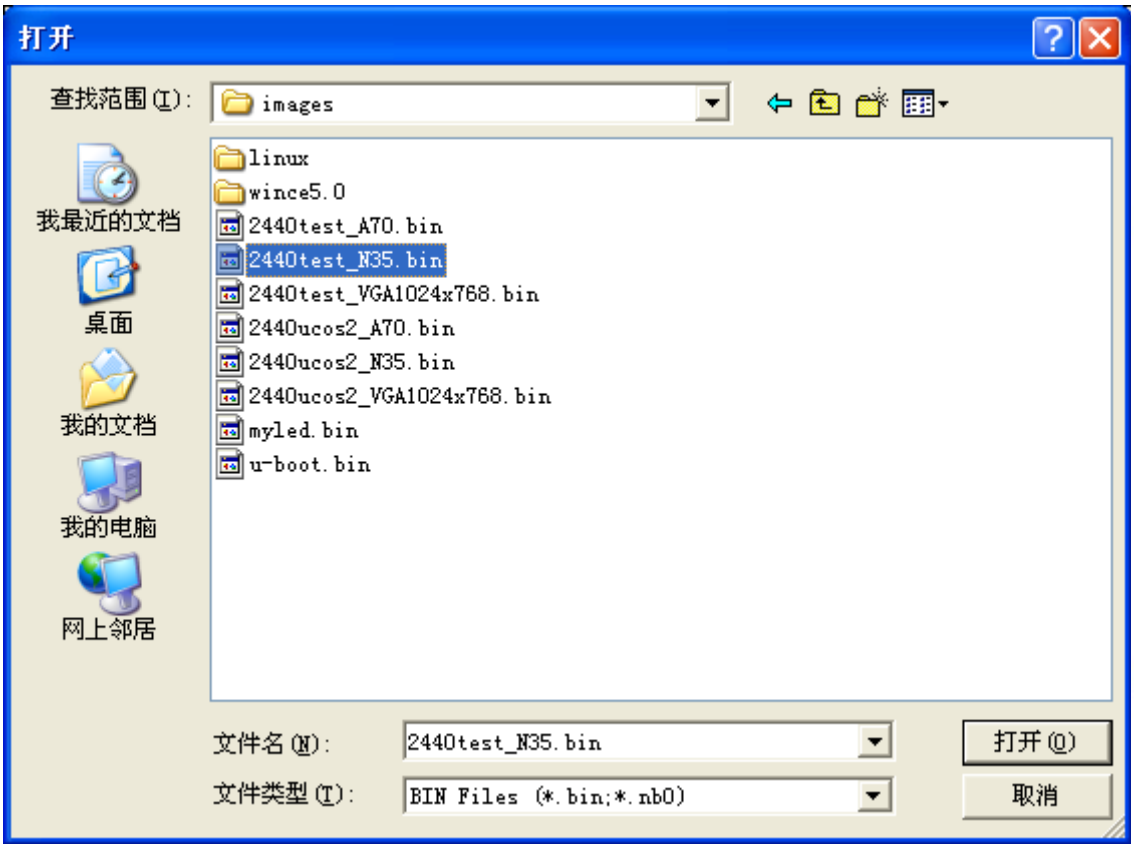


(4) Select item [d] in the BIOS menu, you will see the following screenshot.



(5) Click on “USB Port” -> “Transmit” on the DNW interface, select “2440test.bin,” and “open”

to begin download.



(6) When download is done, it will auto run, you will see the following screenshot

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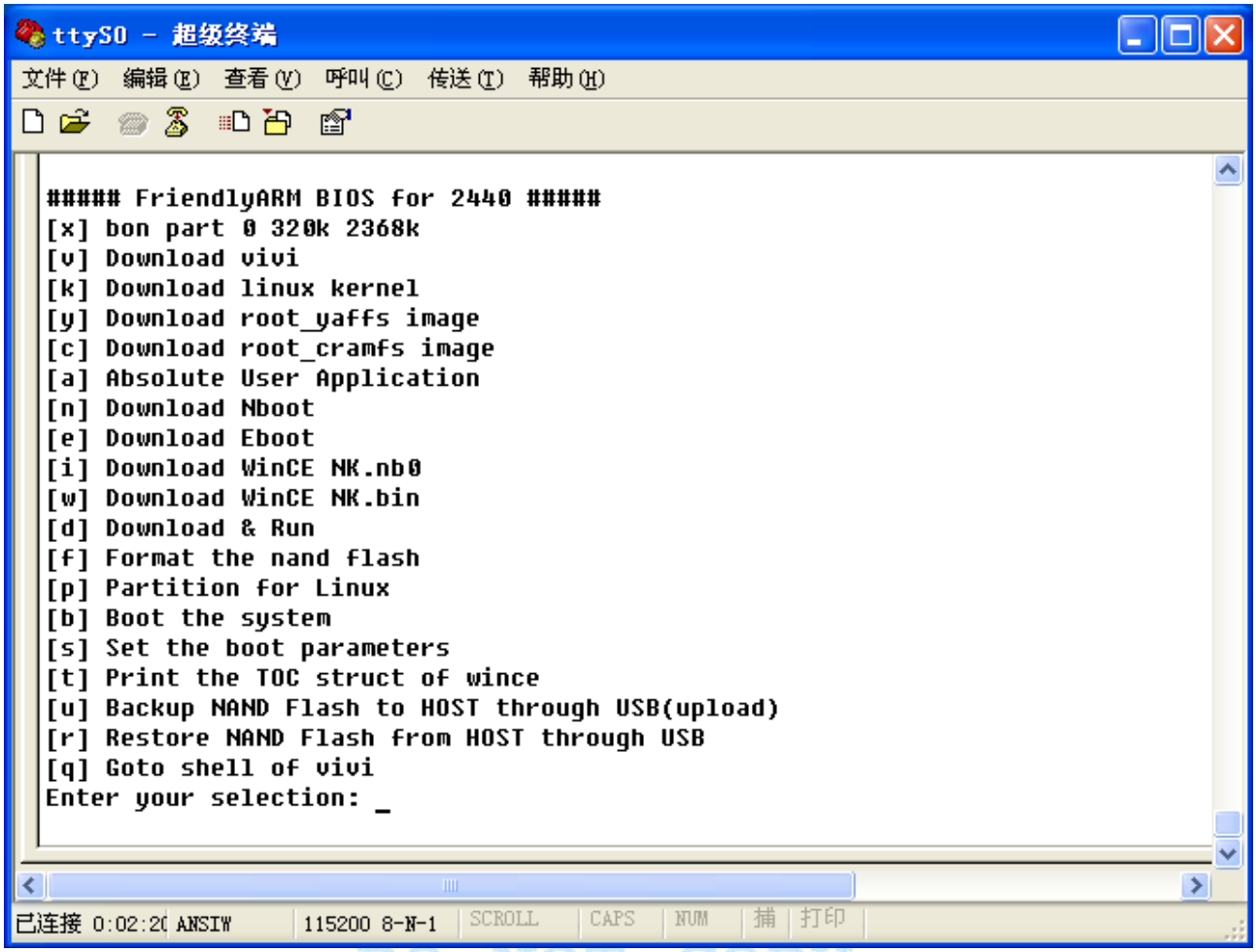

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Meanwhile, the LCD will show the following picture.

Note: when compiling the 2440test, you can set the “LCD_TYPE” in the header file “2440test\inc\Option.h” to choose the LCD type, but you cannot define more than one type value, here our default value is LCD_TYPE_N35, i.e. NEC3.5 inch true color screen.

The header file 2440test\inc\Option.h has the following definitions:

#define LCD_TYPE_N35 1; NEC3.5 inch true color
#define LCD_TYPE_A70 2; 7 inch true color
#define LCD_TYPE_VGA1024x768 3; VGA module, resolution: 1024x768 @70Hz
#define LCD_TYPE LCD_TYPE_N35

If you use the default value, you will see:

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If the default setting is 7 inch LCD, you will see the following screenshot:

If the default setting is VGA, you will see the following screenshot:

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2.3.2 Device Testing

After installing the test utility, you can perform the MINI2440 device testing.

(1) Testing PWM

In the main menu, type “1”, enter and you will hear the sound of the PWM buzzer

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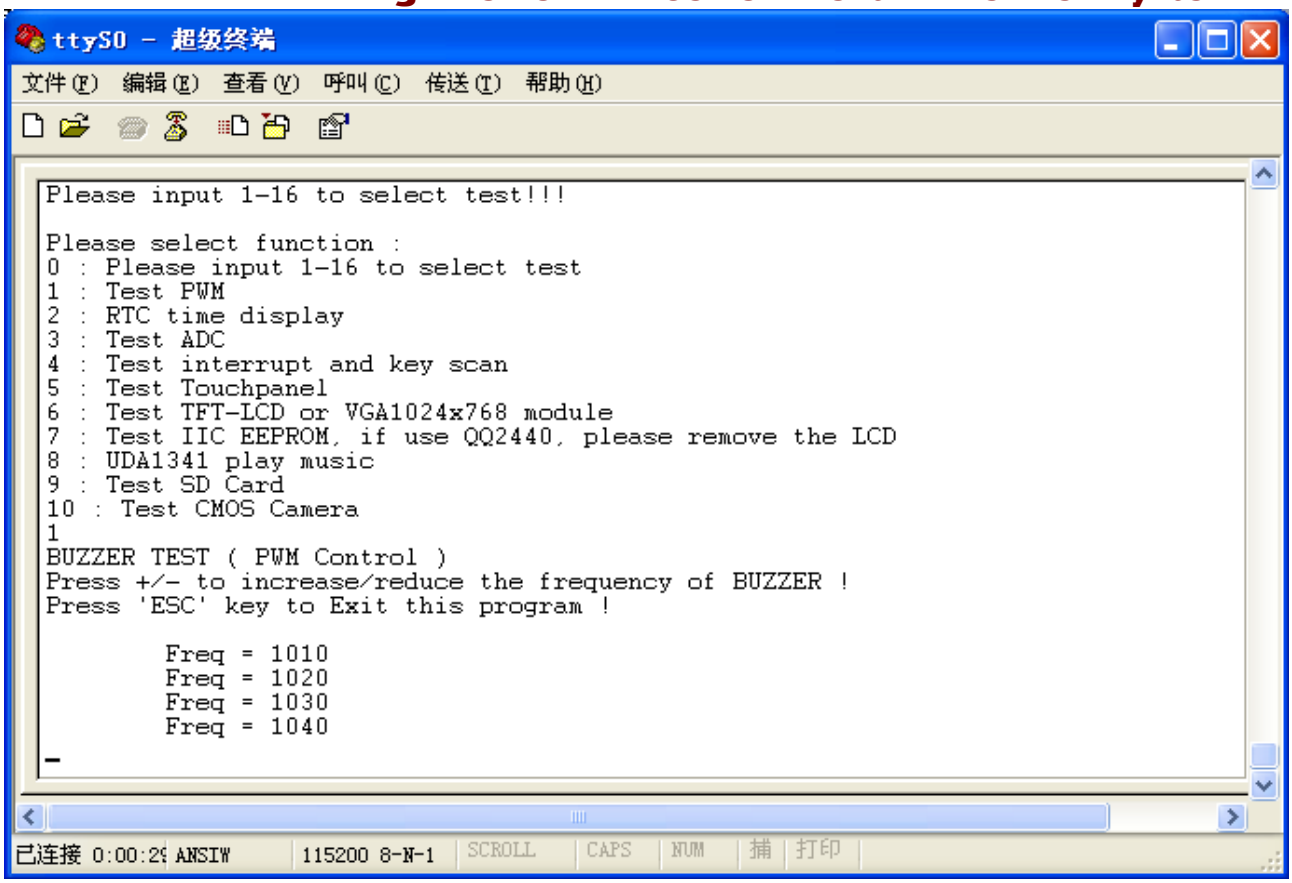

Press the "-" key, the buzzer's frequency will decrease, press the "+" key; the frequency will increase; press the "ESC" key, you will exit the test and return to the main menu.

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(2) RTC real time clock

In the main menu, select "2", enter and you will see the clock is changing which means the CPU's RTC works normally (note: the time the clock shows is not the current time, it is initialized by the test utility)

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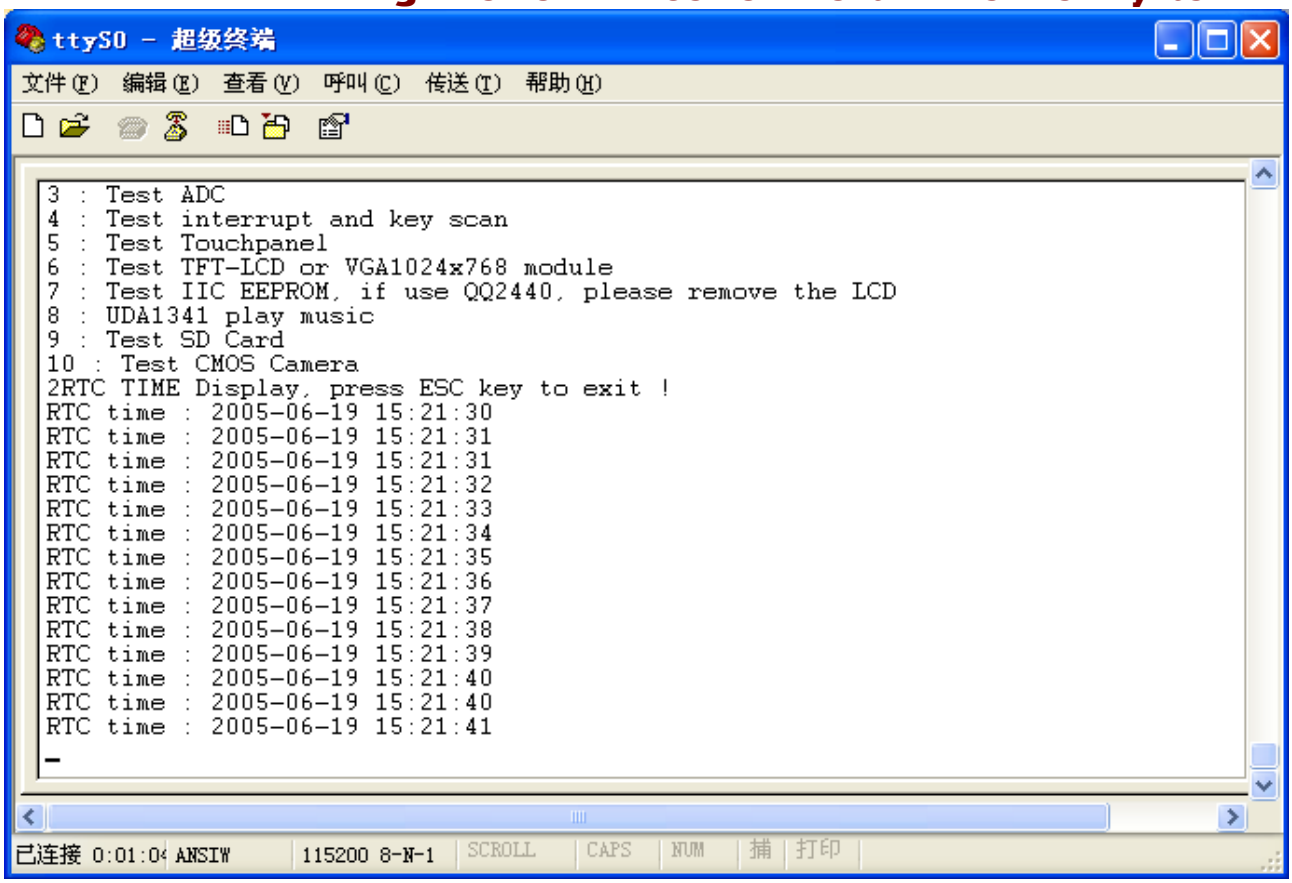

Press the “ESC” key you will exit the test and return to the main menu.

(3) Testing AD conversion

In the main menu, select “3” and enter to test AD conversion. You can use a screw driver to adjust the W1 or W2 (these two adjustable resistors are connected to AIN0 and AIN1) and will see the AD value is changing accordingly.

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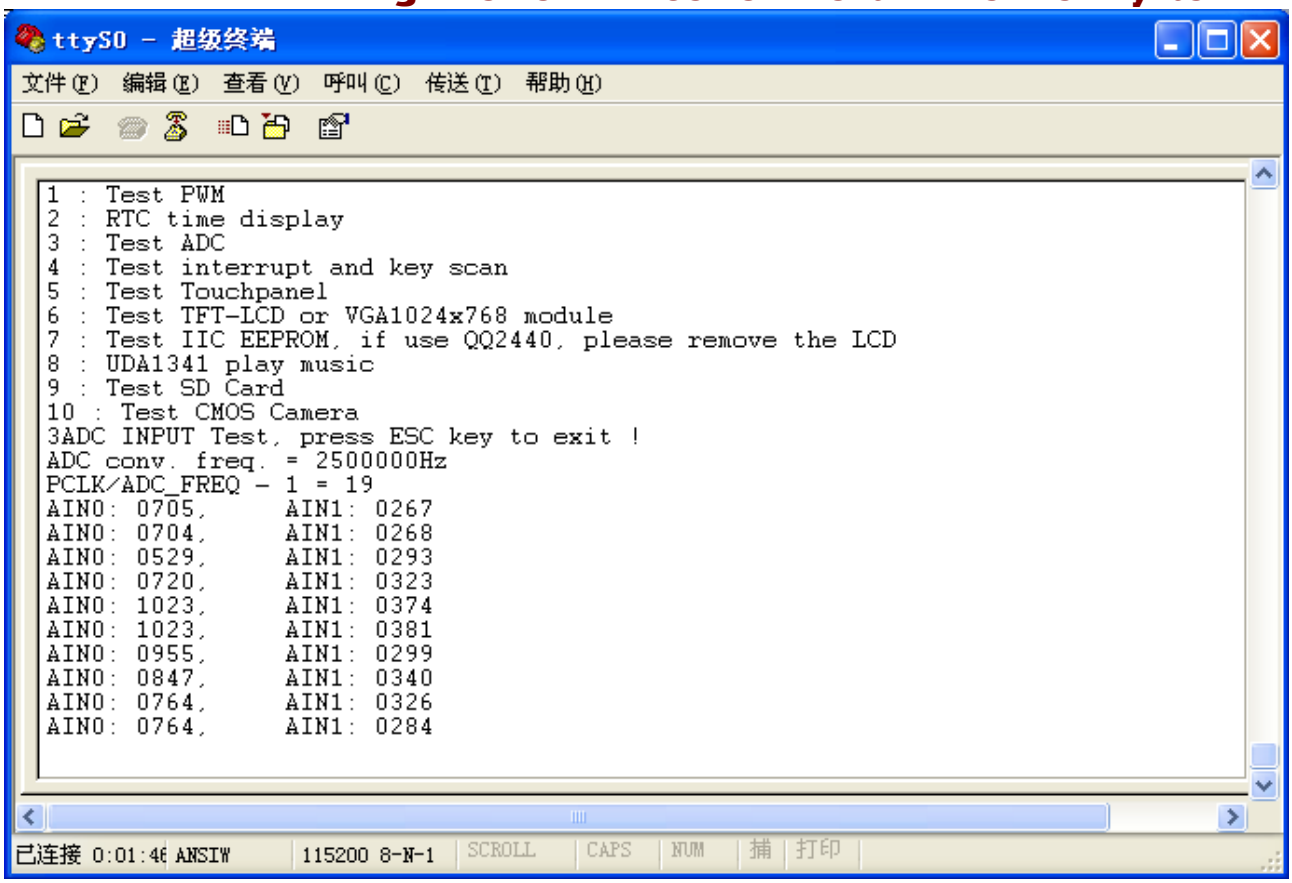

Press the “ESC” key you will exit the test and return to the main menu.

(4) Testing user keys

In the main menu, select “4” and enter to test user keys. Press key K1 – K6, you will see corresponding key press messages come out from the serial port.

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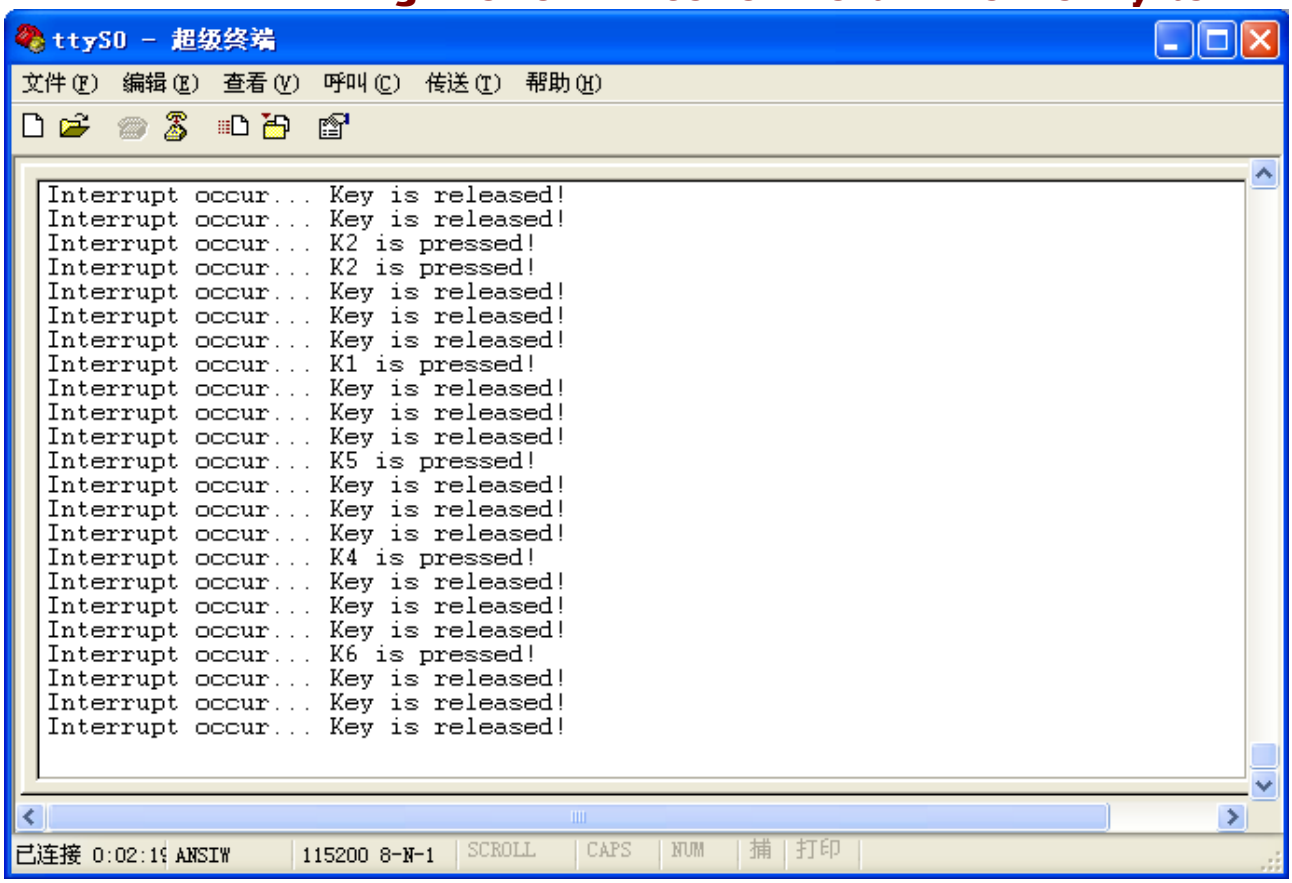

Press the “ESC” key you will exit the test and return to the main menu.

(5) Testing touch screen

If your package has a LCD, you can connect it to your MINI2440 for testing. In the main menu, select “5” and enter to test. Using a touch pen to click on the touch screen, you will see coordinator messages come out from the serial port.

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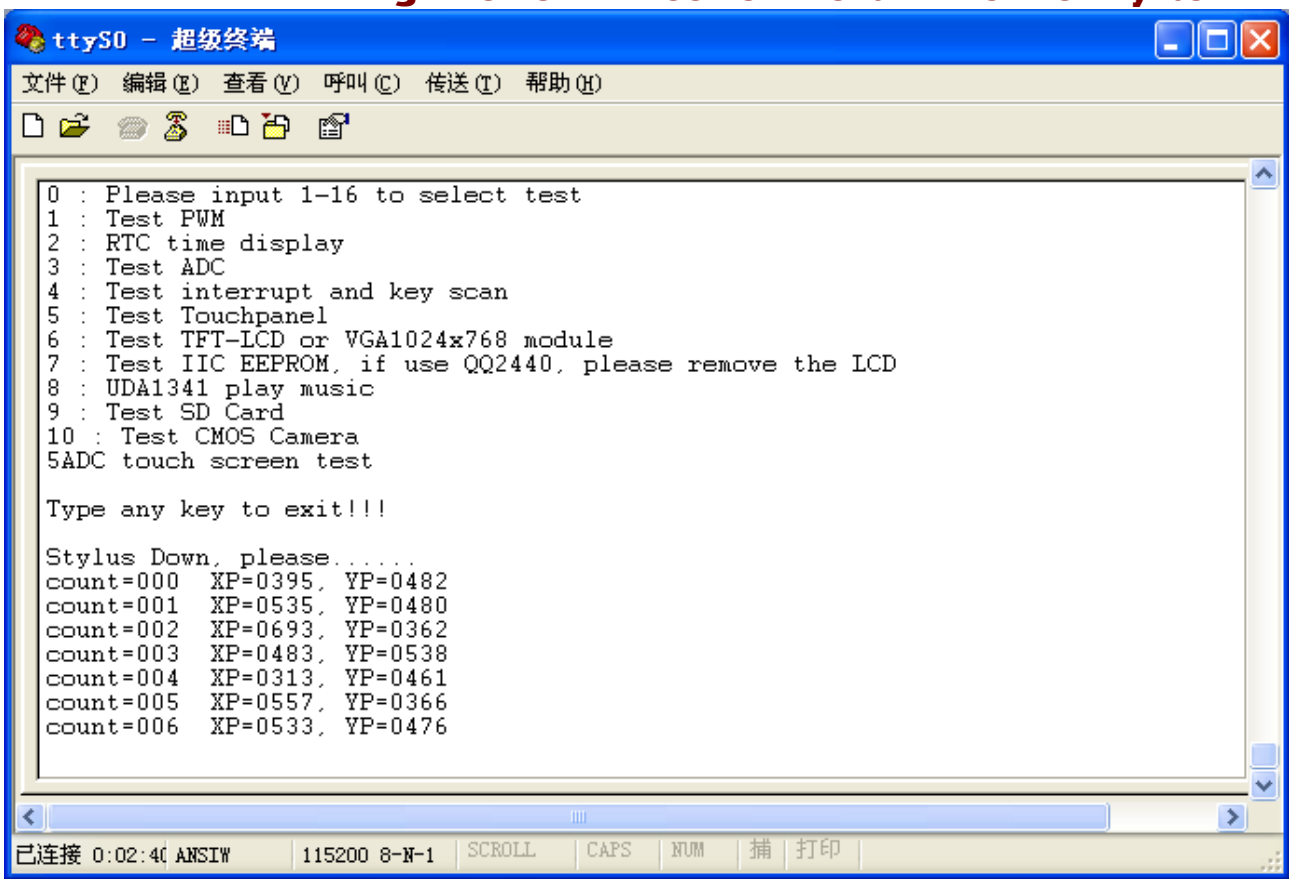

Press the “ESC” key you will exit the test and return to the main menu.

(6) Testing LCD or VGA

Before testing this module, please burn a correct 2440test utility. In the main menu, select “6” and enter to test. Follow the prompt to press any key you will see LCD show different screens towards the last one and return to the main menu.

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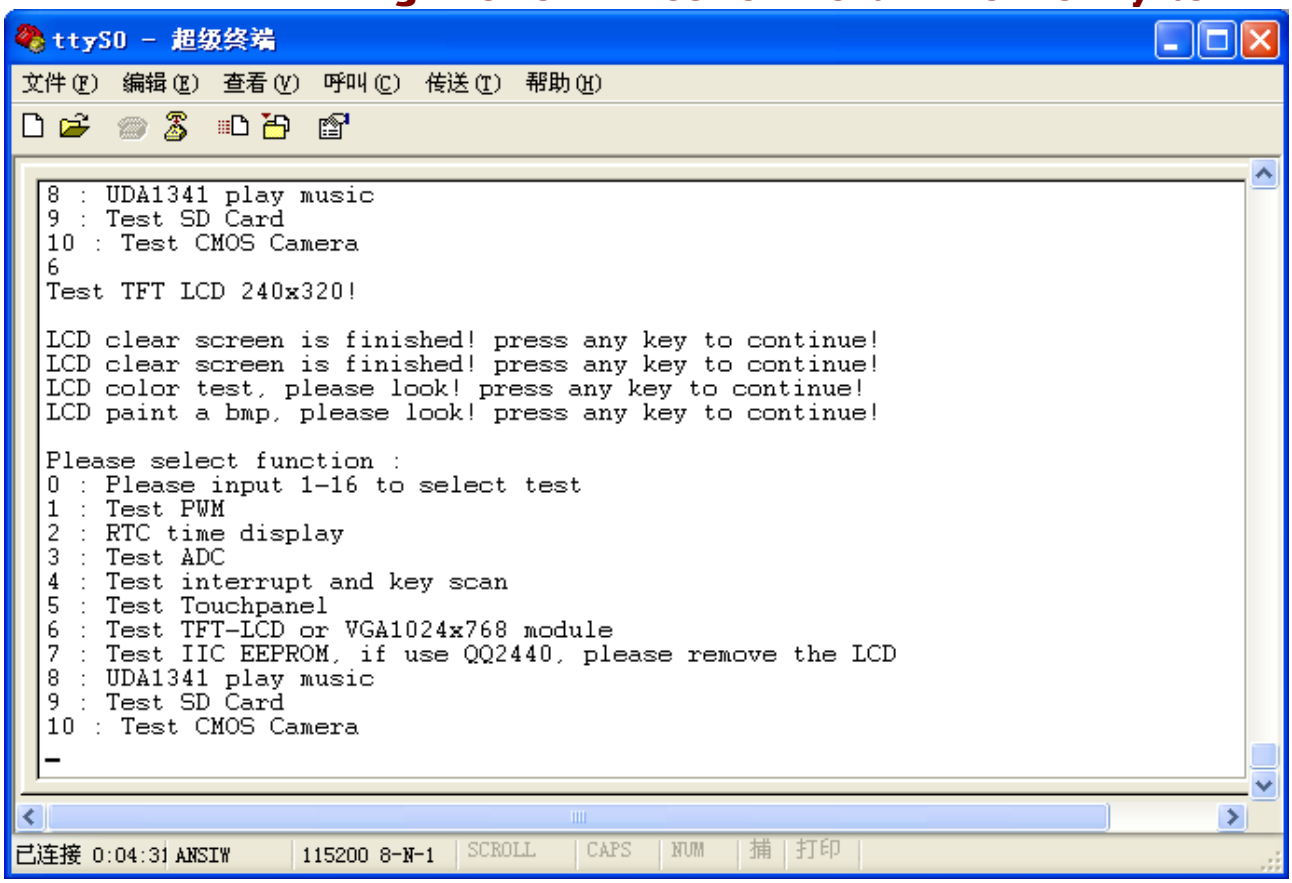

(7) Testing I2C

In the main menu, select “7” and enter to test. The test utility will read from and write to I2C bus chip AT24C08. The test will write 0x - 0xFF to the chip and read them from it.

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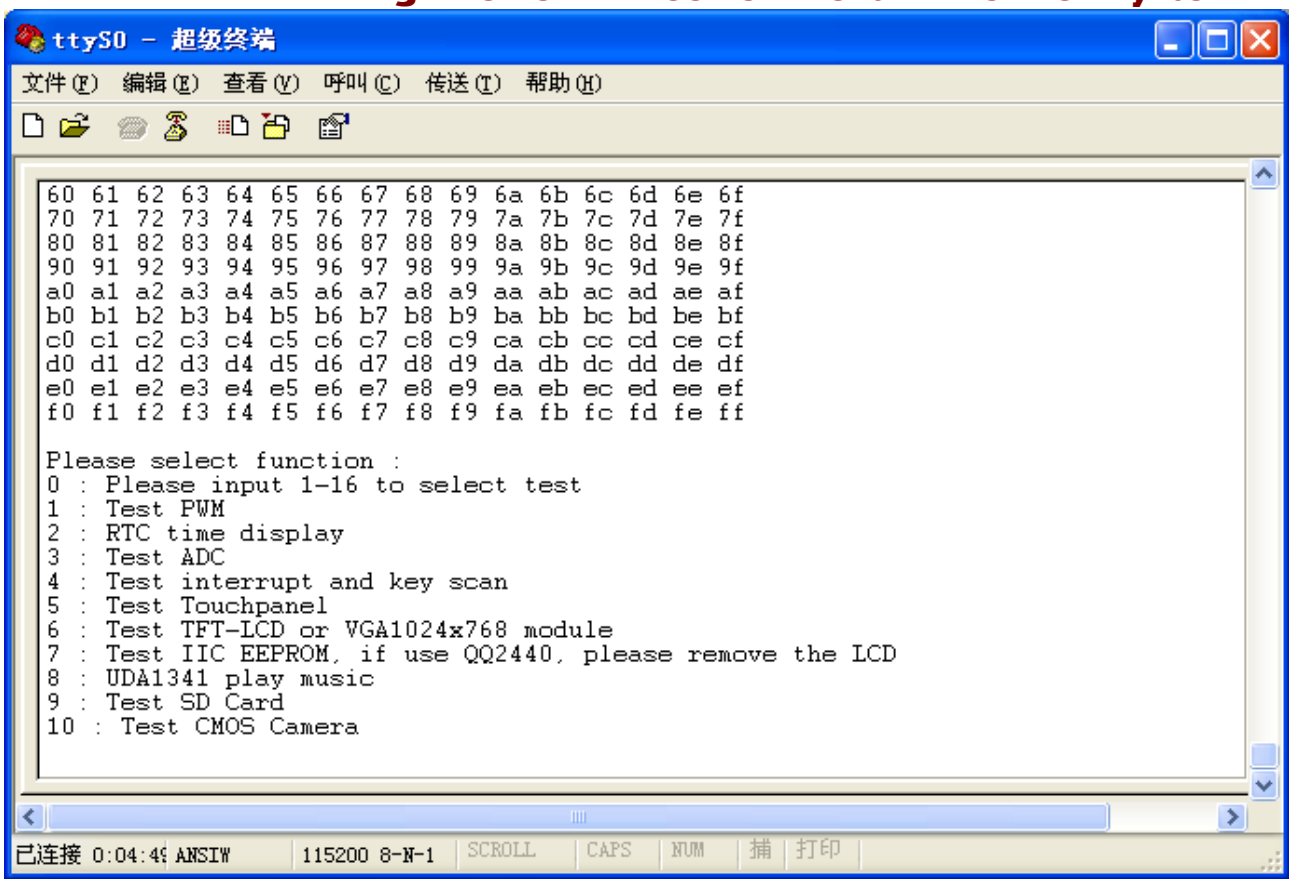

After this test is done, it will automatically return to the main menu.

(8) Testing audio output

Connect a sound box to the green audio output port on the MINI2440 board, select “8” in the main menu and enter, you will hear the Windows XP startup music.

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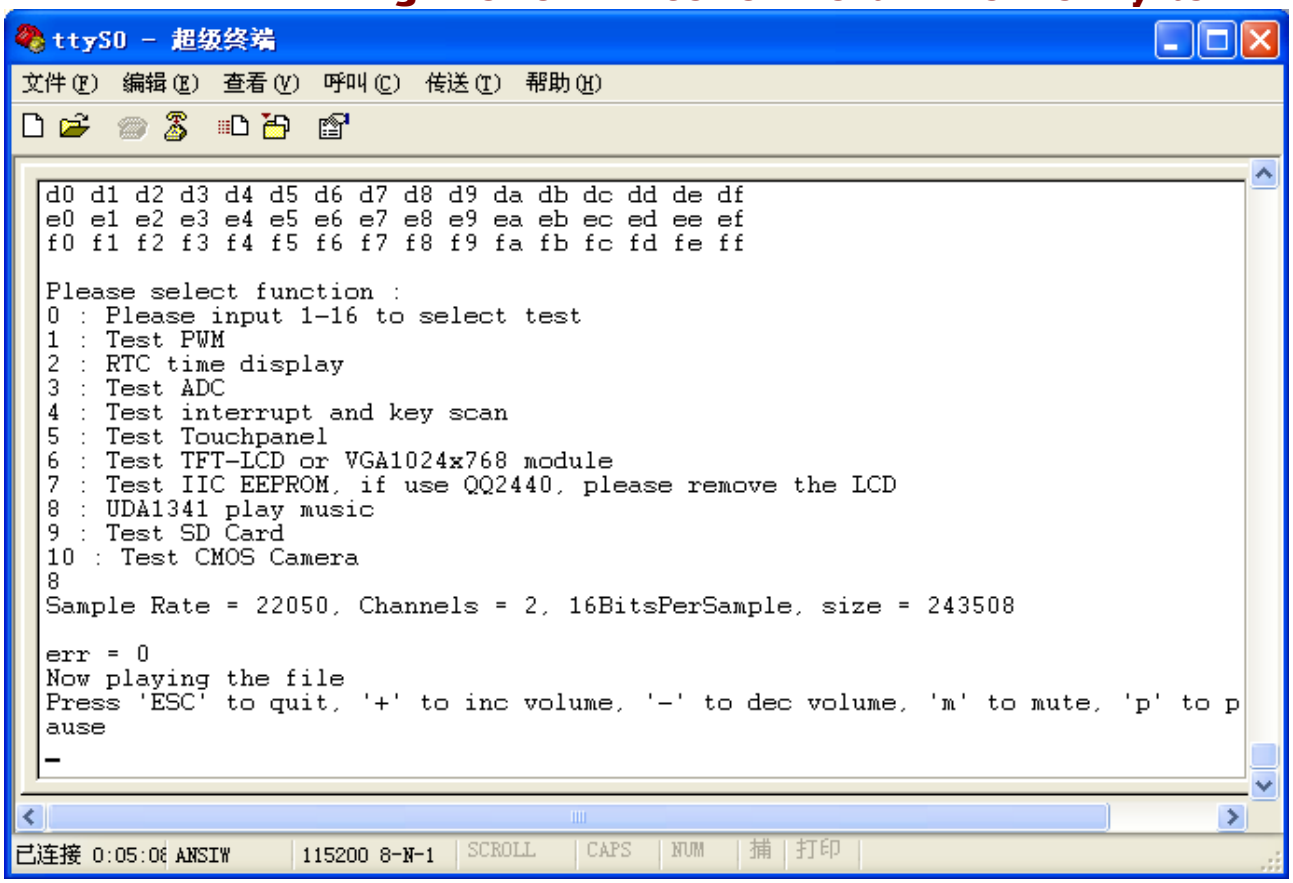

Press the “+” or the “-” button to turn up or down the volume. Press the “ESC” key you will exit the test and return to the main menu.

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(9) Testing SD card

Note: this test will damage the data in your SD card, before testing please backup your SD data.

Insert your SD card into the SD socket, select “9” in the main menu and enter to test. The test utility will read from and write to the card, and you will see the following information.

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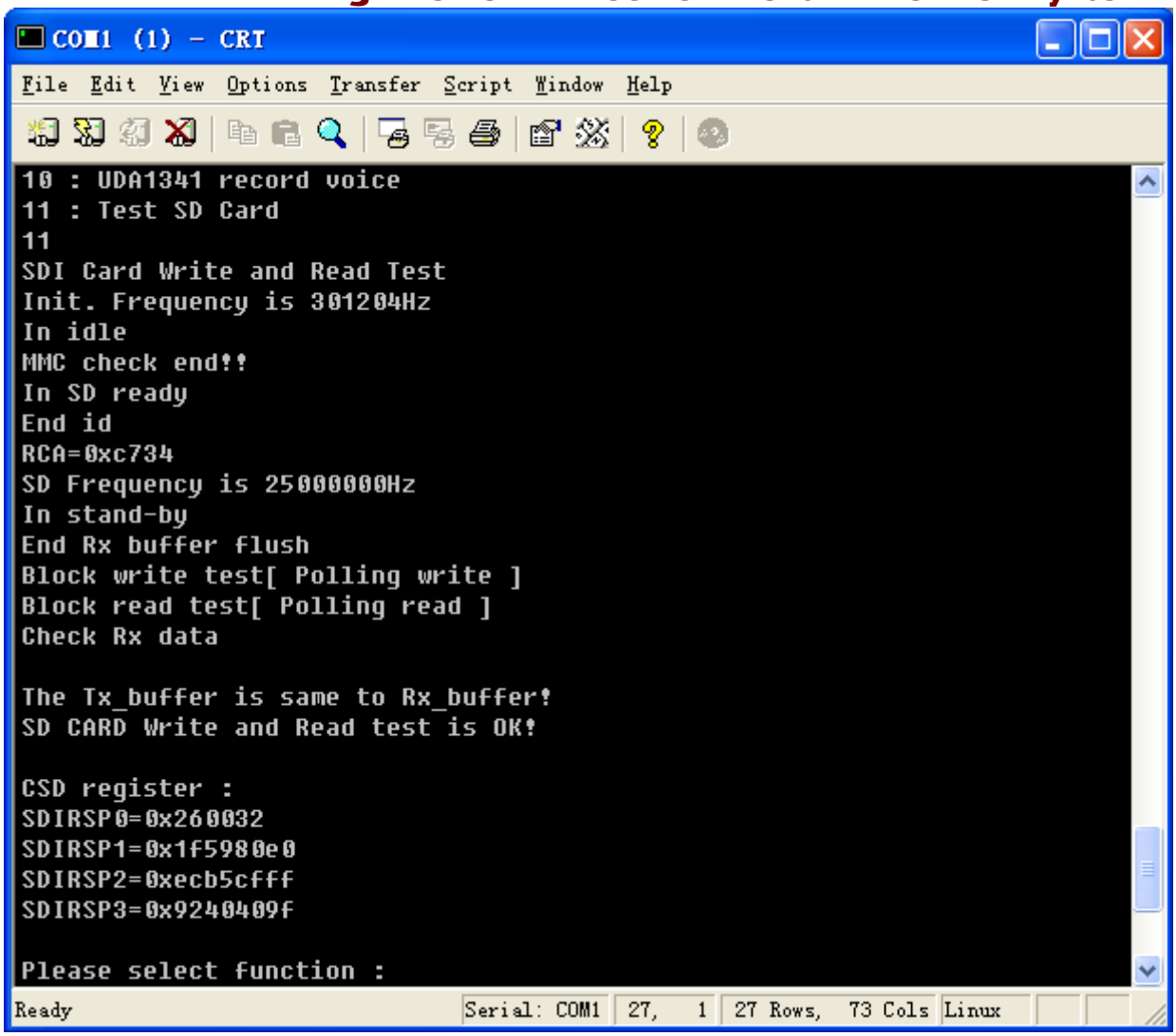

These messages show that SD card access is successful. After the test is done it will automatically return to the main menu.

(10) Testing CMOS camera

If you bought a CAM130 CMOS camera from us, you can test it with our utility. Before power on your board, please connect your camera to the “CAMERA” interface on the board. Then power on the board, select “10” in the main menu and enter to test.

Note: 如if you use a 7 inch screen or VGA, the LCD display may be different.

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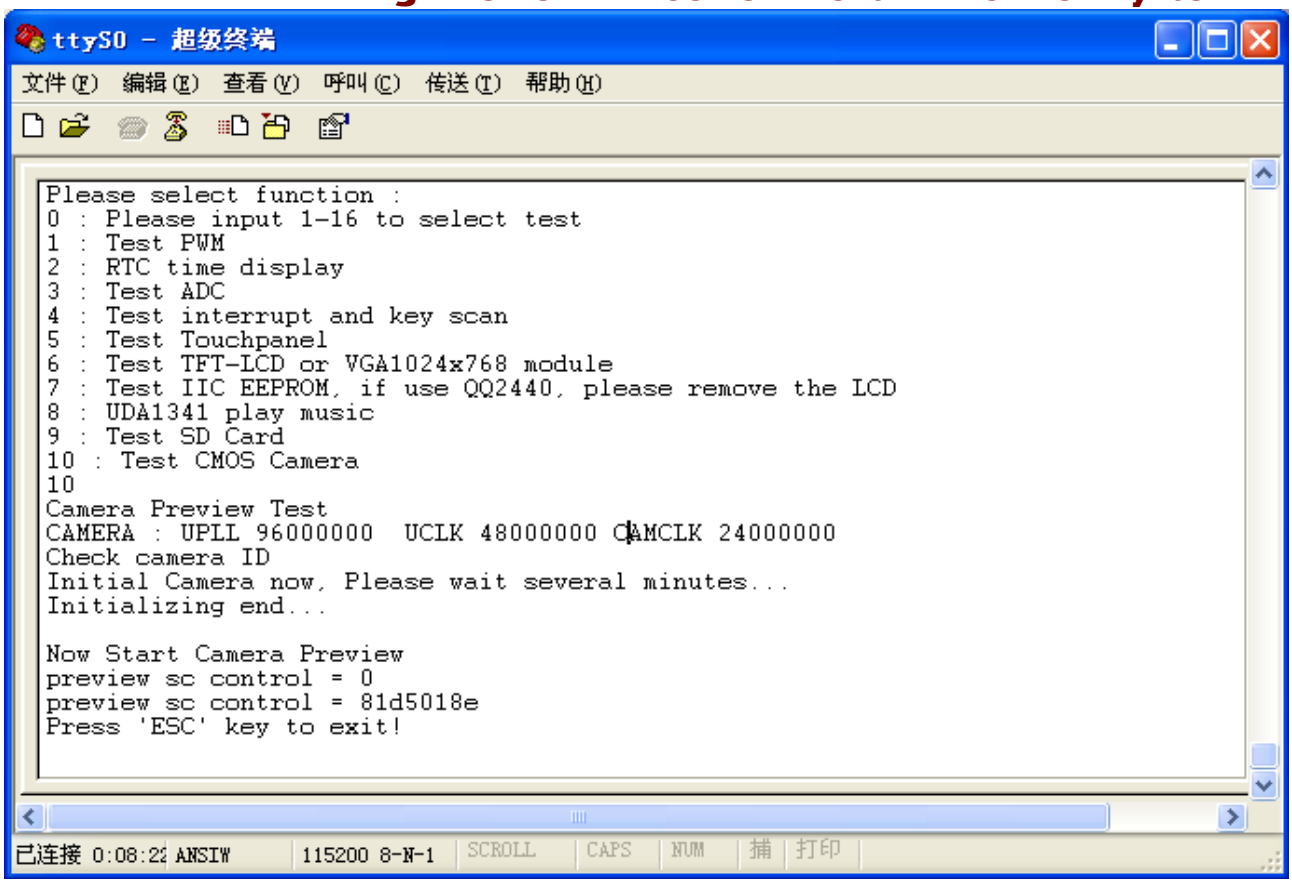
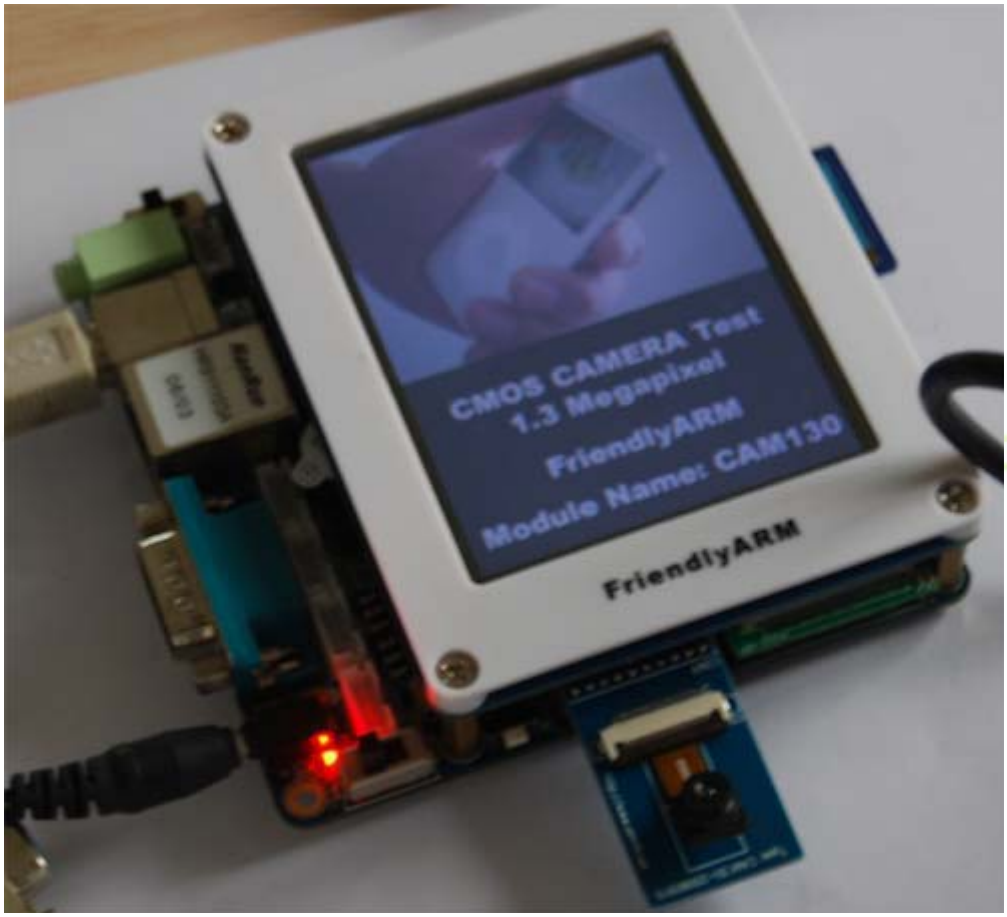


With a 3.5 inch screen, you will see this:



Chapter 3 Running Linux

3.1 Software Applications and Configurations in Linux Qtopia

Note: Qtopia 2.2.0 is developed by Qt based on Qt/Embedded 2.3 graphic interface. After Qtopia 2.2.0, Qt hasn't released any new PDA versioned graphic interface. The latest Qtopia is for cell phones. But it is still developing Qt/Embedded libaries. For most of our released systems, we have installed Linux + Qtopia 2.2.0 by default. It has various useful utilities. When you get our system, just power it on and you will be able to experience its utilities. If your display is VGA, you need a USB mouse connected to your board's USB host.

In addition, our system supports both a USB mouse and a touch screen simultaneously. You can connect both to your board. It supports a USB mouse and keyboard plug and play.

If you use a 3.5 inch LCD, you will see the following screenshot after system boots up:

3.1.1 Calibrating Touch Screen

Note: if you cannot calibrate your screen by following the steps below, please connect a USB mouse to your board, select "recalibrate" in "setting" to recalibrate your screen.

You will see the calibration interface under the following two situations:

1. After you follow the steps to install the Qtopia system and reboot the system, you will see the screenshot below. Follow the prompts on the screen to click on them and then click on the "+" signals.

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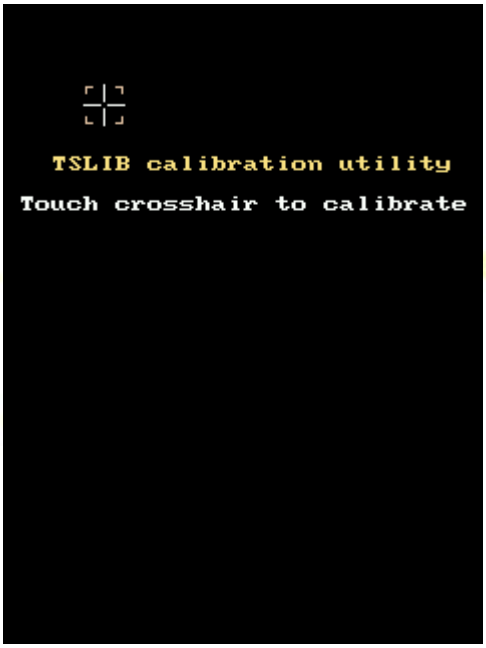

2. After entering the system, go to “Start” -> “Settings” -> “Configurations” -> “Recalibrate”. Click on the “+” signal.

3.1.2 Main Interface

After entering the Qtopia system you will see the following screenshot:

On top of the interface, you will see five icons, which represent five types of programs/files. Single click on anyone you will enter its sub-interface. All of these interfaces are very similar.

In addition, click on the “start” icon on the left bottom of the screen, you will see five sub-menus too, they are the same as the five ones on the top.

Those five sub-interfaces are as follows:

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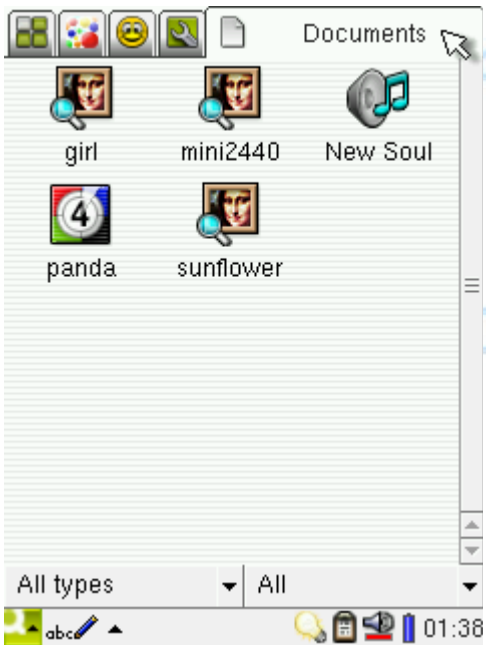

Among those programs, the ones in the “FriendlyARM” sub interface are developed or migrated by FriendlyARM. They are only for testing. All the other programs come with the system.

3.1.3 Playing MP3

Go to “Application Programs”, click on the “Music” icon, and it will popup a audio player window. Go to “Audio”, select a mp3 file and click on the “play” button, it will play this MP3 file.

Note: the Audio list lists all the audio files in the “Documents” sub-interface.

Note: you can also click on a file in the “Documents” sub-interface to play it.

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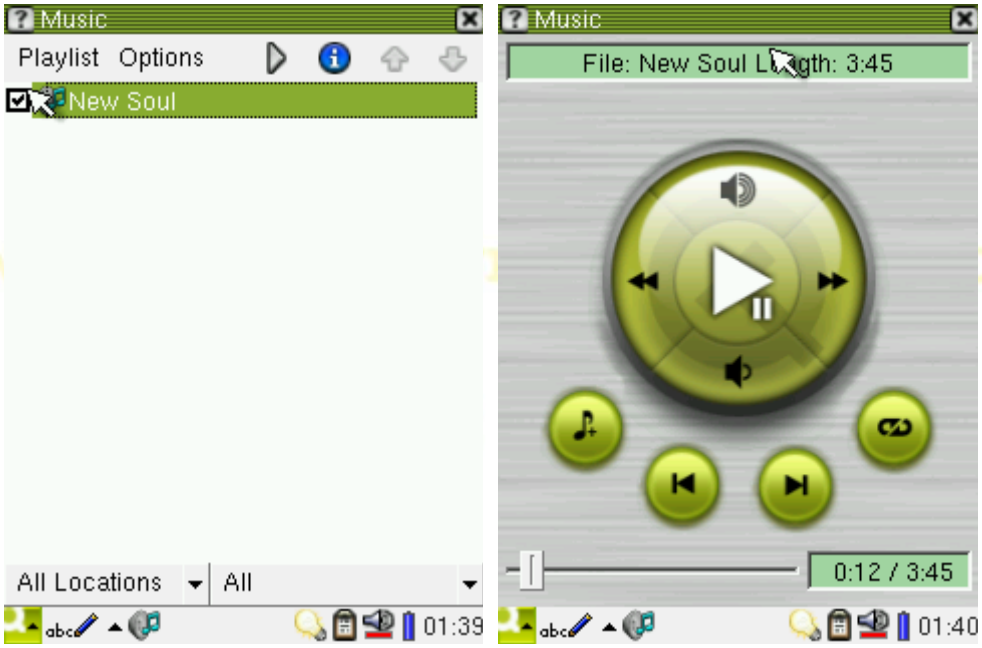

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3.1.4 Playing Video

In the “Application Programs” sub-interface, single click on the “video” icon, the video player interface will popup. Select a file in the “Video” list, and click on the “Play” button to enjoy your video.

Note: the Video list lists all the video files in the “Documents” sub-interface.

Note: you can also click on a file in the “Documents” sub-interface to play it.

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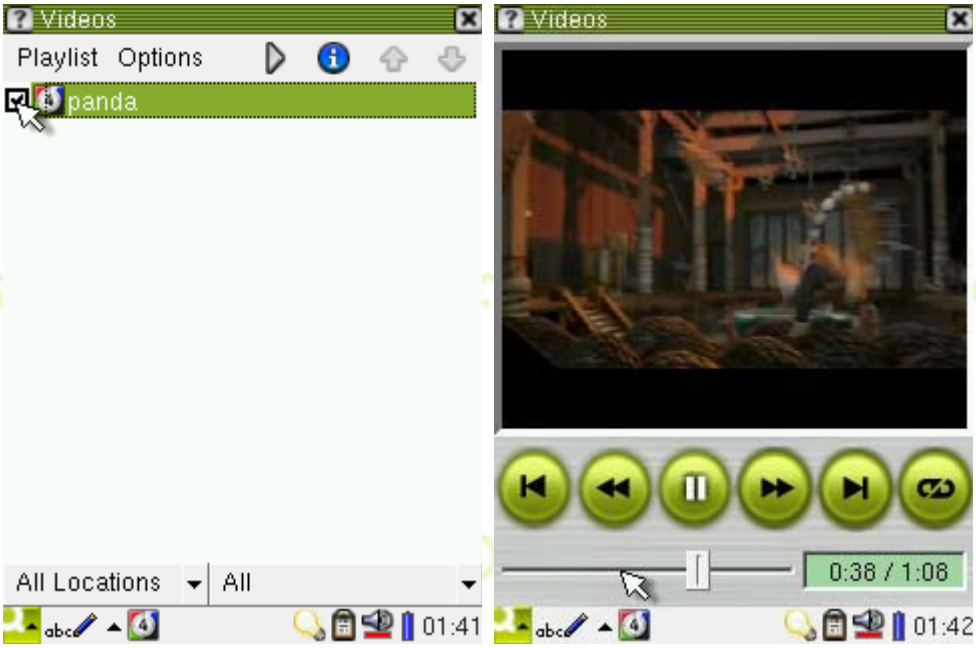
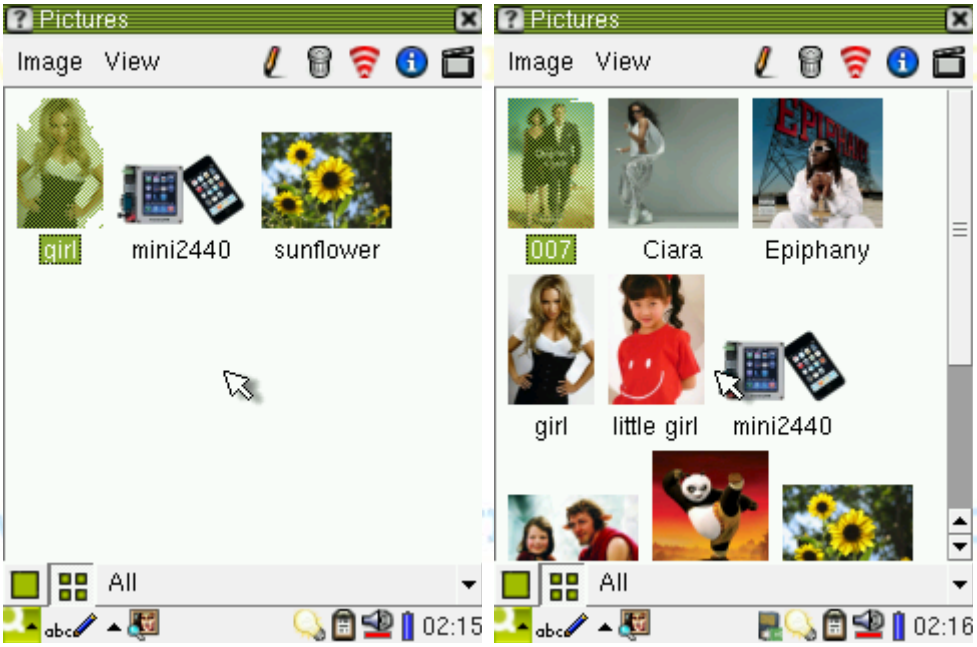


3.1.5 Browsing Pictures

In the sub-interface, single click on the “image” icon to open the image browser. The following screenshot shows 3 pictures the system has and some other images in an SD card.



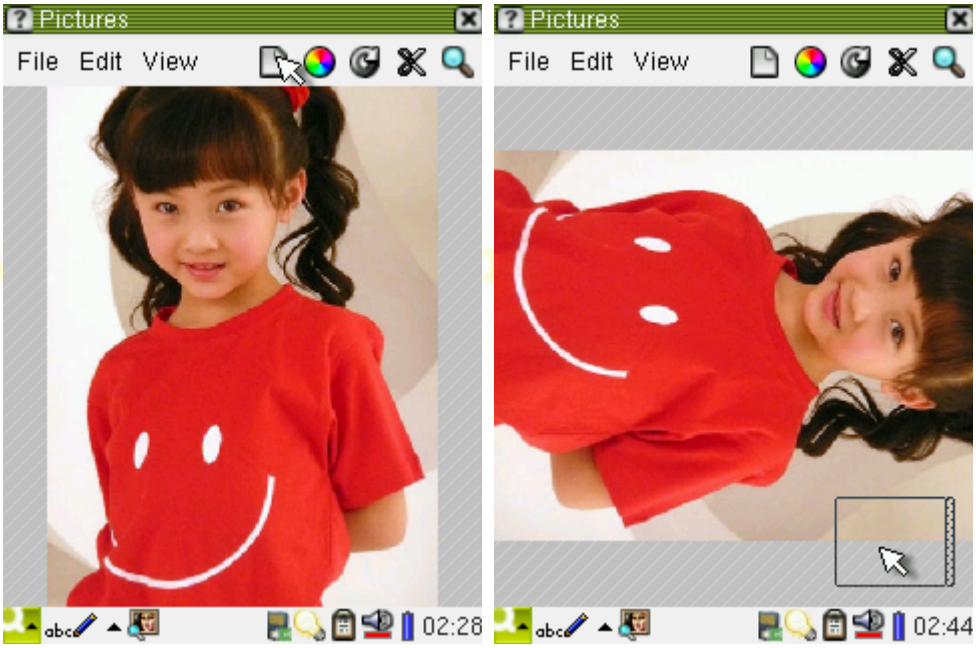
In Qtopia 2.2.0, the image browser has more features than the one in Qtopia 1.7.0 such as editing images.

Editing Images:

Select an image, single click to open it, and click on the pen icon to edit it. Click on the colored round button in the toolbar to adjust its color:

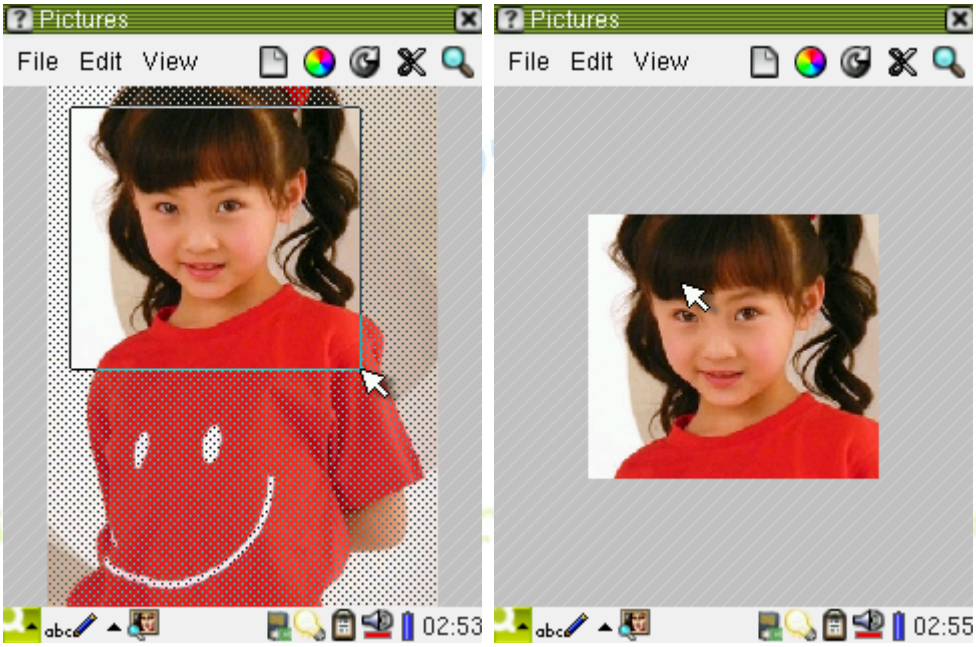
Rotating Images

In the toolbar, click on the clockwise button you can rotate the image by 90 degrees



Cutting Images:

In the edit mode, click on the “scissors” button, the image will be shaded. Select an area within the image with a touch pen, release the pen, the selected area will be isolated and then you can edit this area.



Zooming In/Out Images:

In the edit mode, click on the magnifier icon, you will be able to zoom in or out an image.

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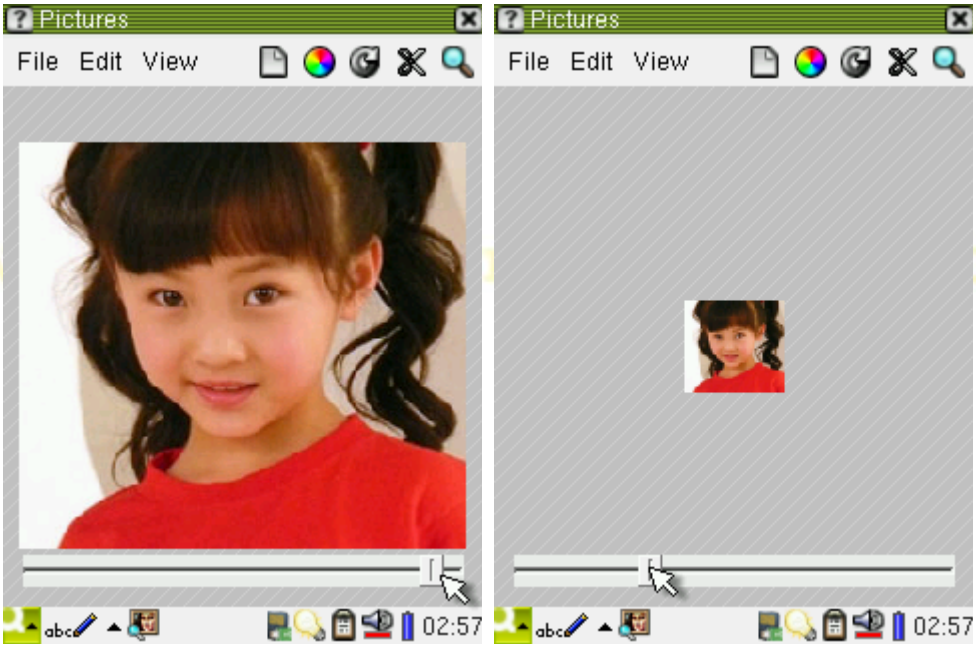

Note: the picture browser lists all the files in the “Documents” sub-interface.
Note: you can also click on a file in the “Documents” sub-interface to open it.

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3.1.6 Auto Mounting SD and USB Drives

As long as your system is active, inserting a SD card (maximum of 32G) or USB portable storage, moments later a removable device icon will appear on the right bottom of the task bar. Our system supports mounting both cards simultaneously. Click on the removable device icon, you will see the screenshot below. Then you will be able to remove it safely like what you do in Windows. The files in the plugged MMC/SD card will be listed in the “Documents” group.

Note: the support for MMC/SD cards and auto mounting is implemented via a Qtopia 2.2.0 plugin developed by FriendlyARM. Now it can only recognize the first partition of a MMC/SD card whose file format should be VFAT/FAT32/FAT16. If you card cannot be recognized, please check whether the file system is VFAT/FAT32/FAT16.

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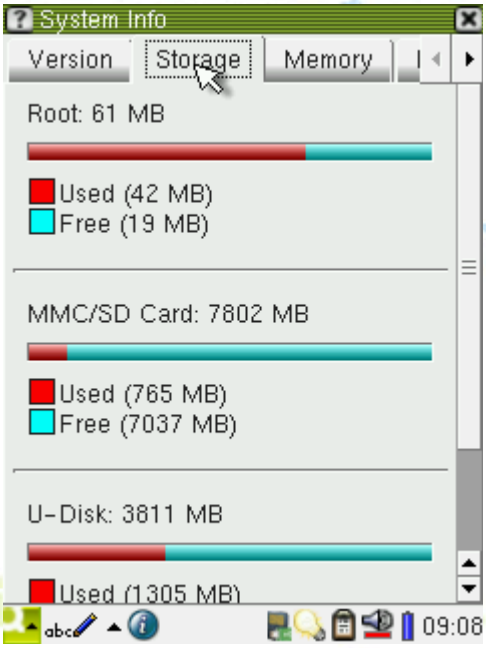
Go to “Application Programs” -> “System Info” -> “Storage”, you will be able to see more details about the SD or USB drive.



3.1.7 Calculator

In the sub-interface “Application Programs”, click on the calculator icon you will see a calculator. You can choose its type by selecting different options (Simple, Fraction, Scientific, Conversion and so on) from the pull-down list.

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3.1.8 Command Line

The “terminal” is a commonly used interface in Linux. Users can command the system very easily via a command line window. There are various ways to open a terminal. For instance, you can set the system’s terminal to a serial port then this terminal will be a serial port terminal whose input and output are both through the serial port terminal without relying on a graphic interface. This is the most popular way in Linux.

On system startup, you can point the terminal to a graphic display device (such as LCD, CRT) and the input to the keyboard. This will create another input output system without using a PC.

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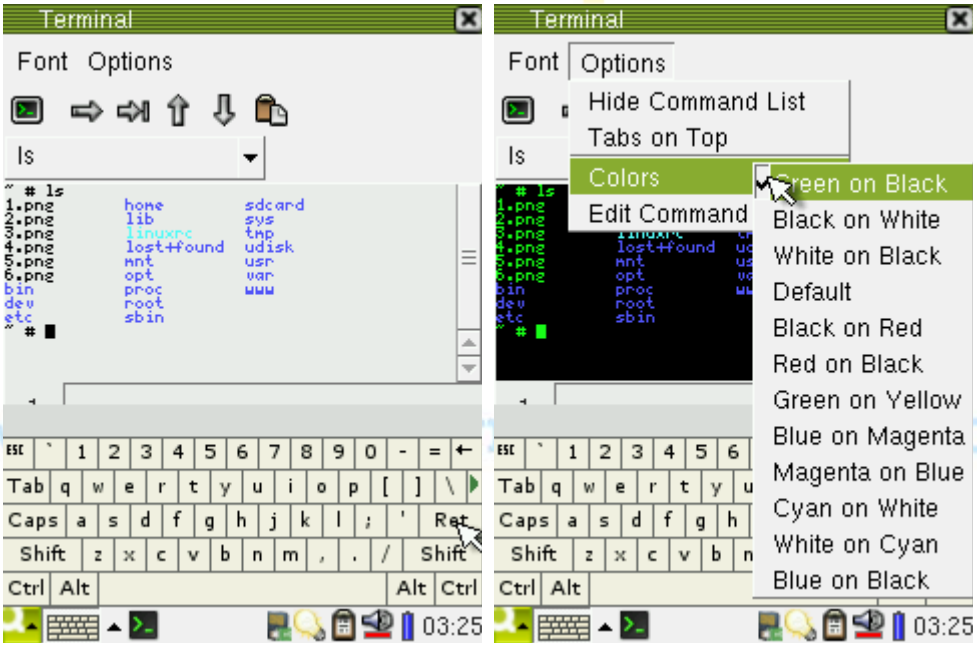
When a graphic display interface is connected and a GUI is incorporated, a GUI based “command window” will be established. Users can interact with the system via either a real keyboard or a virtual “soft keyboard”. This is what this section describes.

In the “Application Programs” subgroup, click on the “terminal” icon, a command line window will popup. You can either connect a USB keyboard (connect it after starting this command line window) to your system or use the keyboard window at the bottom of the screen. You can set the command line window’s display mode by configuring the settings in the “option” menu.



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3.1.9 File Browser

In the “FriendlyARM” group click on the file browser icon:

You can browse the directories and files in the system via this browser.

Note: Qtopia-2.2.0 doesn't have a file browser, FriendlyARM migrated one from Qtopia-1.7.0. They have the same functions and interface.

3.1.10 Configuring Network

In the "FriendlyARM" subgroup, click on the "Network Settings" icon:

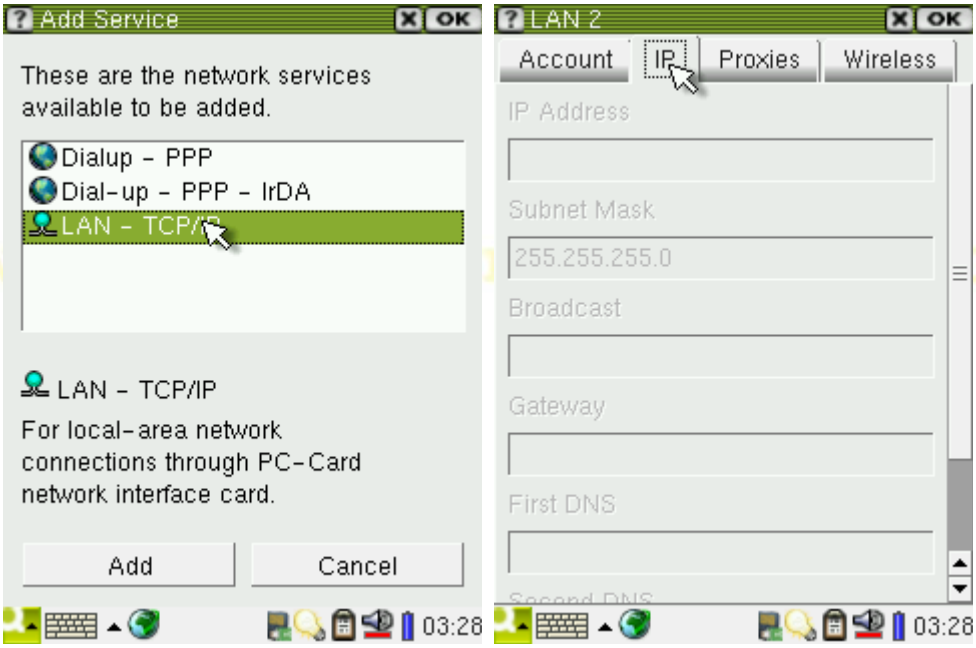
From this interface we can set various network parameters:

- Static IP address, default setting is 192.168.1.230
- Mask, default setting is 255.255.255.0
- Gateway, default setting is 192.168.1.1
- DNS, default setting is 192.168.1.1
- MAC address, default setting is 08:90:90:90:90:90

Click on "Save" to save these parameters and they are effective right now. After rebooting the system, these settings will still be there. The configuration file that contains the settings is "/etc/eth0-setting".

Note: the "/etc/eth0-setting" file will not exist after reinstalling the system. Clicking on the "Save" button will generate one. Because all products are tested extensively by us, this file exists in your system. Executing the "ifconfig" command will not change this file. In fact, Qtopia has a network setting utility by itself. But its interface is too complicated and may not work sometimes. We didn't make any change to this utility however created another one shown above.

The one Qtopia has is as follows:



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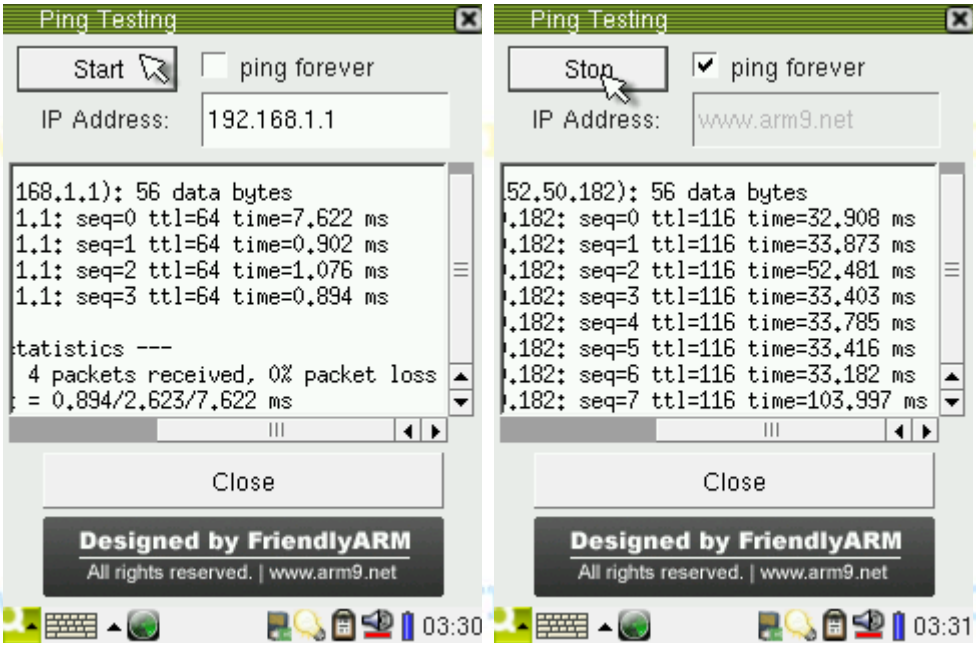
3.1.11 Testing Ping

Please connect your board to a network, set up the network parameters such as gateway, DNS and so on. Then you can use our graphic interface to test network connection. In the “FriendlyARM” subgroup, click on the “Ping” utility:

After you setup your DNS, your system will be able to recognize both character domain names and IP addresses. By default, ping will try four times. But if you check the “ping forever” option, it will ping forever.

Note: To ping an internet domain name, you need to set up your gateway and DNS correctly and make sure your systems is connected to the internet.

Clicking on “Start” to ping, and “Stop” to end it. Before closing the interface you need to stop ping .



Note: ping is a commonly used network utility, and it is in most of the released Linux and Windows systems. In a command line window, typing “ping” will start it. The above utility actually calls “ping” in a command line and shows the results in the graphic interface.

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3.1.12 Browser

In the “FriendlyARM” subgroup, click on the “browser” icon to open a browser, trigger the soft keyboard at the bottom of the screen, enter a website in the address bar, hit enter to open the website.

Note: the web browser this system uses is Konqueror/Embedded” which is an open source browser.

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3.1.13 Testing LED

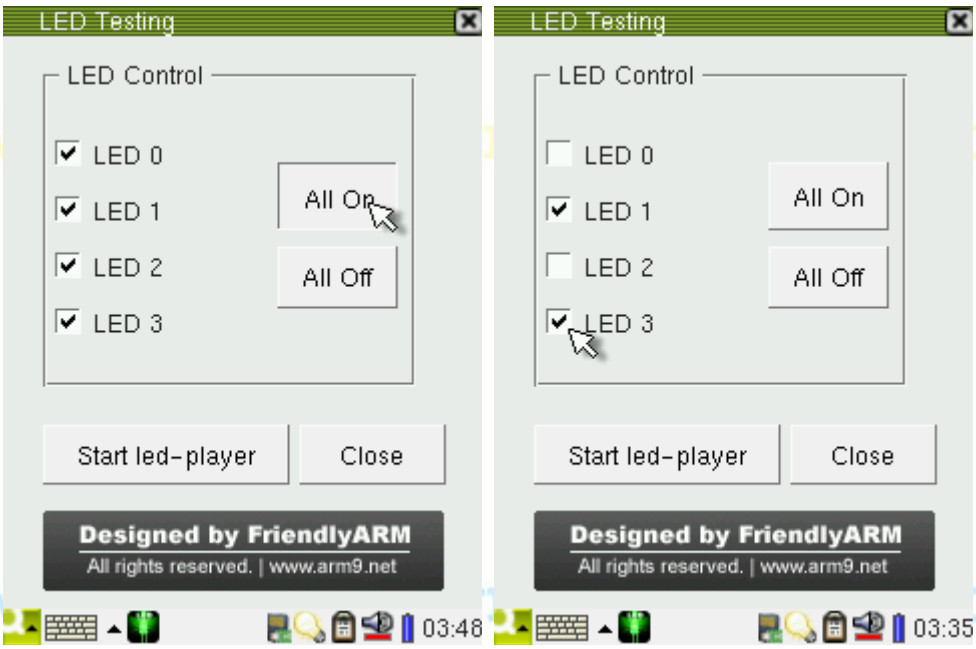
In the “FriendlyARM” subgroup, click on the “LED” icon:

On the popup window, the “Stop led-player” is enabled. This is because the led-player service is started on system startup. After the system boots up, you will see a “sequential led lighting” which is played by this service. To control a single LED, close this service to release the LED resources.

Follow the steps below:

Click on the “Stop led-player” button, its title will change to “Start led-player”, all the LEDs on the board will be turned off, and all the buttons in the “LED Control” frame will be enabled. Clicking on

the “All On” button will turn on all the LEDs, and clicking on the “All Off” will turn off all the LEDs. Checking any LED box will turn on that LED, and unchecking will turn it off. Close the LED Testing interface the led-player service will be restarted.

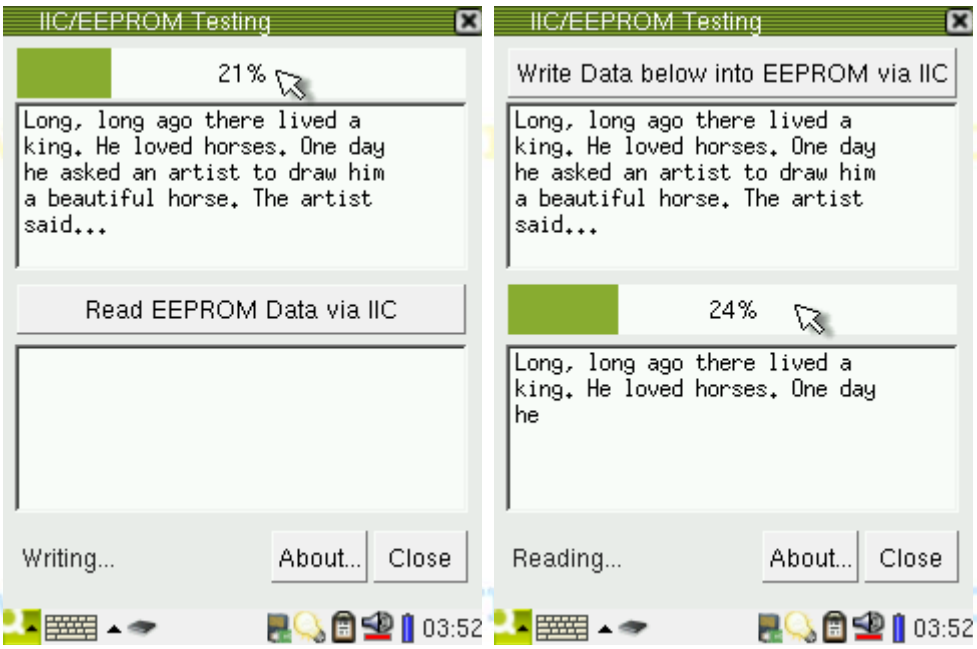


3.1.14 Testing EEPROM

In the “FriendlyARM” subgroup, click on the “I2C-EEPROM” icon to open the interface below:

From top to bottom there are a “Write Data” button, Write area, “Read Data” button and read area. Click on the soft keyboard icon in the task bar, write some characters in the write area, click on the

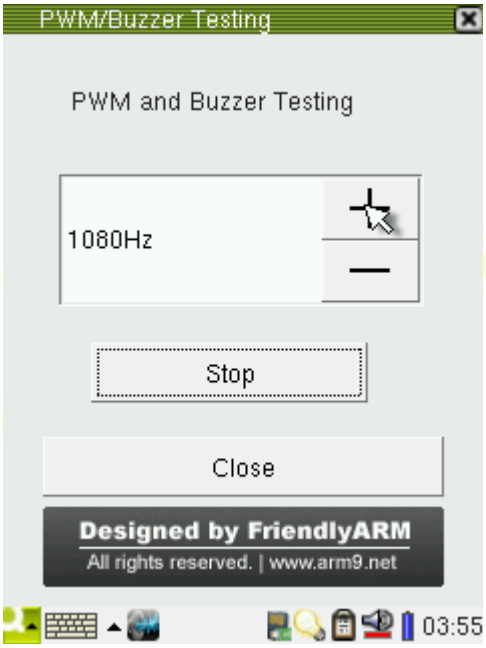
"Write Data" button, the button will change to a process bar indicating the writing process; click on the "Read Data" button, it will change to a process bar too indicating the reading process.



3.1.15 PWM Buzzer

In the "FriendlyARM" subgroup, click on the "PWM/Buzzer Testing" icon:

By default, the output frequency of PWM is 1000Hz. Click on the "Start" button, the buzzer will beep. Clicking on the "+" or "-" button will change its frequency and sound as well. Clicking on the "Stop" button stops the buzzer.



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3.1.16 Serial Port Assistant

Note: before start this program please connect the serial port your want to test to your board.
- The on board CON1, 2 and 3 are CPU UART0, 1 and 2. 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 two ports CON2 and 3 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). When connect the OneCom module's COM2 and COM3 make sure they match your cable
- 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.

In the "FriendlyARM" subgroup, click on the "Serial Port Assistant" icon to start the interface below:

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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.

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)

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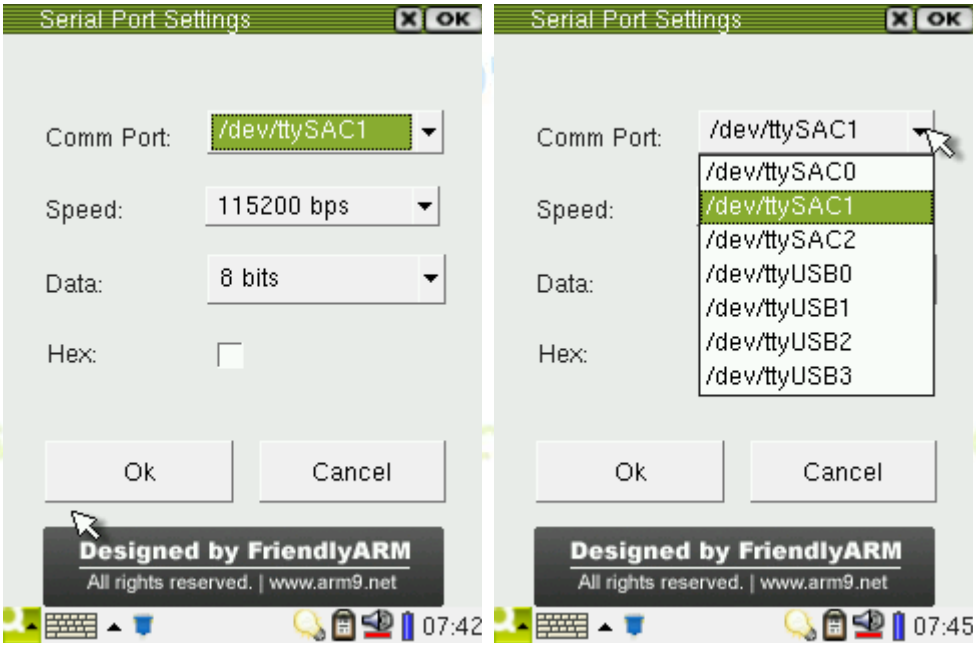
Click on “Disconnect” to disconnect the connection. Click on “Setting…” to enter the parameter setting interface which lists some basic serial port parameters:
Comm Port: you can choose “/dev/ttySAC0,1,2” or the USB to Serial “/dev/ttyUSB0,1,2,3”
Speed: bits per second
Data: `data bits`, 8 or 7, usually 8.
Hex: input and output data in Hex format



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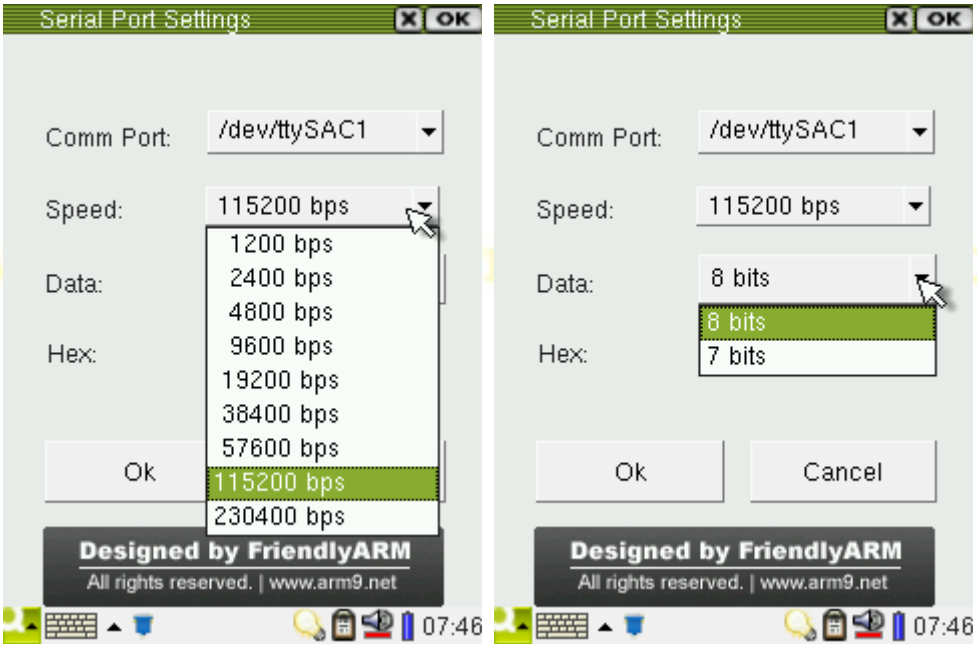

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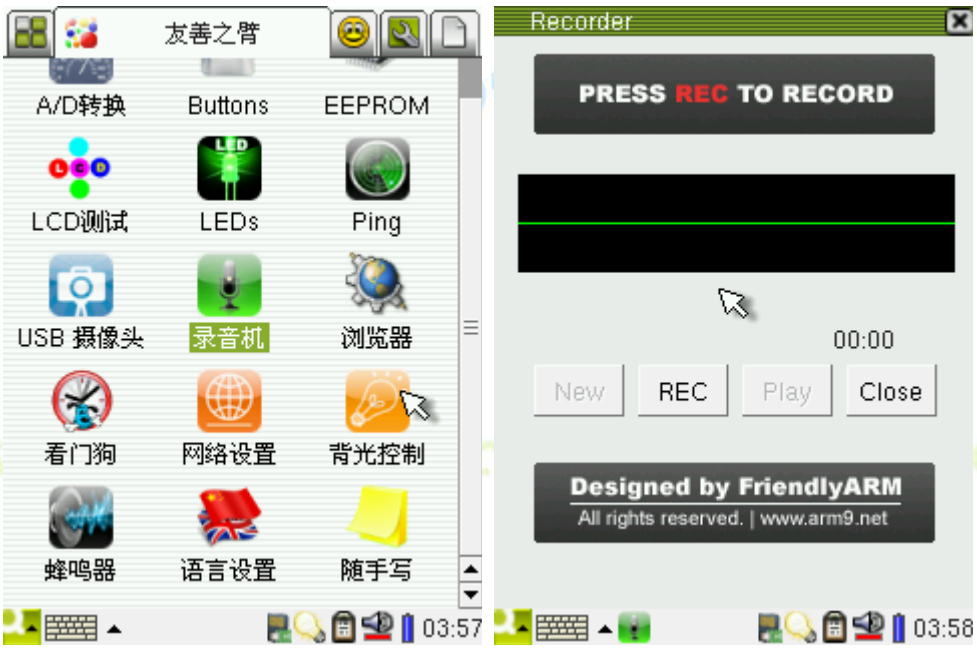
3.1.17 Audio Recording

In the “FriendlyARM” subgroup, click on the “recorder” icon:



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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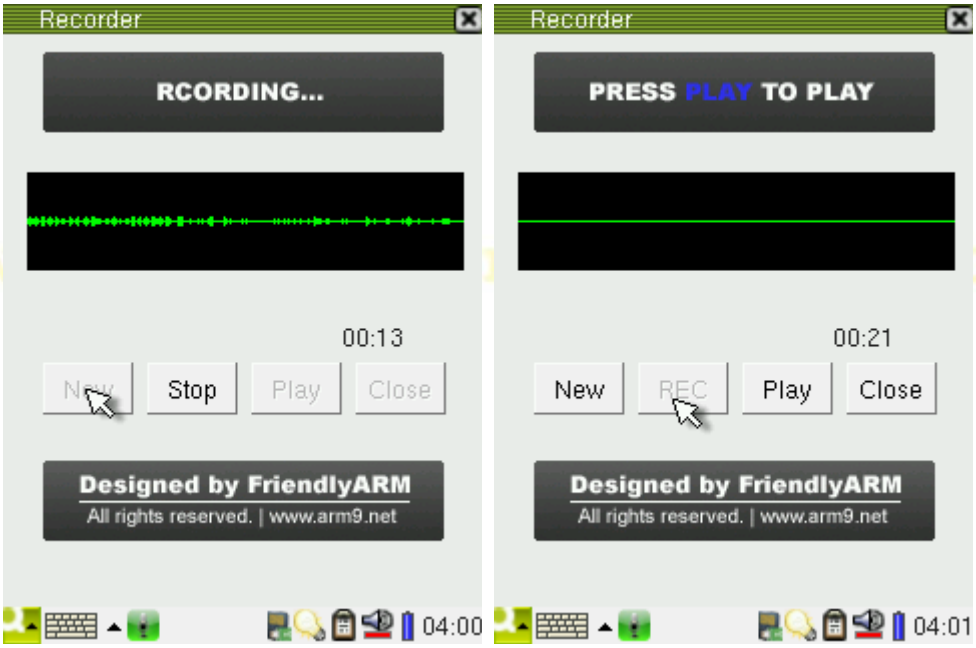
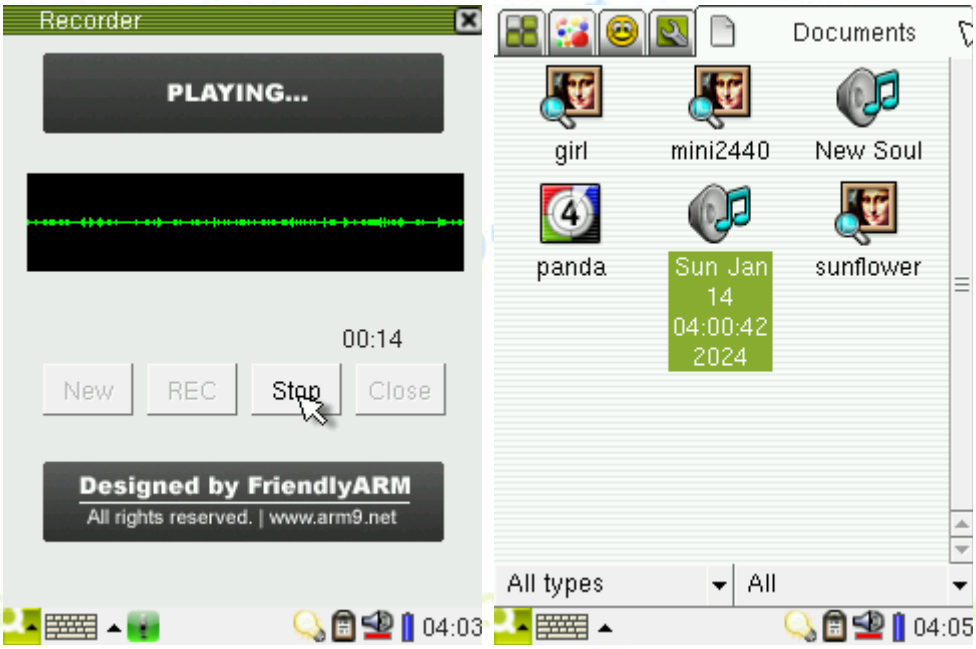


Click on the “PLAY” button to play what you recorded and you can see what you recorded has been saved as “WAV” files in the “Documents” directory.



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

3.1.18 Using USB Camera

You can use any USB camera with our system which already has drivers for all existing USB cameras. Plug your camera to the USB host port on the board, click on the “USB Camera” in the “FriendlyARM” subgroup you will see a dynamic preview interface. Click on the “Snap” button you

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will take a picture which will be saved in the “Documents”. This utility has provides functions to adjust brightness, contrast and gamma value. When you start this utility, it will read the camera preset parameters.

Note: although the system already has drivers for USB cameras, each camera might have different output format. Since we cannot collect all cameras this utility would only work for some common cameras, if your camera doesn’t work with our system please email us at tech@microarmsystems.com .

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3.1.19 Using CMOS Camera

This utility can only work with the CMOS camera CAM130. Before power on, please connect your camera to the “CAMERA” interface on the board, and then click on the “CMOS Camera” icon in the “FriendlyARM” subgroup.

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Click on the "Snap" button you will be able to take a picture which will be saved in the "Documents" subgroup (in the "/root/Documents/image/jpeg" directory). Then the "Snap" button will change to "Continue". Click on it, you will be ready for picture taking again. When clicking on a taken picture in the "Documents" subgroup, it will be opened with Qtopia's picture browser utility.

3.1.20 Testing LCD

The LCD test utility is to test whether a LCD has dead pixels. We can only allow at most 3 dead pixels for our systems. In the "FriendlyARM" subgroup, click on the "LCD Testing" icon:

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This utility has two test modes: auto and manual.

Auto-loop loops automatically. By executing in this mode, it will display red, yellow, white, cyan, blue, green, pink and black eight colors sequentially. During this process, click anywhere on the screen, the system will end the test.

Manual-control is run manually. By executing in this mode, every single click on the screen will change the screen from one color to another until it displays red, yellow, white, cyan, blue, green, pink and black eight colors.

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3.1.21 Backlight Control

In the “FriendlyARM” subgroup, click on the “backlight testing” icon:

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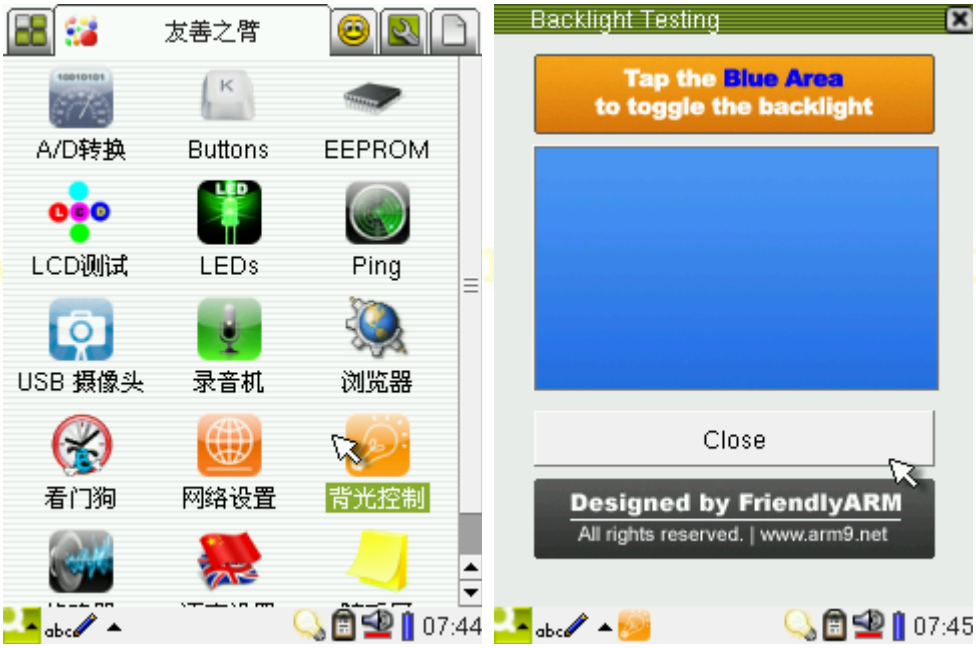

Follow the prompt, click on the blue area, you will close the backlight. Note:you just close the backlight, all the running program are still active. Click on the blue area again, the backlight will be turned on again.

3.1.22 A/D Conversion

The Samsung S3C2440 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 AIN0-3 which reside on CON4. 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 how:

Click on the “ADC Testing” icon in the “FriendlyARM” subgroup:

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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.

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.

Note: the W1 adjustable resistor is hidden under the LCD, to test it, you might need to remove the LCD

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3.1.23 Testing User Buttons

Note: the user buttons don't have special functions, they are just for testing low level drivers.

Click on the "Buttons" icon in the "FriendlyARM" subgroup:

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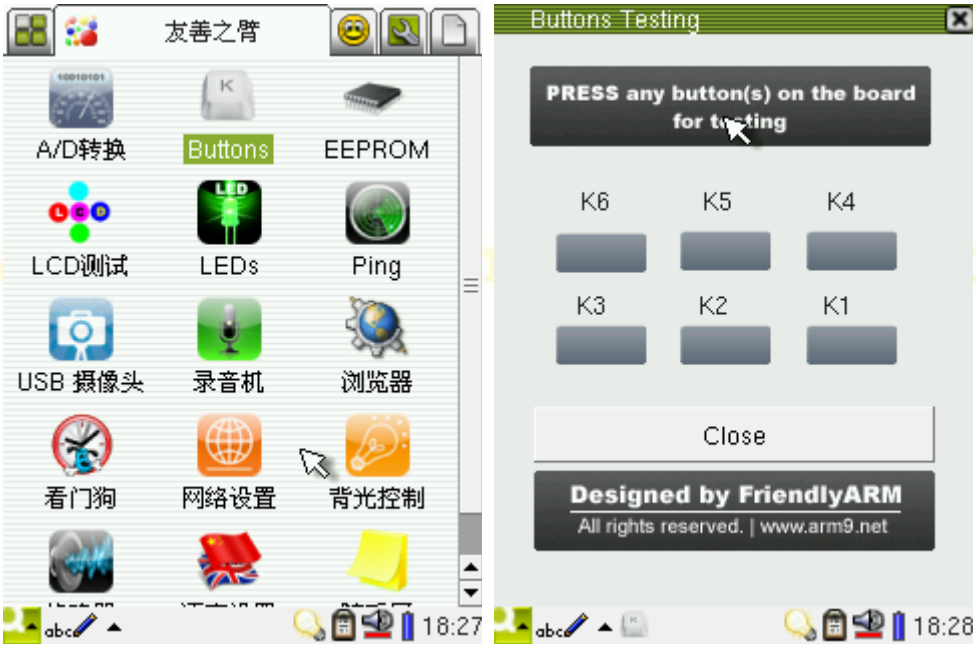
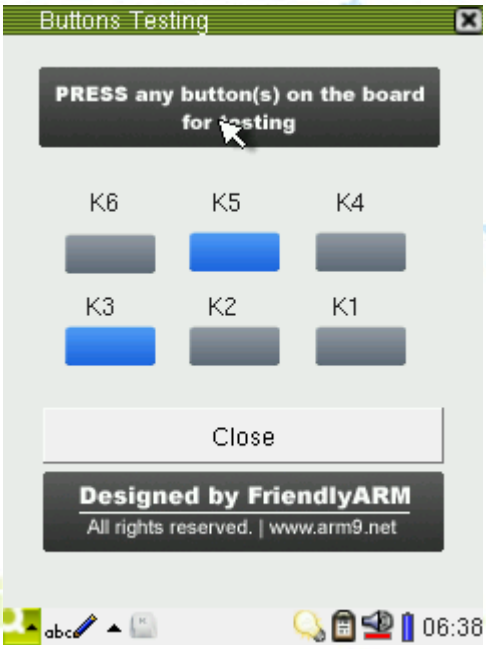
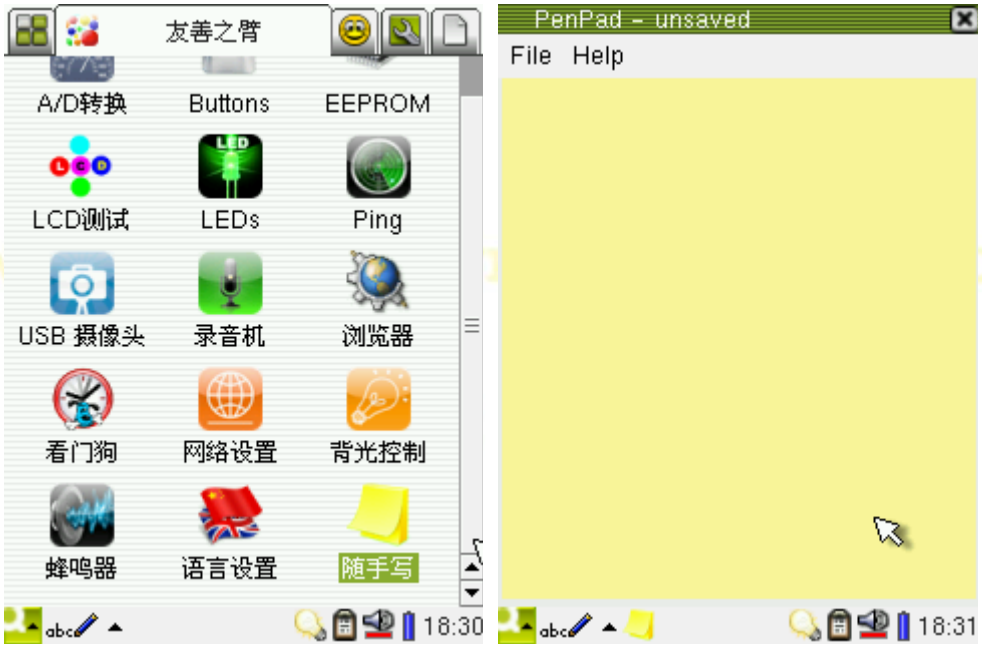


Press down any buttons on the board, the corresponding button icons will change to blue, release them, their icons will change back to grey.

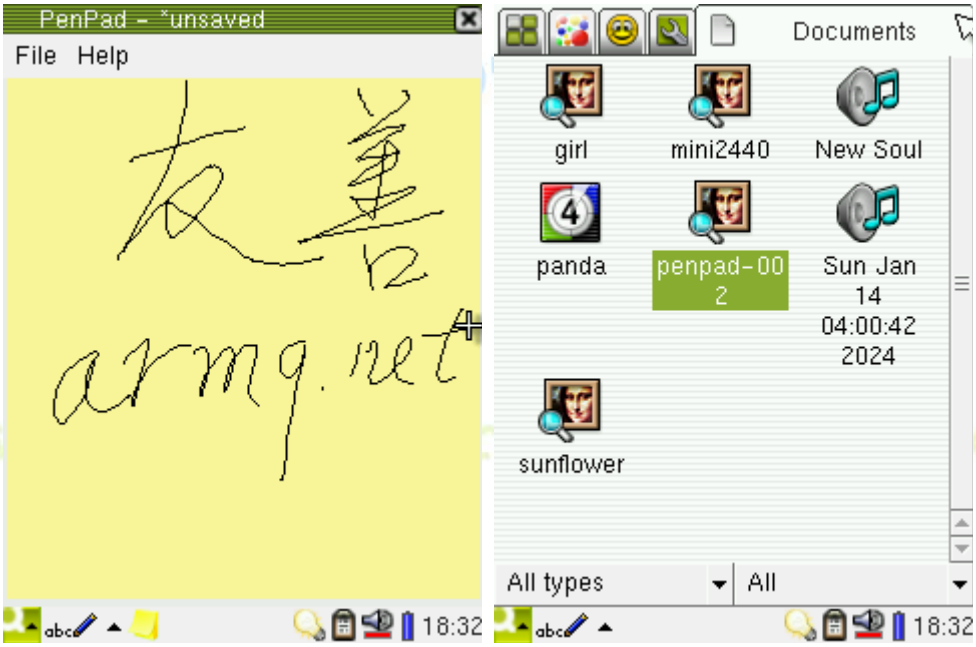


3.1.24 Testing Touch Pen

To test whether or not a touch pen works accurately, 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” subgroup:



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” subgroup, 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.



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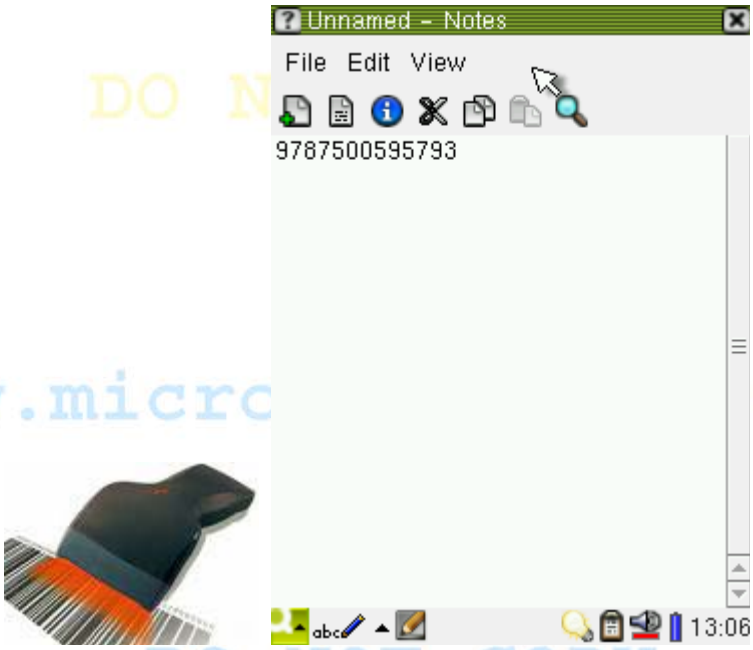
3.1.25 Barcode Scanning

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.



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3.1.26 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” subgroup.

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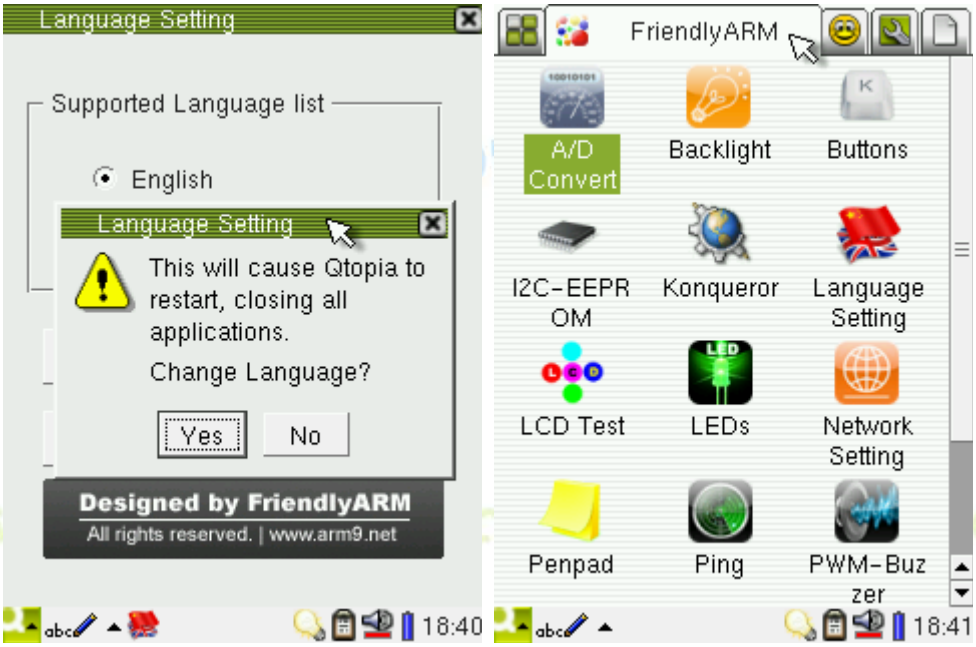
It now supports three languages: English, Chinese and Japanese. When you select “English”, then click on “OK”, a message will popup asking you if you want to change your language setting. Clicking on “Yes” Qtopia will reboot; clicking on “No” it will return. (Note: the Chinese and Japanese versions only translate program names).



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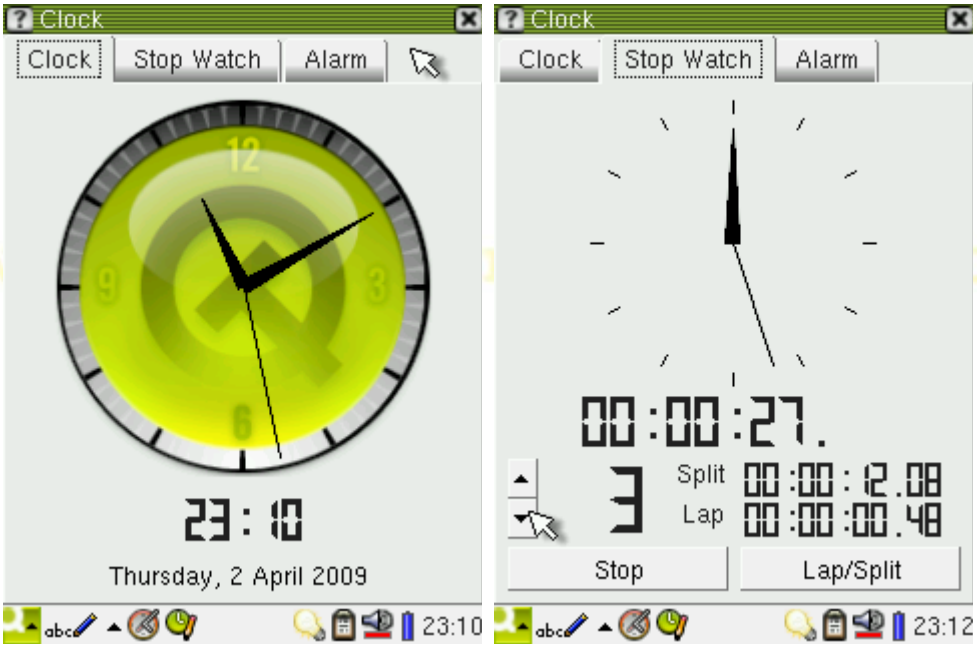
3.1.27 Setting up Time Zone, Date, Time and Alarm Clock

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

Select “Clock” from the menu, click on “Stop Watch” to open a stopwatch utility



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.

3.1.28 Rotating Screen

Click on the “rotation” icon in the “settings” subgroup 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.

3.1.29 Setting up Auto Run Programs

By setting “auto run” you can set Qtopia to run 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 Program” icon in the “FriendlyARM” subgroup.

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.

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.

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3.1.30 System Shutdown

In the “Setting” subgroup, 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.

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.

Terminates 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.

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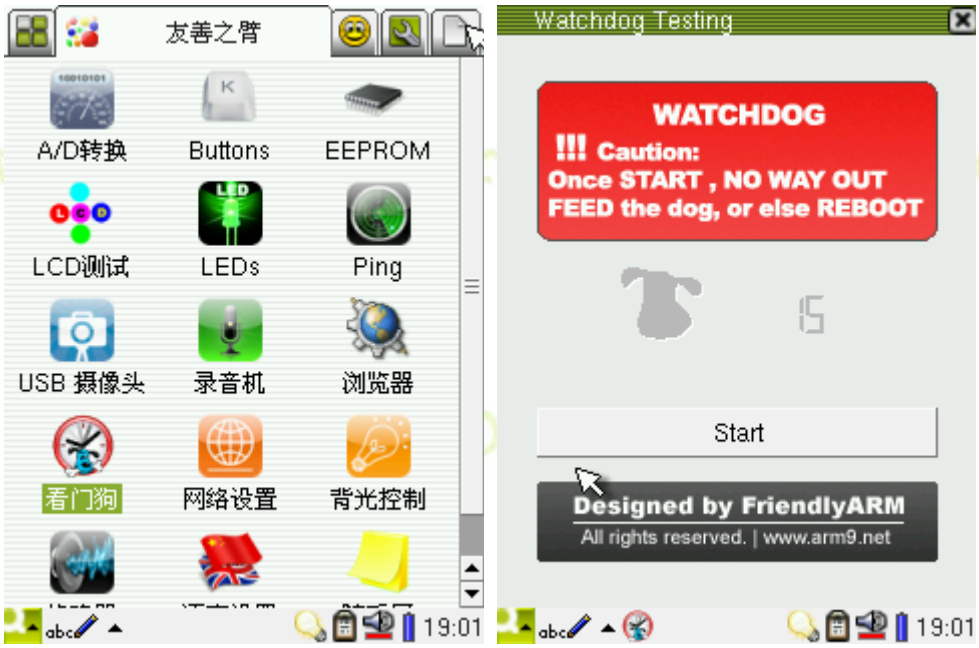
There is a “brightness and power” icon in the “setting” subgroup. Since our system doesn’t have a power management circuit, this icon is not active.

Note: the original Qtopia 2.2.0 system doesn’t “shutdown” or “reboot” effectively, we changed its code to make it work.

3.1.31 Watchdog

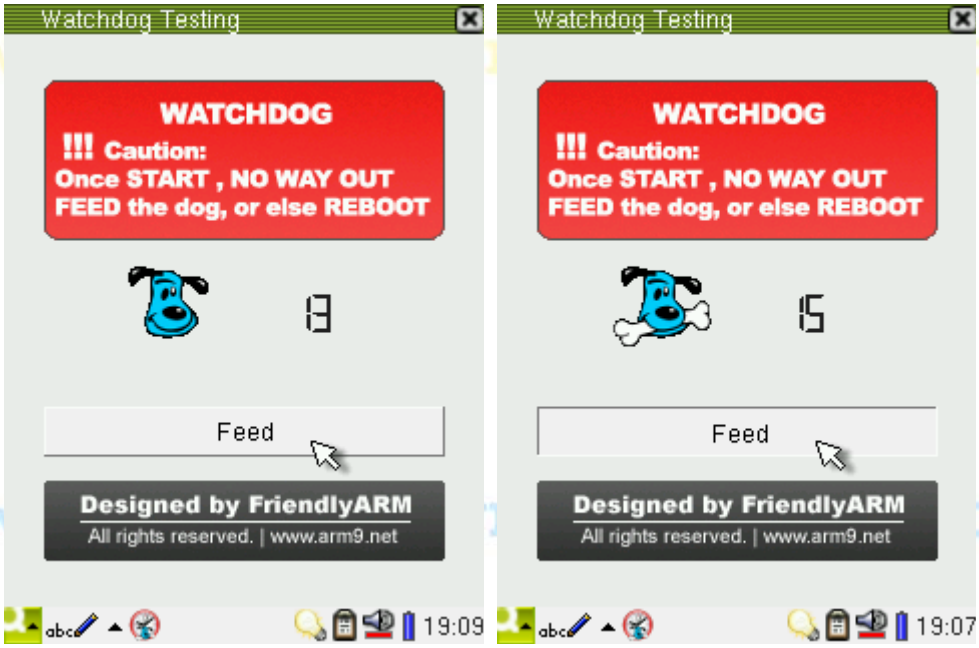
The “Watchdog” is a very basic utility in embedded systems. The S3C2440 chip already has a watchdog. The latest Linux kernel has drivers for it.

Click on the “Watchdog” icon in the “FriendlyARM” subgroup



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.



3.2 Operating MINI2440 Linux via Super Terminal

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, 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.

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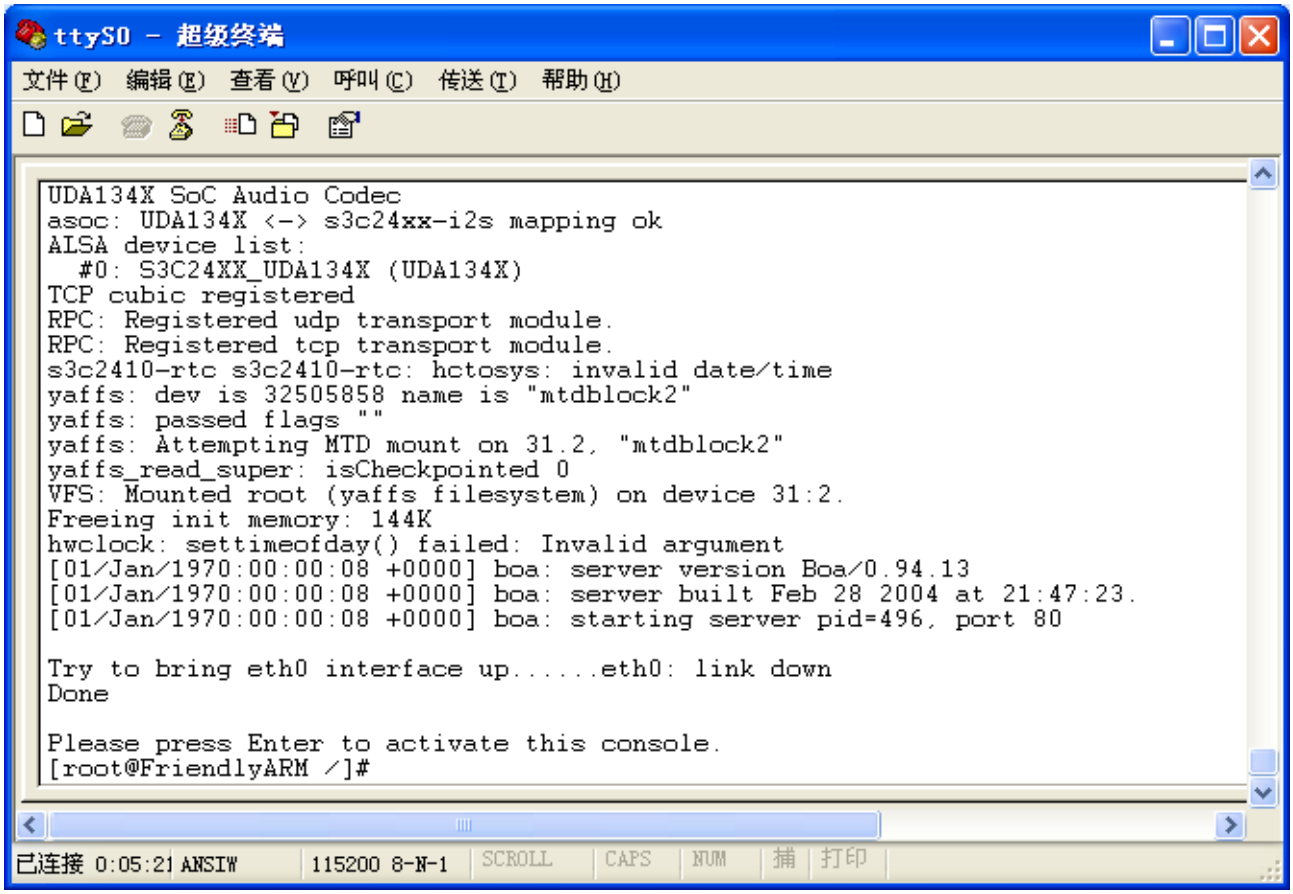

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3.2.1 Mounting a USB Drive/Portable Hard Disk

After inserting a USB drive, the system will automatically create a “/udisk” directory and mount the drive on it, you will see the following messages:

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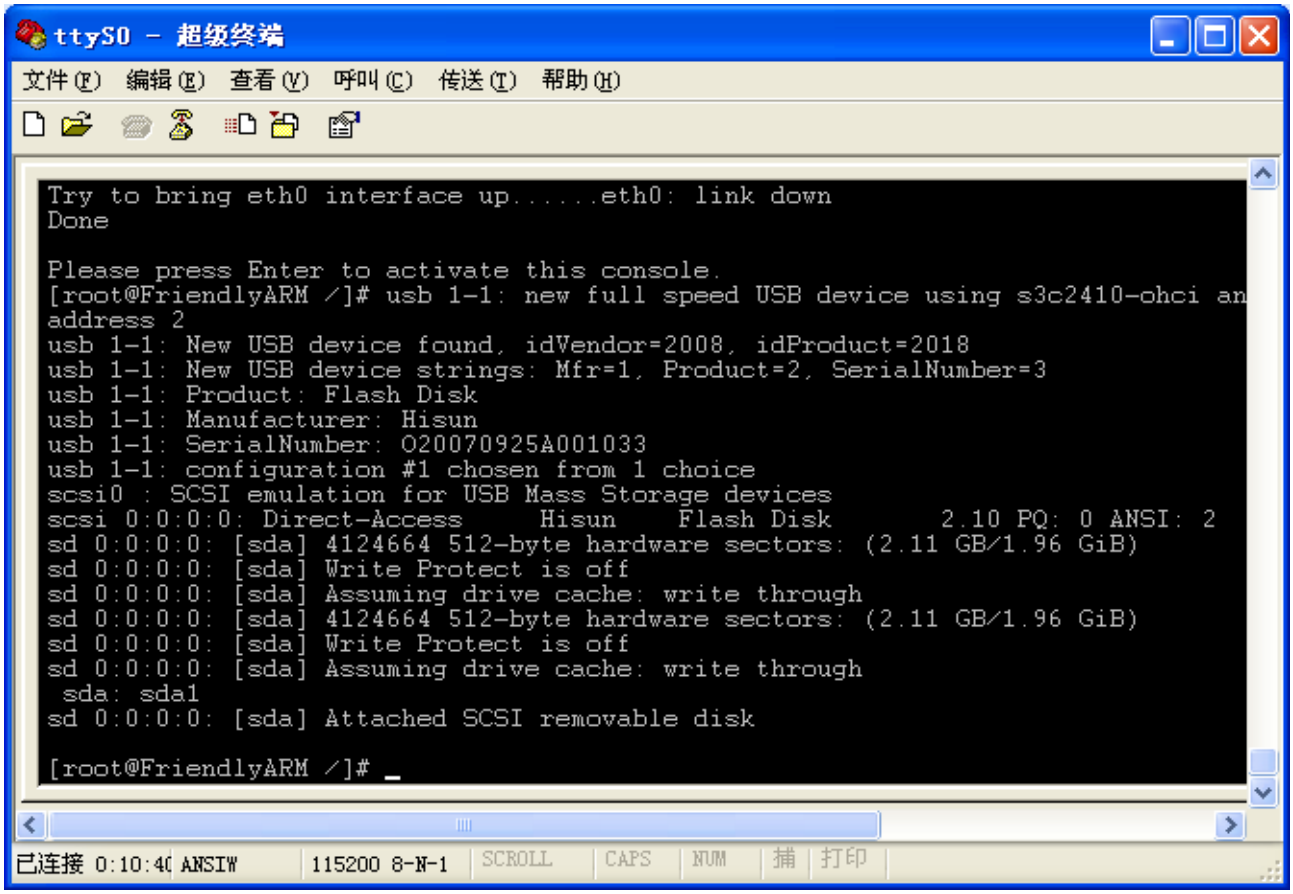

The USB drive has a device name "**/dev/udisk**". Entering the "/udisk" directory, you will be able to browse its contents. Note: if your drive cannot be detected, please check whether it is FAT32/VFAT.

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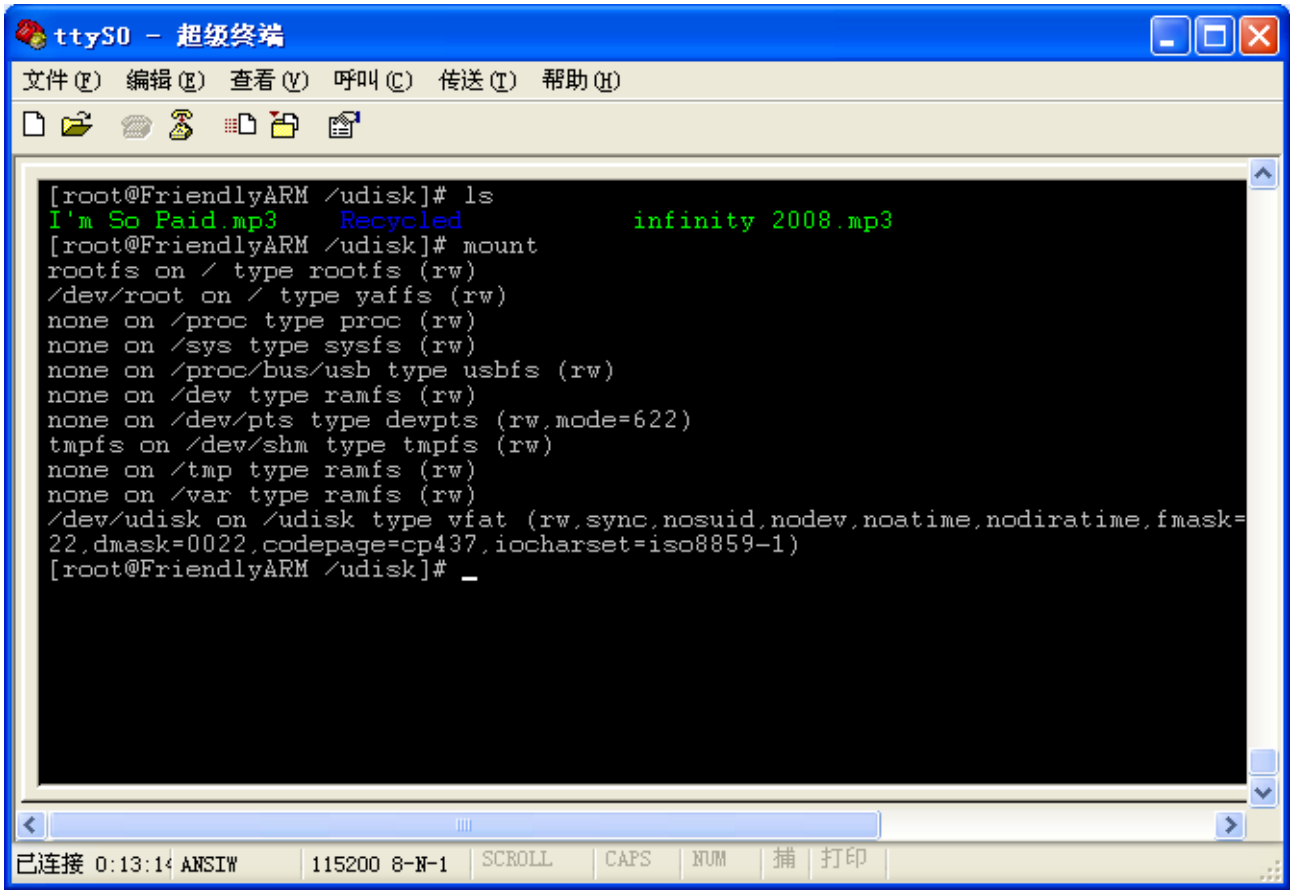

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3.2.2 Mounting a SD Card

Similar to USB drive mounting, a SD card will be automatically detected and mounted. After inserting a SD card, you will see the following messages:

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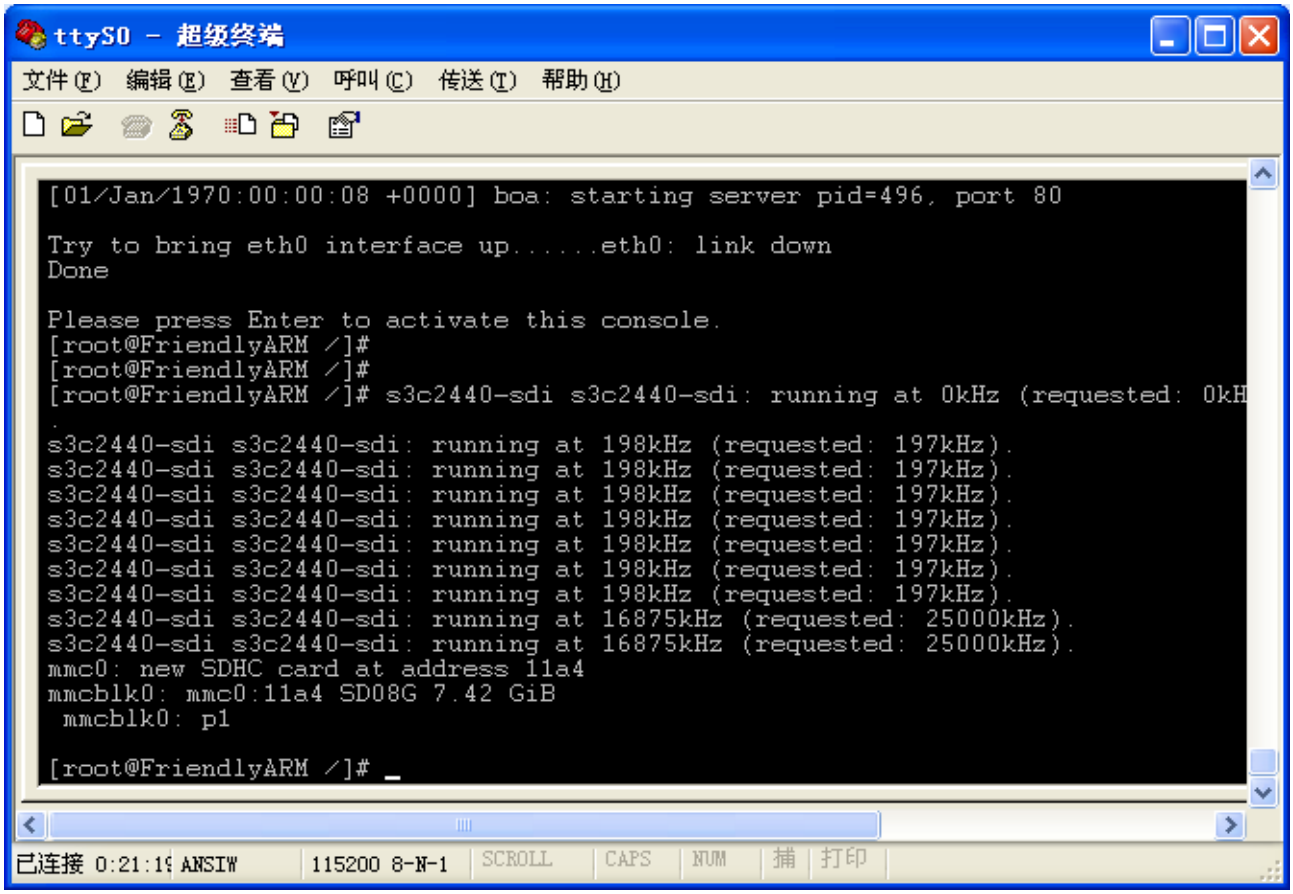

The system will create a “/sdcard” directory and mount the SD card on it.

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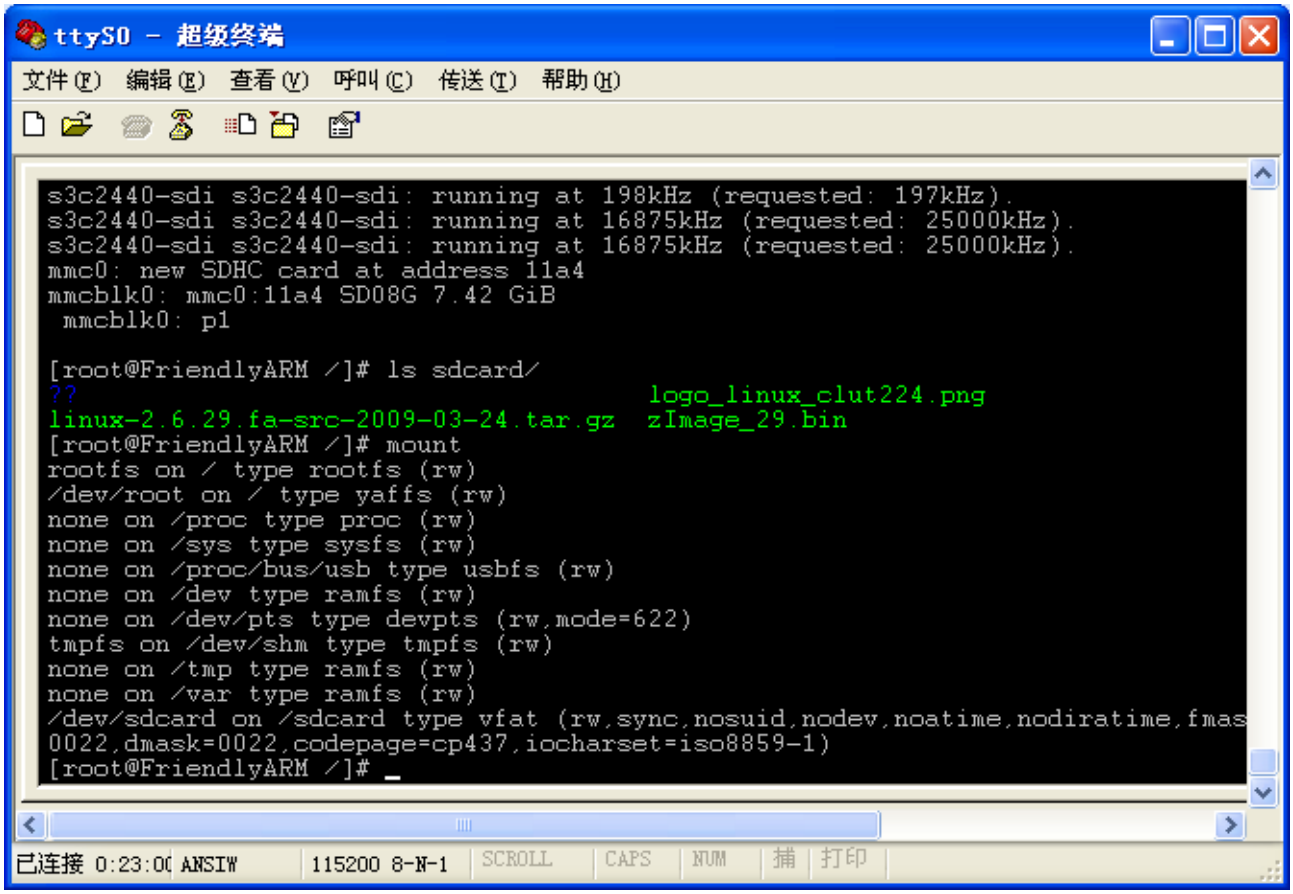

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3.2.3 Mounting a CMOS Camera

Connect a CAM130 camera to your board's CAMERA interface, power on your board and login the system. Type the "camtest" command you will see the following screenshot:

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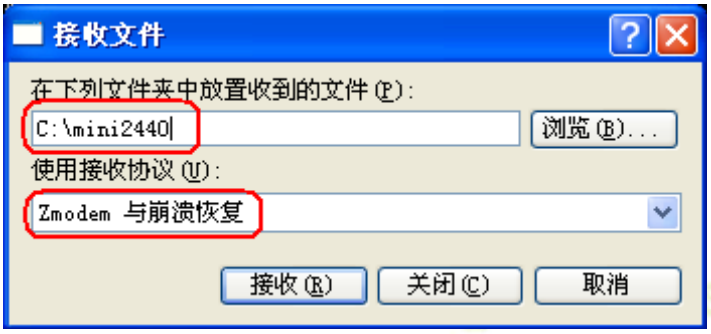
3.2.4 File Transfers to and from a PC via a Serial Port

After login into the MINI2440 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 teminal, 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:



Type "**sz /shanghaitan.mp3**" in the shell to transfer the "shanghaitan.mp3" file under the "/" 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:

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(2) Transfering files by using "rz"

In your MINI2440 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:

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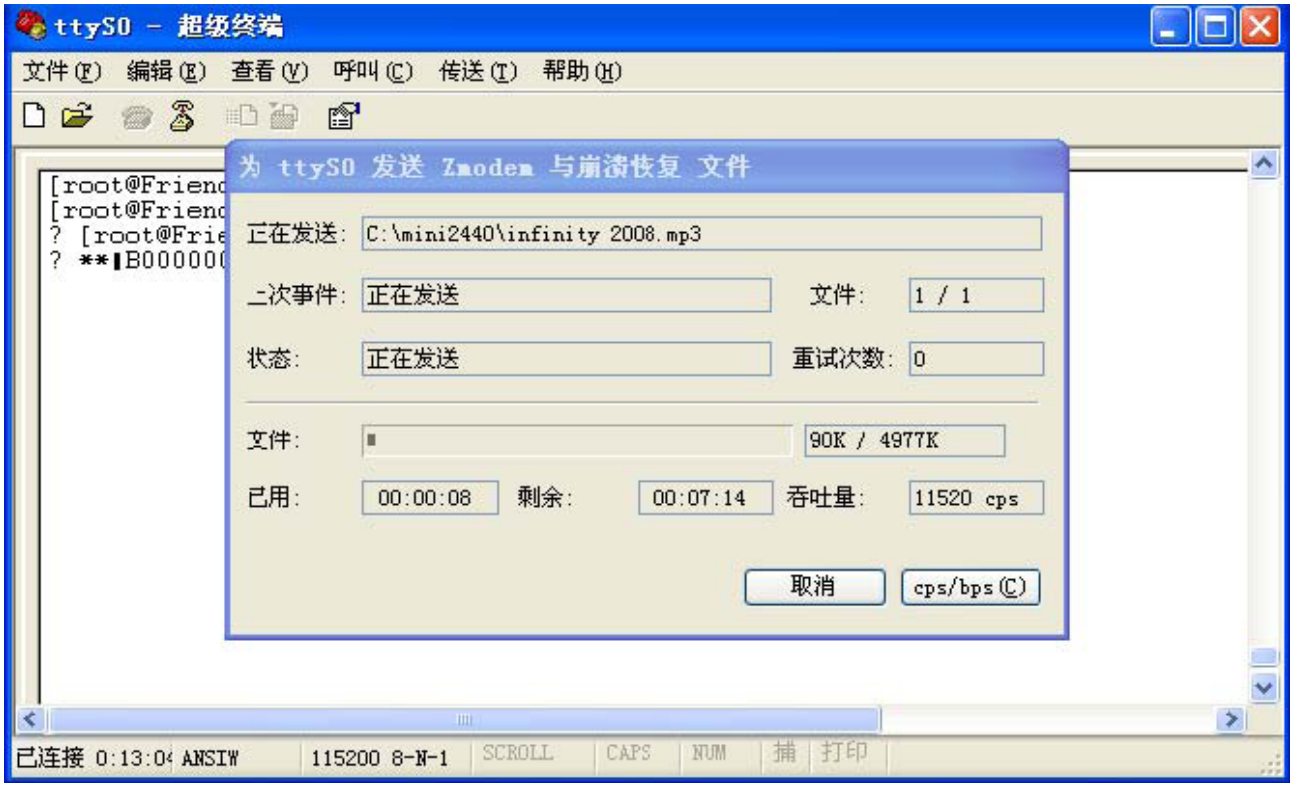
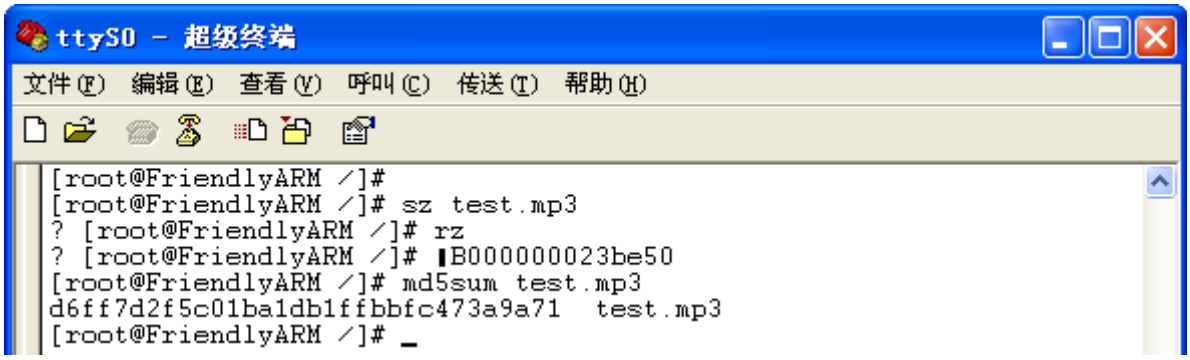


After the transfer is done, the current directory will get this file. You can verify it by using "md5sum" to check whether this file is the same as the original one.



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Chapter 4 Running WinCE

4.1 Software Applications and Configurations in WinCE

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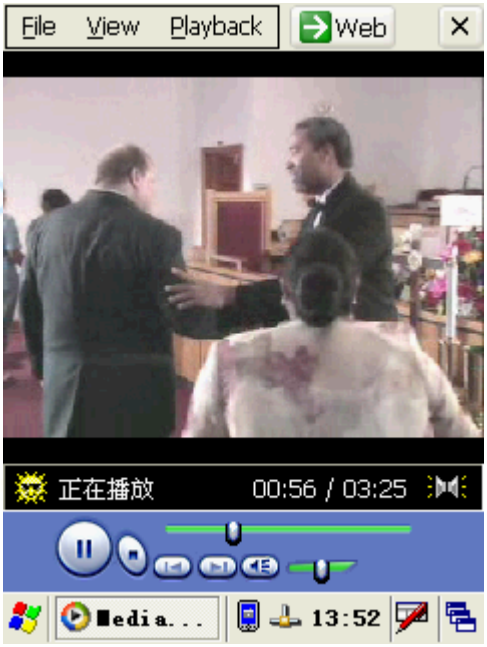
4.1.1 Playing MP3

After starting WinCE, double click on the “Media Player” icon, the Windows Media Player will pop up as shown below. Select “File”-> “Open”, follow the prompt, locate an mp3 file you want to play, it will be run like what it does in a PC Windows system. In addition, the Media Player can also play the WMV files.



4.1.2 File Transfer with FTP

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Linux or Windows by default has a FTP command line program. Using the FTP service can remotely login a host, transfer files to and from it. The MINI2440 system has a default FTP command line program and starts this service on system startup. To test this service, you can login the sytem via a command line window from a host PC and transfer files to and from it.

Note: please make sure the directory in which to run the FTP commands has the files for FTP test. In this example, it was a “hope.mp3” file.

After the transfer is done, you can check if a “hope.mp3” file exists under “/home/plg”.

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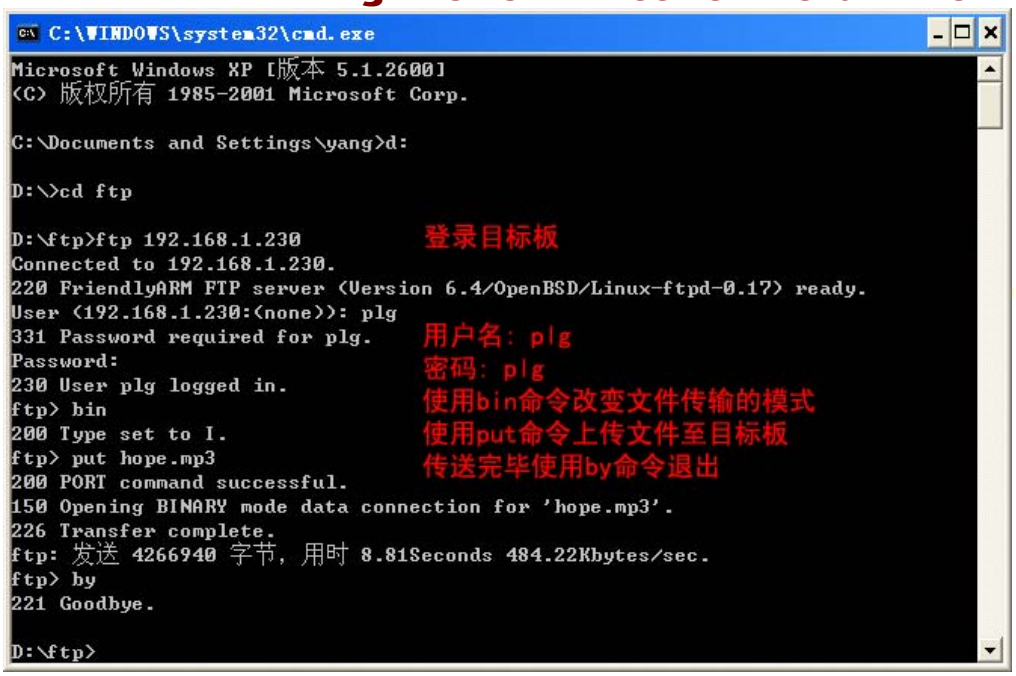

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4.1.3 Configuring Web Server

If the HTTP service is set to auto-run in WinCE, it will be started on startup. This service is what is commonly called “web server”. Connect the MINI2440 board which runs WinCE to a host PC, type the board’s IP address in IE’s address bar, if you see a preset home page as the example shown below, it indicates the web server has been started.

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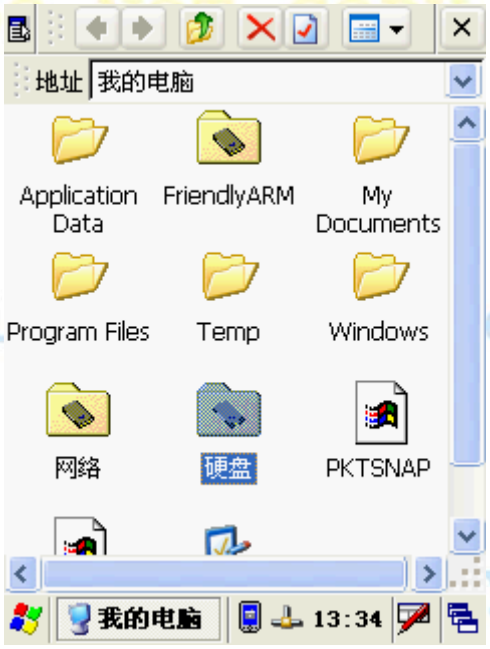
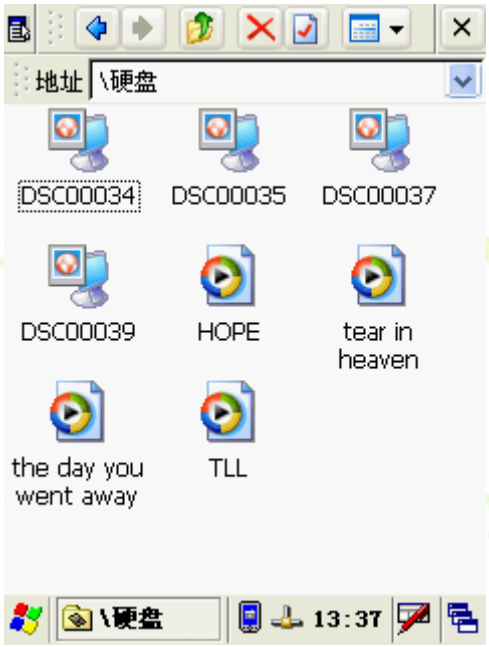
4.2 Testing Hardware in WinCE

4.2.1 Mounting a USB Drive

Using a USB drive in WinCE is similar to Linux. After entering WinCE, plug a USB drive in the USB host port, the power led on the USB drive will be flashing, several seconds later this drive will be mounted on the system. Double click on the “My computer” icon, open the “resource manager”, you will observe that a USB device has been created. Please refer to the screen shot below:

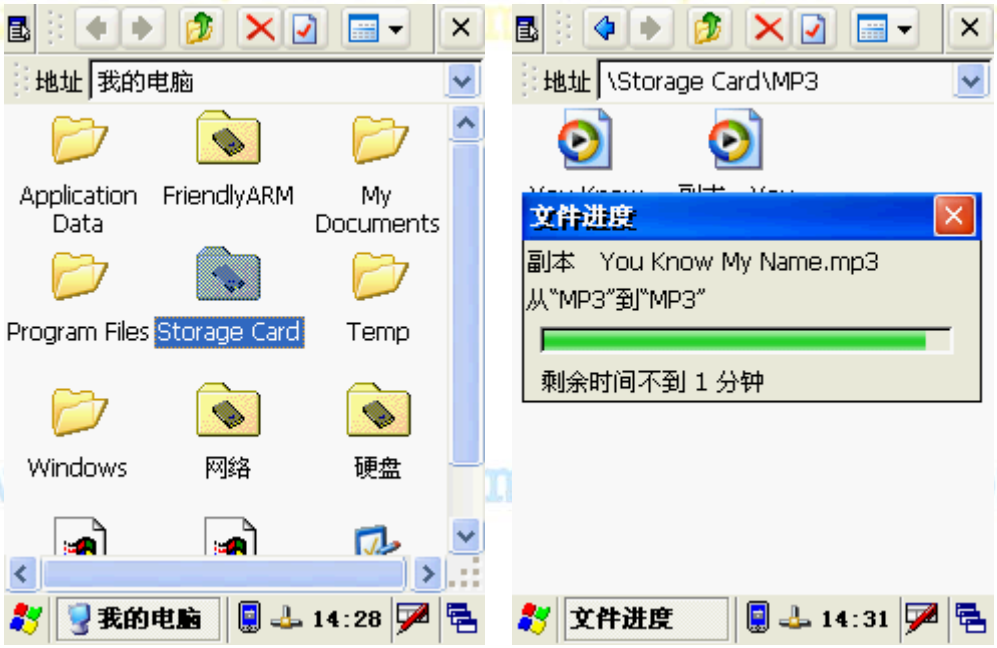


Double click on the USB drive icon, you will be able to browse its contents, read and write files.



4.2.2 Mounting a SD Card

Plug a SD card in the SD interface of the board you will be able to see a SD device “Storage Card” is created in the “resource manager”. Double click on the SD card icon, you will be able to browse its contents, read and write files.



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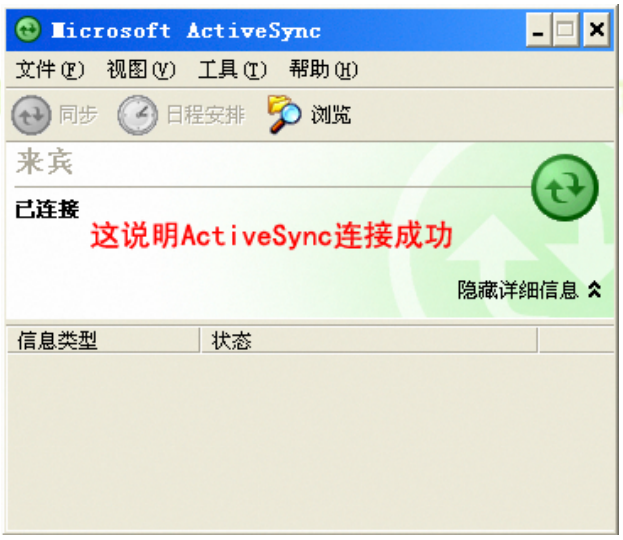
4.2.3 Connecting a USB Device via ActiveSync

Note: Please use the “\windows platform tools\CE ActiveSync USB driver” to install a USB driver.

After successfully installing the driver and the ActiveSync application, connect the MINI2440 board to a host PC, if everything goes smoothly, you will see the screen shot below:



4.2.4 Testing Serial Ports

Note: The MINI2440 system goes with a standard driver for three serial ports. To test ports 2 and 3, you need to utilize the shipped extended serial port board.

After booting the system, click running the “SComAssistant” icon on the desk like the screen shots shown below:

Click on the “Configure” button, open the configuration window, set the serial port to “COM2”, the “Port speed” to 115200, the others to what the above screen shots present and then click on “OK”.

In the meantime, connect the “COM2” port on the extended board to a host PC and set up the serial port configurations in the PC system.

On the main window, click on the “open” button, it will be changed to “close”. Type characters in the terminal window, click on the “send” button and the PC will receive those input characters. Please see the screen shots below:

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In your MINI2440, run the "SComAssistant" application, click on the "receive" button (it will be changed to "Stop"), type characters on the opened PC terminal, and you will see those characters simultaneously. Please see the screen shot below:

Please follow the same procedure to set up COM3.

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Chapter 5 Setting up Linux Development Environment

5.1 Setting up Fedora 9.0 Development Environment

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5.1.1 Installing Fedora 9.0

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Note: users can download a Fedora 9.0 DVD image from **http://www.arm9down.cn/linux/fedora9.iso**

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”.

Step2：The system will check the installation disk. It can be ignored, just press “Skip” to the next step.

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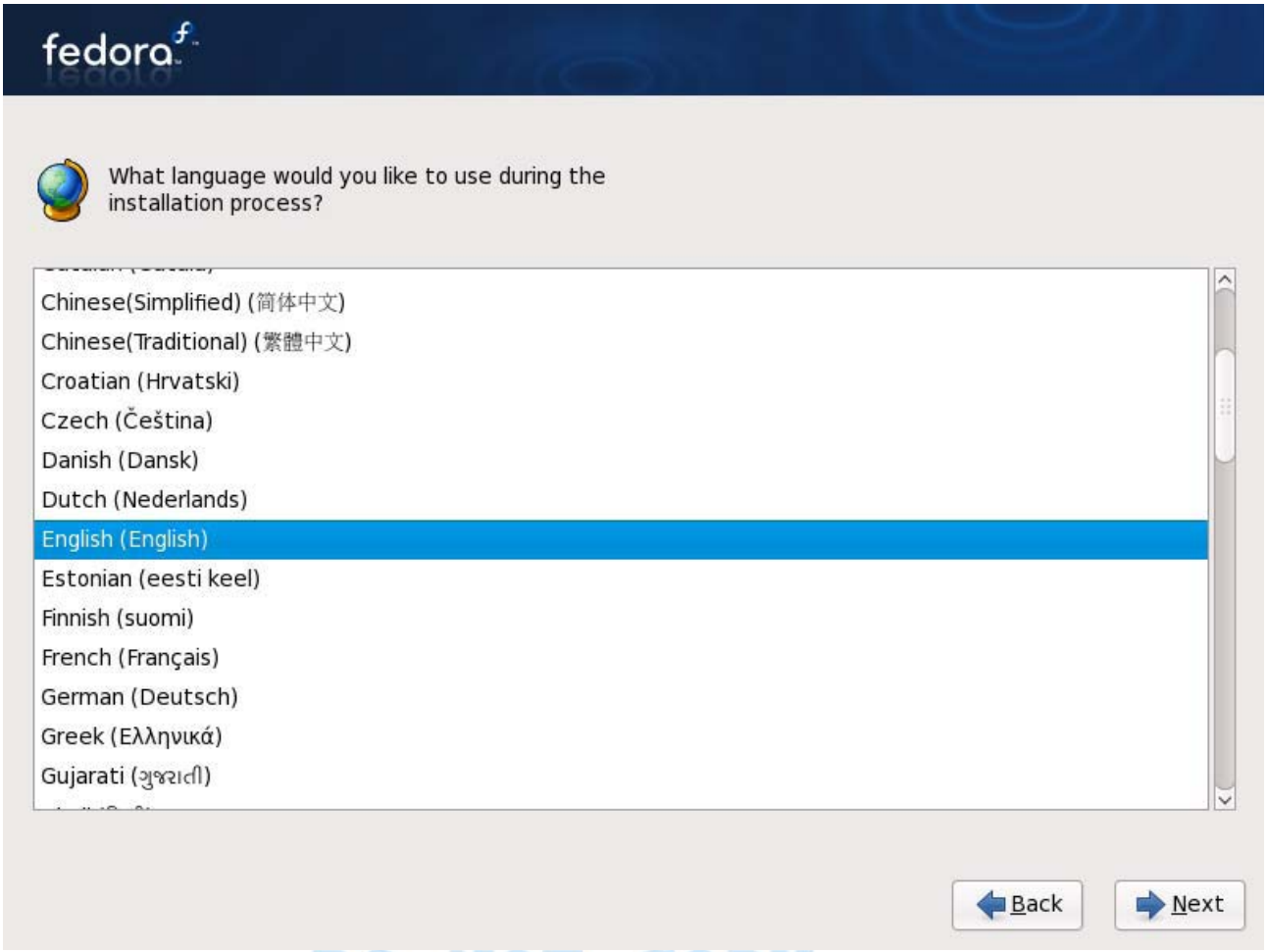
Step3：it enters the graphic interface, click on the “Next” button.

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



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

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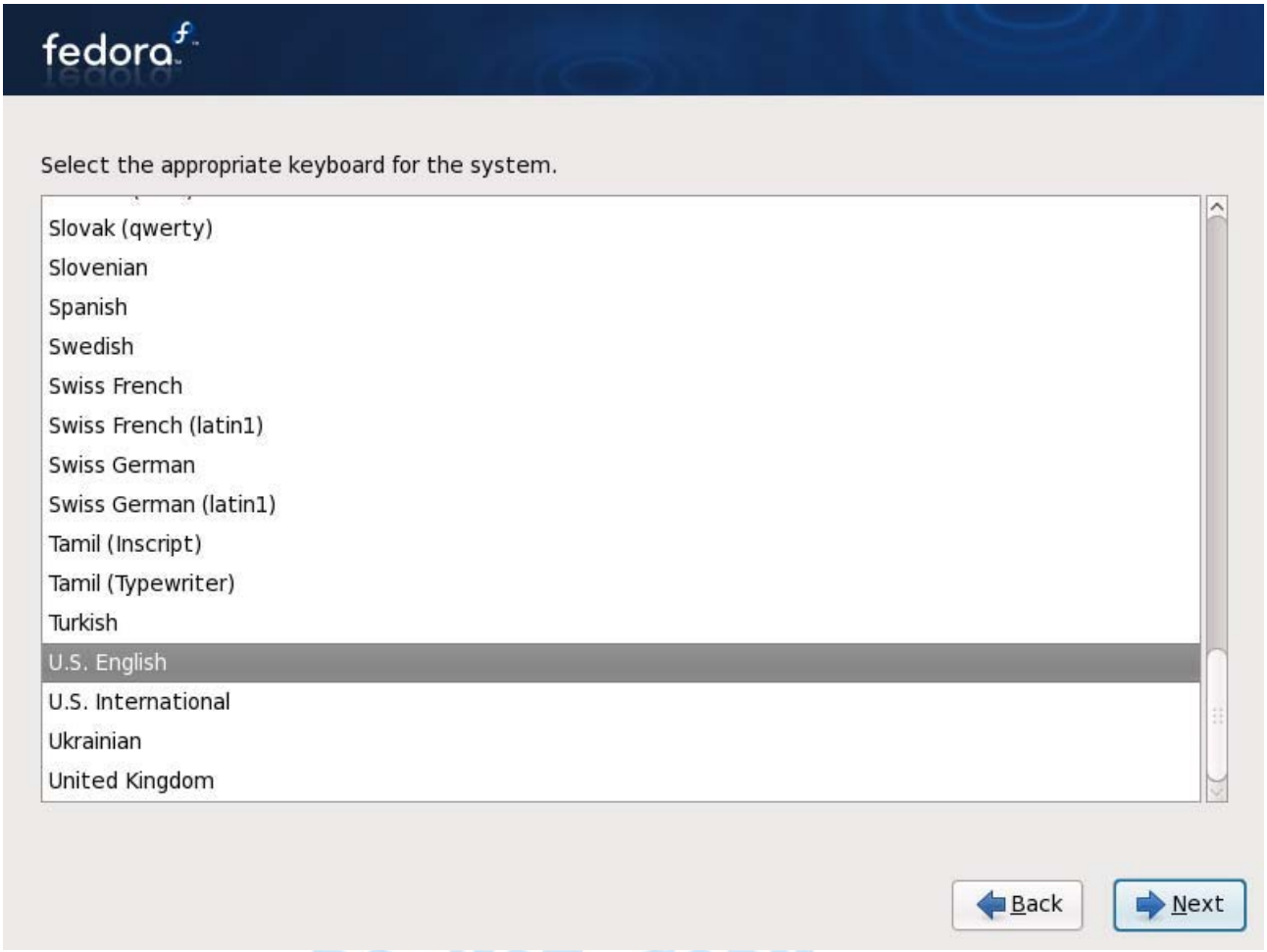

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Step 6：configure the network.

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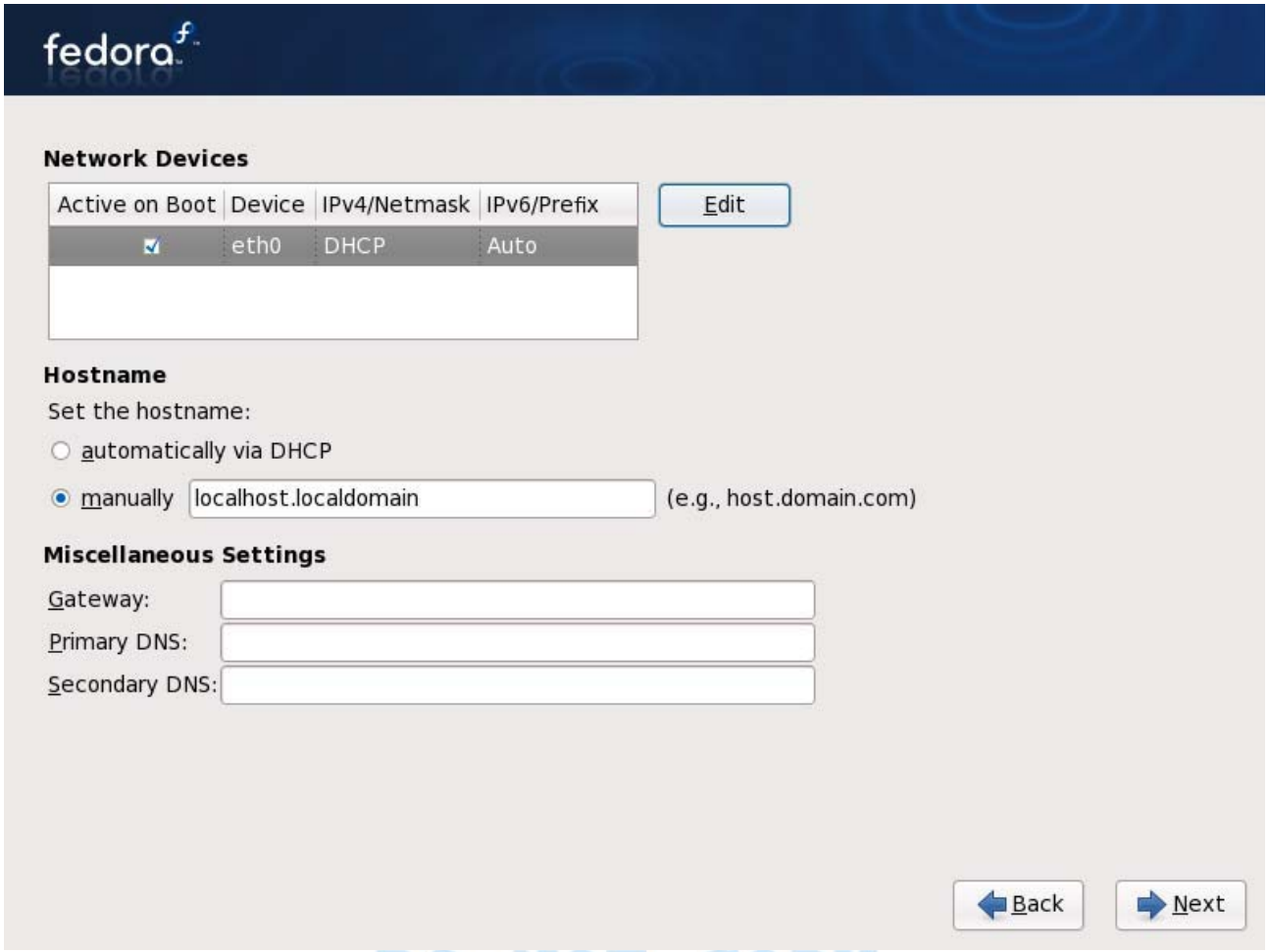

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In our example, we didn't set it as "DHCP", we used a static IP instead, and typed the IP and subnet mask as follows.

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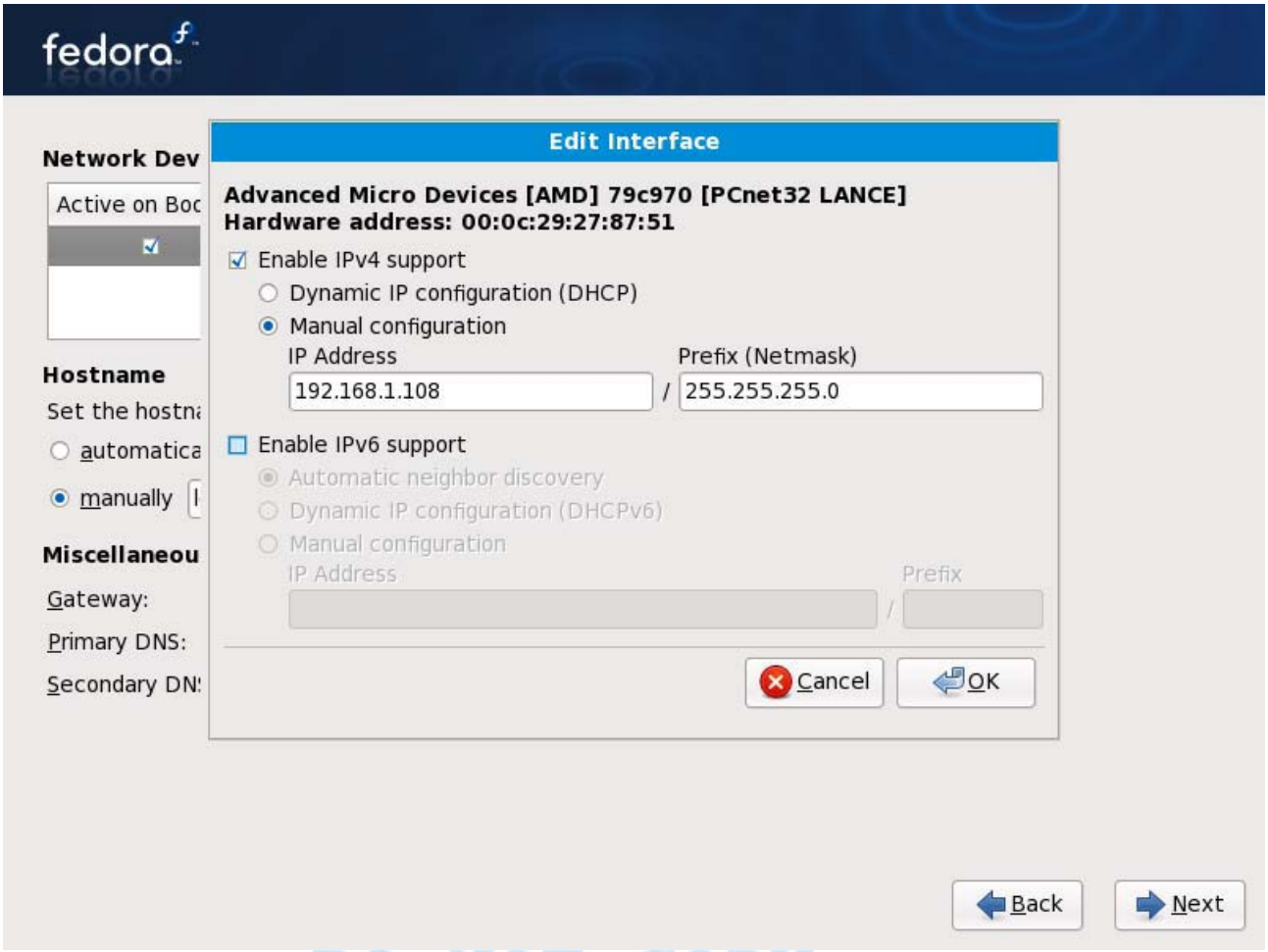

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Click on the OK button and go on to set the machine name, gateway and DNS.

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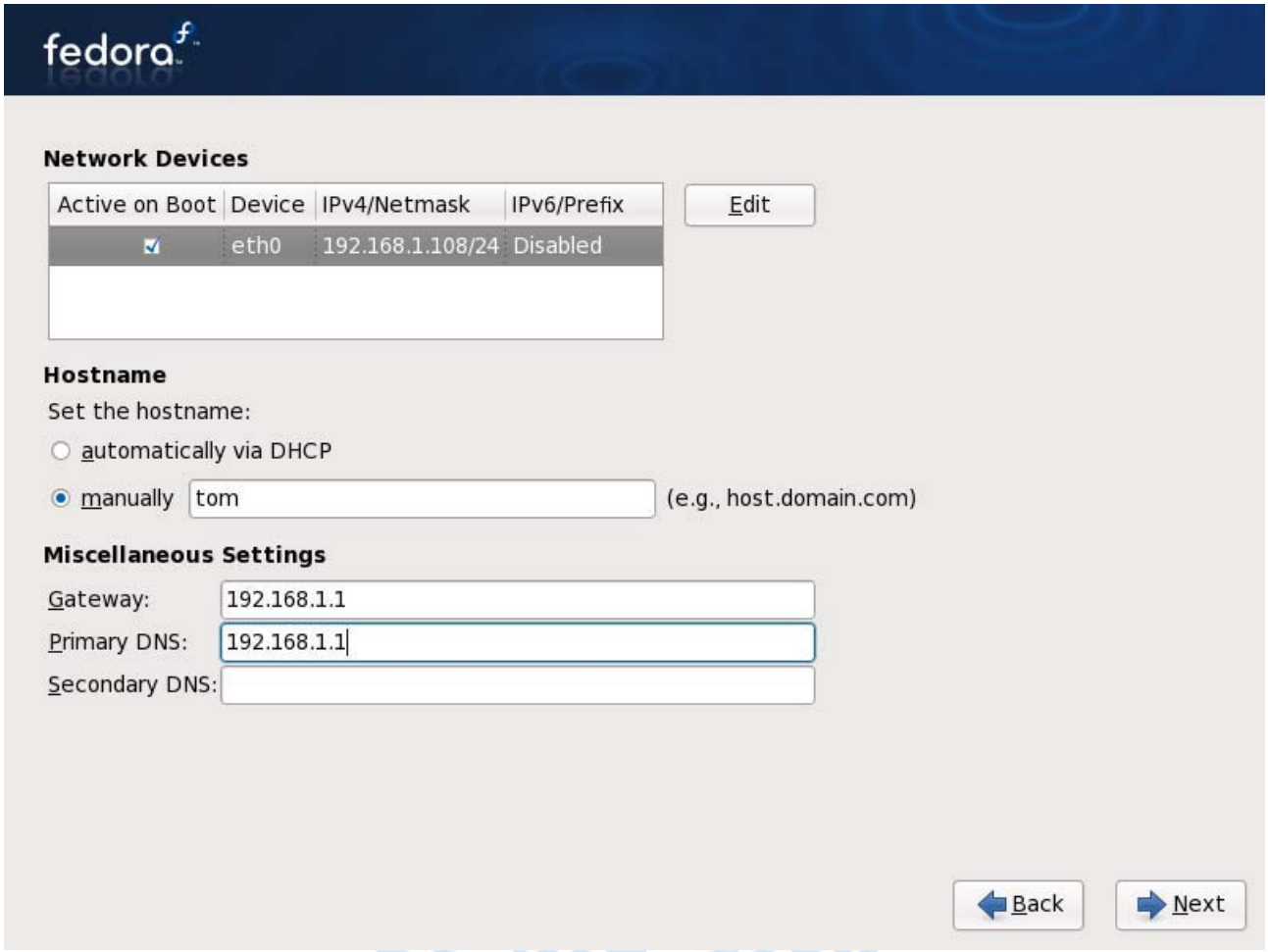

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Step 7：set the time zone. We chose “Asia/Shanghai”.

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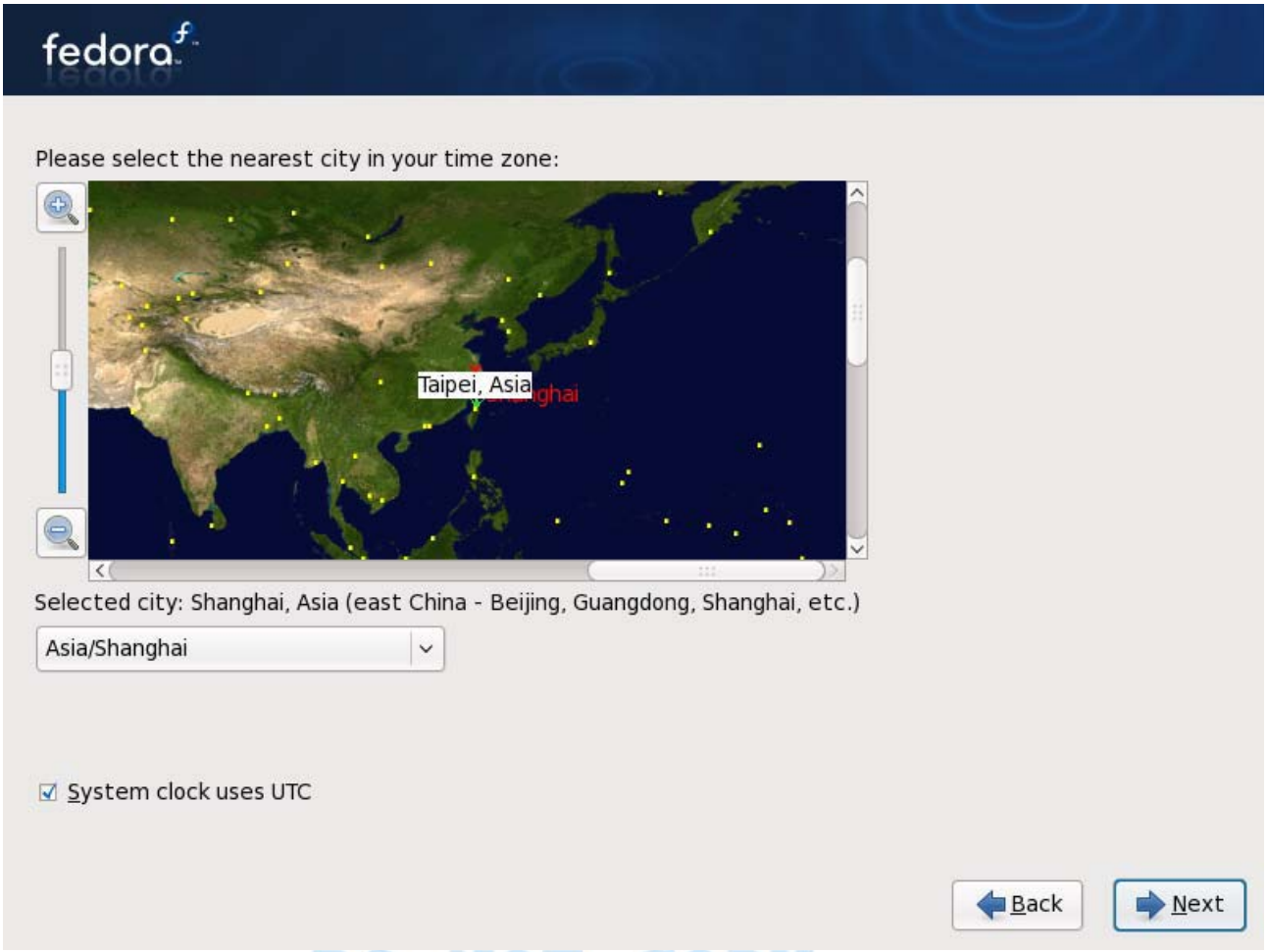

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Step 8：set up the administrator's password, i.e. the root's password. "root" is the super user. It should be at least 6 characters

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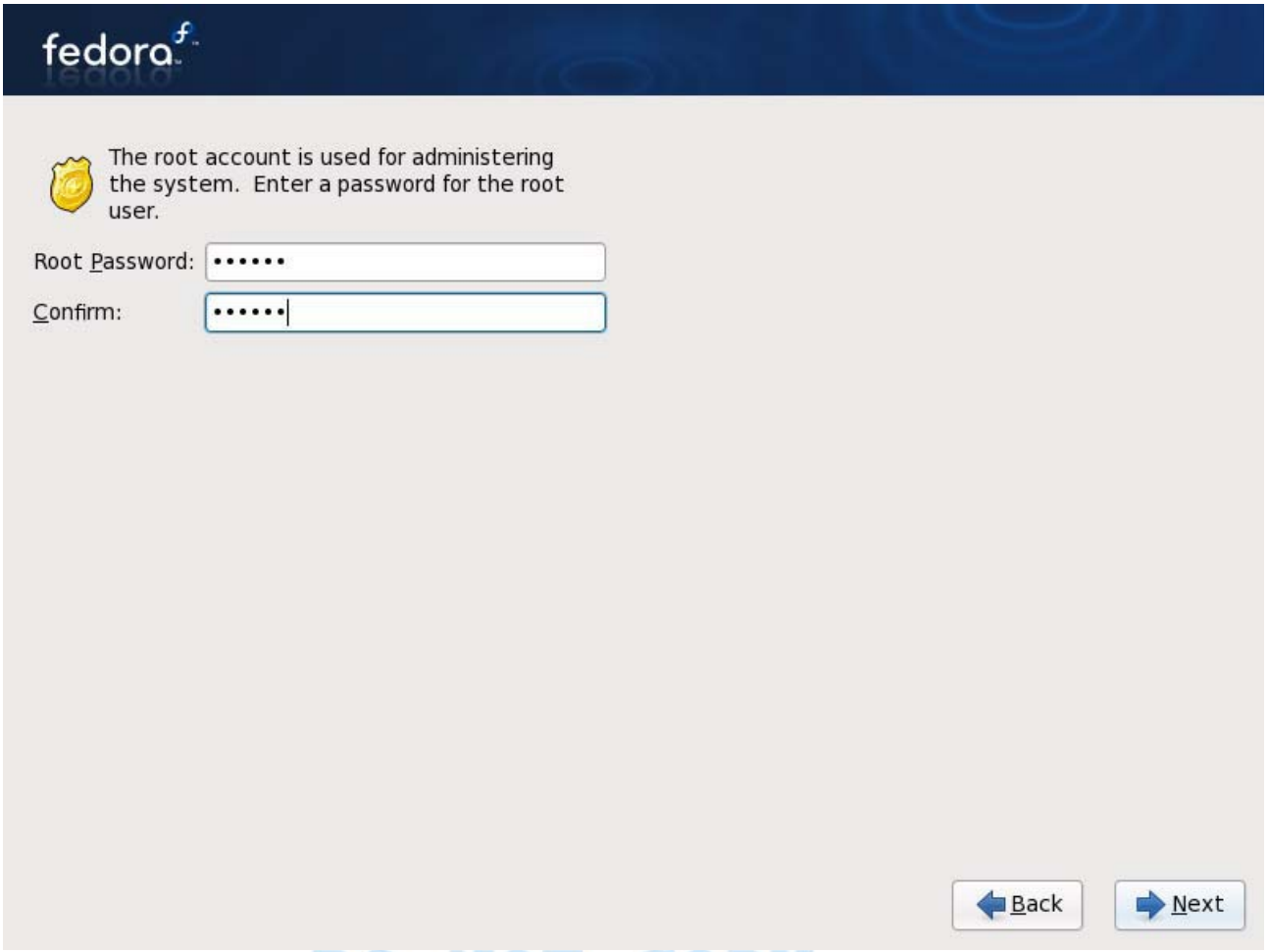

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Step 9：disk partition. We followed the default option. Before do this, please back up disk data.

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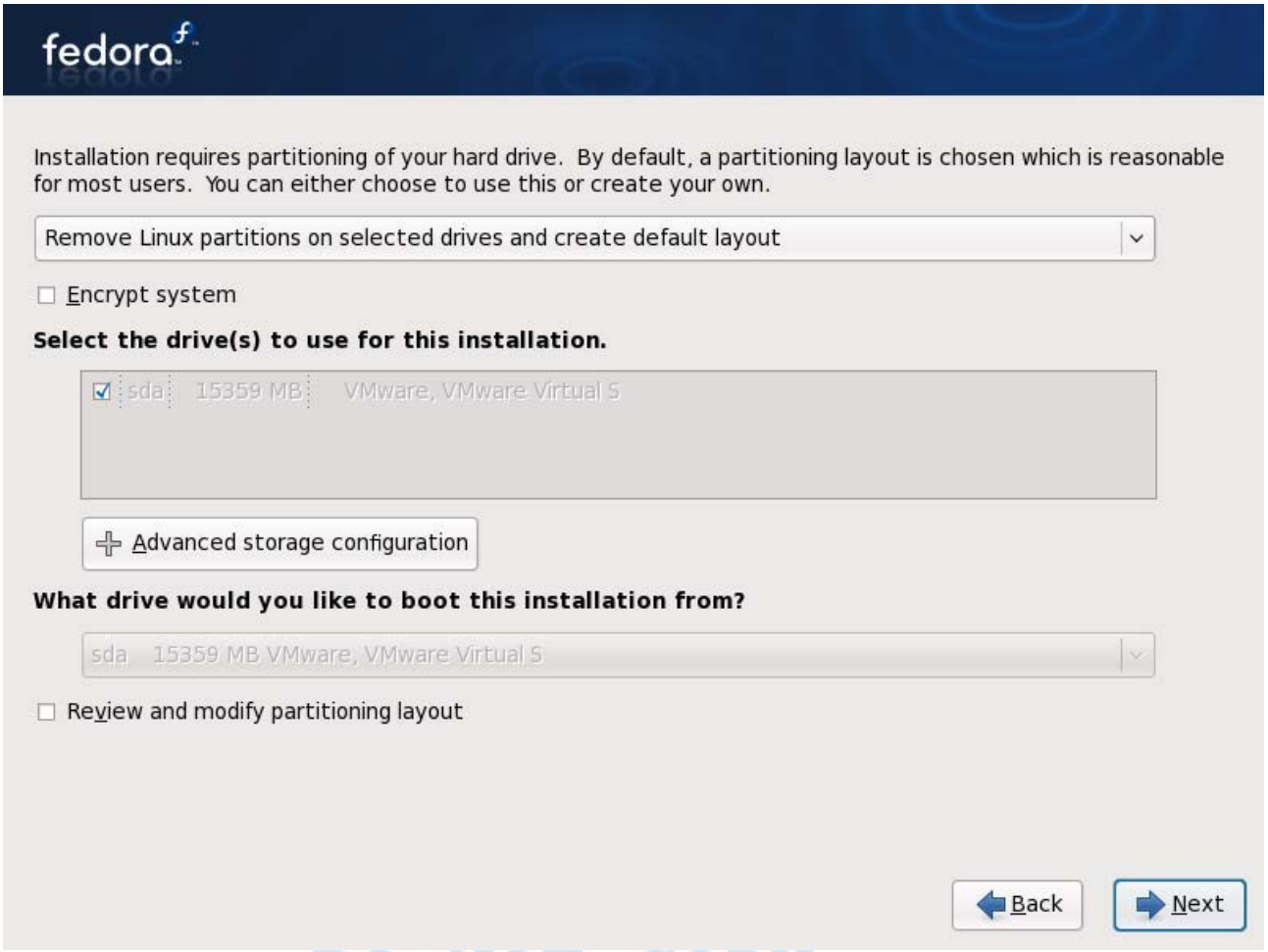

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Click on “Next”, it will warn the user that all the data will be deleted. Usually we would do this installation in VMWARE, so we chose “Write changes to disk” and disk format would begin.

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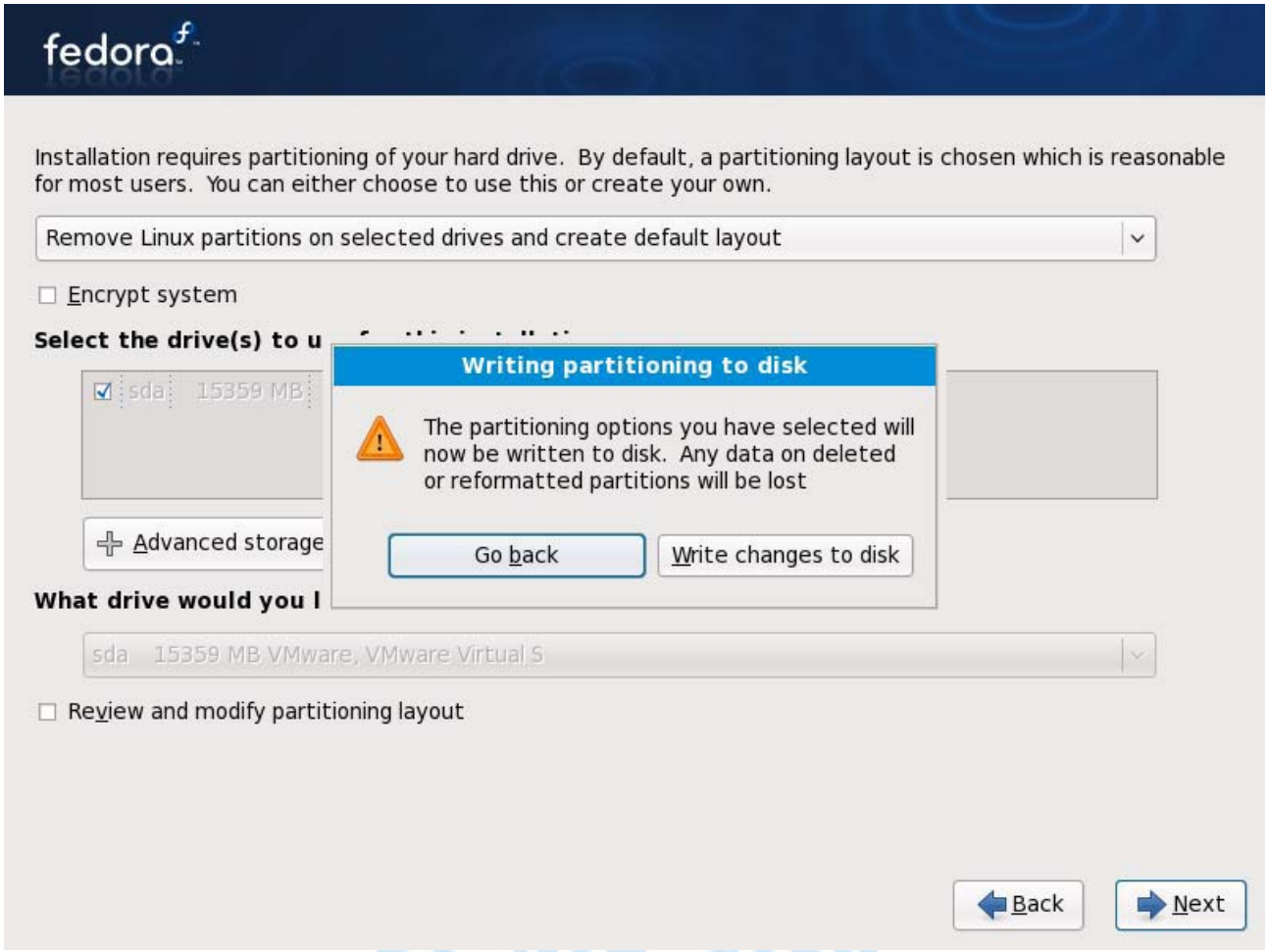

Here is the format process:

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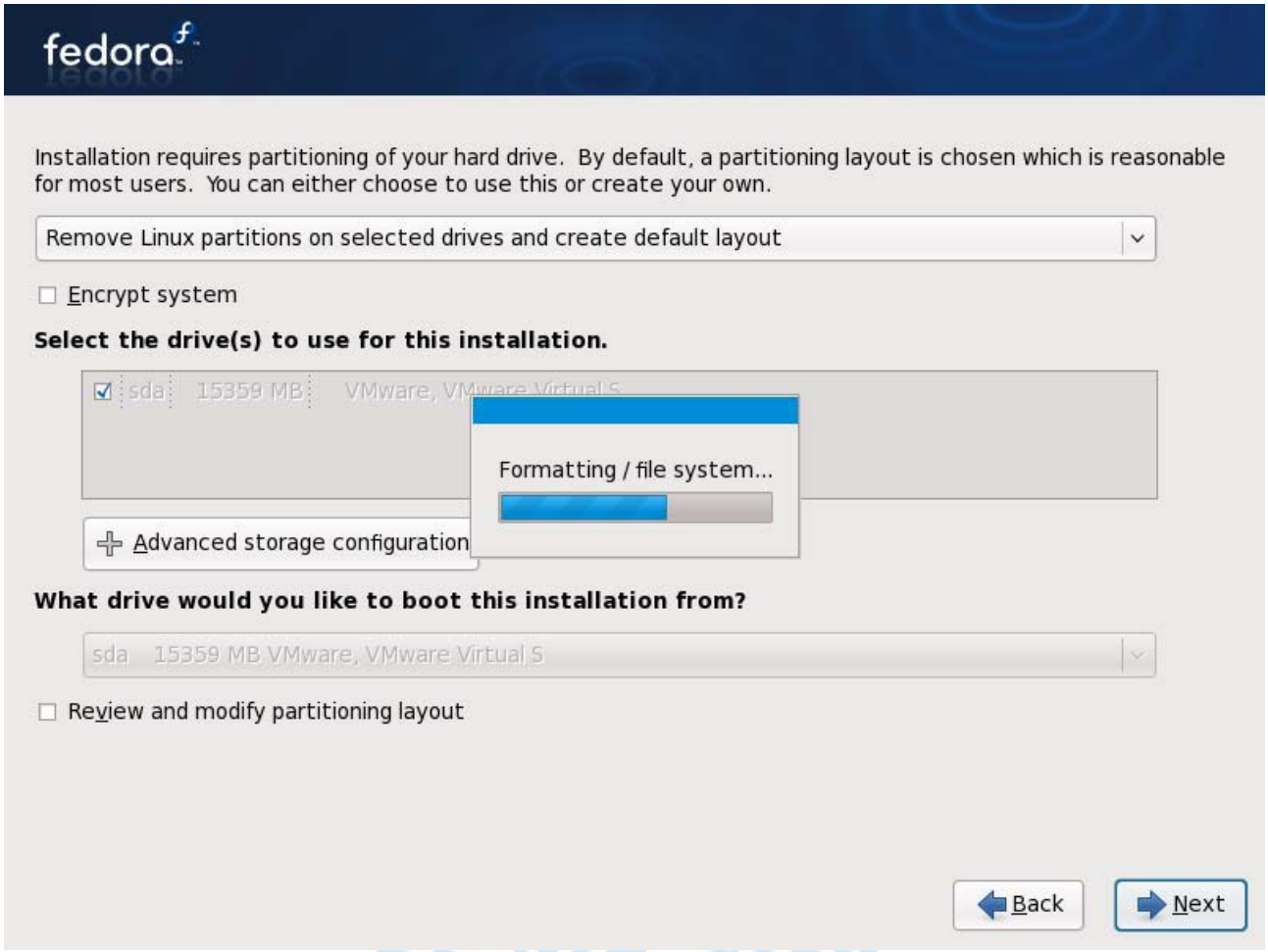

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Step 11：select the installation type, in this example, we chose “customize”

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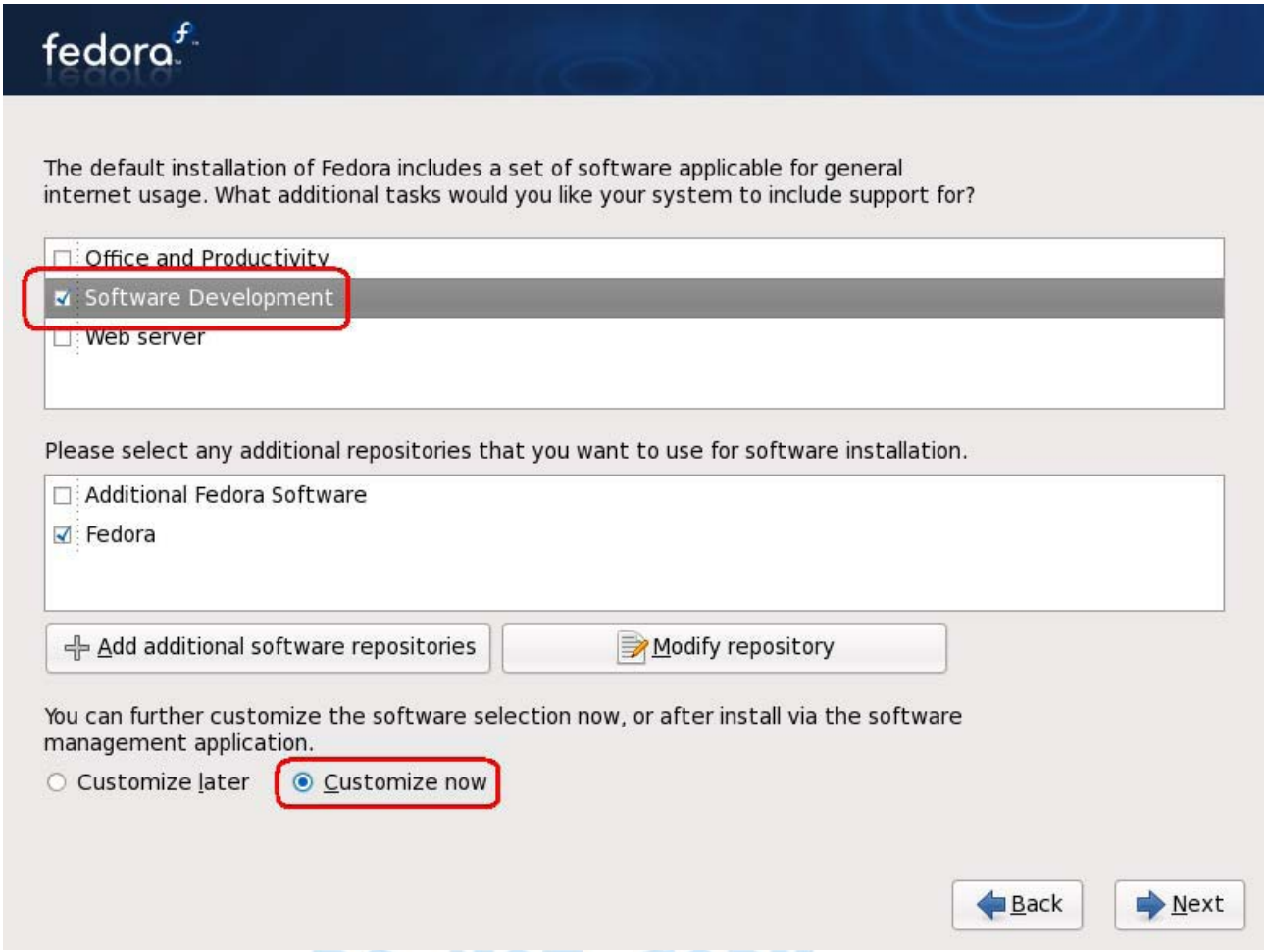

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Step 12：configure the “server” item as follows:

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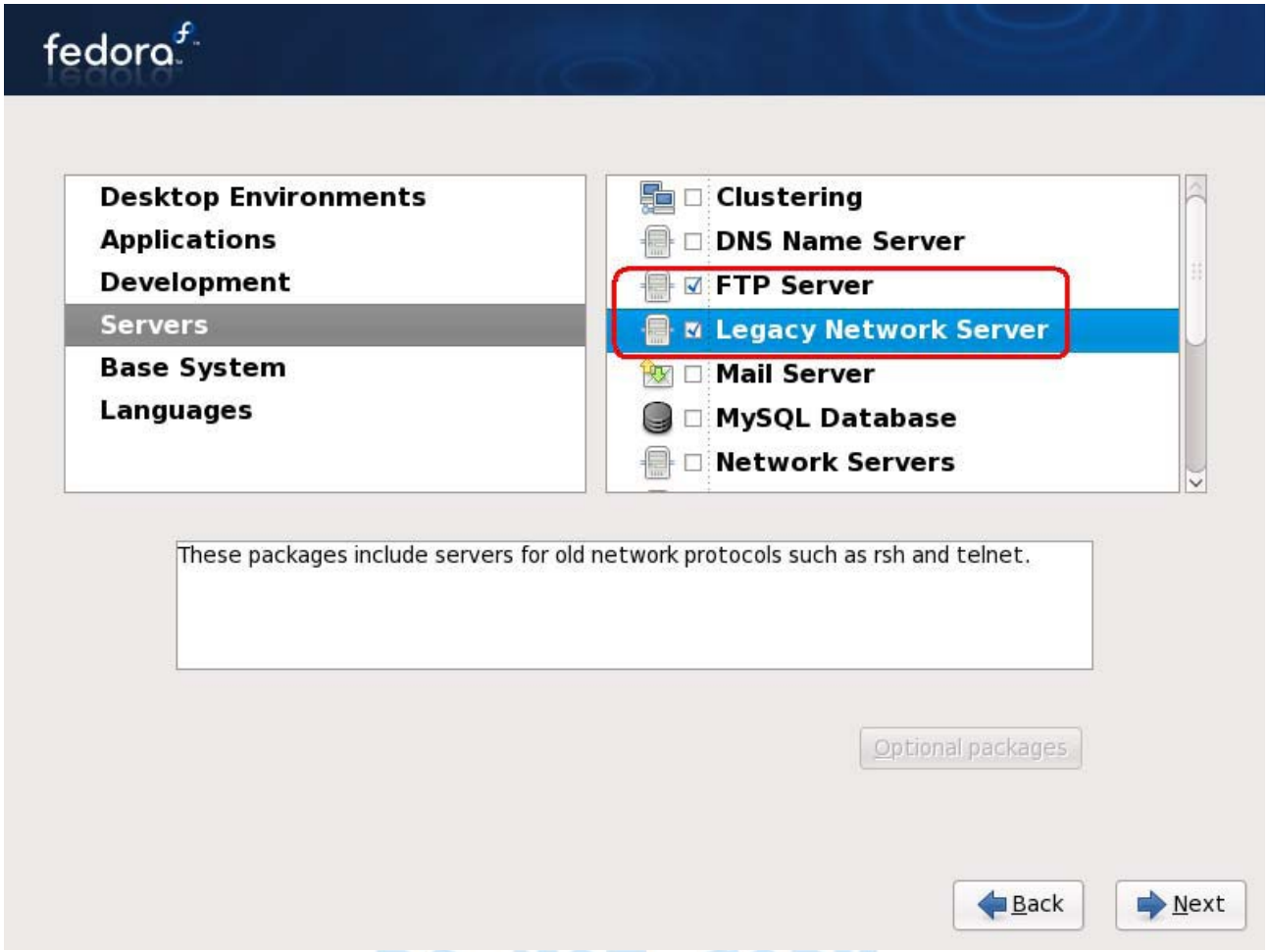

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Step 13：begin installation

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Step14: installation complete.

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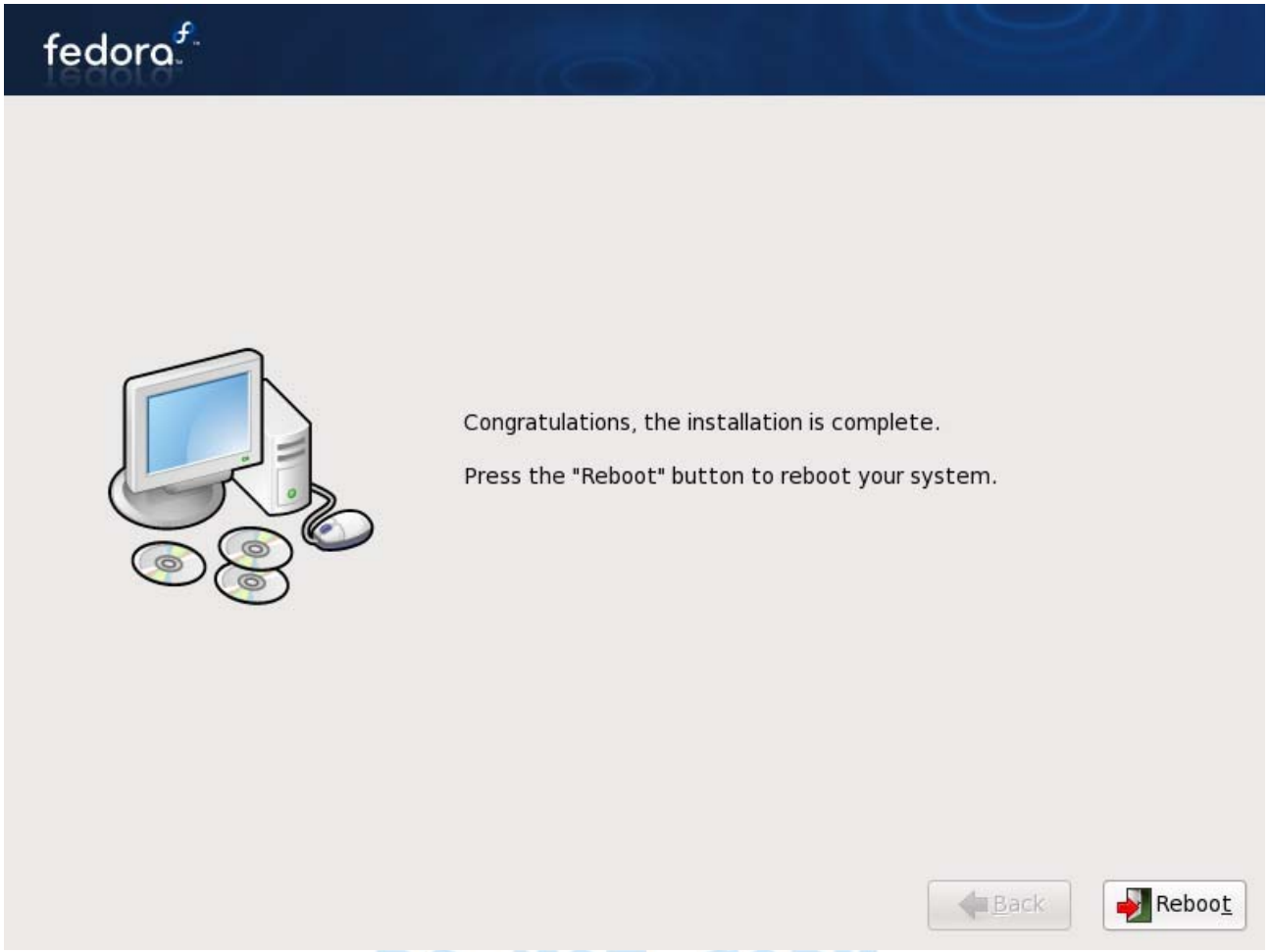

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Step15: after installation completed, click on the reboot button on the page shown in step 14

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Step16: skip this license page and go “forward”

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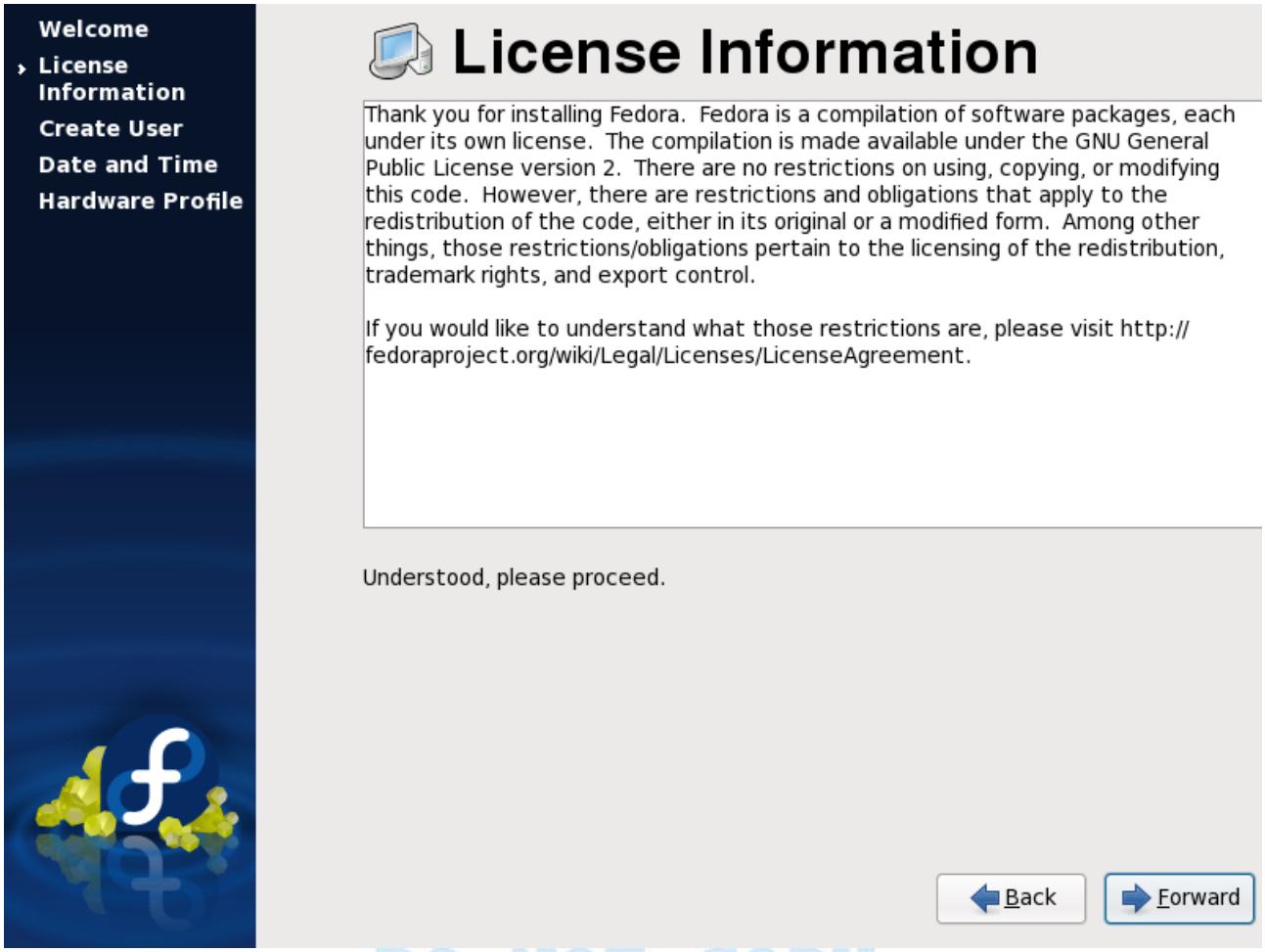

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Step17: create new users. We ignored user creation and went to the next step.

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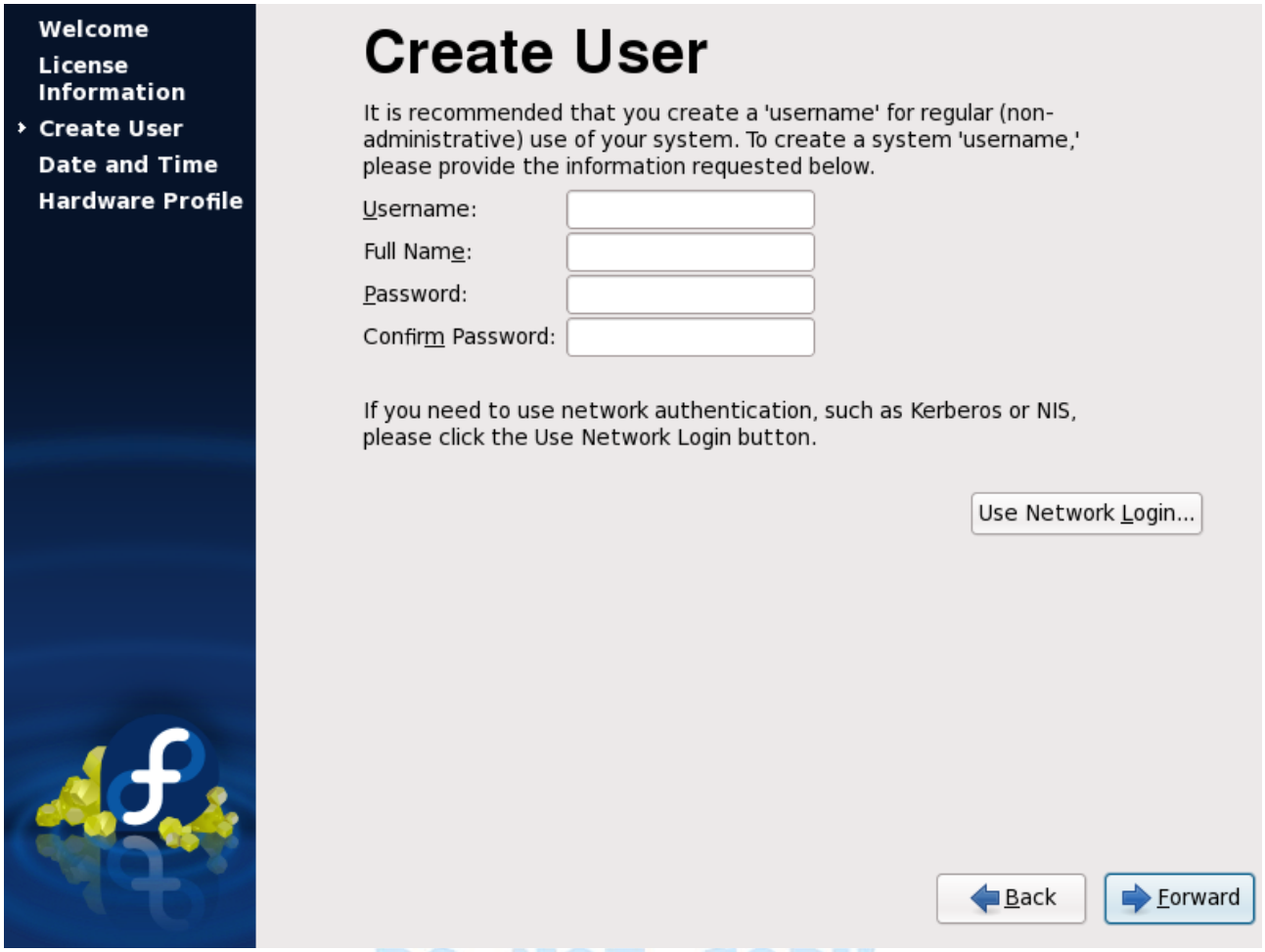

Press “continue” to go on.

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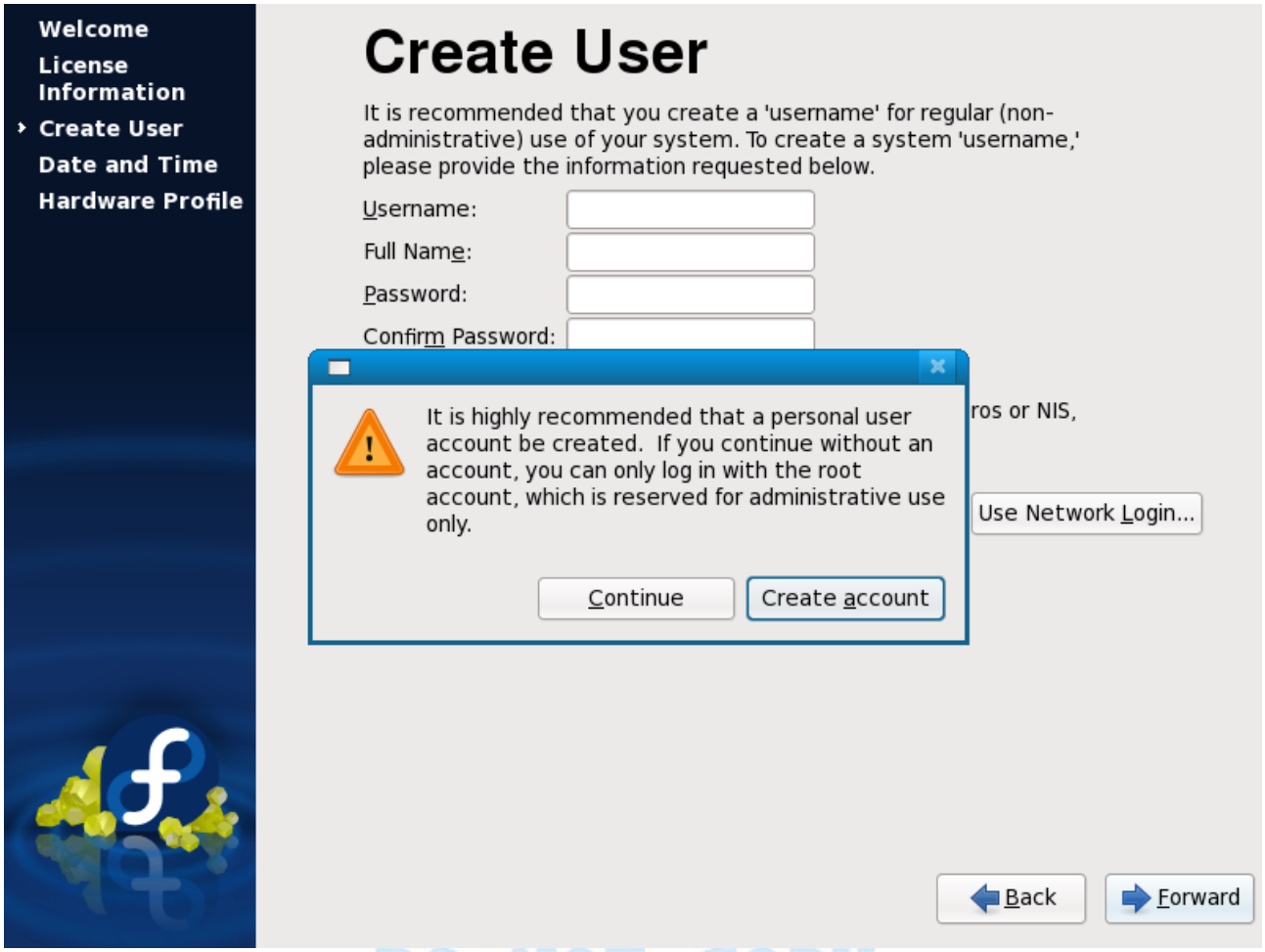

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Step18: setup date and time. We ignored this and went to the next step.

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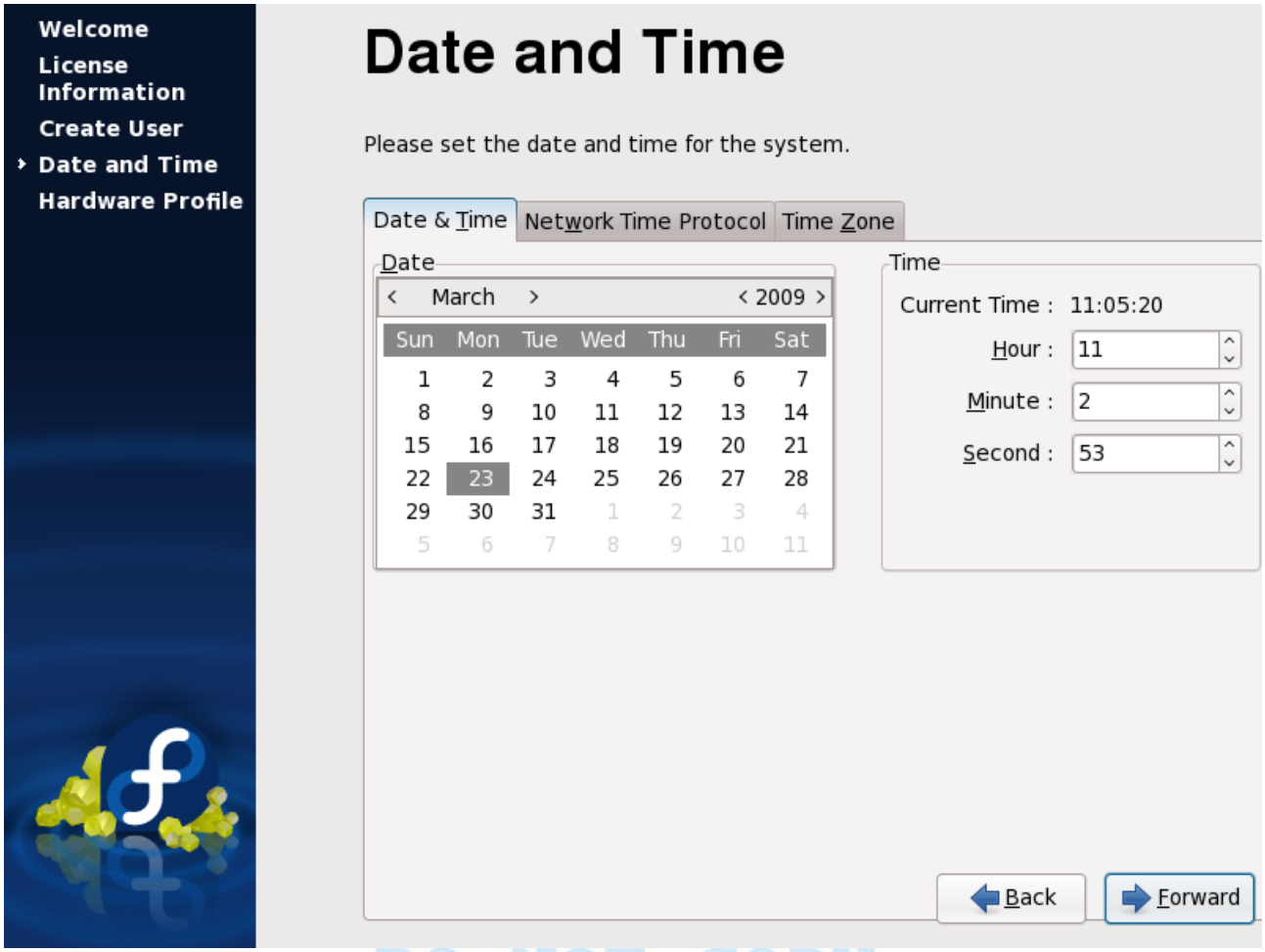

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Step19: confirm hardware information. We just clicked on “Finish”.

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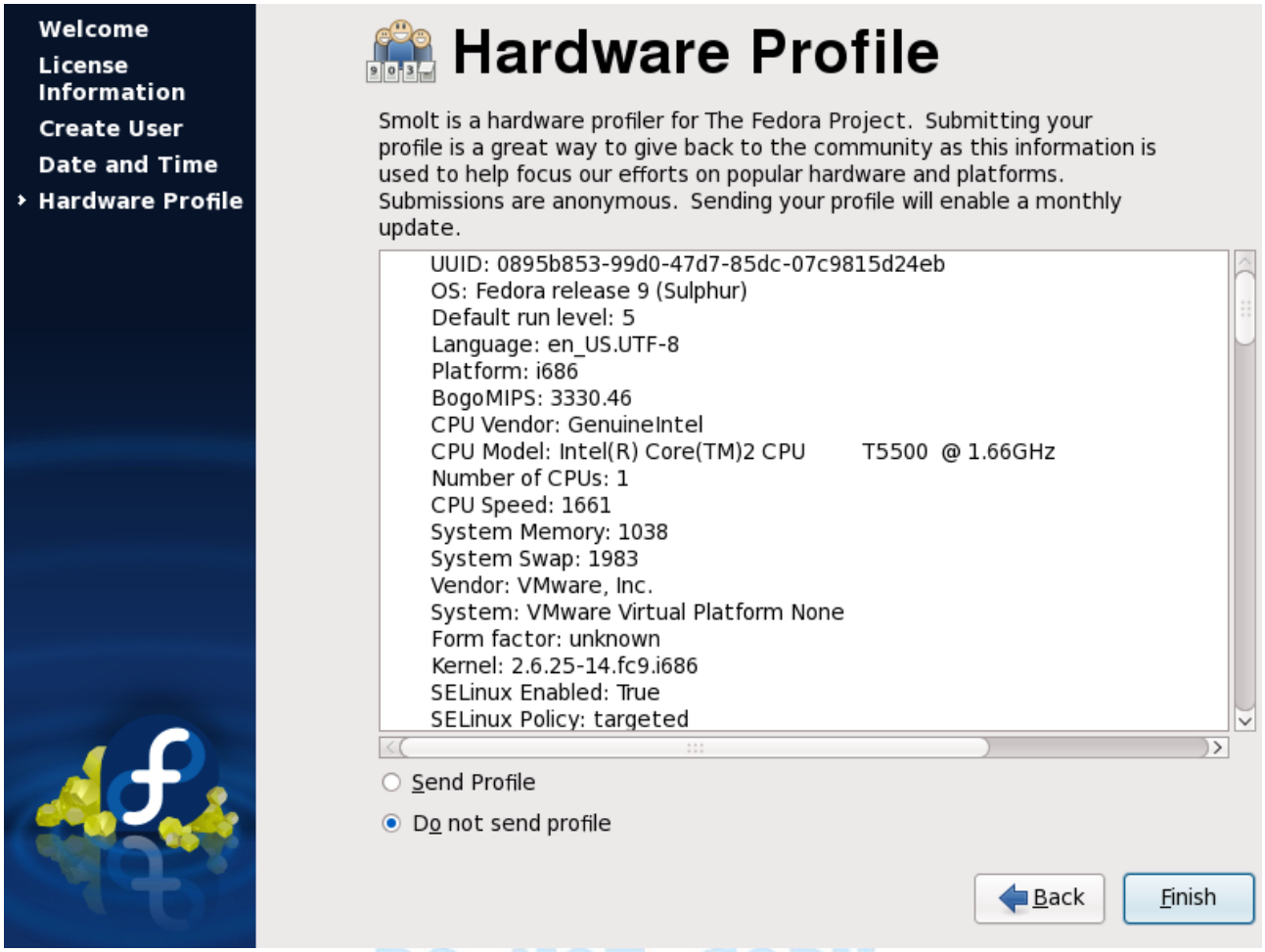

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On the popup window shown below, just click on the red marked button.

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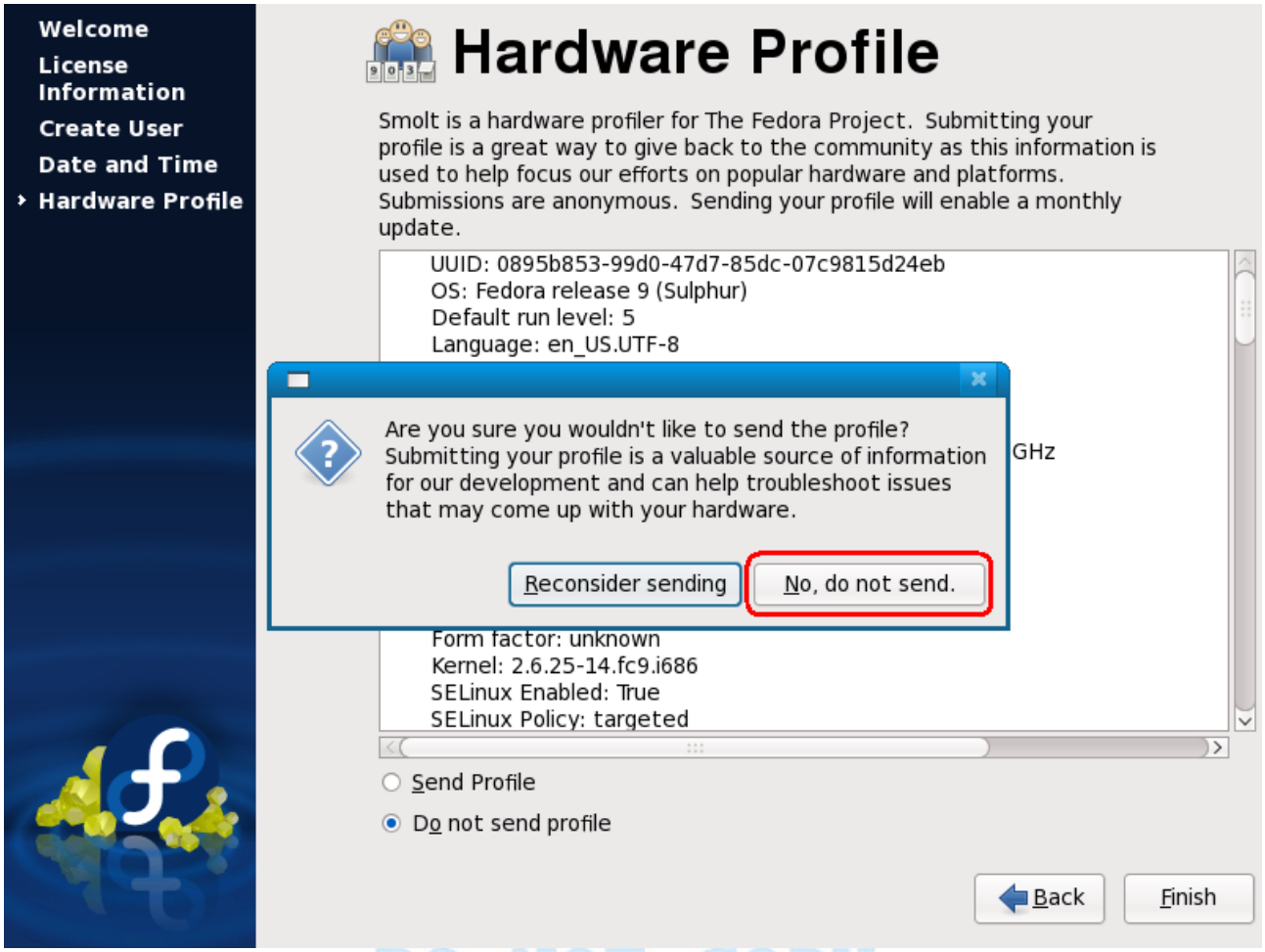

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Step 20: on the login page, login as “root”

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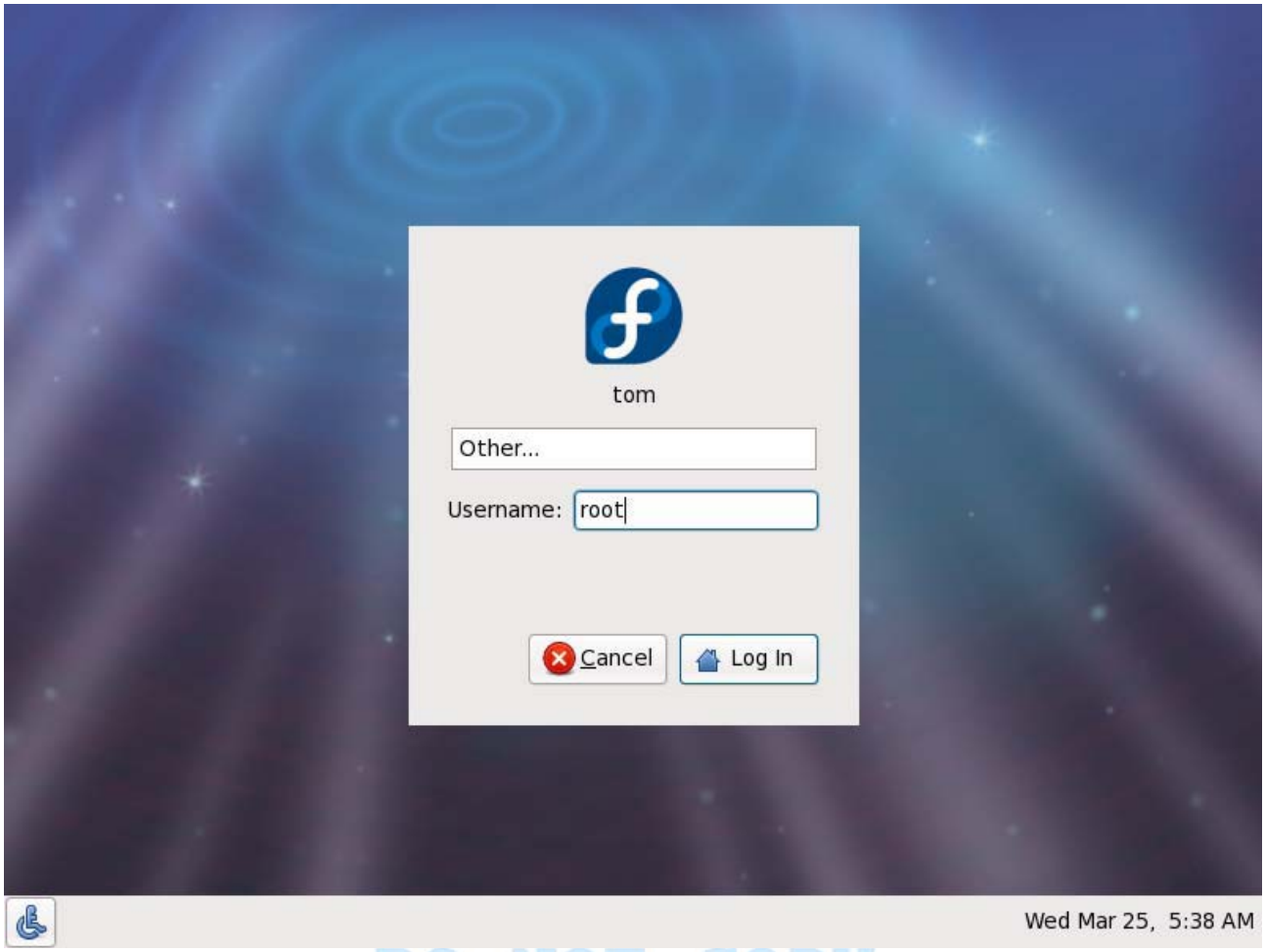

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Input the password we just created for “root”

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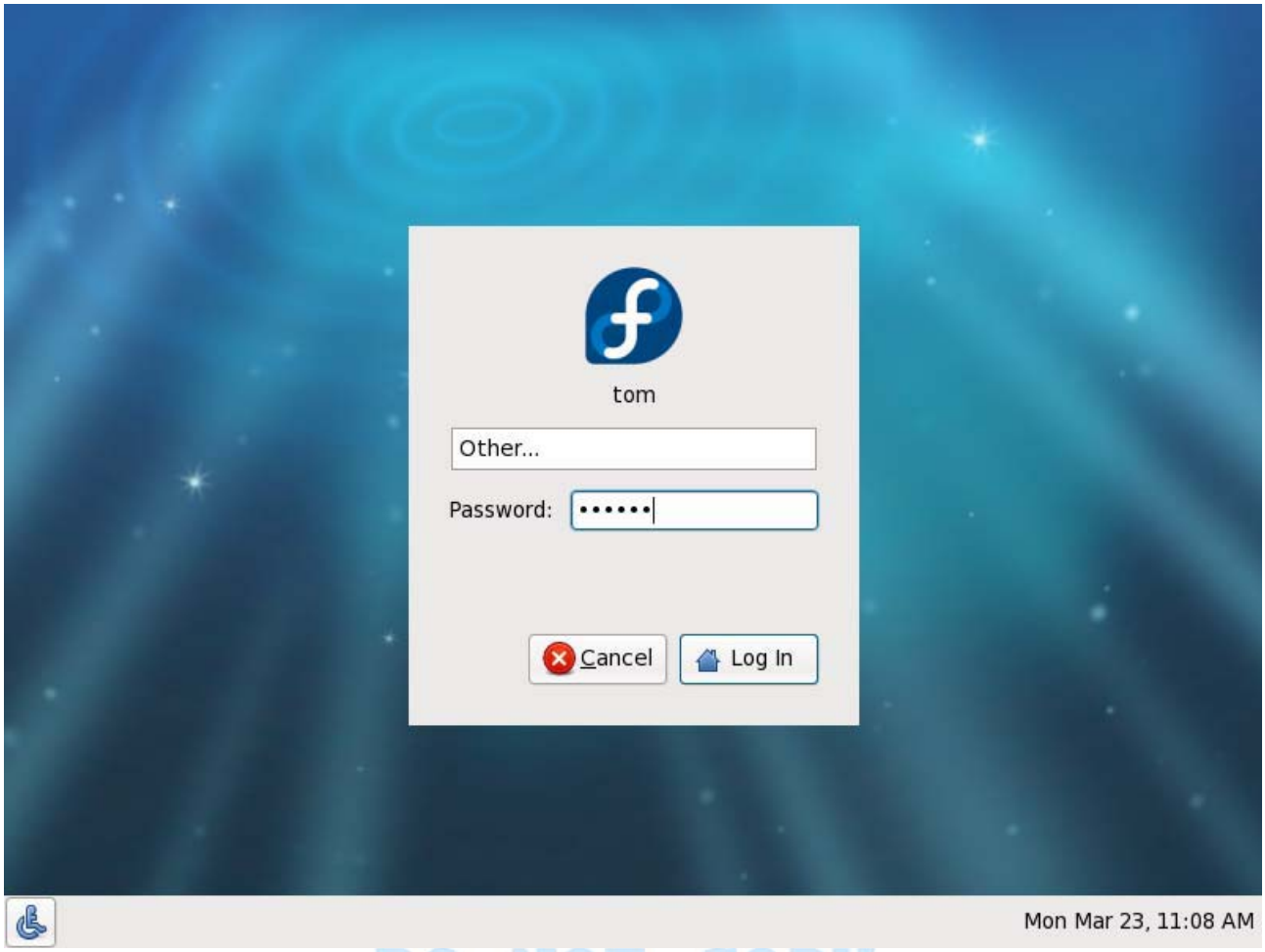

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When login as “root”, the following popup window will show up, just click on “Continue”

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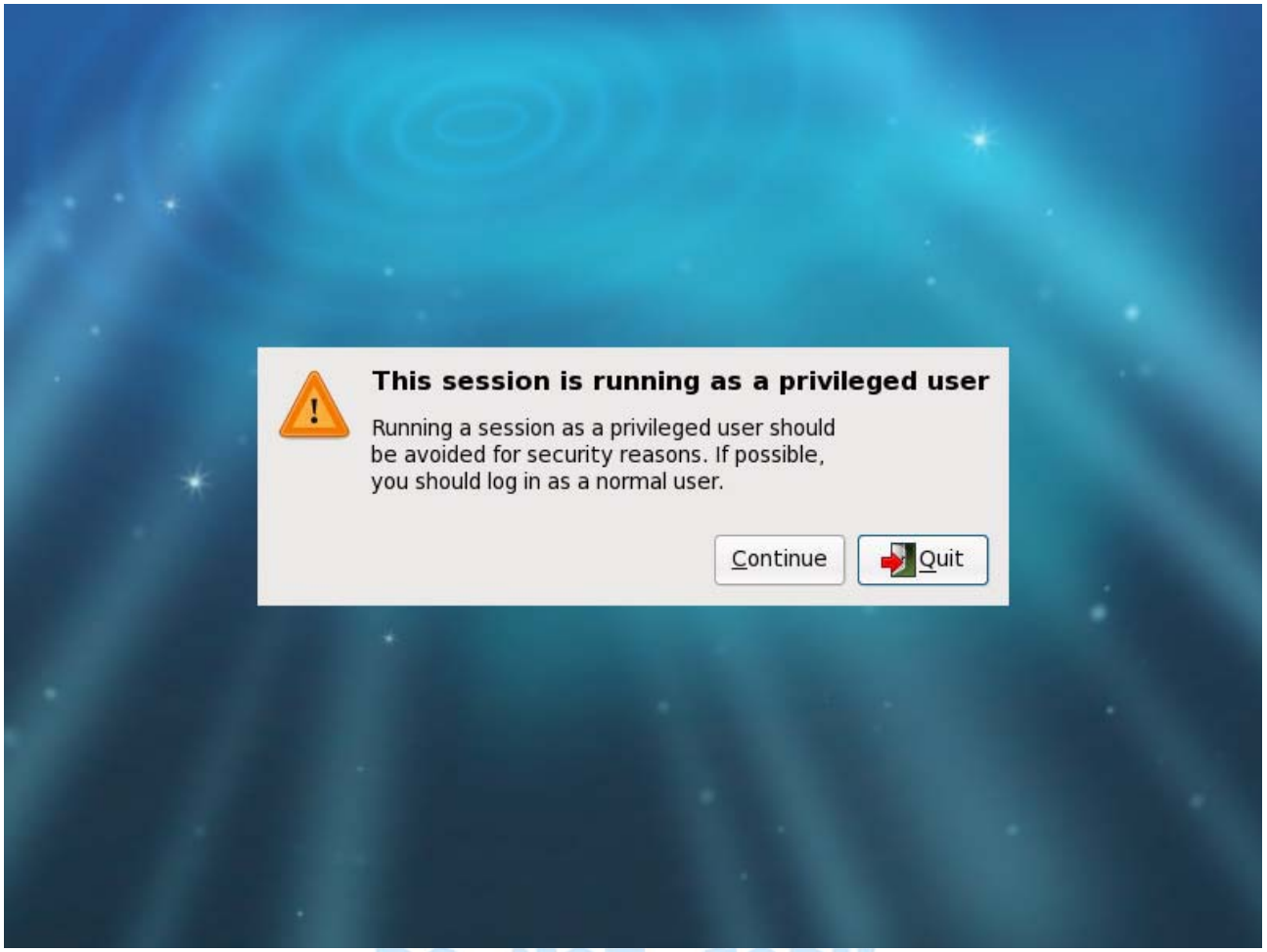

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Below is the interface the user will see after a successful login.

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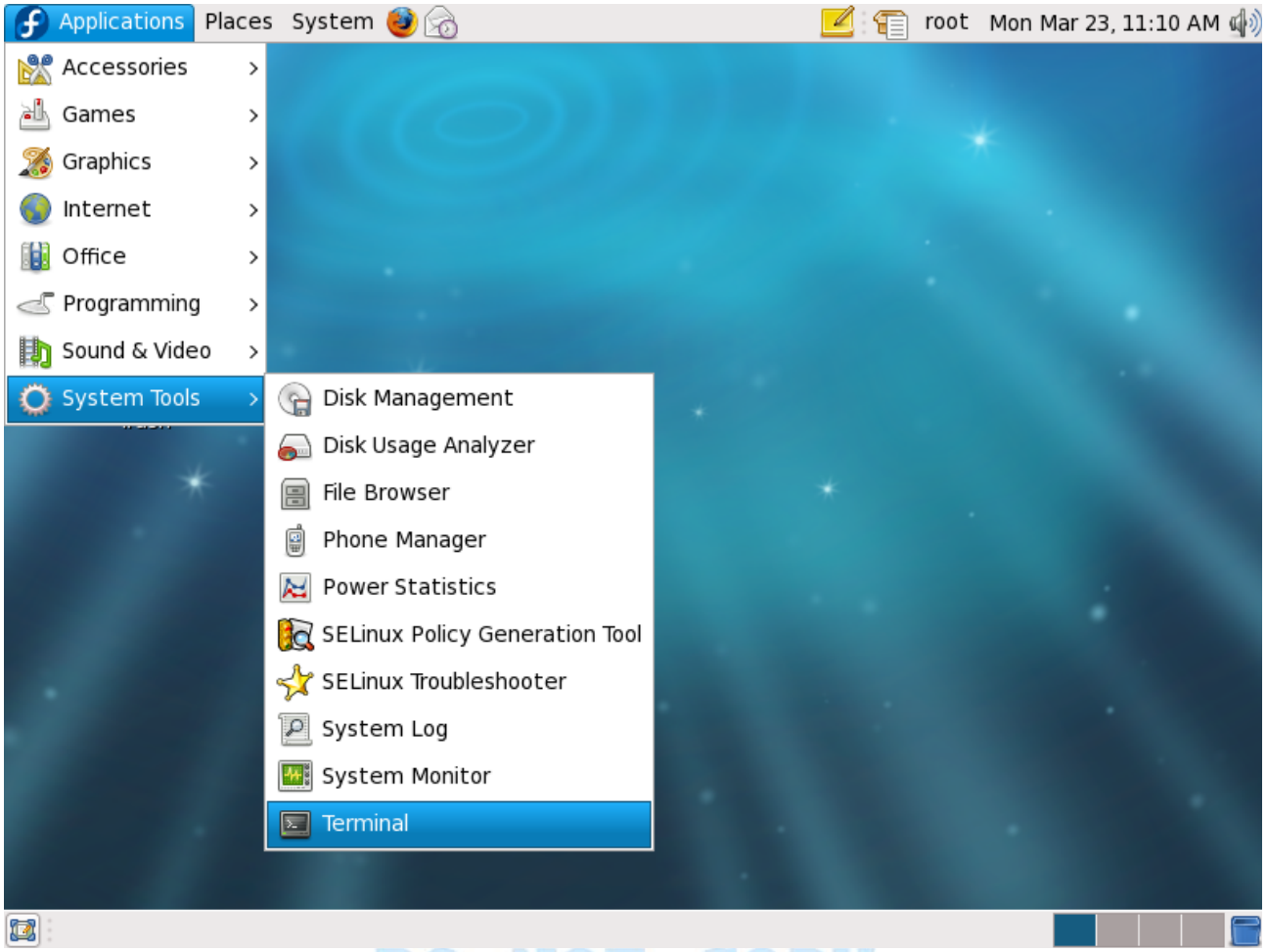

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5.2 Basic Configurations and Applications

5.2.1 Adding a New 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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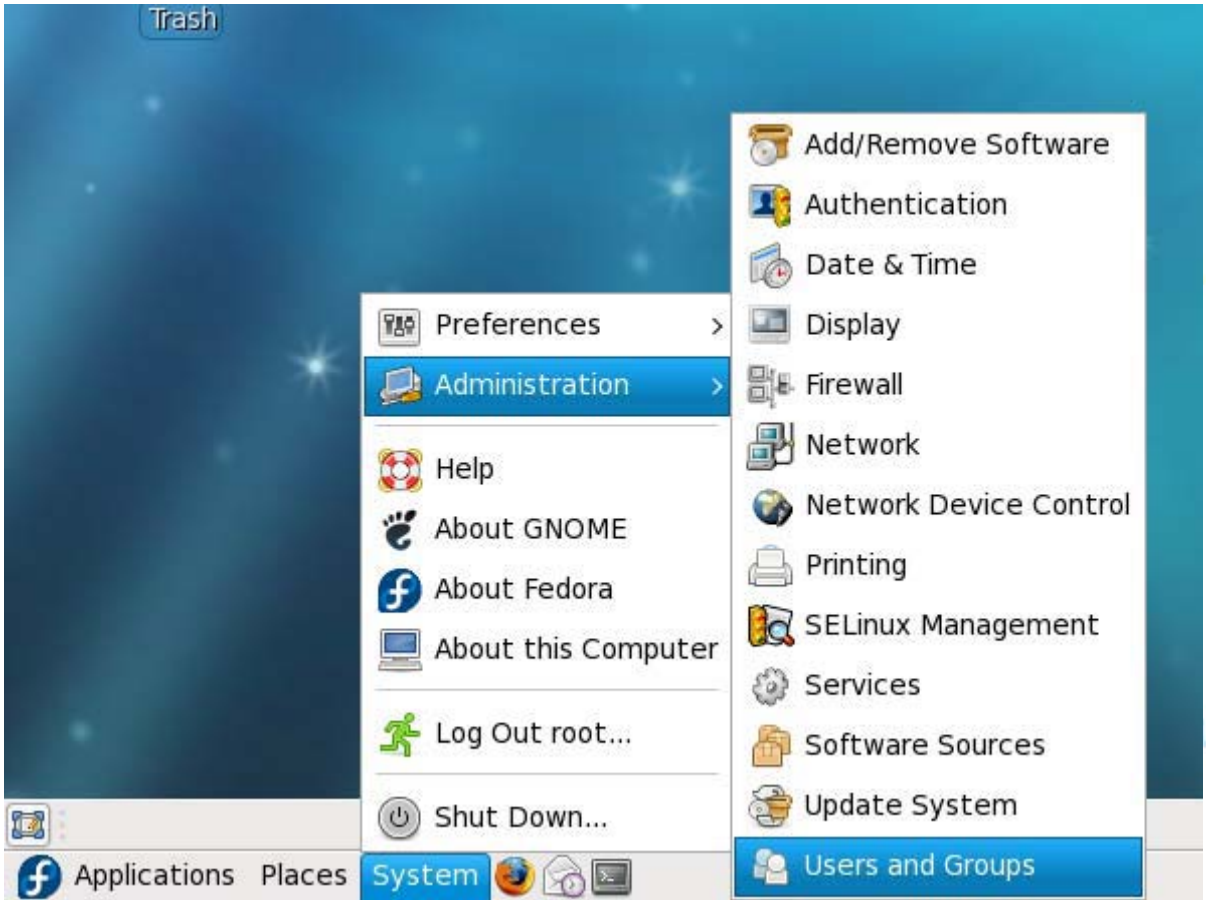

Step 2: open the “Users Manager” window

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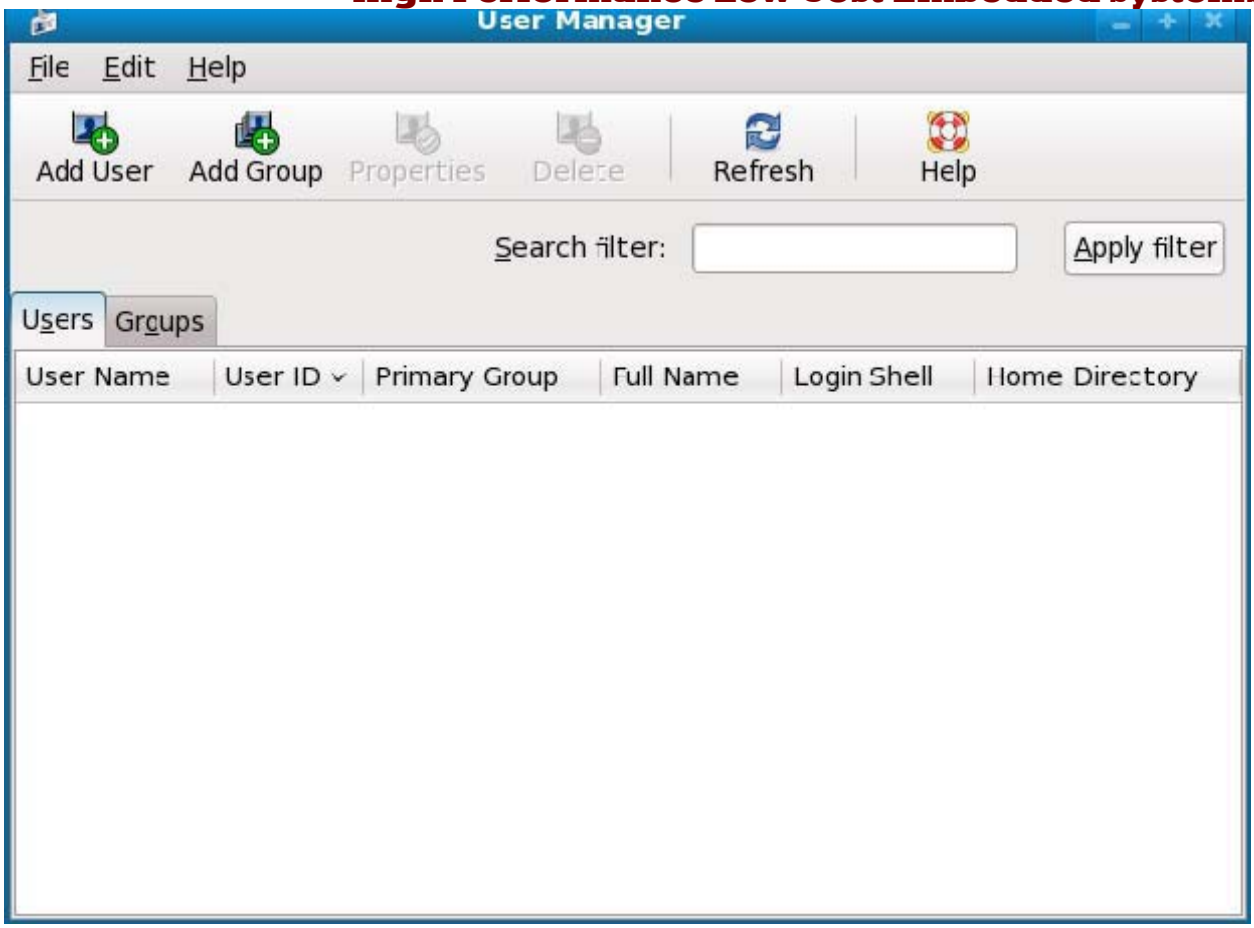

Step 3: click on the “Add User” button, type the user name and password

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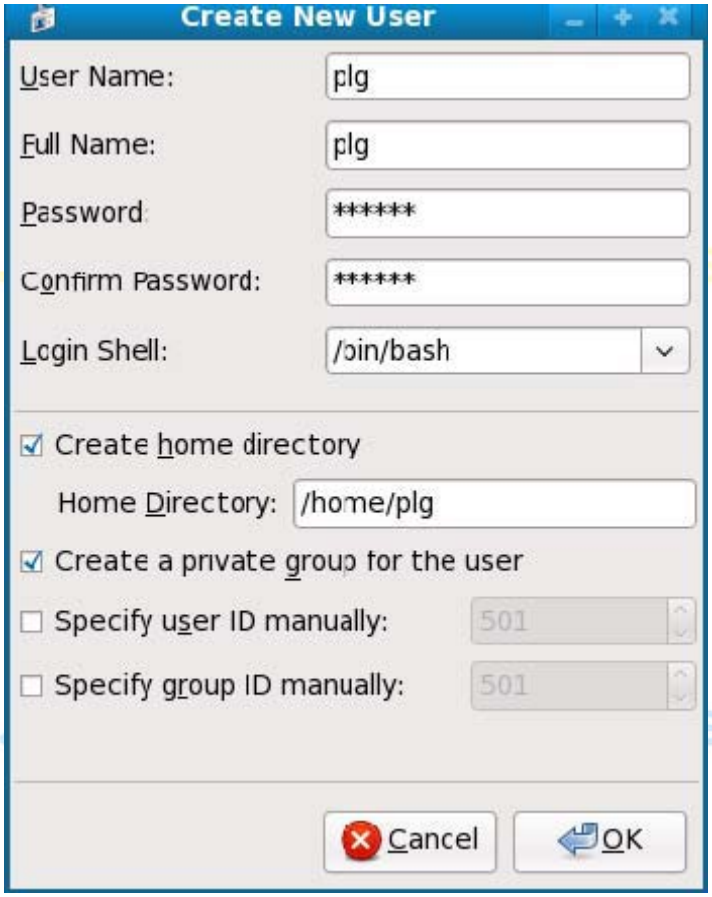
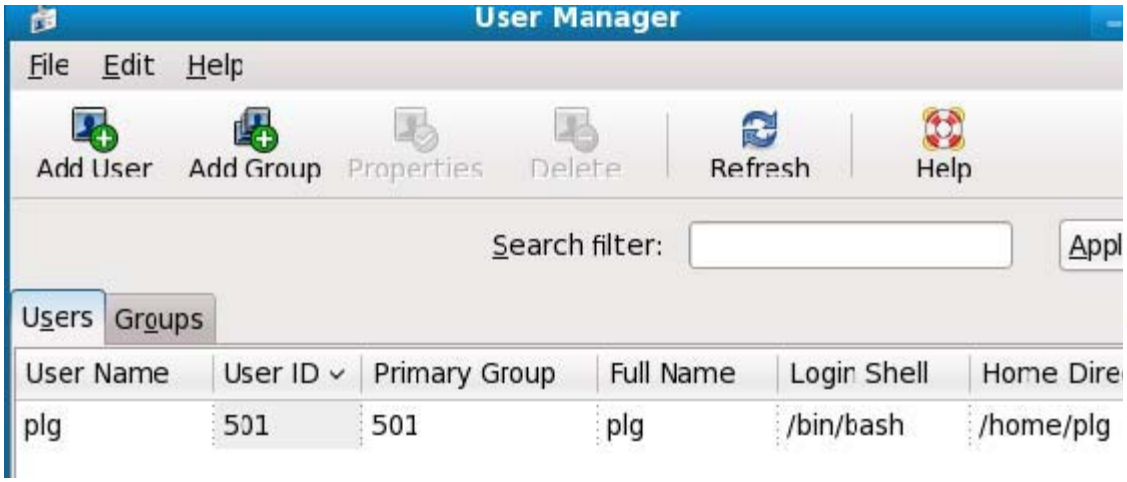
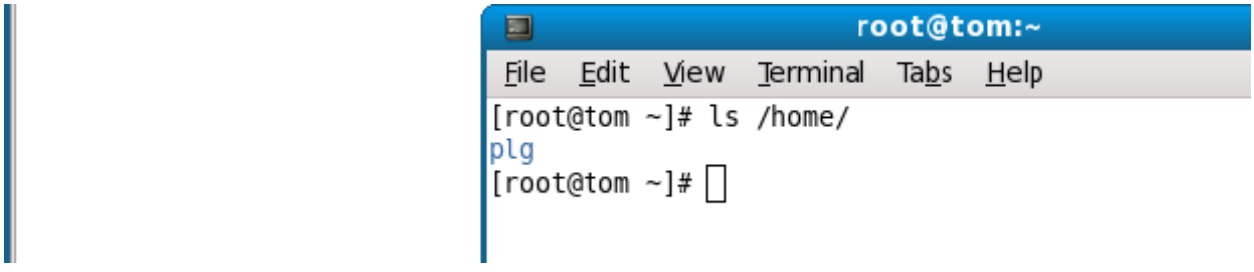


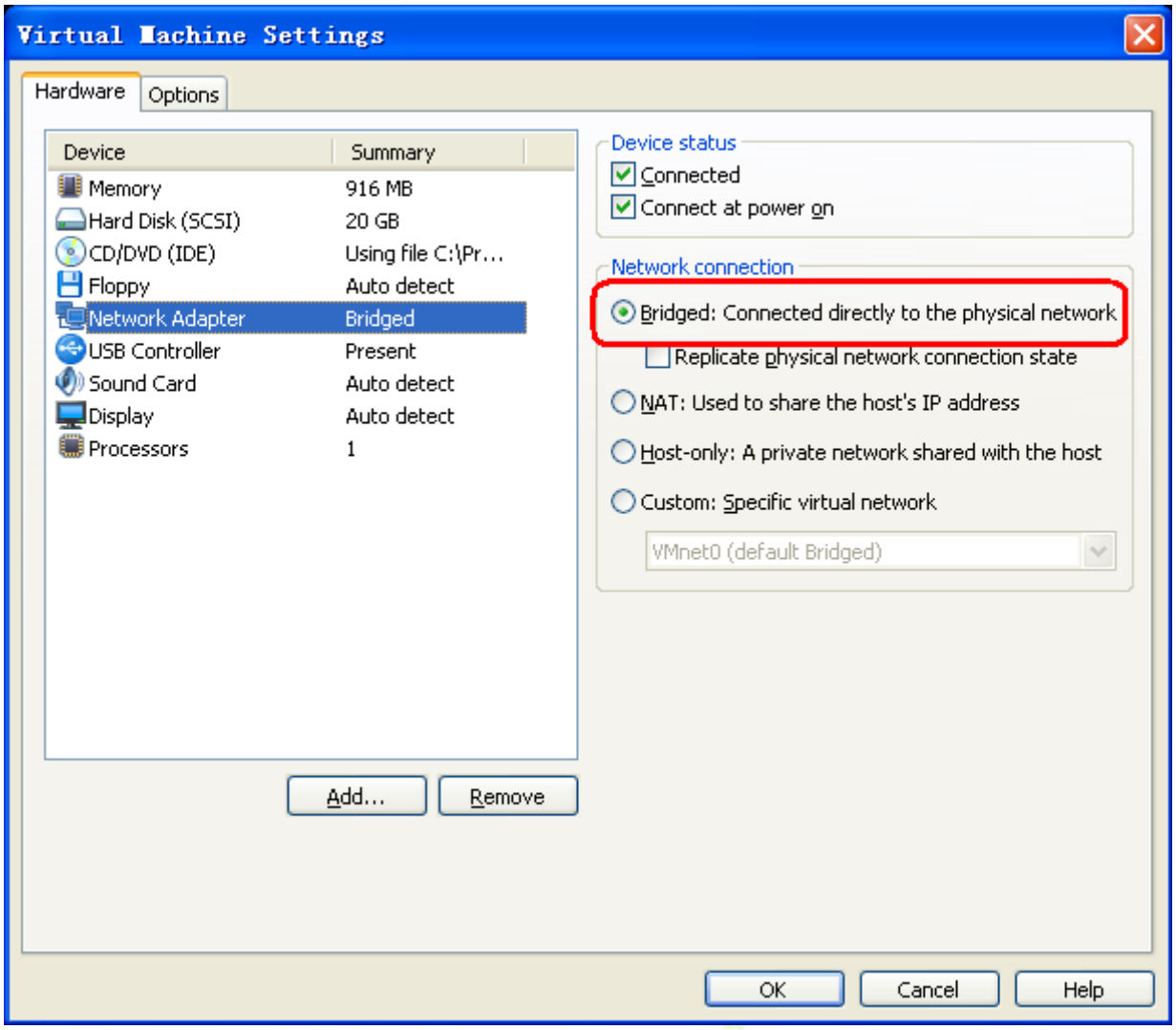
Click on “OK”, you will see that a new “plg” user has been created, and a “plg” directory has been created in the “/home” directory too.





5.2.2 Accessing 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.



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”

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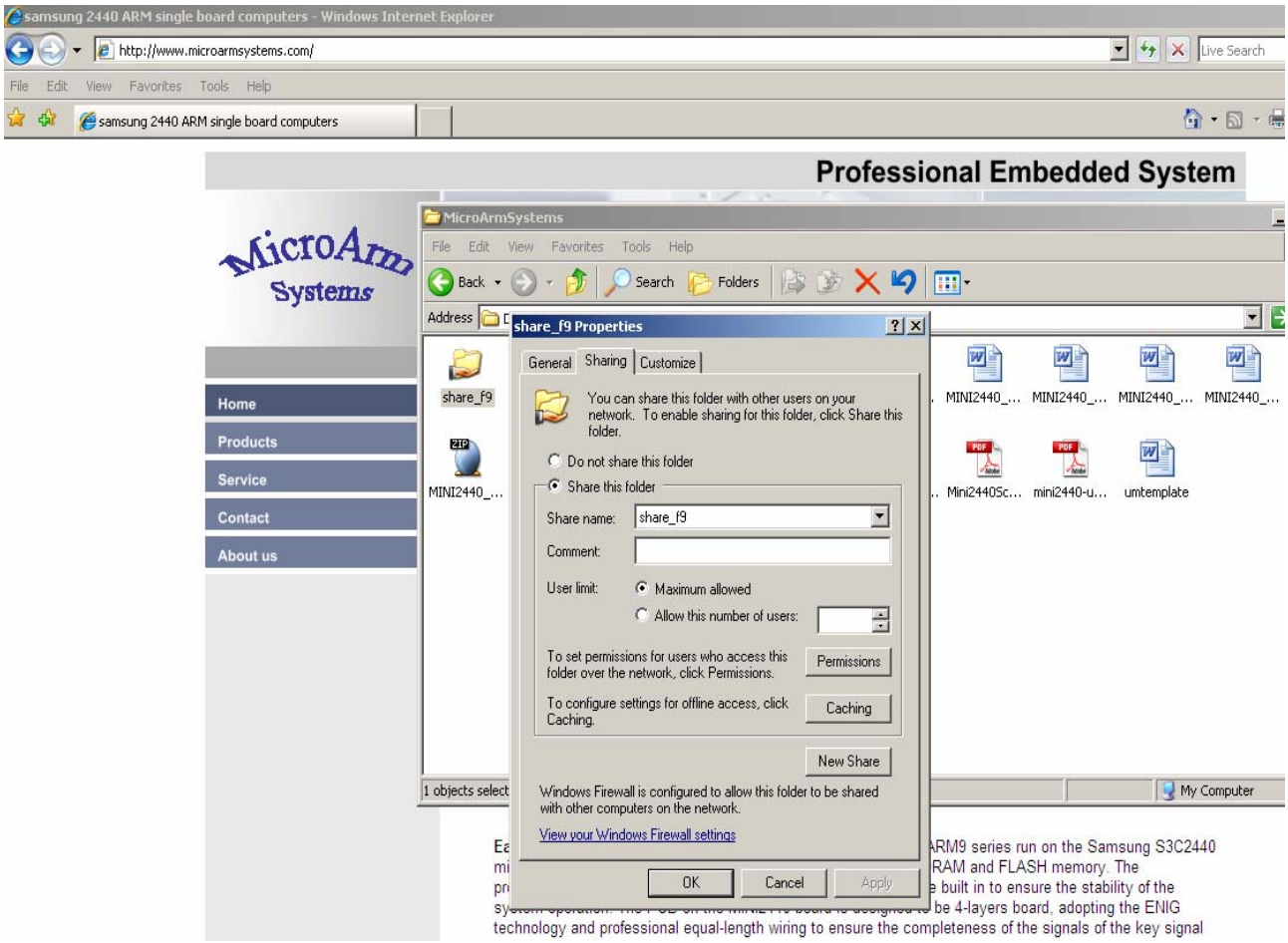

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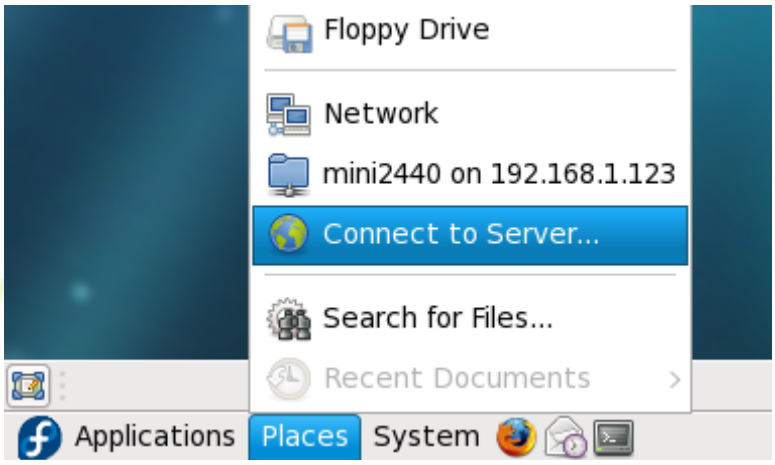
Step 2: set Fedora9



Open the window below:

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Select “Windows share” in the “service type” field

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

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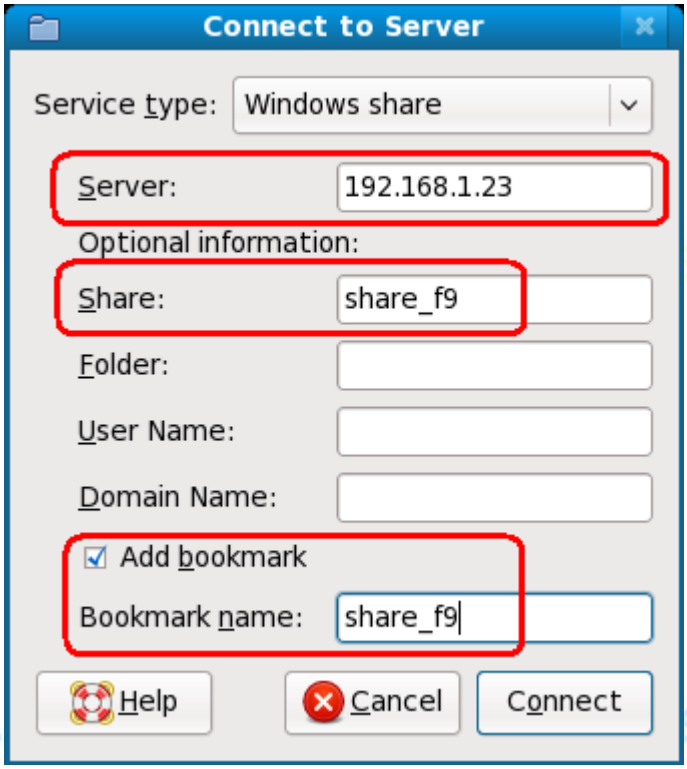

Click on “connect”, the following window will show up:

Go ahead and “connect” again, you will see the shared files you just set in your windows system.

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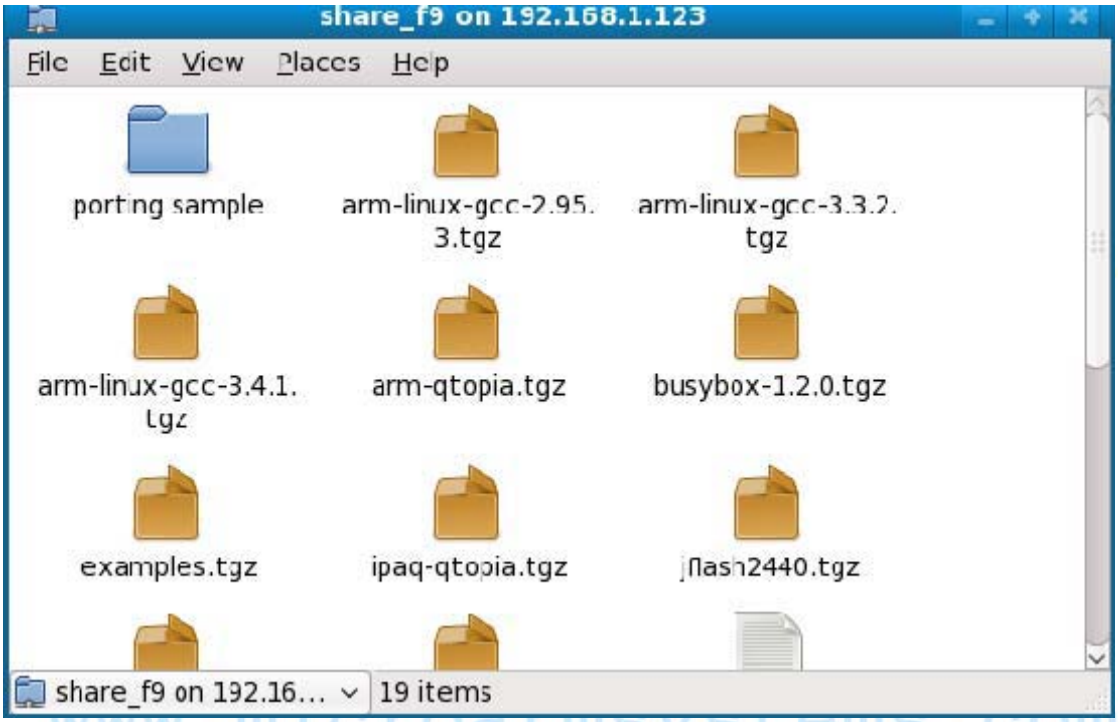
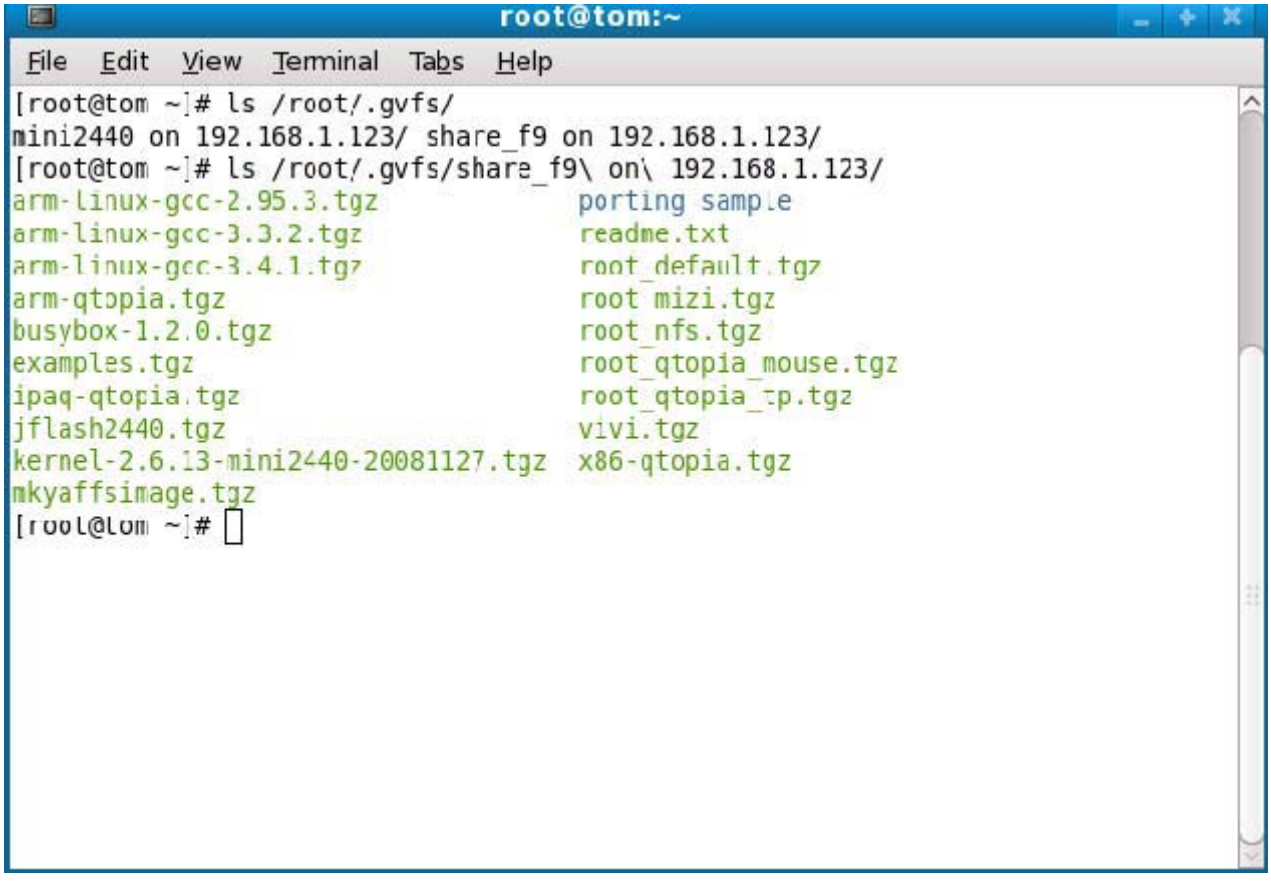
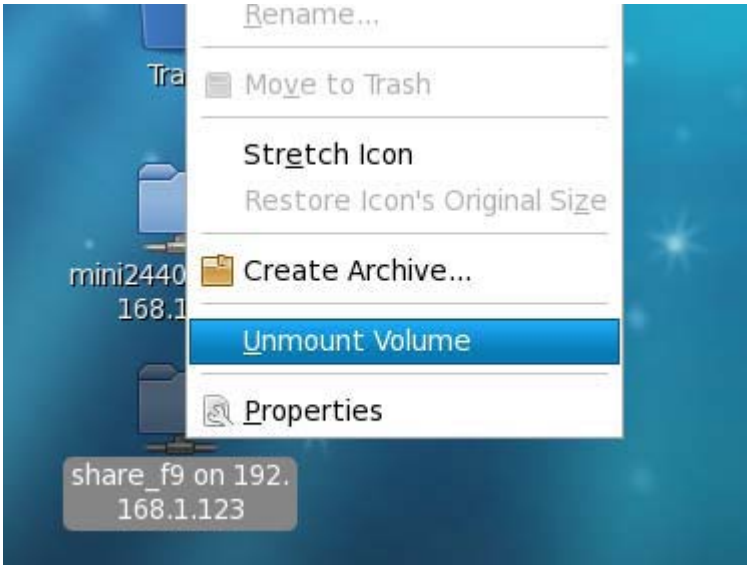


If you want to access this directory from the command line utility, you can do it by hitting the TAB key.



To disconnect the shared directory, right click on the shared directory and following the operations in the screenshot below:



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5.3 Setting up Cross Compile Environment

A main step to build a development environment in the MINI2440 Linux system is to set up a cross compile environment. The following steps will introduce how to build a compile environment that can compile arm-linux kernels, drivers and applications.

From our updated Linux-2.6.29, we use “arm-linux-gcc-4.3.2” as our uniform cross compiler. Here are the steps on how we set up this utility.

Step 1: copy the compressed file “arm-linux-gcc-4.3.2.tgz” under the “linux\” directory 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-4.3.2.tgz –C /

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

These commands will install “arm-linux-gcc” in the “**/usr/local/arm/4.3.2**”

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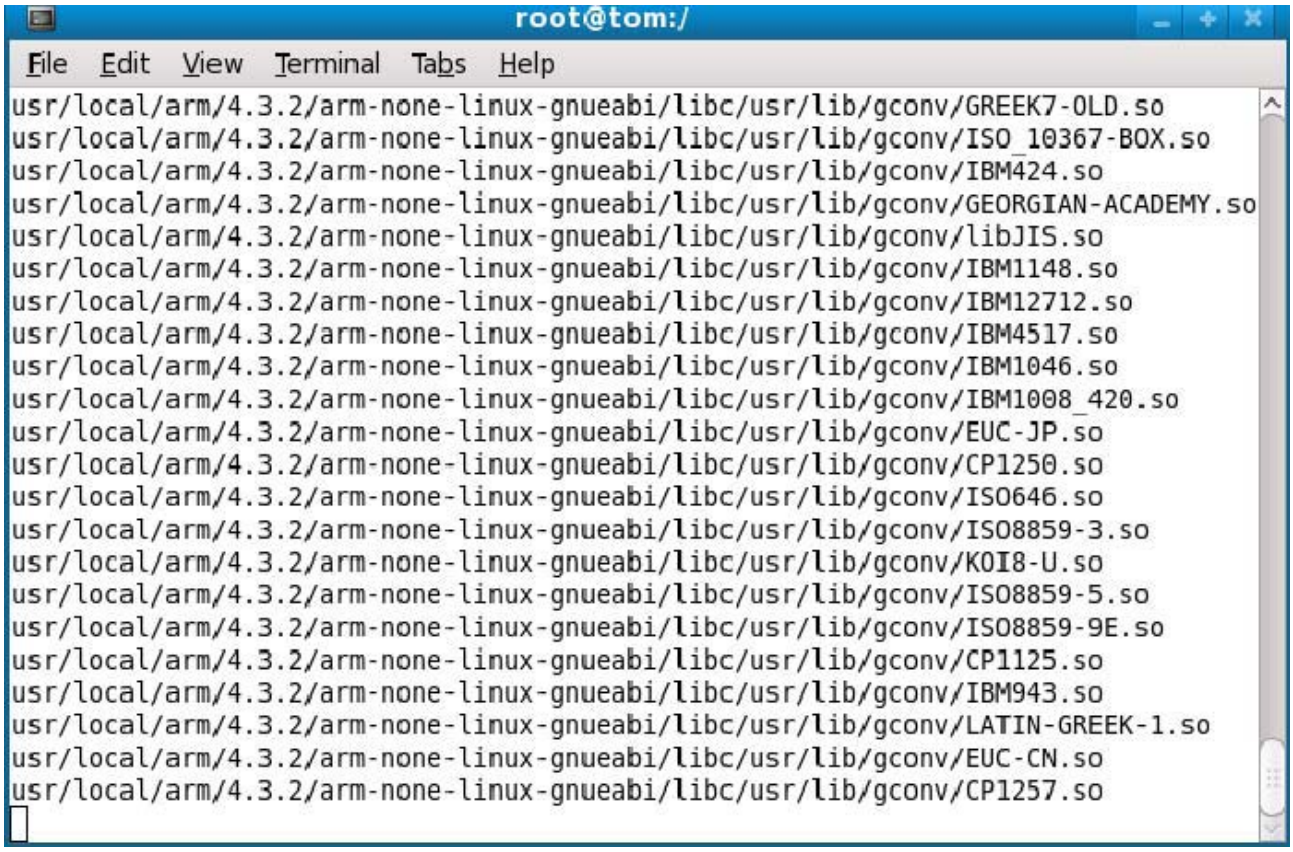

.

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

#gedit /root/.bashrc

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This is to edit the "/root/.bashrc" file. Append line "**export PATH=$PATH:/usr/local/arm/4.3.2/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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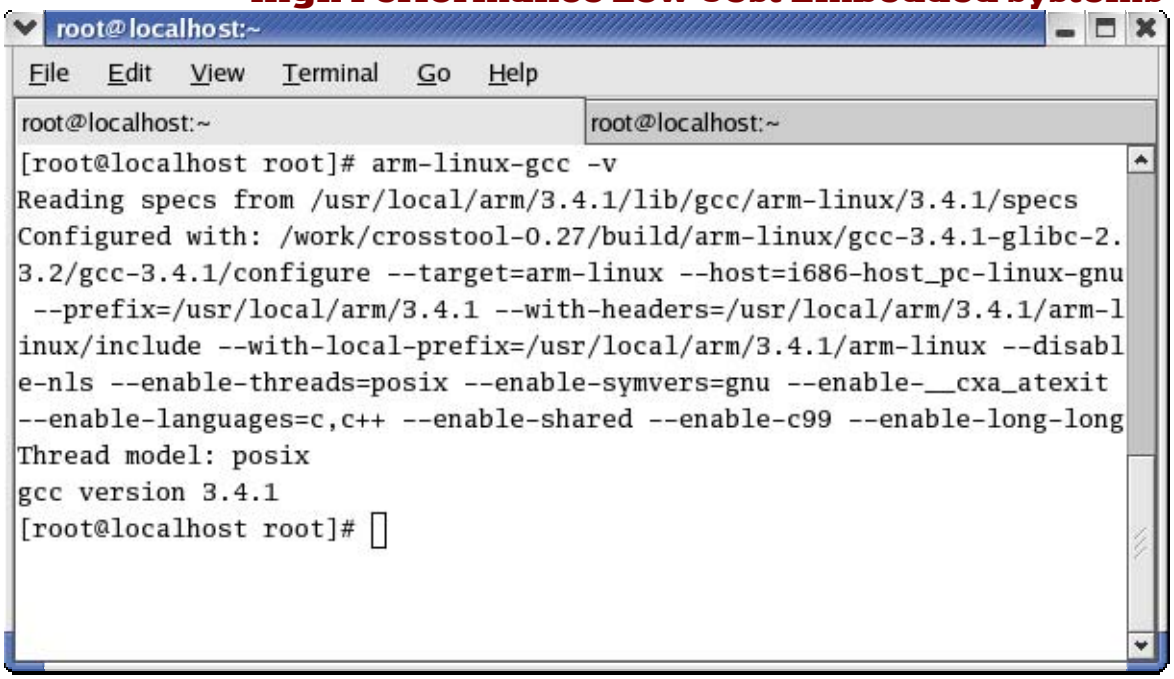
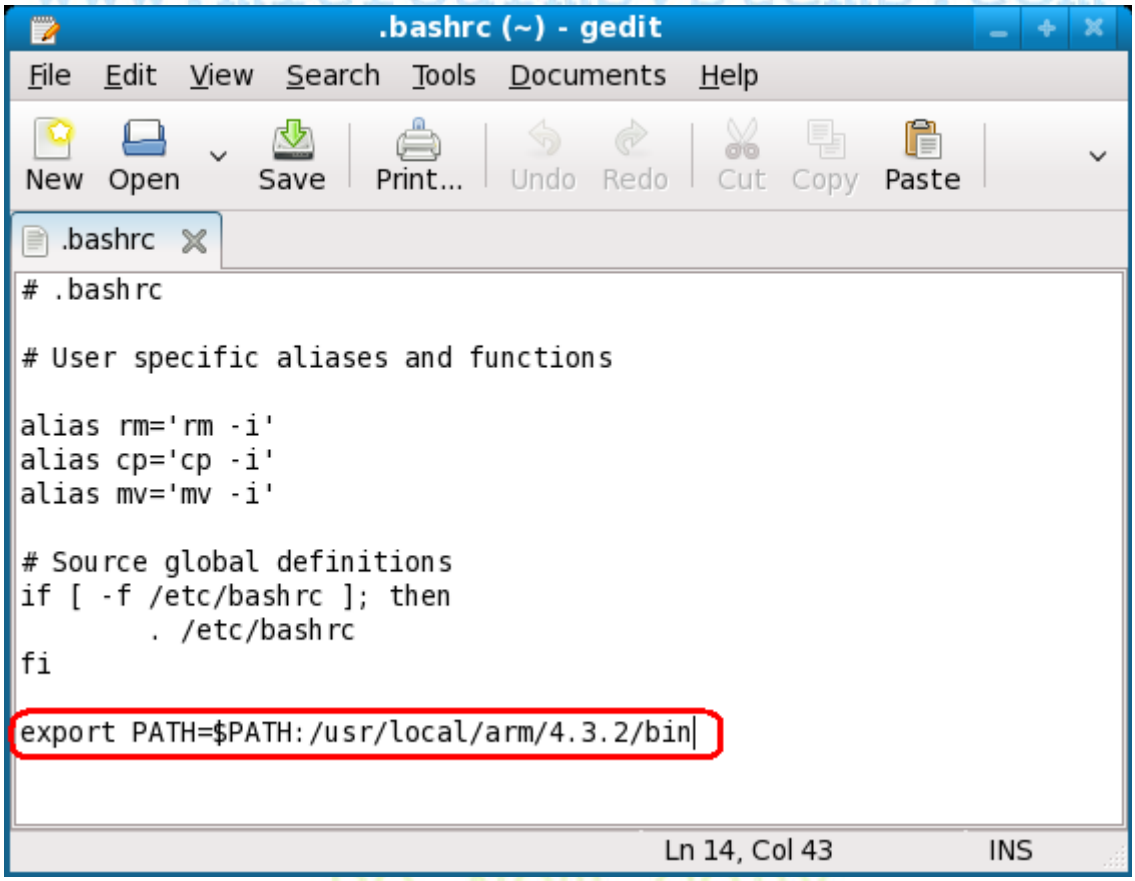


To configure a 2.95.3 compiler append line "**export PATH=$PATH:/usr/loca/arm/2.95.3/bin**" in the "/root/.bashrc" file.



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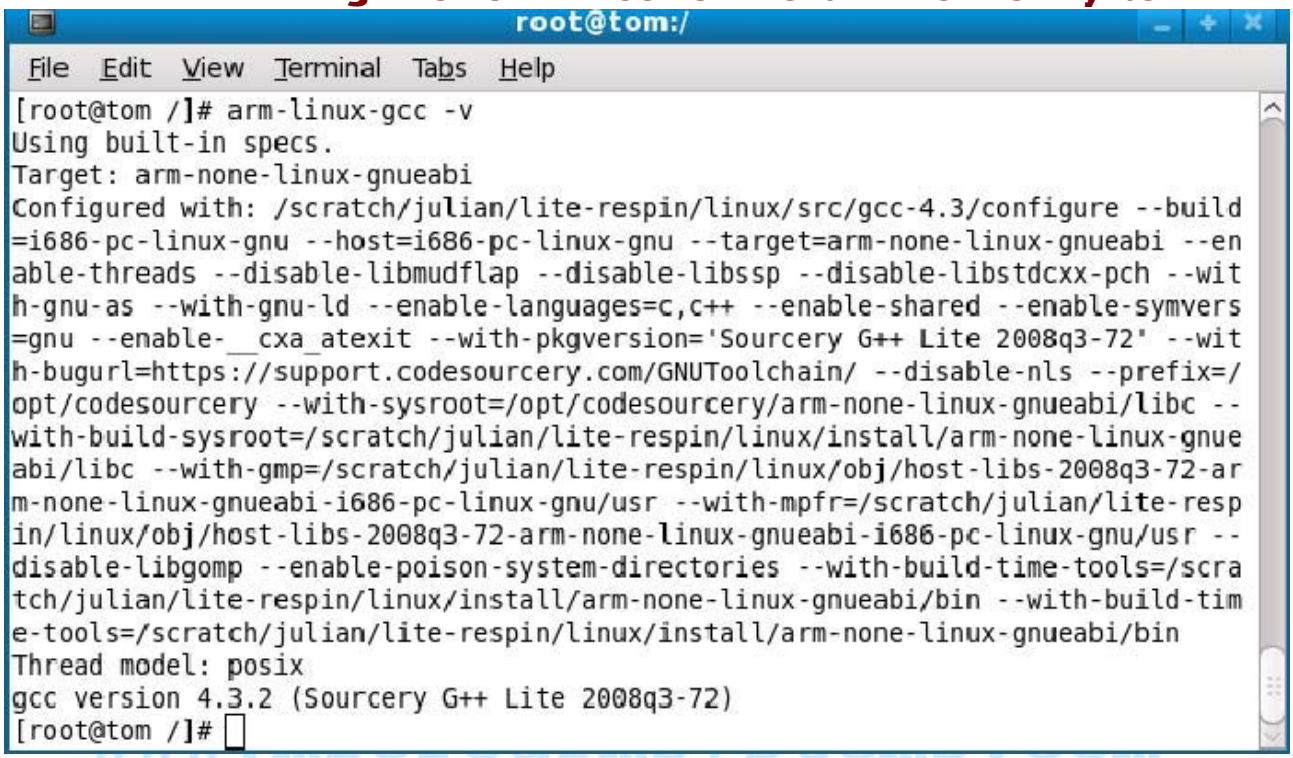
Logout and login system again, the configurations will be effective, in the command line, type "arm-linux-gcc -v", you will see the following messages if it is a successful install.



5.4 Uncompressing Source Code and Installing Application Utilities

This section will introduce how to uncompress all the source code that users may need and install some application utilities including:

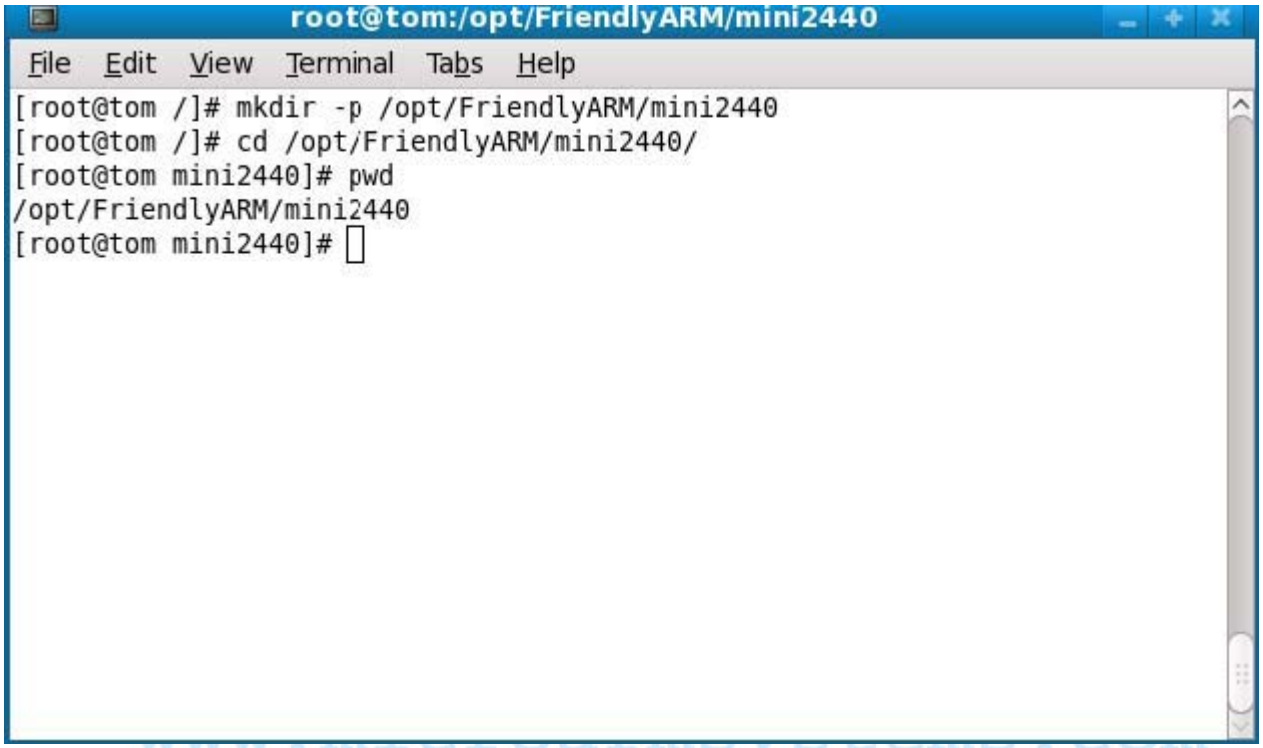
- Linux-2.6.29 kernel source code
- Qtopia source code (for x86 and arm)
- Busybox-1.13 source code
- Sample programs code (developed by FriendlyArm)
- Open source bootloader (vivi and u-boot)
- Boa and madplay
- Target file system directory
- File system image maker mkyaffsimage
- Linux logo maker: logo_maker

Note: all source code and utilities should be uncompressed and compiled with arm-linux-gcc-4.3.2

5.4.1 Uncompressing Source Code

Firstly, create a work directory: /opt/FriendlyARM/mini2440

After execute command “mkdir –p /opt/FriendlyARM/mini2440”, 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/mini2440, run the commands below:

#cd /opt/FriendlyARM/mini2440

#tar xvzf /tmp/linux/linux-2.6.29-mini2440-20090331.tgz

A linux-2.6.29 directory will be created, it includes a complete copy of linux kernel source code. Note: 20090331 is the date when FriendlyARM released the new version, the file name in the shipped CD may be different.

(3) Uncompress Qtopia source code

In the work directory /opt/FriendlyARM/mini2440, run the commands below:

#cd /opt/FriendlyARM/mini2440

#tar xvzf /tmp/linux/x86-qtopia.tgz

#tar xvzf /tmp/linux/arm-qtopia.tgz

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.

(4) Uncompress busybox source code

The Busybox is a compact Linux tool kit. Here we used busybox-1.13.3. Users can download its latest version from http://www.busybox.net

In the work directory /opt/FriendlyARM/mini2440, run the commands below:

#cd /opt/FriendlyARM/mini2440

#tar xvzf /tmp/linux/busybox-1.13.3-mini2440.tgz

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A busybox-1.13.3 directory will be created, and its source code will extracted into this directory.

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

(5) Uncompress Linux sample programs

In the work directory /opt/FriendlyARM/mini2440, run the commands below:

#cd /opt/FriendlyARM/mini2440

#tar xvzf /tmp/linux/examples.tgz

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

Note: all these sample programs are developed by FriendlyARM.

(6) Uncompress bootloader source code

This package has three open source bootloaders, among which vivi and u-boot are developed and compiled in Linux.

In the work directory /opt/FriendlyARM/mini2440, run the commands below:

#cd /opt/FriendlyARM/mini2440

#tar xvzf /tmp/linux/bootloader.tgz

A bootloader directory will be created, it includes the source code for vivi and u-boot.

5.4.2 Creating Target File System

In the work directory /opt/FriendlyARM/mini2440, run the command below:

#cd /opt/FriendlyARM/mini2440

#tar xvzf /tmp/linux/root_qtopia.tgz

A bootloader directory will be created, it includes the source code for vivi and u-boot.

Note: our previous releases had four file systems: root_default, root_nfs, root_qtopia_tp and root_qtopia_mouse which were for different boot modes and external devices. Now in this release all have been integrated into one, which includes a qtopia system, busybox and some basic tool kits. It has the following features:

- Self detection of NFS boot and local boot
- Support for both mouse and touch screen
- Self detection of whether or not the display module is connected to a touch screen to judge if screen calibration is needed on initial system boot. If the display module is not connected to a touch screen, system will boot directly and mouse will be ready for use otherwise system will calibrate the touch screen.
- Self detection of SD or high speed SD card (maximum 32 G) and flash drive

5.4.3 Uncompressing Application Utilities

(1) File system image maker mkyaffs2image

To burn the root_qtopia directory into the target board, you need the mkyaffs2image tool. It is a command line program.

Go to the work directory /opt/FriendlyARM/mini2440 and run:

#cd /opt/FriendlyARM/mini2440
#tar xvzf /tmp/linux/mkyaffs2image.tgz –C /

Note: C is a capital letter, there is a space after C, C here means to change the uncompress directory.

Our previous kernel systems supported the yaffs file system, the current release is using the yaffs2 system, so it needs a different make tool, we call it “mkyaffs2image”. After running the above commands, it will be installed in the /usr/sbin directory, it has contains one file.

(2) LogoMaker

In the work directory /opt/FriendlyARM/mini2440 run:

#cd /opt/FriendlyARM/mini2440
#tar xvzf /tmp/linux/logomaker.tgz –C /

Note: C is a capital letter, there is a space after C, C here means to change the uncompress directory.

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.

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.

5.4 Configuring NFS Service

If you have installed Fedora9 on your system, all the corresponding NFS components will be installed by default, you can just follow the steps below to setup and configure the NFS service.

5.4.1 Setting up Shared Directories

Note: to access a shared directory, you need to follow what were described in 5.4.2 to install the root_qtopia system.

(1) Set up Shared Directories

Run the command below:

#gedit /etc/exports

This command edits the NFS configuration file. Add the following line (*Note：if this file is opened for the first time, it will be empty*):

/opt/FriendlyARM/MINI2440/root_qtopia *(rw,sync,no_root_squash)

"**/opt/FriendlyARM/mini2440/root_qtopia**" is a NFS shared directory, it can be mounted as the root file system through NFS;

* means all clients can mount to this directory.

rw means all clients that have been mounted to this directory have the read and write rights to this directory.

no_root_squash means all clients that have been mounted to this directory can be set to a root user.

5.5.2 Starting NFS

You can start the NFS service through either command line or graphic interface. We set up the NFS service to let others access shared directories. By default Fedora starts it firewall which will disable the NFS service. So you need to disable the firewall by typing "lokkit" in a command line window.

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Select (*) Disabled, and click on the "OK" button to disable the firewall permanently. Now you can start the NFS service:

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(1) Start and Stop the NFS service

Run the command below:

#/etc/init.d/nfs start

This command will start the NFS service. The user can verify whether the service is running by commanding:

mount -t nfs localhost: **/opt/FriendlyARM/mini2440/root_qtopia** /mnt/

If no err messags come up, the user can then browse the contents of the "**/mnt**" directory and verify if the contents are the same as the "**/opt/FriendlyARM/mini2440/root_qtopia**" directory.

Stop the service by commanding:

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#/etc/init.d/nfs stop

(2) Starting the NFS service through the graphic interface

To auto run the service on system startup, the user can execute the command below:

 # serviceconf

Open the system configuration window, on the left side of the window, check the NFS box, click on the "Enable" button to start it.

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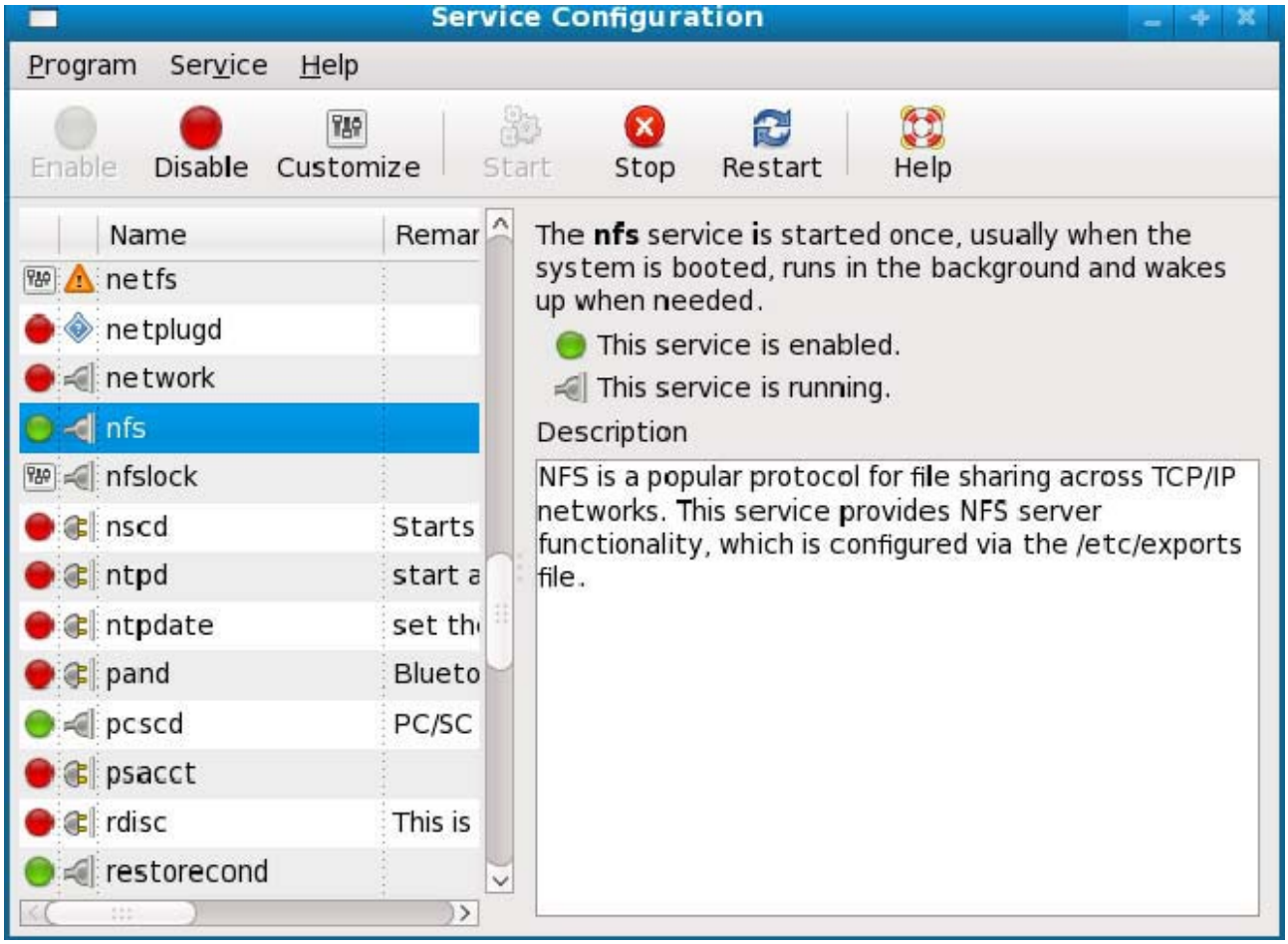

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5.5.3 Booting System via NFS

After setting up and running the NFS service, the user can set the NFS as the root file system to boot the board. To boot the system via NFS, the board can fully utilize a “big” hard disk because the user can use the host PC’s hard disk, this trick is widely used in Linux development.

Switch the target board’s boot mode to the “Nand Flash” side, connect the power cable, serial port cable and the network cable, and open a super terminal. Right after the user powers on or resets the board, press the space key in the host PC’s keyboard, the system will be directed to the vivi shell, type the following command:

Supervivi>param set linux_cmd_line "console=ttySAC0 root=/dev/nfs nfsroot=192.168.1.111:/opt/FriendlyARM/mini2440/root_qtopia ip=192.168.1.70:192.168.1.111:192.168.1.111:255.255.255.0:MINI2440.arm9.net:eth0:off"

“param set linux_cmd_line” sets the linux startup parameters.

“nfsroot” is the board’s IP.

The number strings after “ip=” are detailed as below:

The first item, in this example “192.168.1.70” is the target’s temporary IP (please make sure this IP doesn’t conflict with other IPs within the same network);

The second item, in this example “192.168.1.111” is the host’s IP,

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The third item, in this example “192.168.1.111” is the target board’s gateway IP,

The fourth item, in this example “255.255.255.0” is the subnet mask,

The fifth item is the board’s machine name (the user can give whatever name he likes)

“eth0” is the network adaptor’s name

This command is so long that it could be easily typed wrong. In this shipped CD, this command has been written in the “nfs.txt” file for the customer’s convenience. The user can copy it directly.

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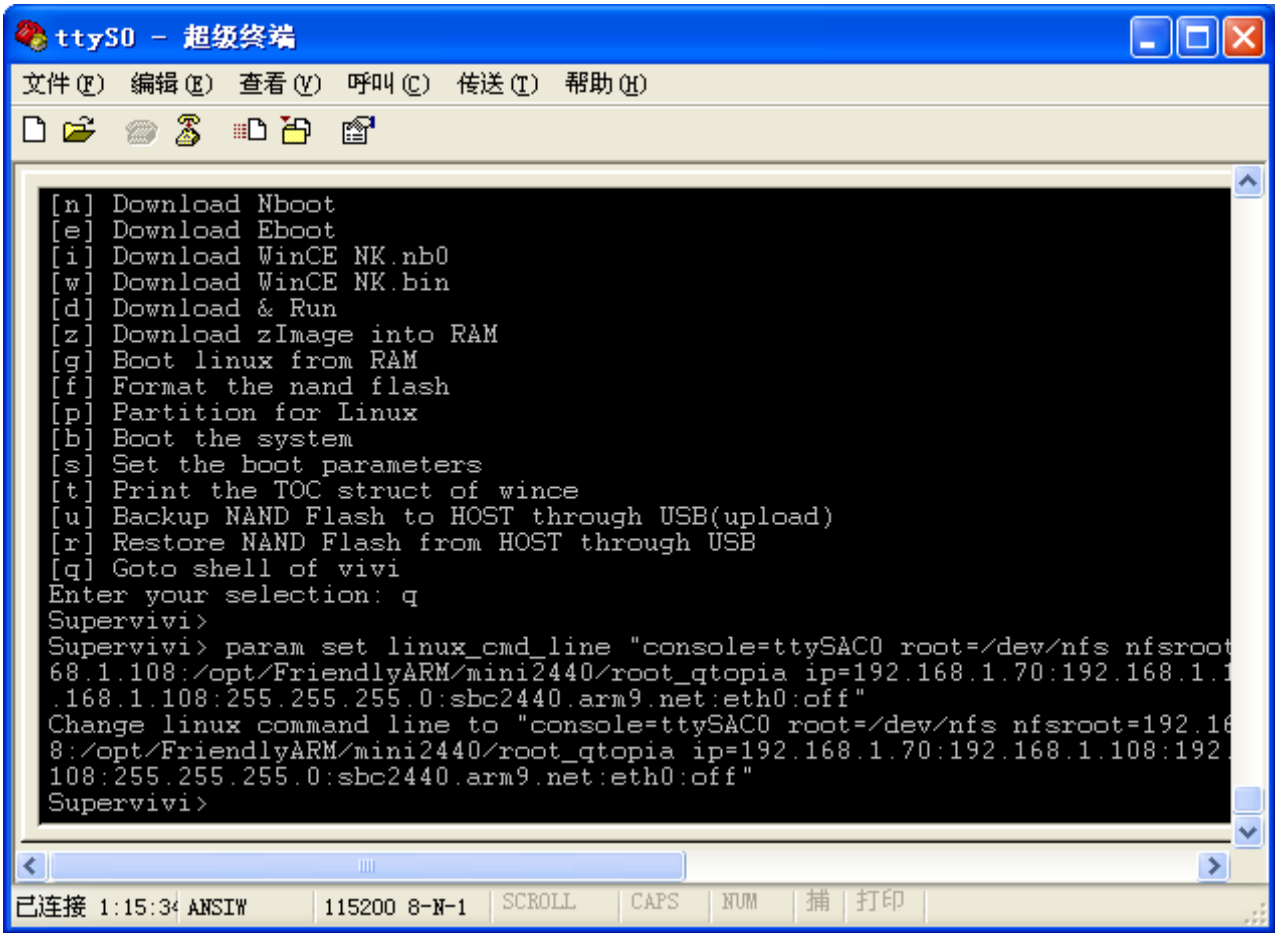
Then type “boot” and press “enter” to boot the system via NFS.



Type “boot” and enter, system will be rebooted through NFS.

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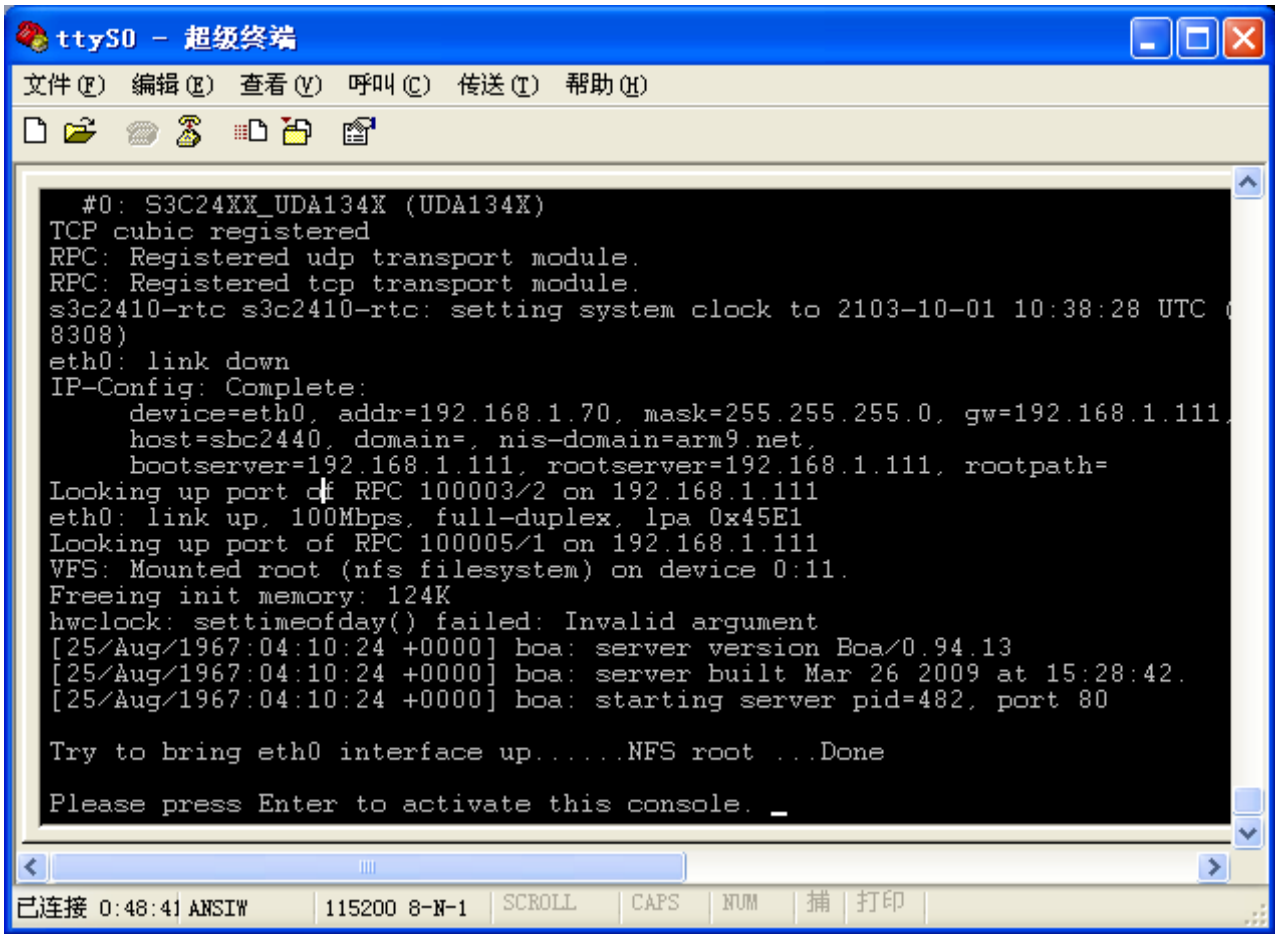

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Chapter 6 Setting up WinCE Development Environment

6.1 Setting up WinCE 5.0 Development Environment

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6.1.1 Installing Platform Builder 5.0 (Including 2007 Patches)

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Note: the Platform Builder 5.0 patches are located in the "\WindowsCE5.0\PB5 Patches 2007\" directory in the shipped CD.

The chapter will introduce how to install "Platform Builder 5.0"(abbriated as "PB5") in WindowsXP. This is a popular tool for developing, configuring and debugging WinCE kernels. Installing this package may need 5-7G space.

(1)PB5 depends on dotnet framework1.1, if the system doesn't have that component installed, it will pop up the following window:

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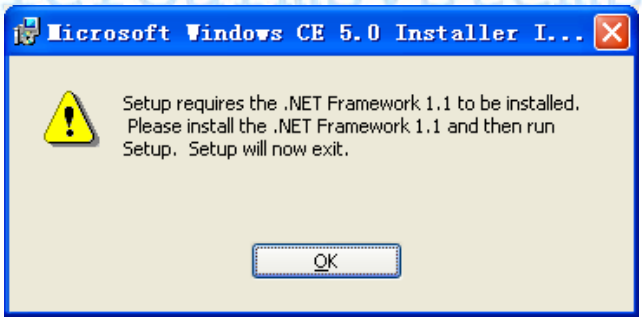

An installation CD of PB5 should have this component. Double click on the icon to start the installation:

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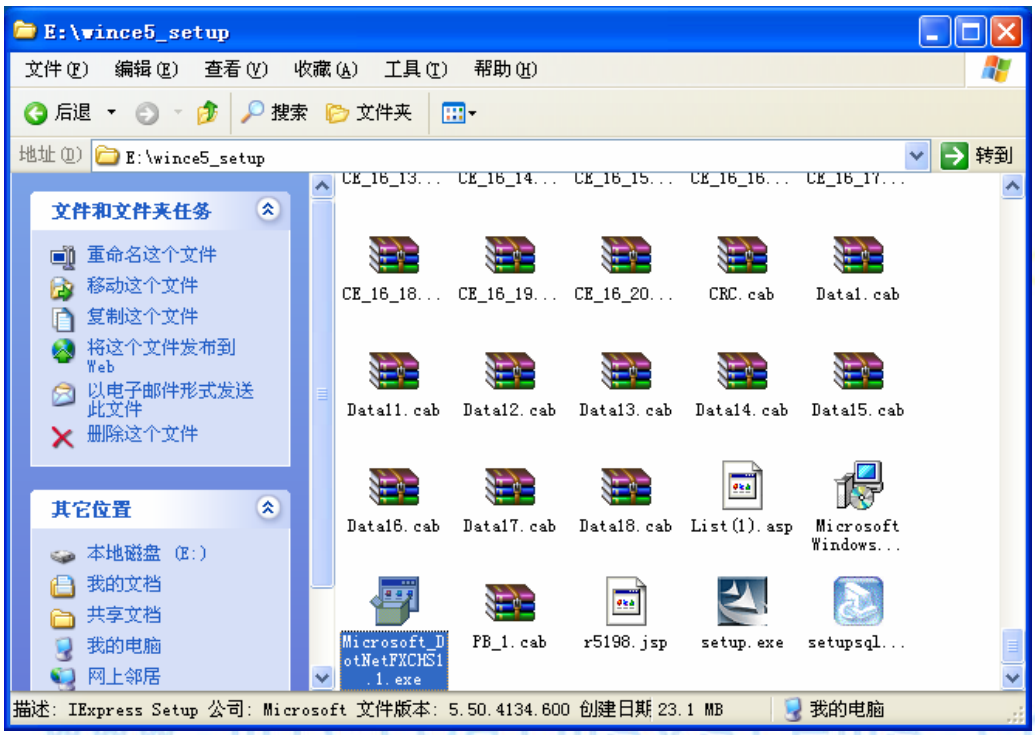
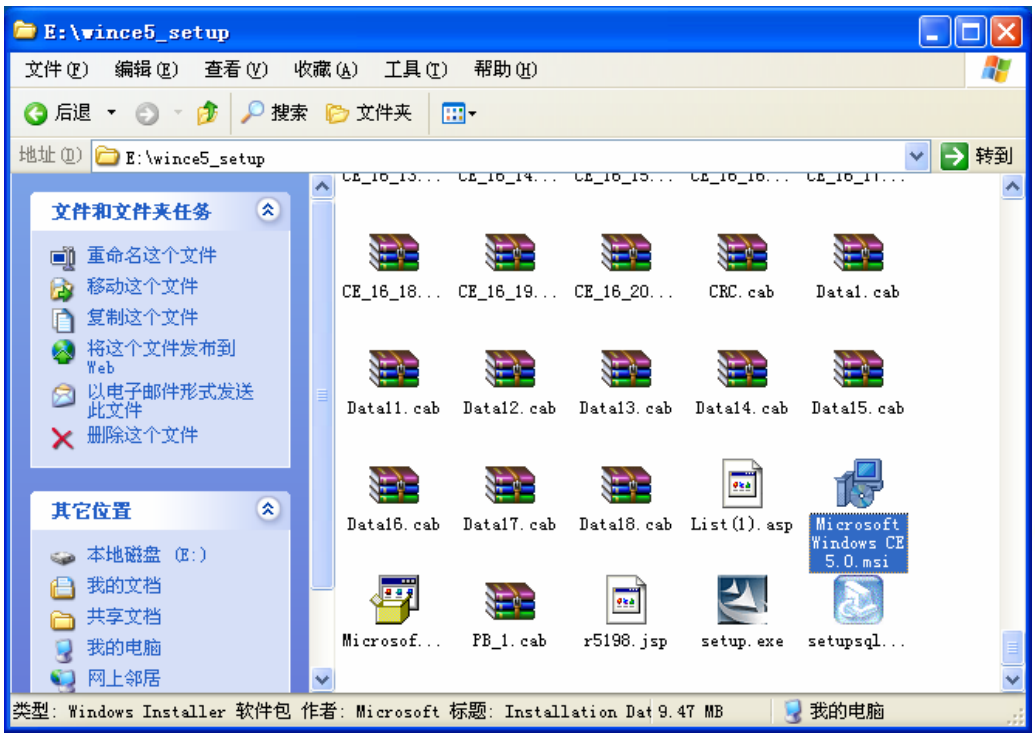


(2)Locate the “Microsoft Windows CE 5.0.msi.exe” icon in the installation CD and double click on it to start installing PB5:



(3)On the installation wizard window, click on the “Next” button:

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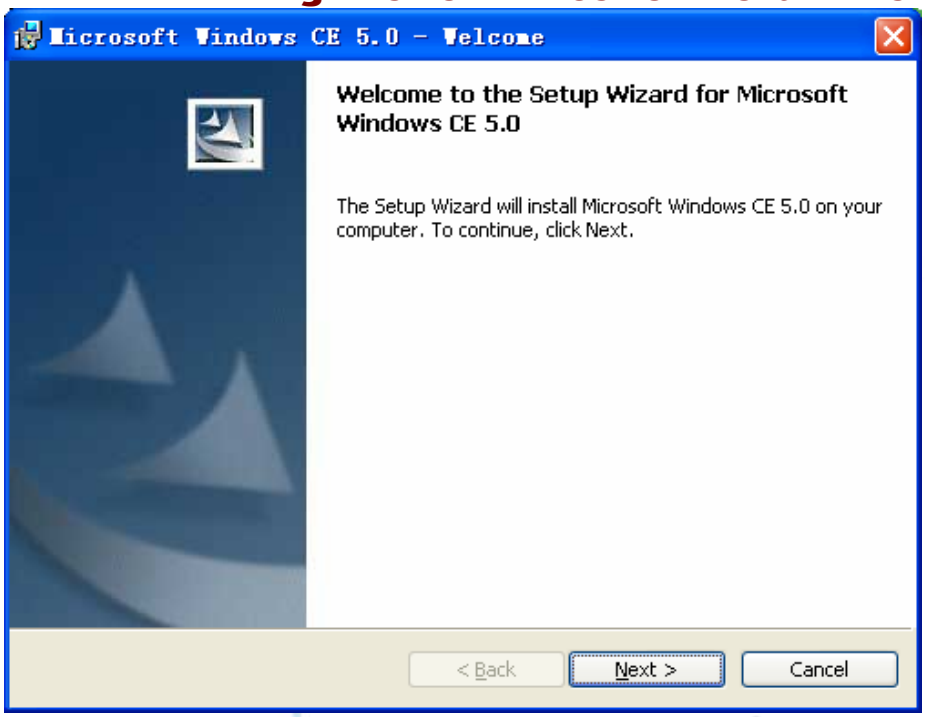
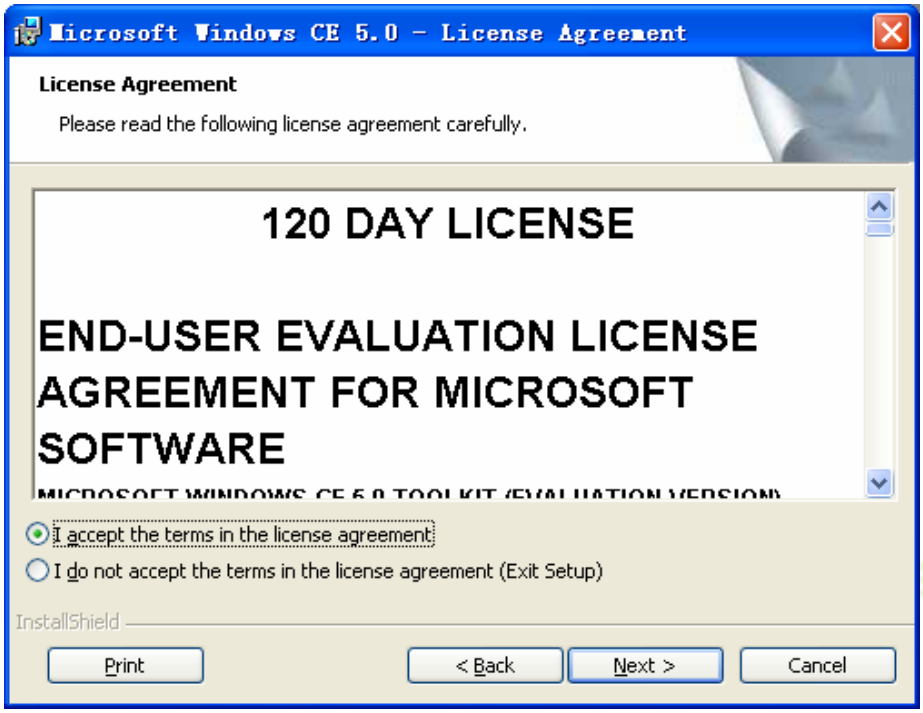


(4) On the "License Agreement" window, check "I accept the terms in the license agreement" and go to "Next":



(5)Input the user information and serial number, go to "Next":

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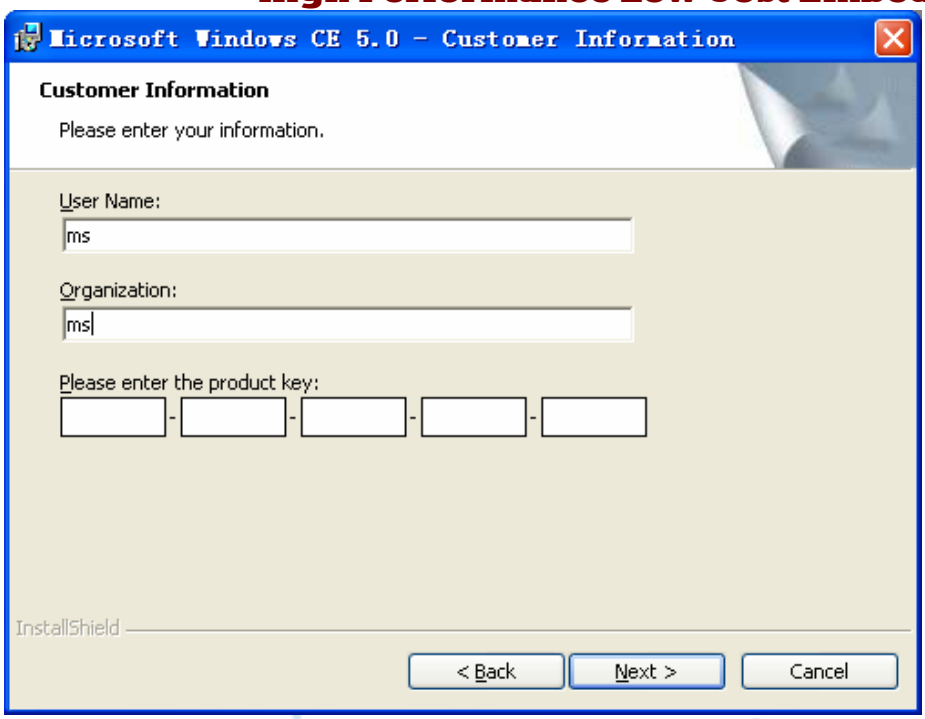
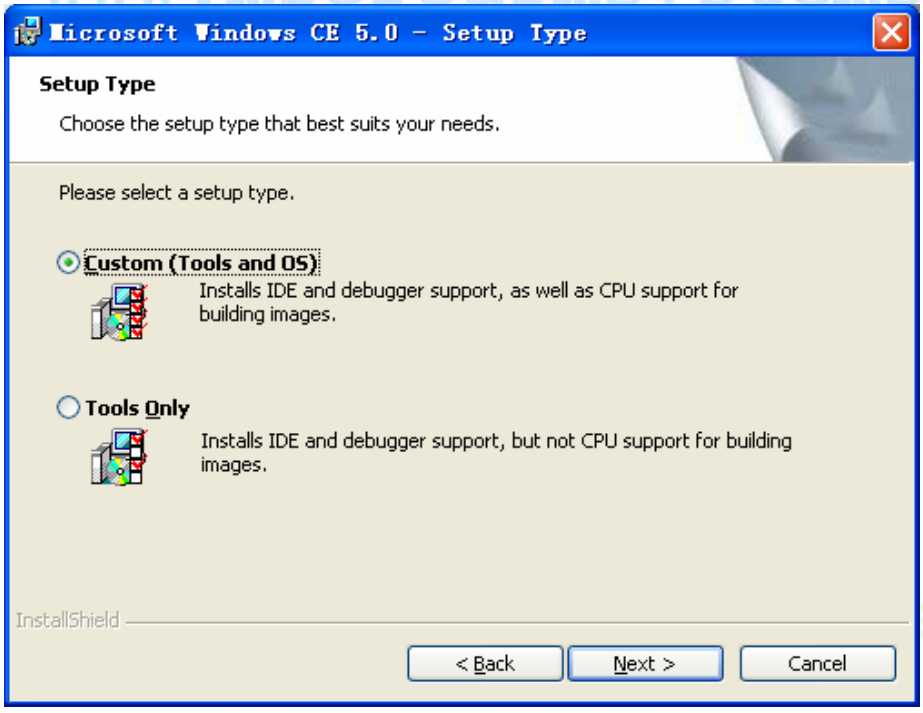


(6)Select “custom” and go to “Next”



(7)Select the destination folder, (in this example, we chose the default one) and go to “Next”

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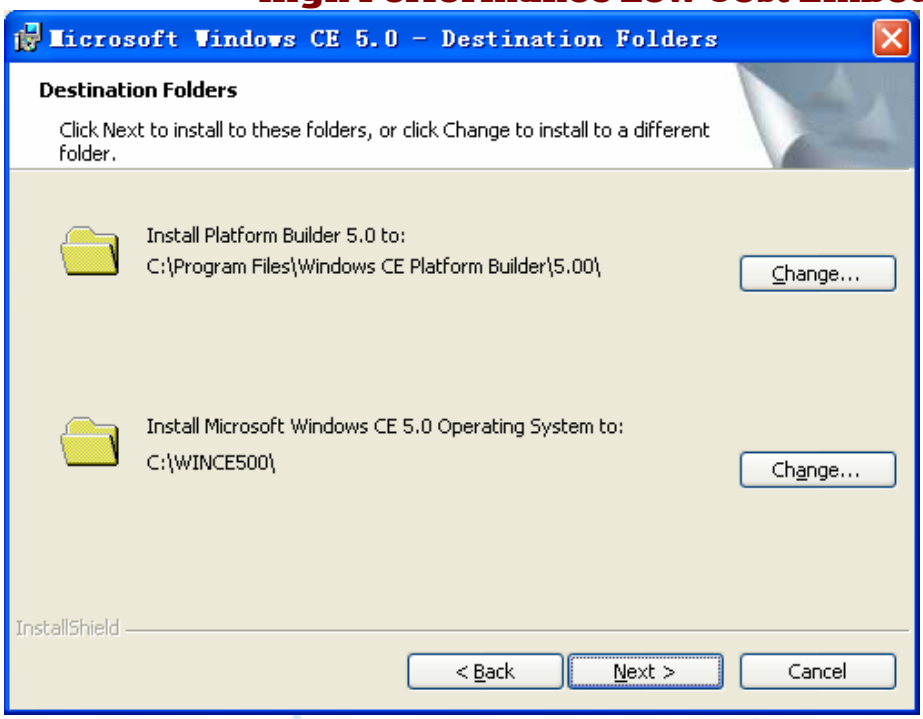
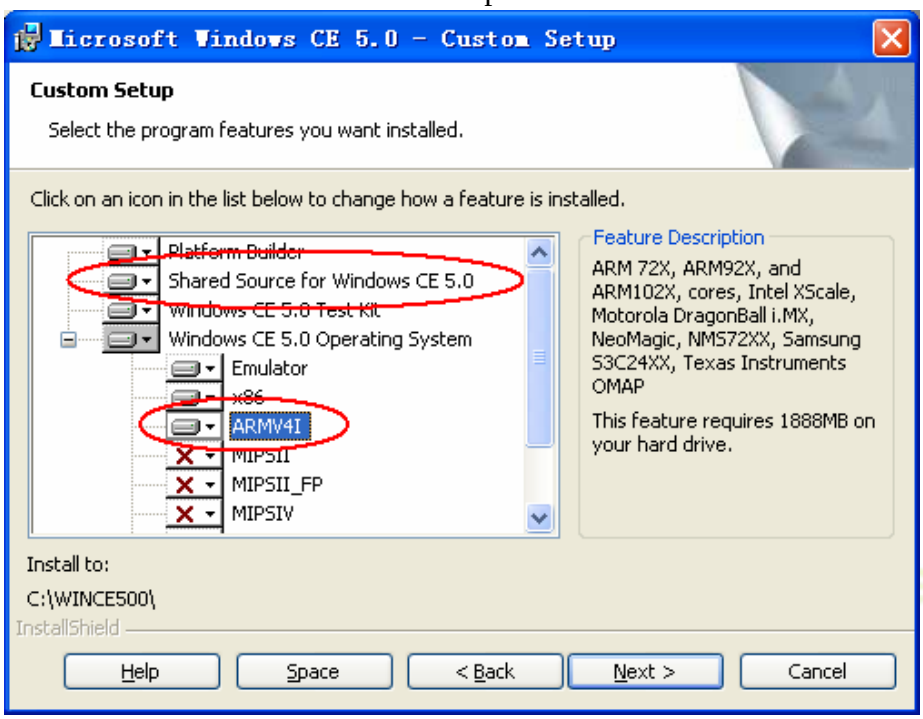


(8)Select the system platform. Please select the "ARMV4I" option, it would be better to check the "Shared Source for Windows CE 5.0" option as well. Go to "Next":



(9) On the license agreement window, select "I accept the terms in the license agreement" and go to "Next":

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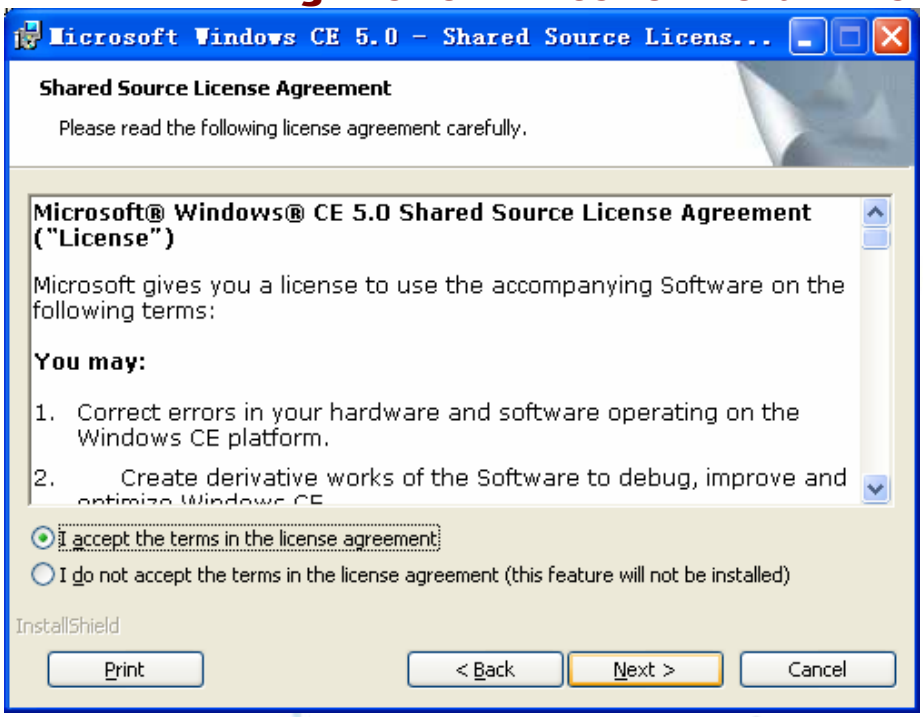
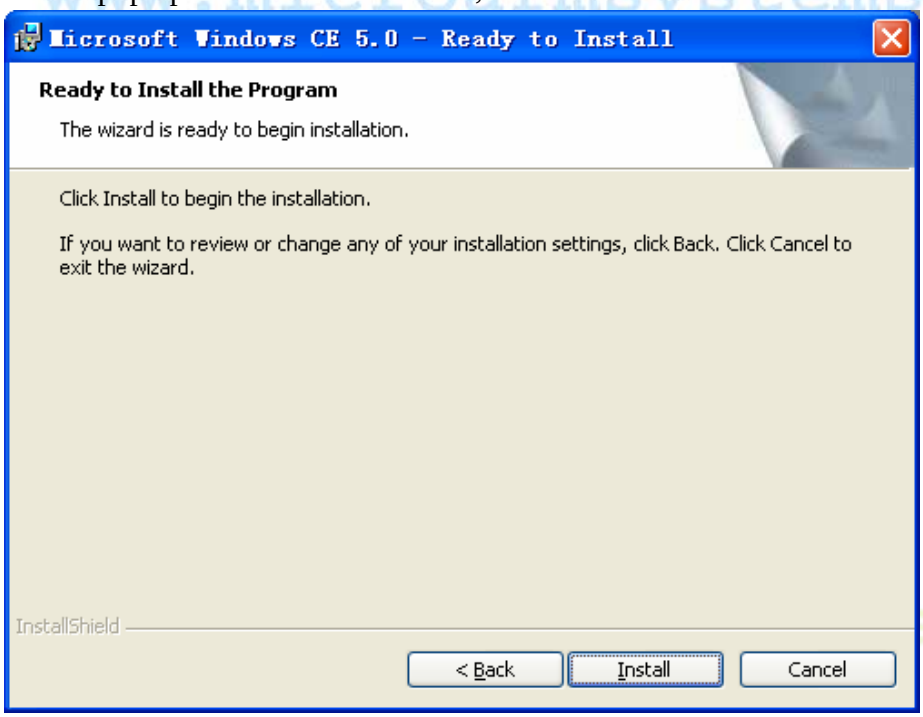


(10) On the pop up window shown below, click on the "Next" button:



(11)Enter the installation interface. This process may take a while

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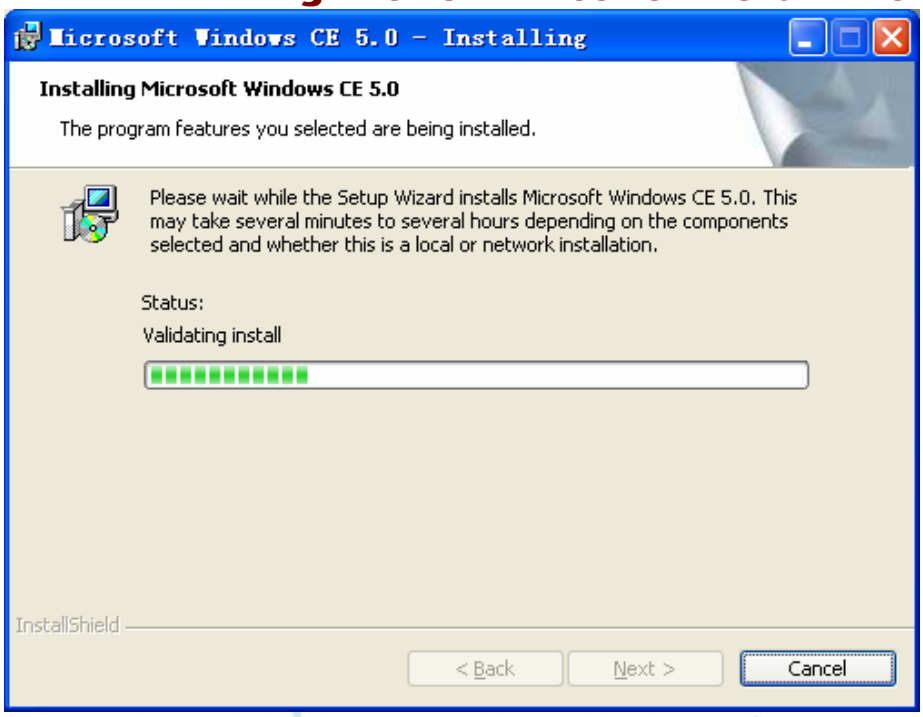
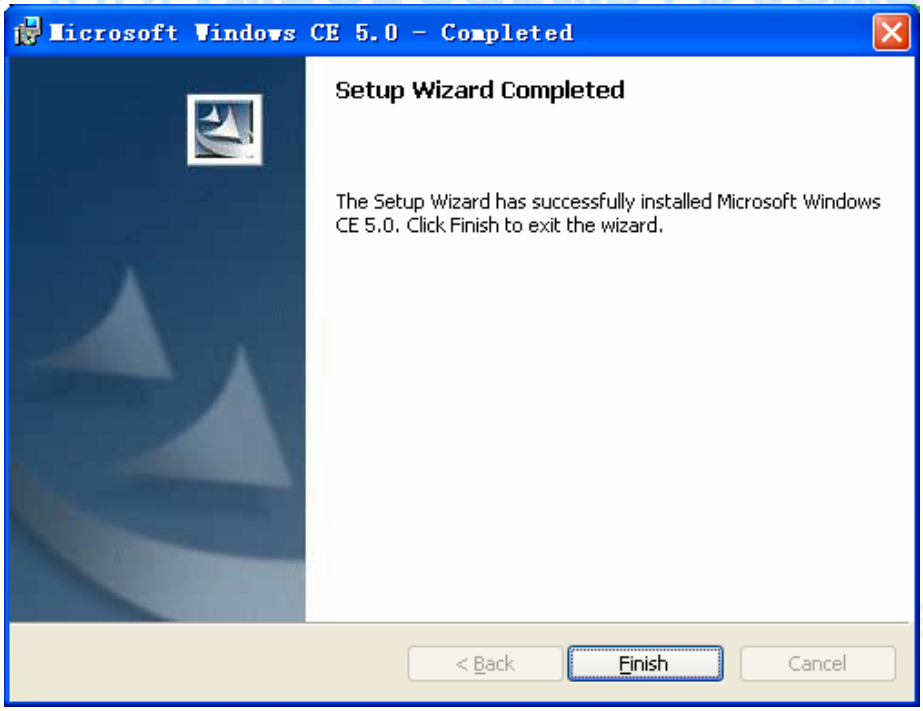


(12)Finish installation



(13)The next step is to install the PB5 patches. They are in the "WindowsCE 5.0\PB5 Patches 2007" directory of the installation CD. Double click on the icon to start installing:

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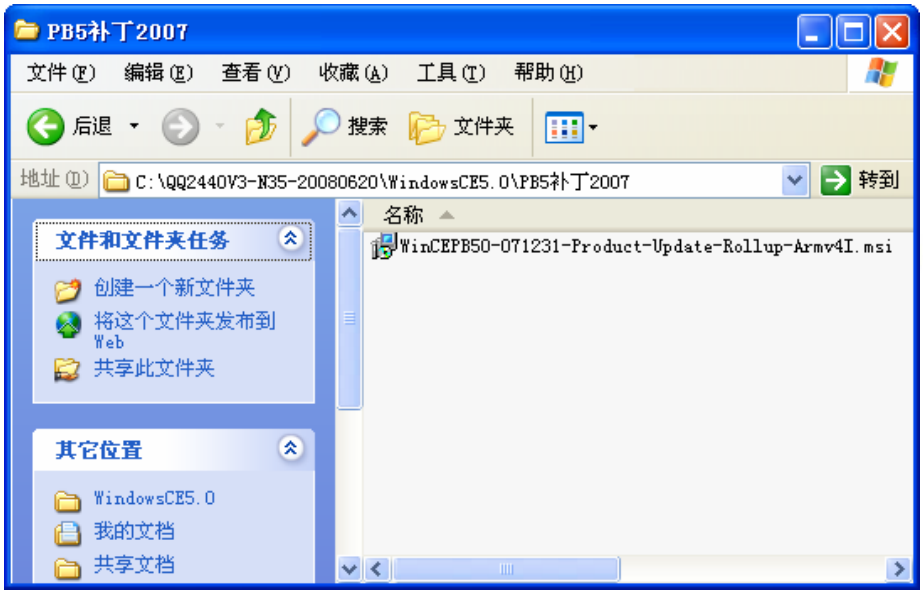
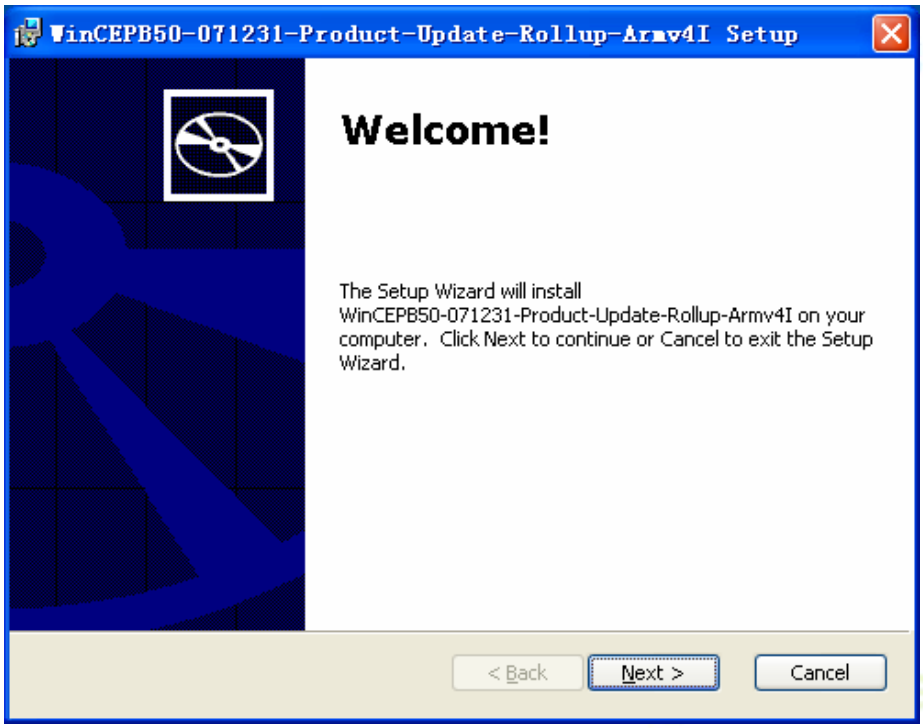


(14) On the instllation wizard, click on the “Next” button:



(15) On the license agreement window, select “I accept the terms in the license agreement” and go to “Next”:

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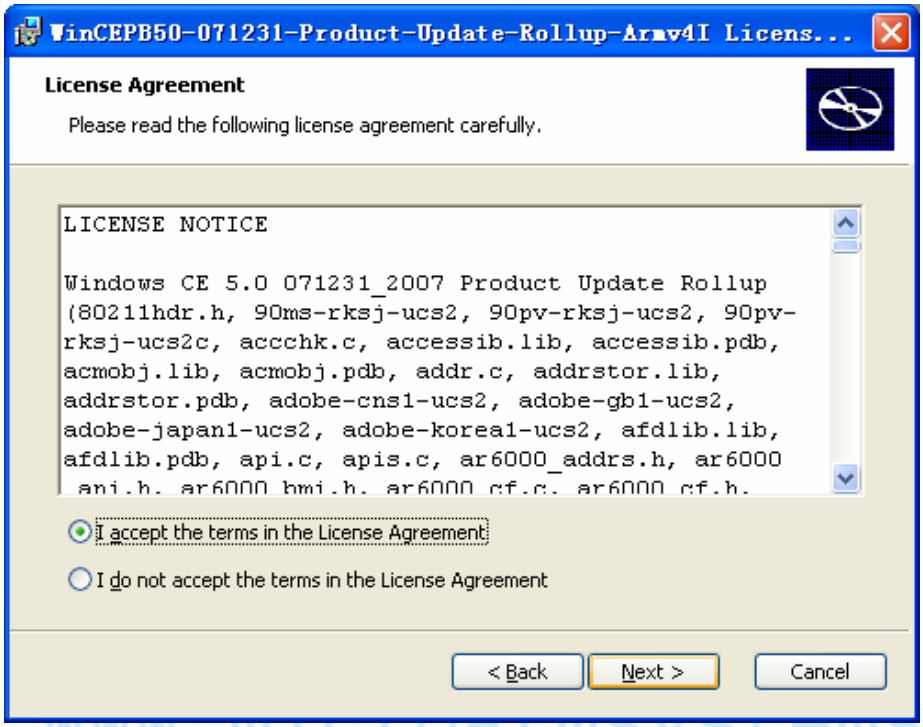
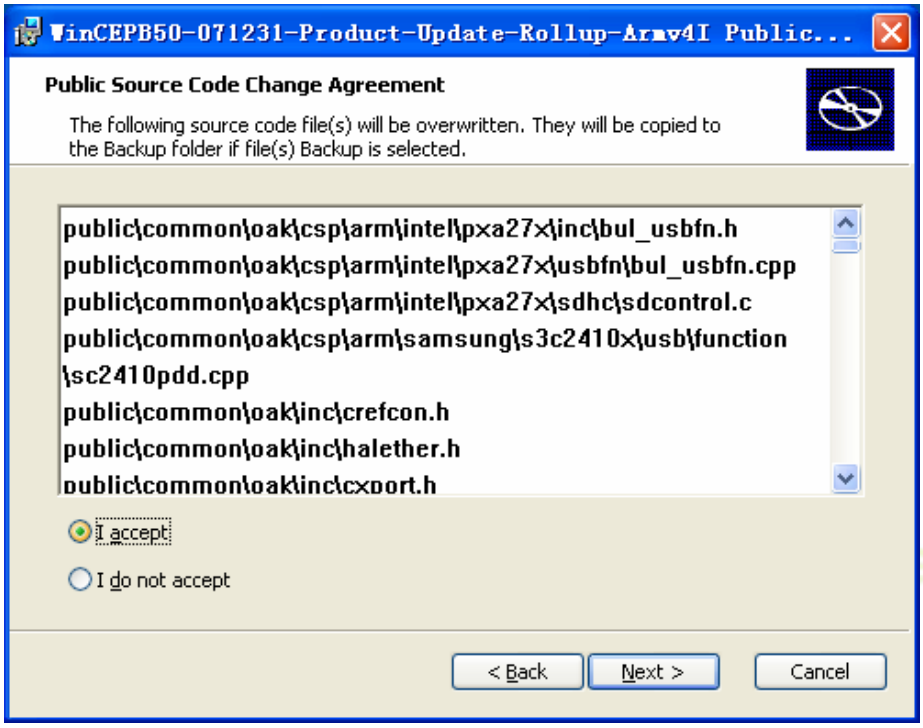


(16) On the public source code change agreement, select “I accept” and go to “Next”:



(17) On the custom setup window, follow the default settings, go to “Next”:

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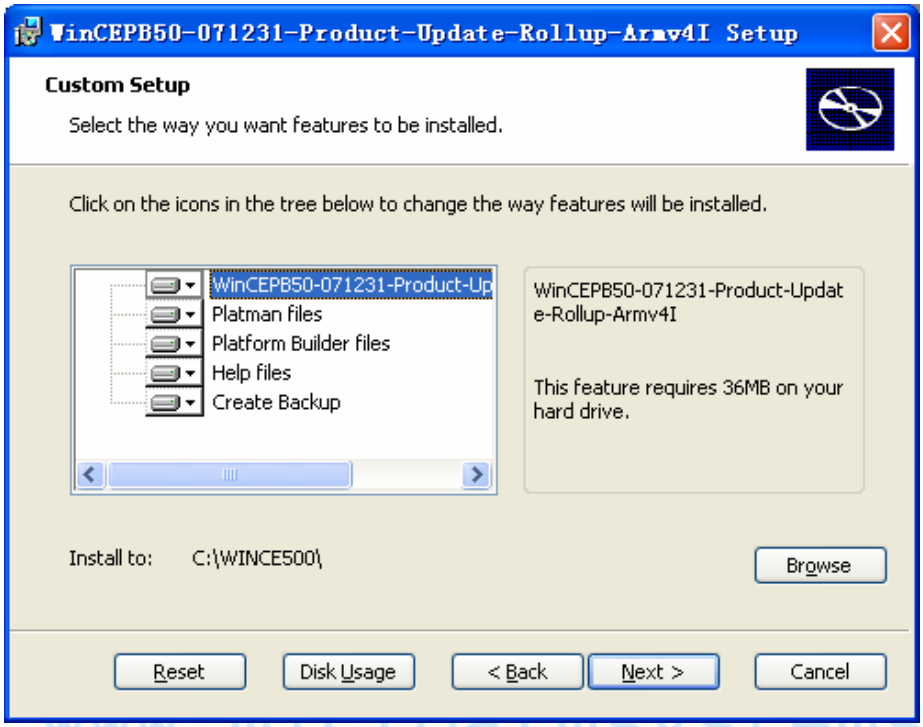
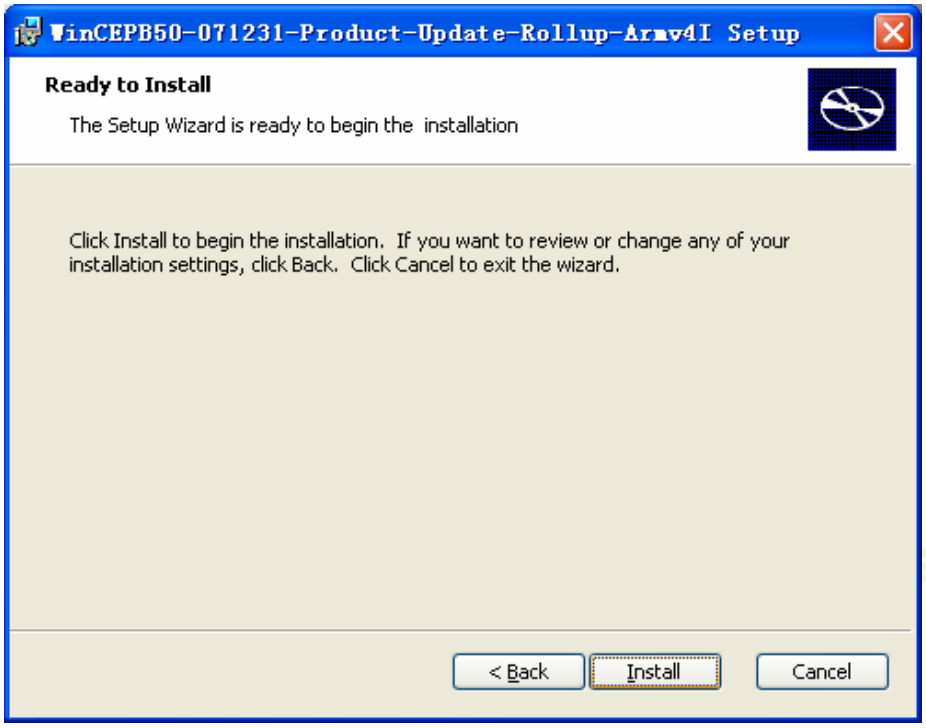


(18) On the window shown below, click on the "Next" button:



(19) Start the installation process. It may take a while:

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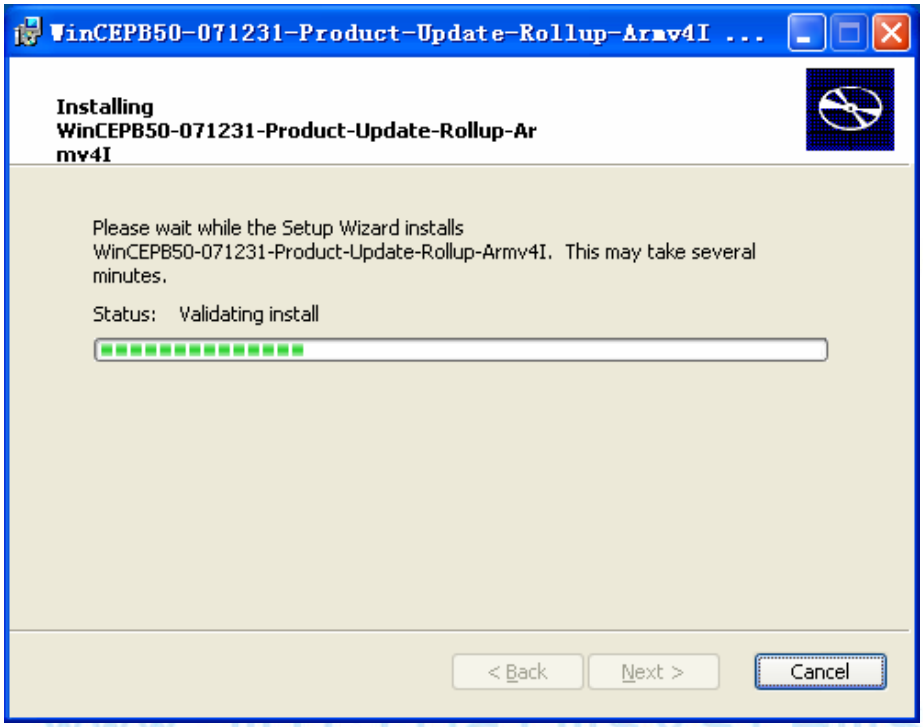
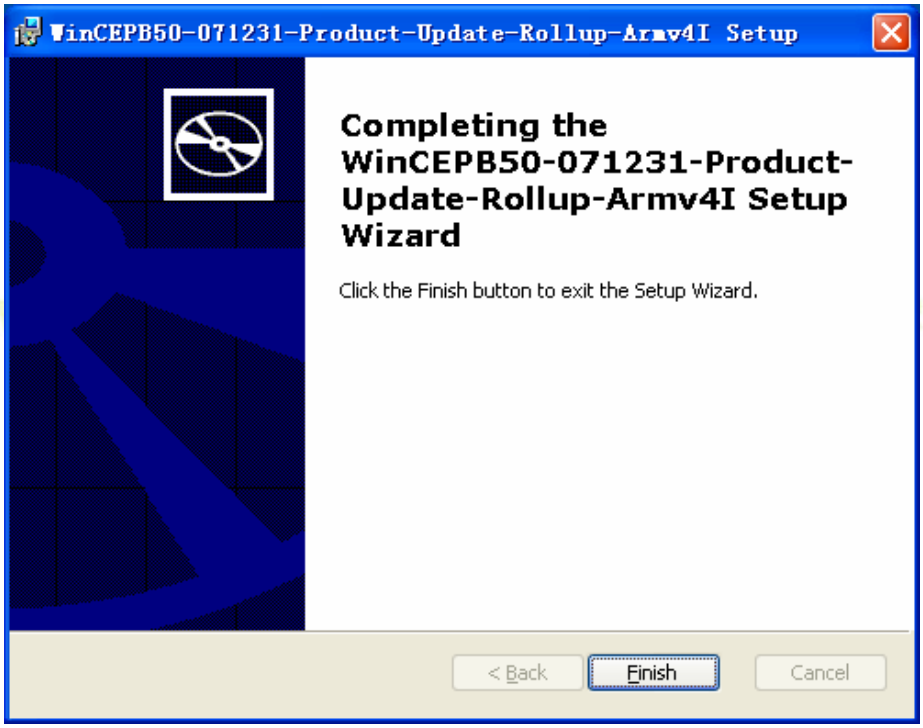


(20)If the following pop up window shows up in the process, just click on the "OK" button to advance:

(21) Finish installation



6.1.2 Installing BSP

Note: if the installation CD has a BSP i.e. "WindowsCE5.0\smdk2440", it will support the following types of LEDs:

- NEC 3.5-inch touch screen
- 7-inch touch screen
- VGA, 1024x768

To make it work for a specific type, the user needs to make corresponding changes in the BSP:

1. Change the LCD_TYPE in the "\smdk2440\INC\s2440.h" file. Locate the following definitions:

```
#define LCD_TYPE_N35      1    //for NEC 3.5-inch screen
#define LCD_TYPE_A70      2    //for 7-inch screen
#define LCD_TYPE_VGA1024x768 3 //for VGA, 1024x768
#define LCD_TYPE  LCD_TYPE_N35
```

Set LCD_TYPE to what the user needs, here the default is "LCD_TYPE_N35"

2. Modify the "smdk2440\smdk2440.bat" file (it can be opened with a "notepad")

```
REM - LCD_TYPE for FriendlyARM
set BSP_LCD_TYPE_N35=1
set BSP_LCD_TYPE_A70=
```

Set the user needed type to "1", and leave the rest as blank. It defaultly sets "BSP_LCD_TYPE_N35=1", currently it doesn't support VGA.

To use PB5 to compile a WinCE kernel, the user needs to install a BSP targeted at a board and set up its configurations. Please follow the instructions below:

Step1: Copy the whole "/WinCE5.0/smdk2440" directory in the CD to "C:\WINCE500\PLATFORM" and uncheck its readonly property

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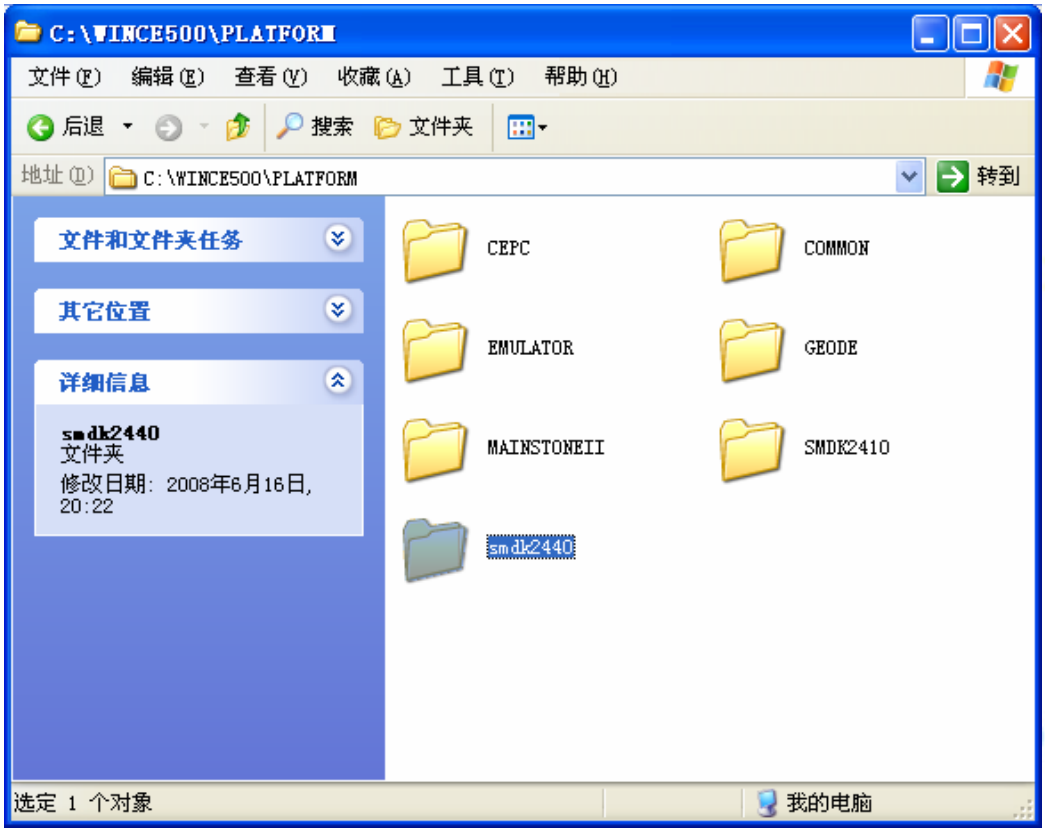
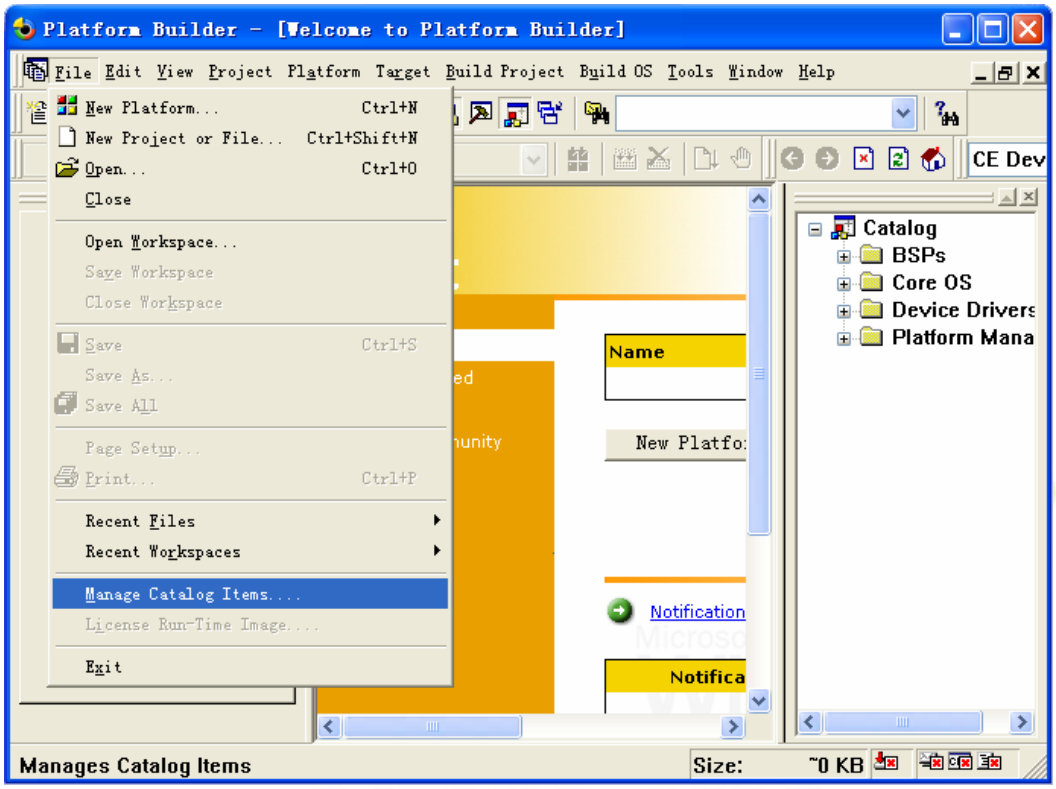
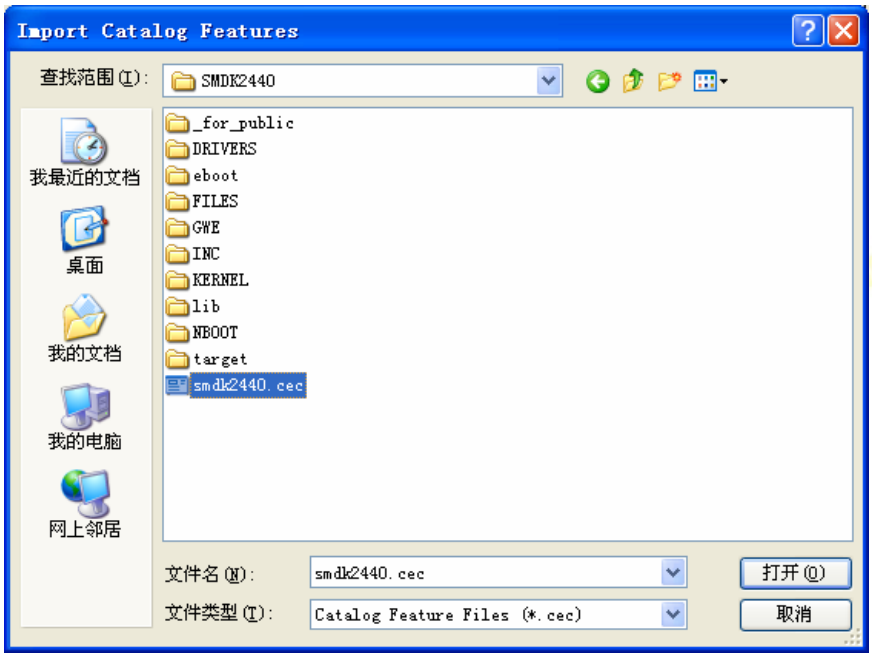


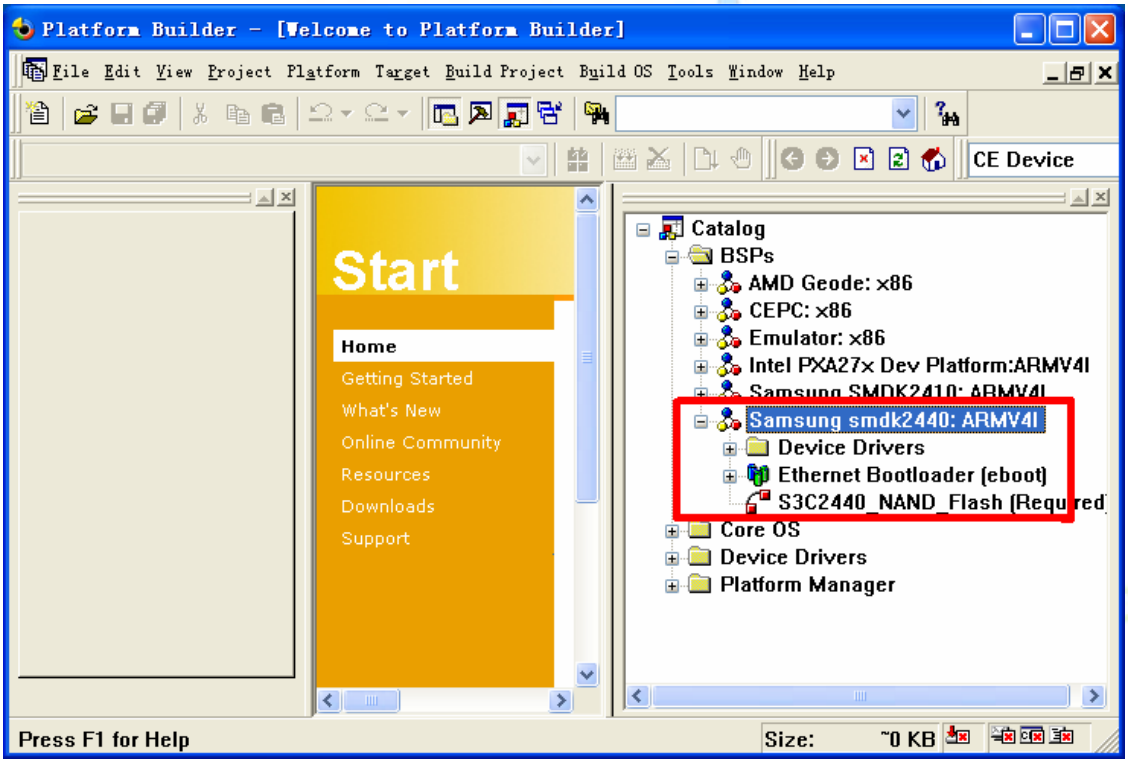
Step2：Start “Platform Builder 5.0”, go to “File” -> “Manage CatalogFeatures”



Click on the “Import” button to import the “platform\smdk2440\smdk2440.cec” file.



Step3：Expand the “Catalog” tree and its subtree “BSPs”, select the “Samsung SMDK2440:ARMV4M” option to complete the installation.



6.1.3 Compiling Kernel

(1) Create a “C:\WINCE420\PBWorkspaces\mini2440” directory if it doesn’t exist. Copy the “WindowsCE 5.0\mini2440.pbxml” file into the “C:\WINCE420\PBWorkspaces\mini2440”

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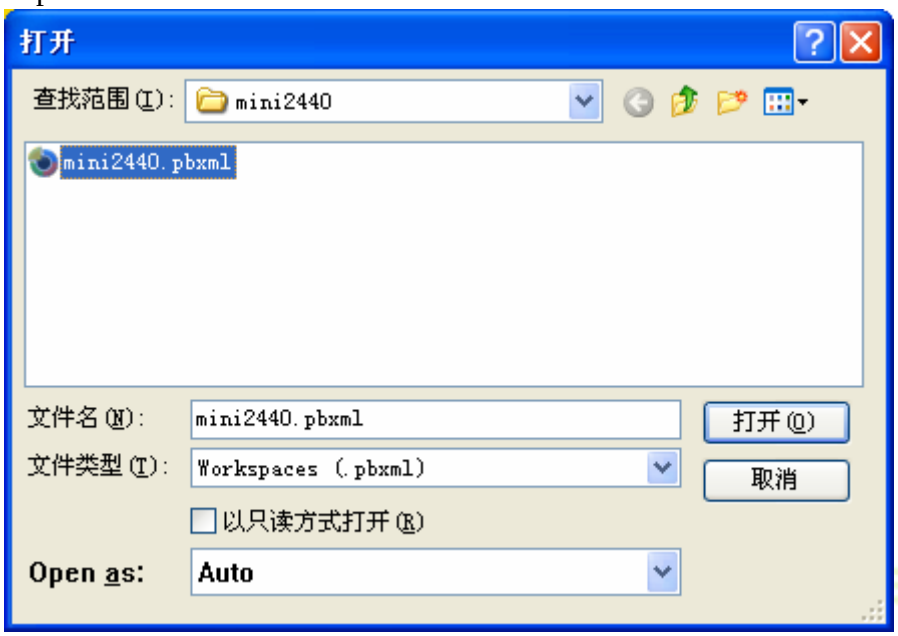
directory and ucheck its readonly property.

(2) Start the PB program and click on "File" -> "Open Workspace…" and select the "mini2440.pbxml" file



The screen shot below is the PB's interface:

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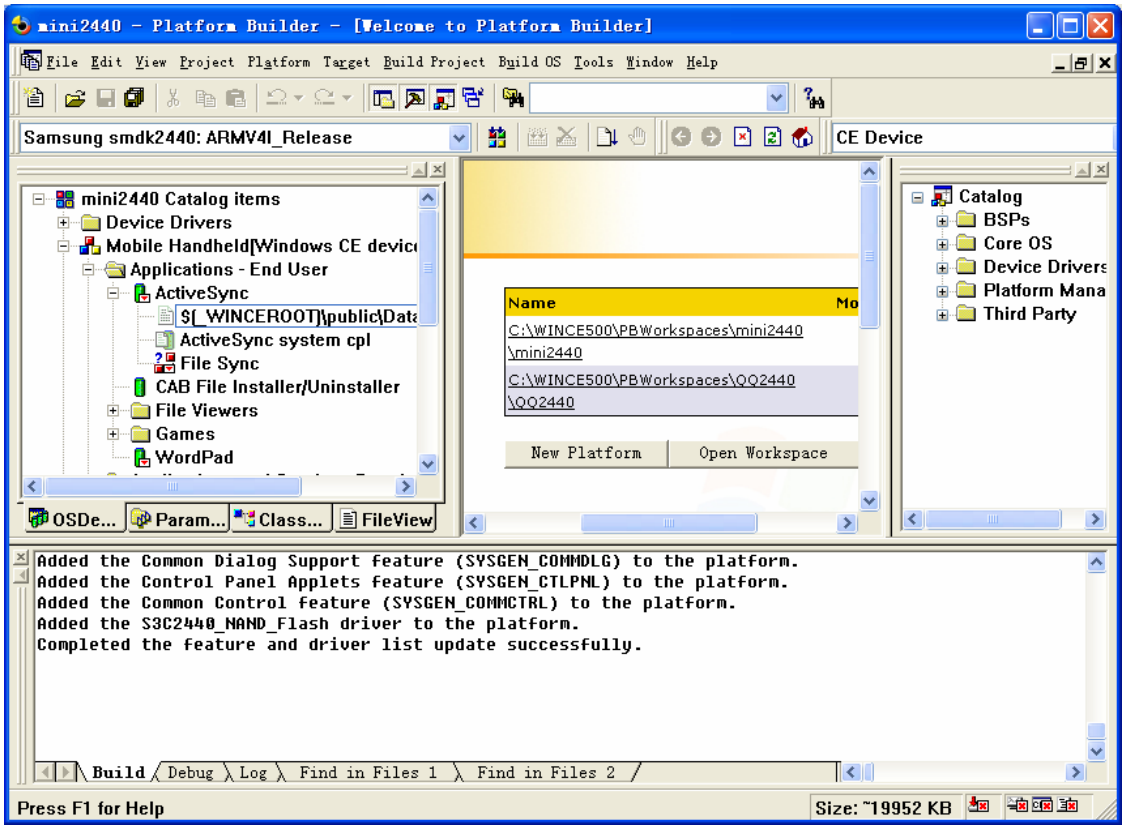

(3) Select “Build OS” -> “Sysgen” to compile, or the user can click on the “  ” icon to compile. This process takes a while.

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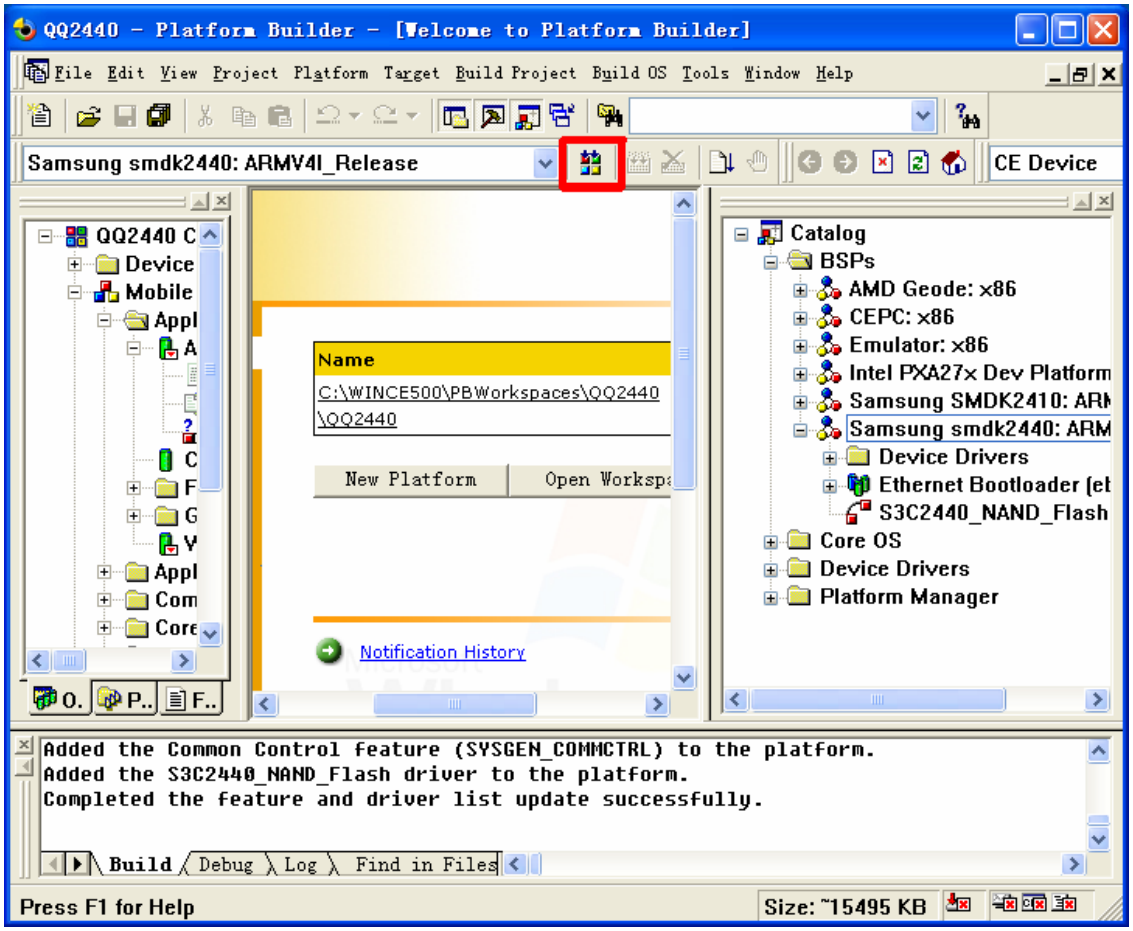

(4) After the compilation is done, an “nk.bin” and an “nk.nb0” files will be generated. The “nk.bin”is a release version and the “nk.nb0” is an executable version that can be run in RAM. The “nk.bin” is more often used than the other. Both are located in the “**C:\WINCE500\PBWorkspaces\mini2440\RelDir\smdk2440_ARMV4I_Release**” directory.

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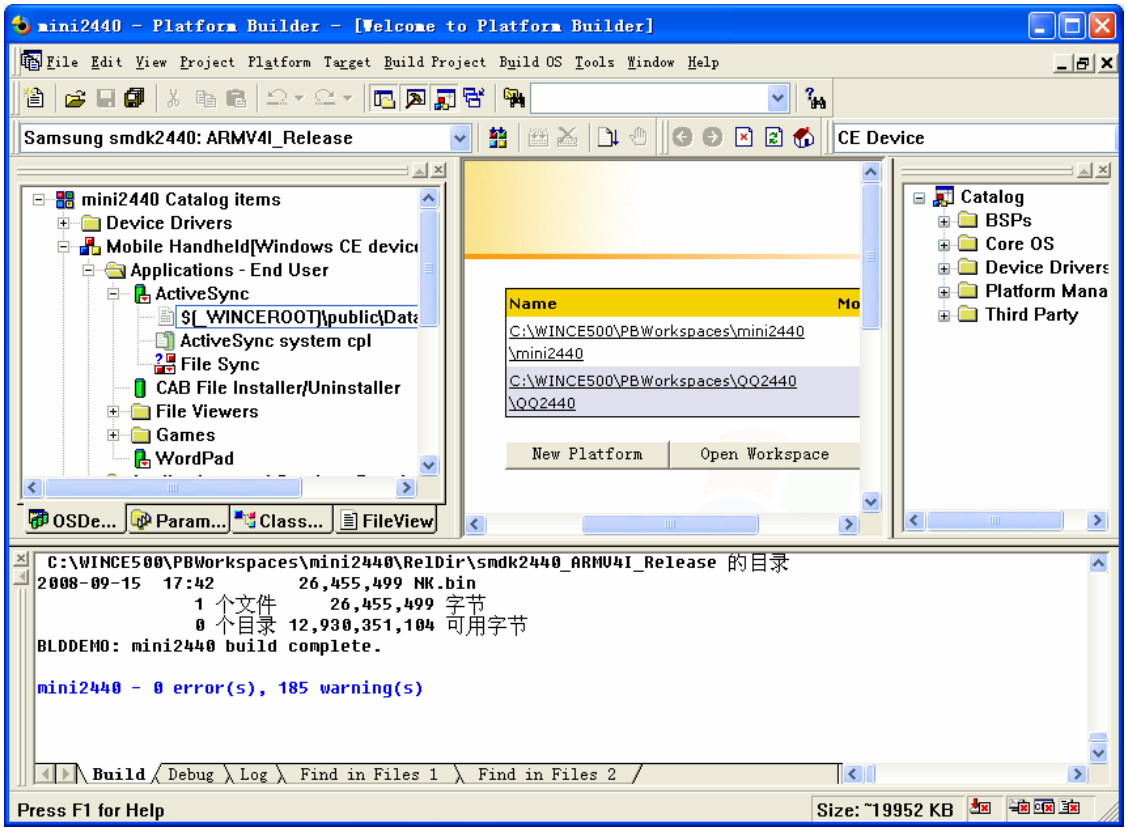

In the compiling process, there could be various warnings, usually they don't cause trouble and can be ignored.

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6.1.4 Exporting SDK

The compiled kernel can be exported as an SDK installation file which provides developers with platform related header files, libraries and documents. The user can develop platform based applications with Embedded Visual C++ after installing an SDK file.

Note: it already contains an SDK file in the "\WindowsCE5.0\SDK" directory in the installation CD.

Here are the detailed steps for exporting an SDK file:

(1) Firstly, open a project and go to "Platform" -> "SDK" -> "New SDK…"

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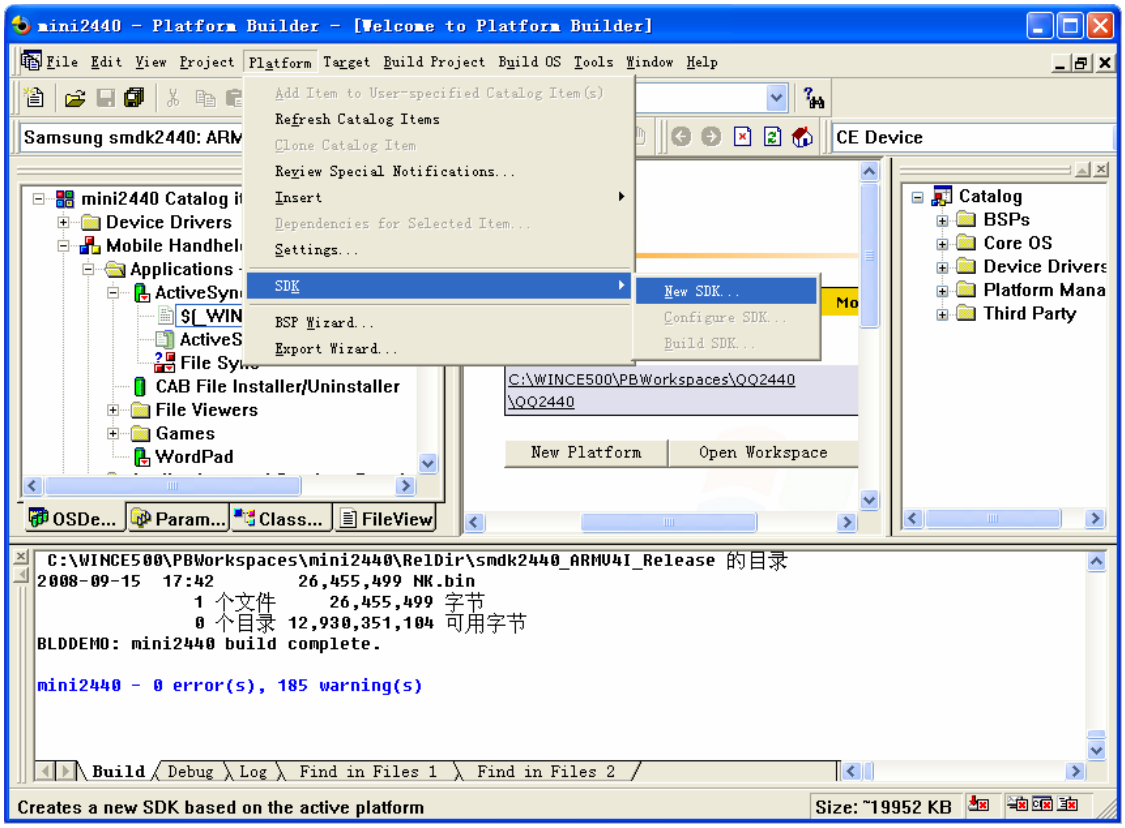
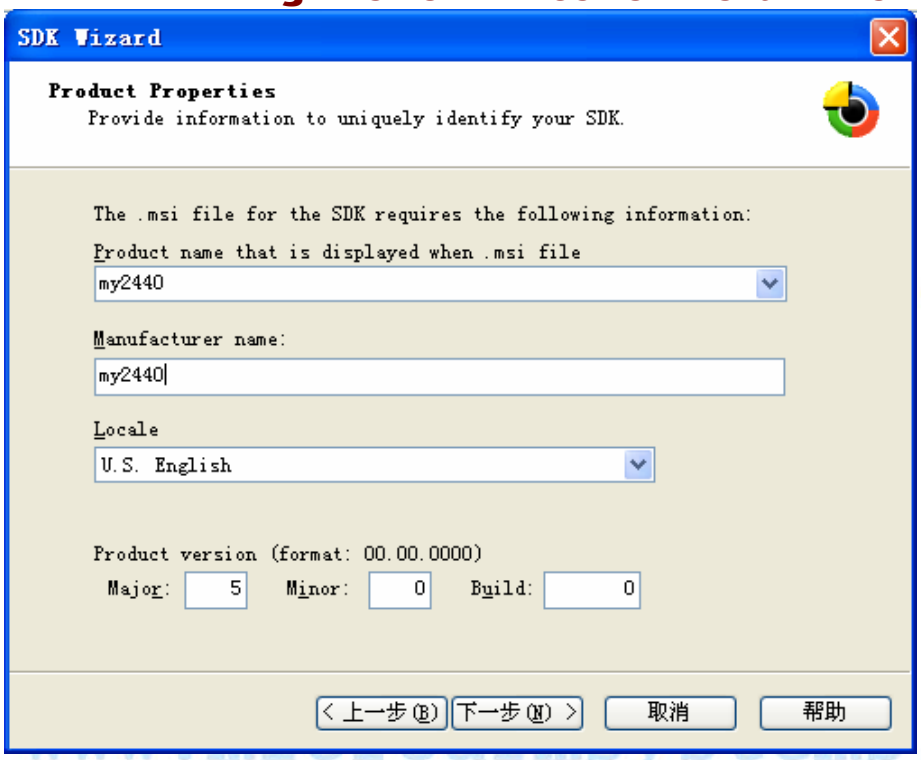
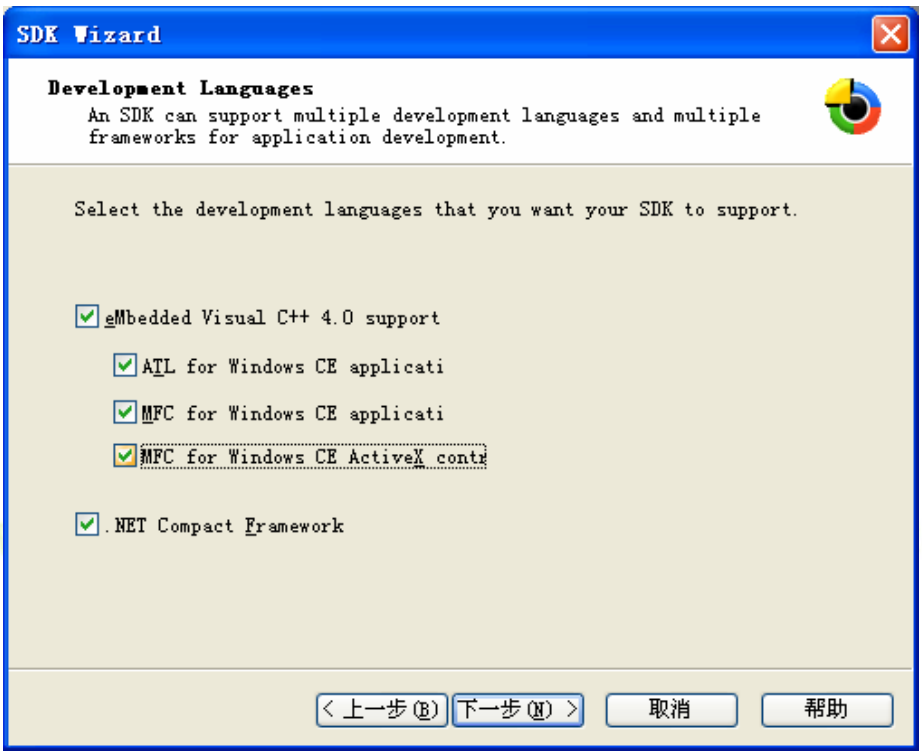


(2) On the “Export SDK Wizard” window, click on the “Next” button

(3) On the “Prodect Properties” window, fill in the fields with required information, go to “Next”



(4) On the "Development Language" window, check the languages the user wants the system to support, go to "Next"



(5) Finish the setup process, click on the "Finish" button

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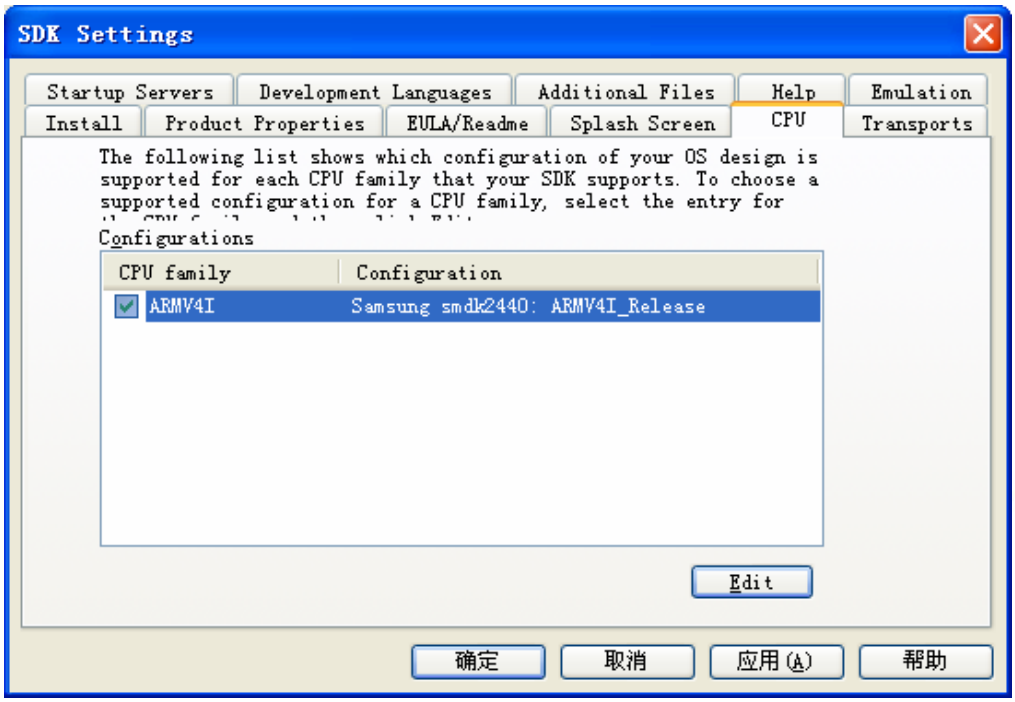
(6) Go to "Platform" -> "SDK" -> "Configure SDK…" and a setup window will pop up. The user can set up more configurations here. Click on the "CPU" tab and the following window will come up:



(7) Click on the "Edit" button, the window shown below will appear, check the "Samsung smdk2440: ARMV4I_Release" option:

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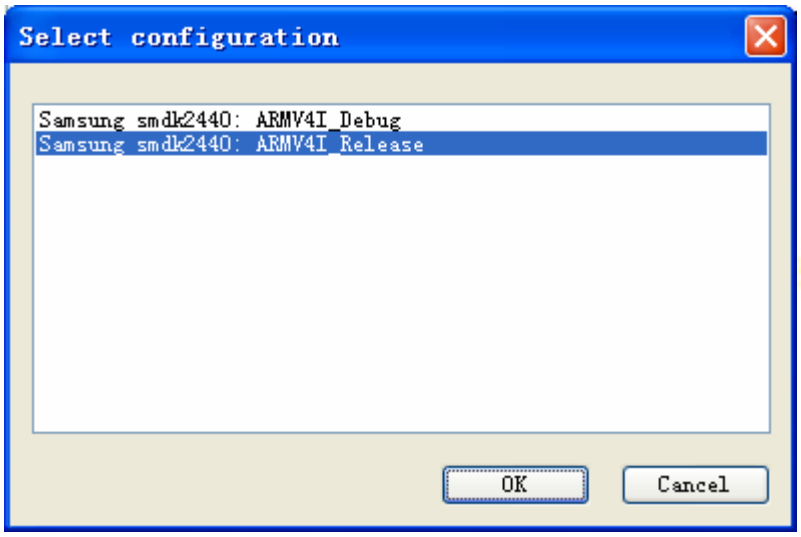
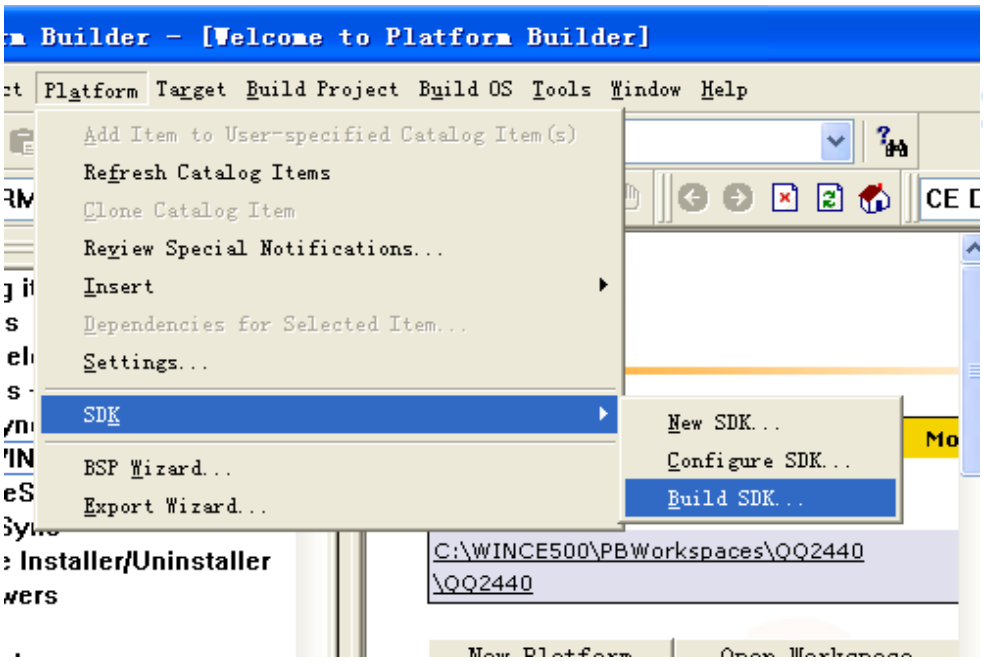


(8) Click on the “OK” button to return to the PB5 main menu then select “Platform” -> “SDK” -> “Build SDK…”



(9) On the compile wizard window, start compiling an SDK file:

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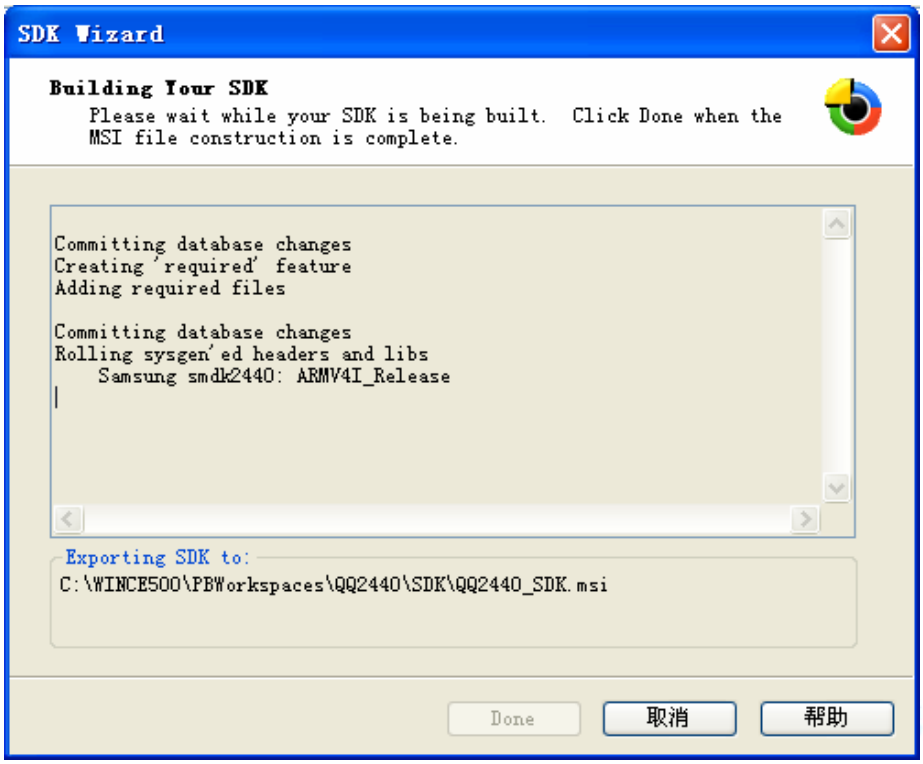
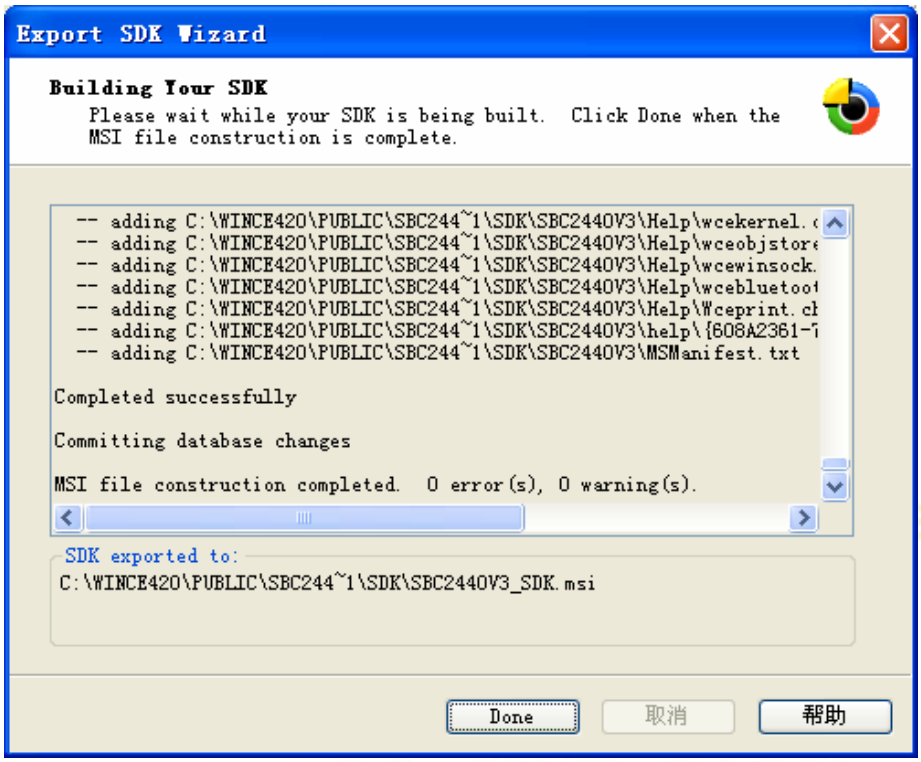


(10) The compiling process takes several minutes, after it is done, click on the "Done" button:



(11) An SDK file will be generated in the directory shown in the following screen shot.

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6.1.5 Installing Embedded Visual C++

In order to develop API based WinCE applications, the user may need to install EVC and its corresponding SDK. The following are the installation steps:

(1) An EVC package is located in the “Embedded Visual C++\” directory. Double click on the “setup.exe” program to start the installation process

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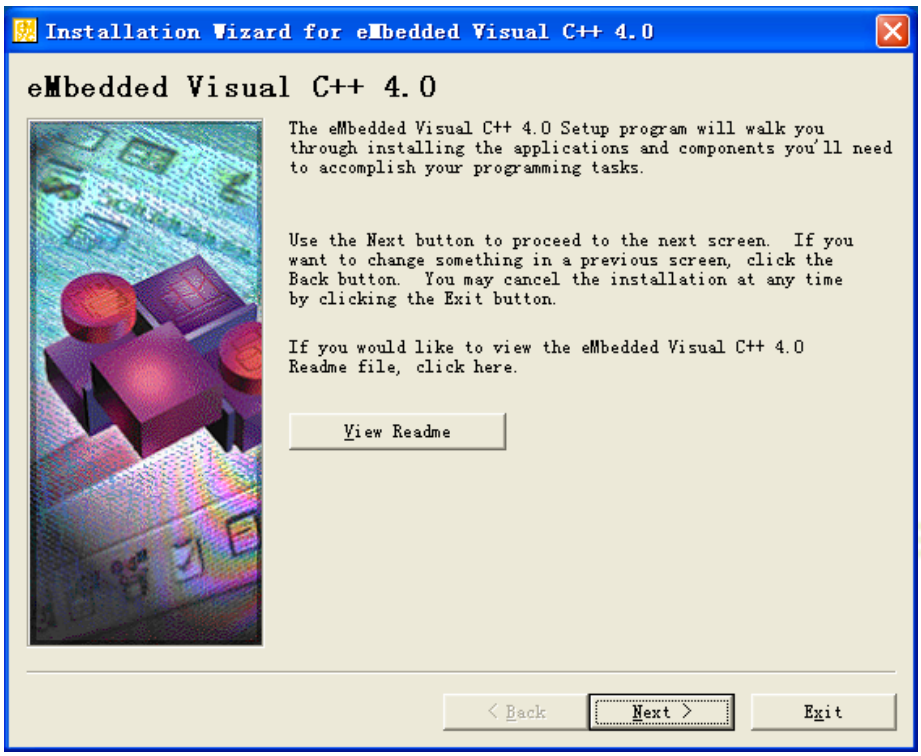
(2) On the installation wizard window, click on the “Next” button



(3) On the license agreement window, select “I accept the agreement” and then go to “Next”

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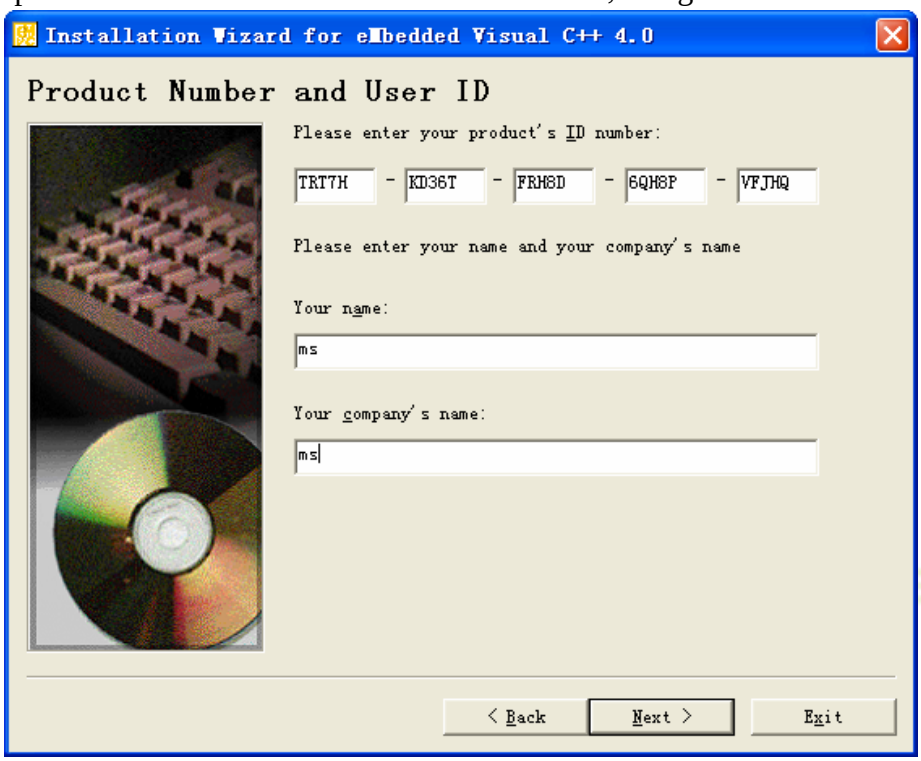
(4) Input the serial number and the user information, and go to "Next"



(5) Select components. Follow the default setting and go to "Next"

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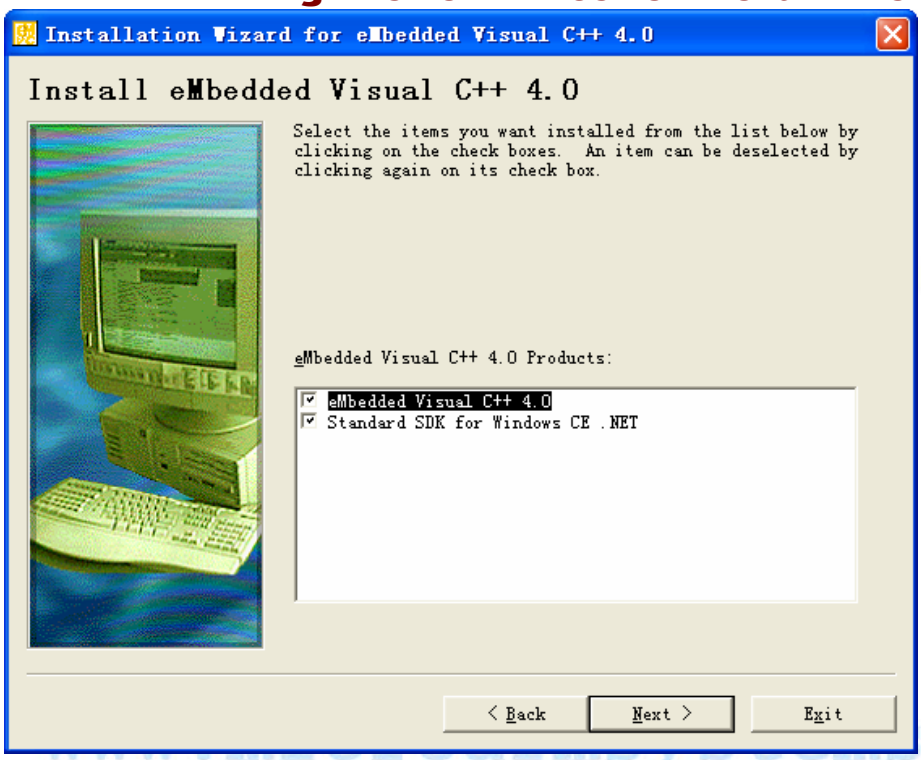
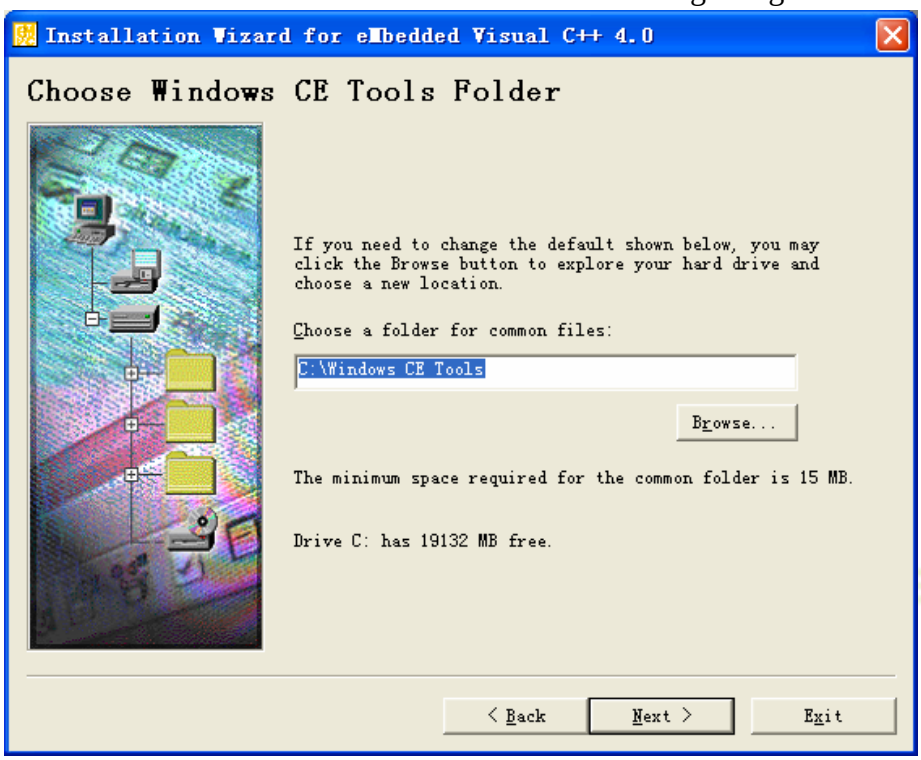


(6) Choose the destination folder. Follow the default setting and go to "Next"



(7) On the pop up window shown below, select "Yes"

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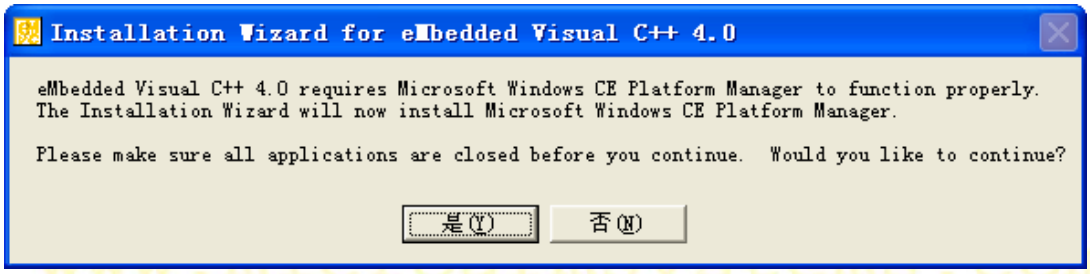
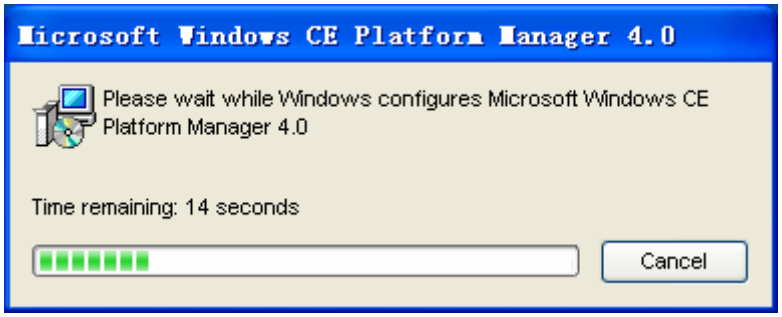
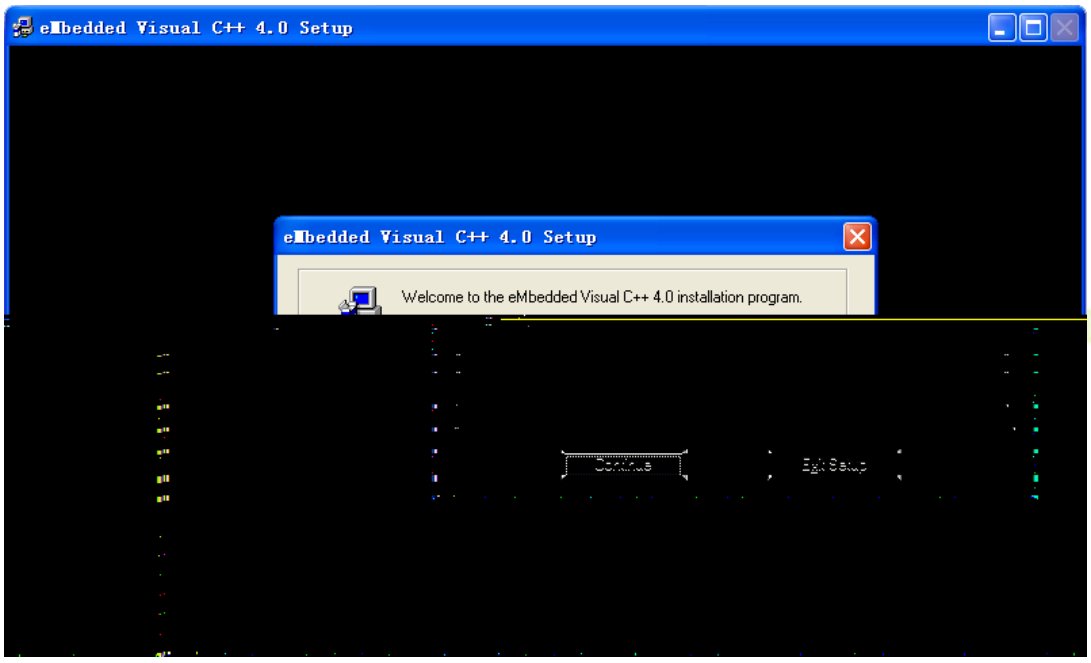


(8) Start installing the EVC manager, the following window will pop up, wait till it is done.

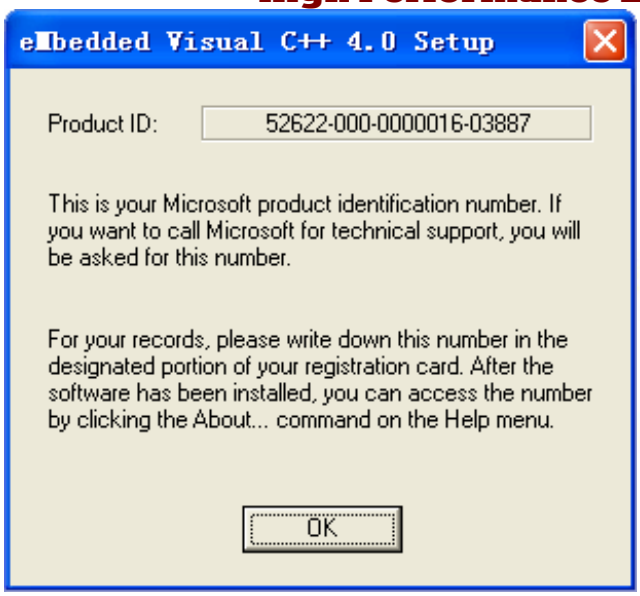


(9) After this installation is done, click on the "OK" button

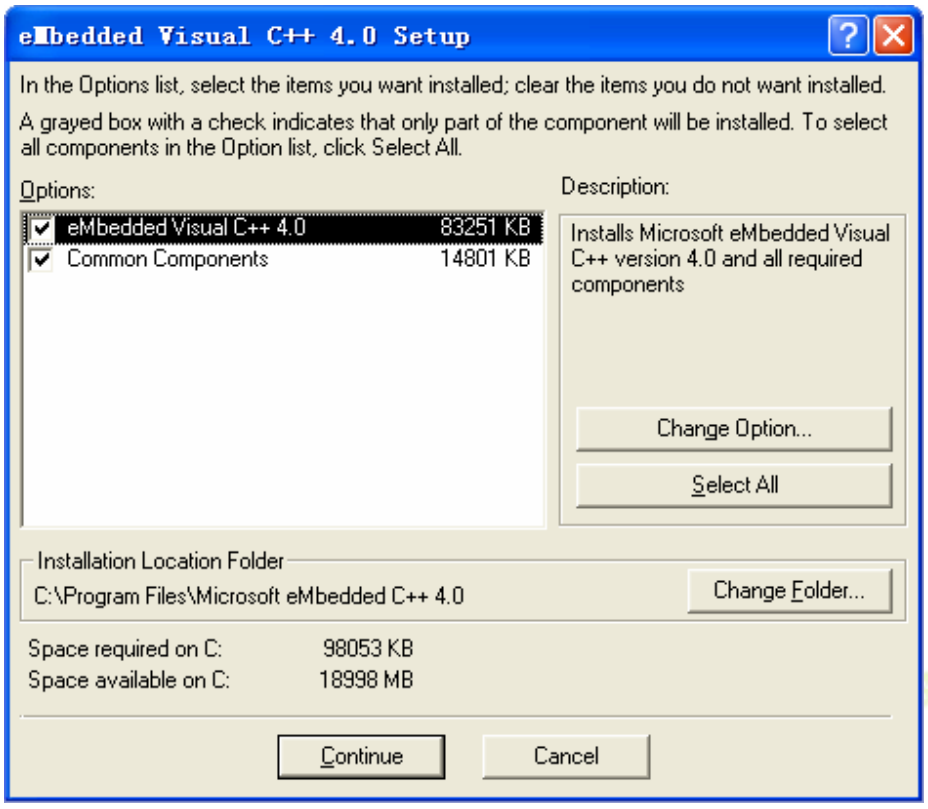
(10) On the pop up window shown below, click on the "Continue" button



(11) Click on "OK" on the window shown below



(12) Select required components and the destination folder. Follow the default setting and go to "Next"



(13) Start the installation process

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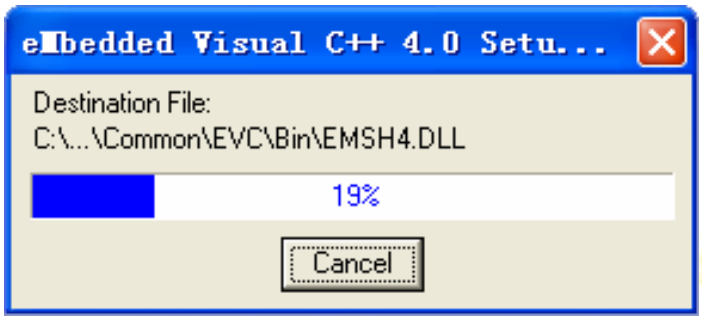
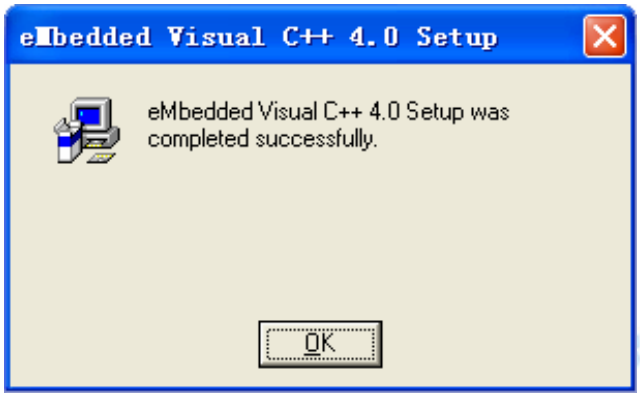


(14) After the installation is done, click on the "OK" button



Note: if the user now clicks on "Start" -> "Programs" -> "Microsoft eMbedded Visual C++ 4.0" -> "eMbedded Visual C++ 4.0", it may not start successfully. The following window might show up. The user needs install an SDK file to run it. The next section will introduce such an installation procedure.

6.1.6 Installing EVC Patches and Exported SDK

To run an exported SDK correctly, **the user should install EVC SP4 patch. It is located in the "\Embedded VisualC++\SP\evc4sp4\DISK1" directory.** This section details the steps to install the patch files and then an exported SDK file.

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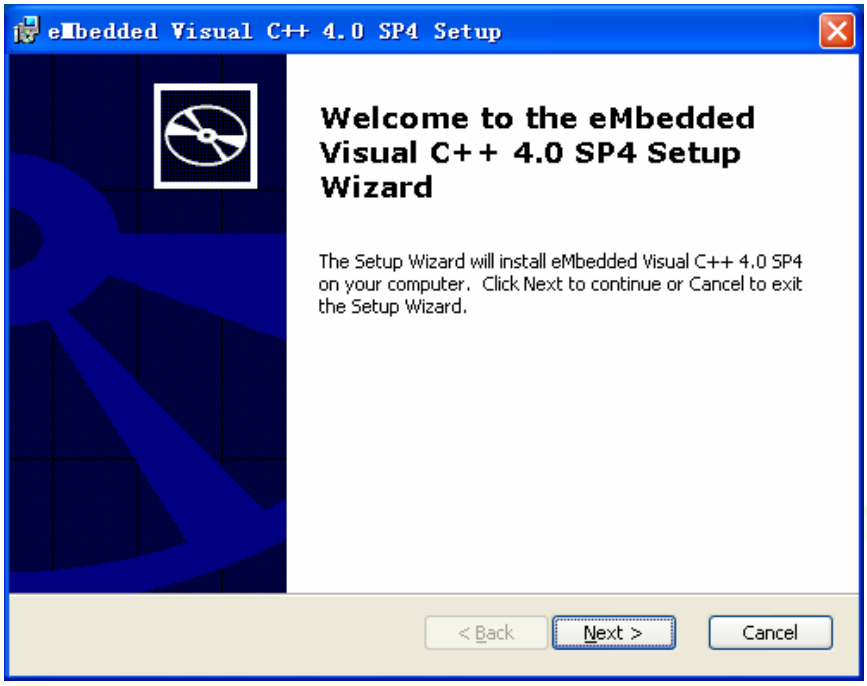
(1) Double click on the SP4's "setup" icon, on the wizard, click on "Next"



(2) On the license agreement window, choose "I accept" and go to "Next"

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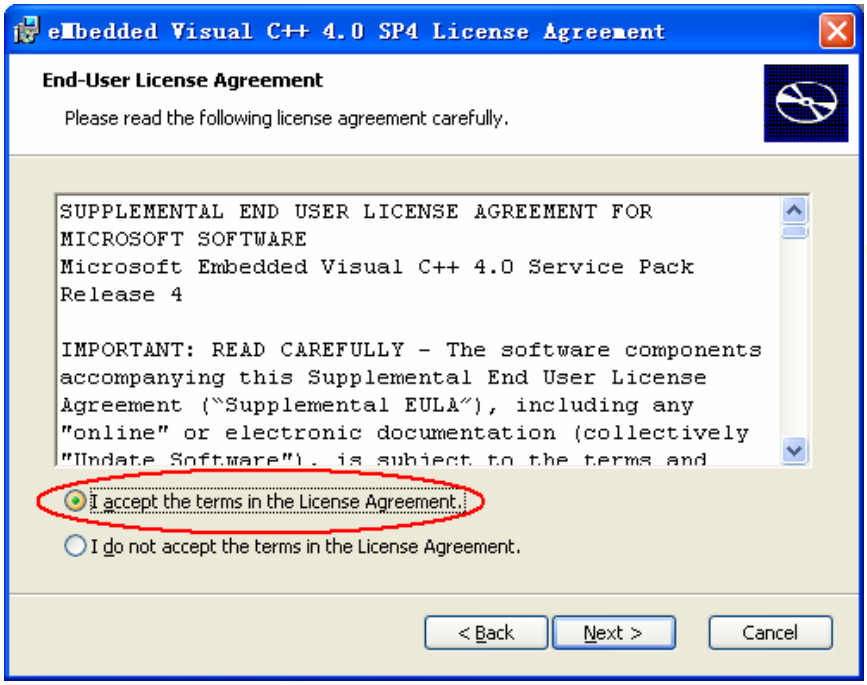
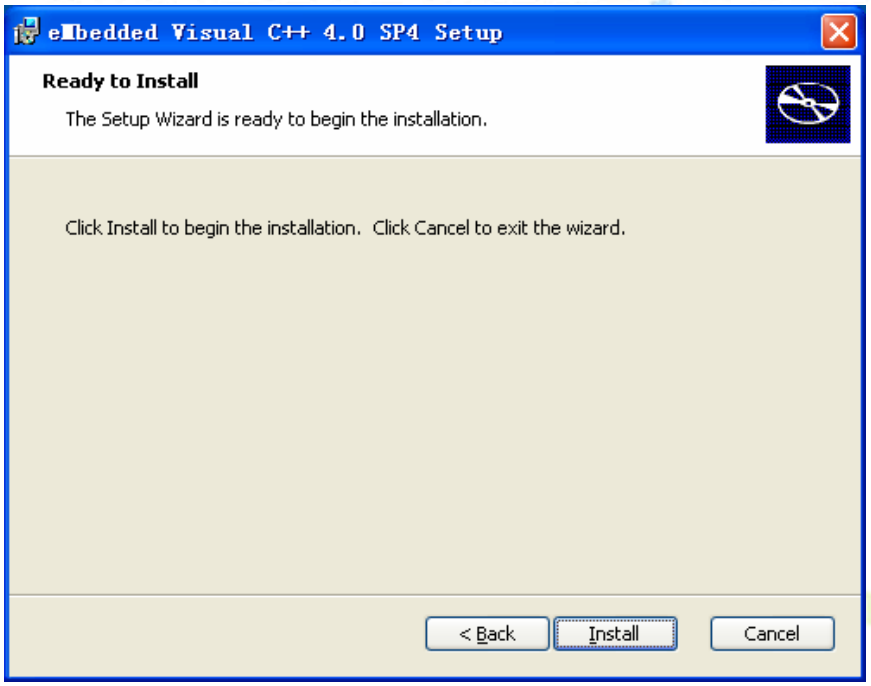


(3) Ready to install SP4, go to "Next"



(4) Start the installation process

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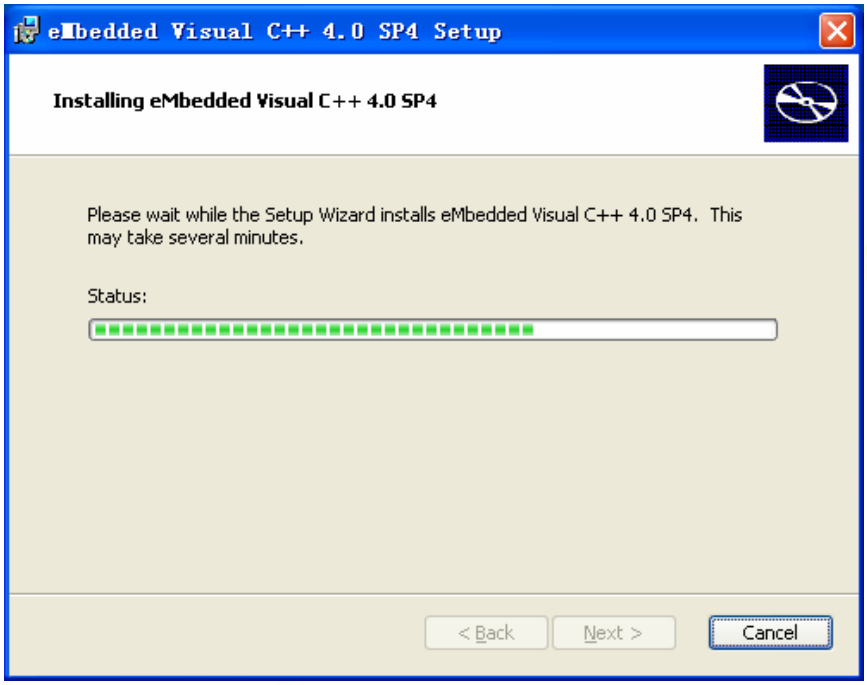
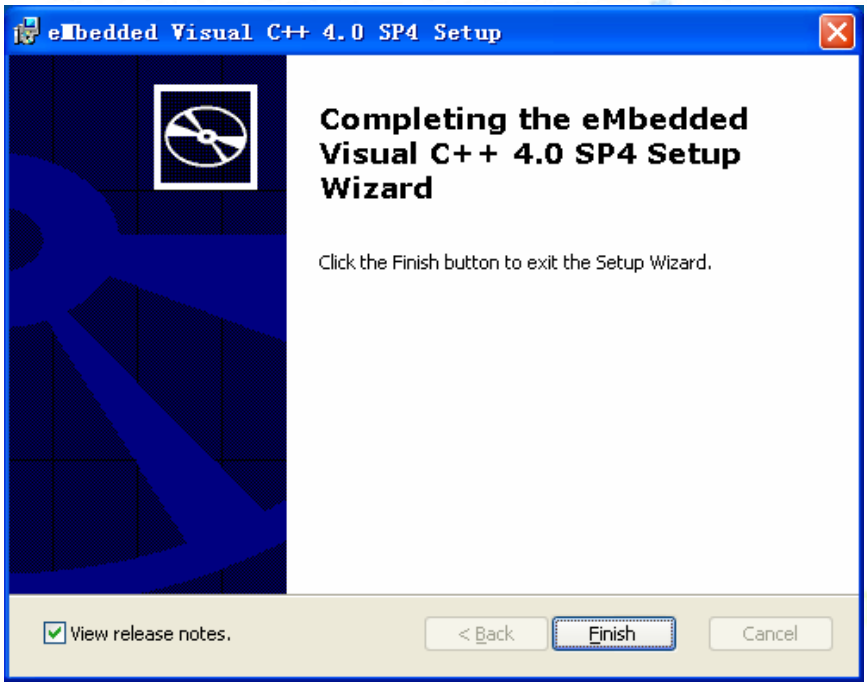


(5) Done with the installation



(6) It is time to install the SDK file that was exported in the last section. The user can export an SDK file by himself or use the one in the installation CD (located in the "WindowsCE5.0\SDK", named "QQ2440_SDK.msi.exe"). Double click on the exported file and a wizard window will come up. Click on the "Next" button.

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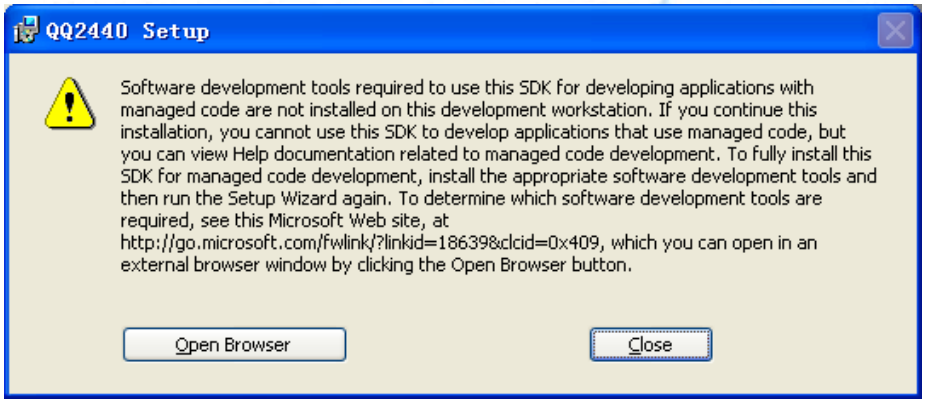
(7) On the window shown below, click on “Close”



(8) On the license agreement window, select “Accpet” and go to “Next”

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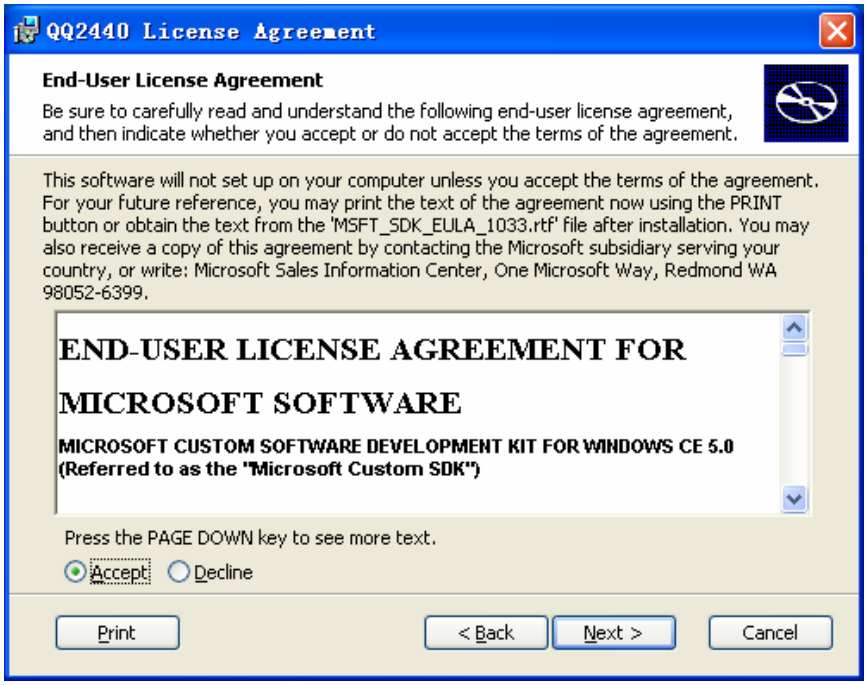
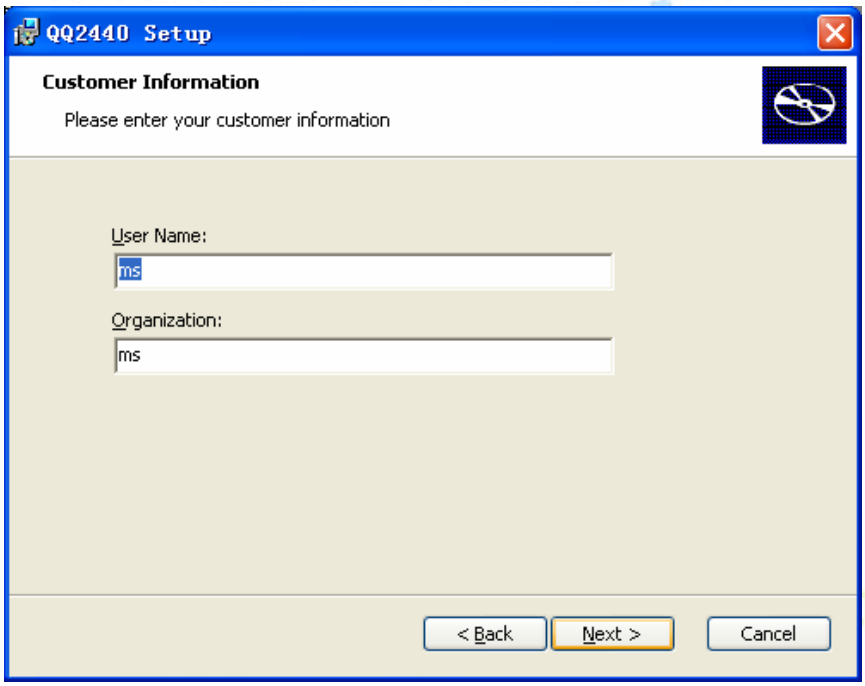


(9) On the "Customer Information" window, type corresponding information and go to "Next"



(10) On the setup window, type the user information and click on the "Complete" button

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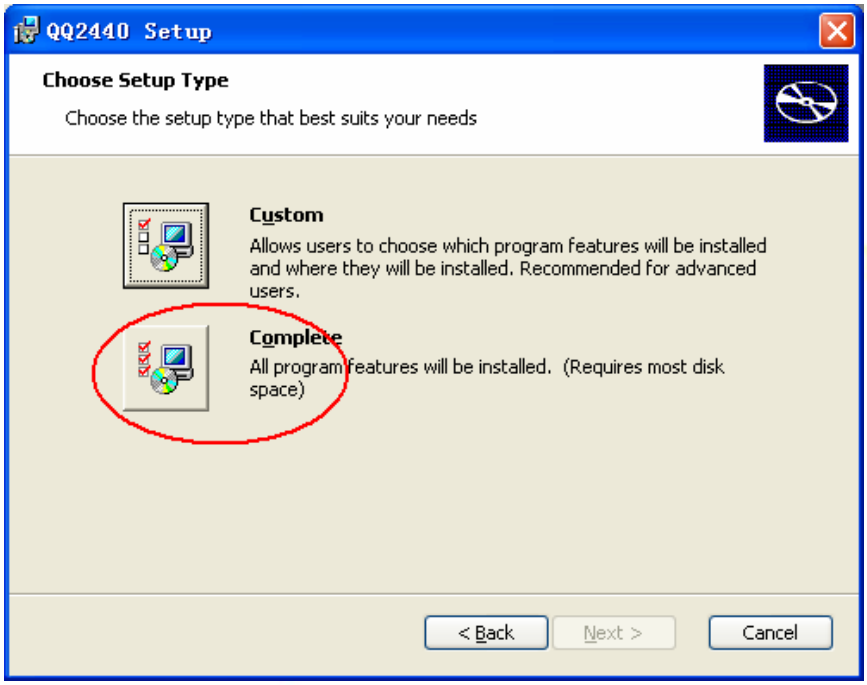
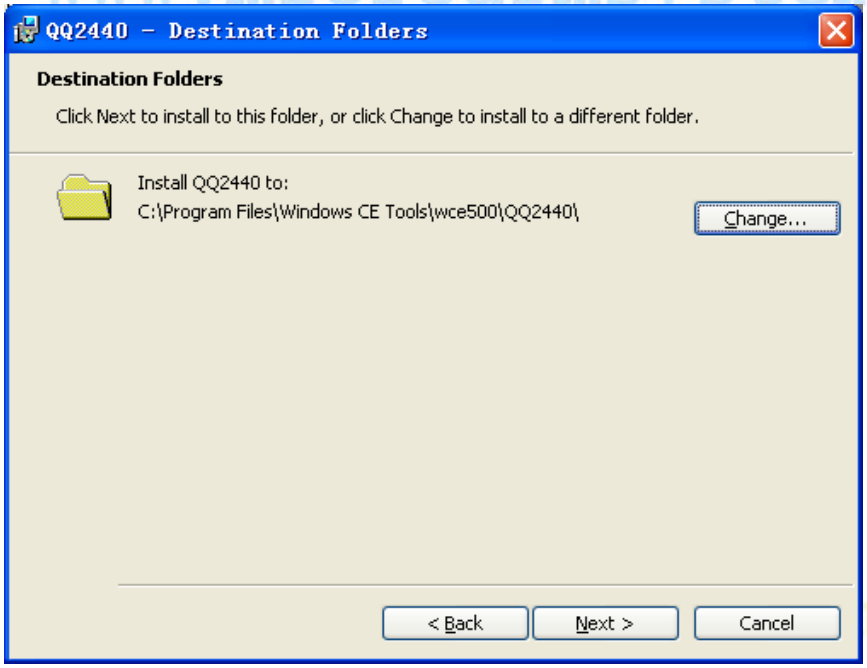


(11) On the destination folder window, follow the default setting, go to "Next"



(12) On the ready to install dialog, click on "Install"

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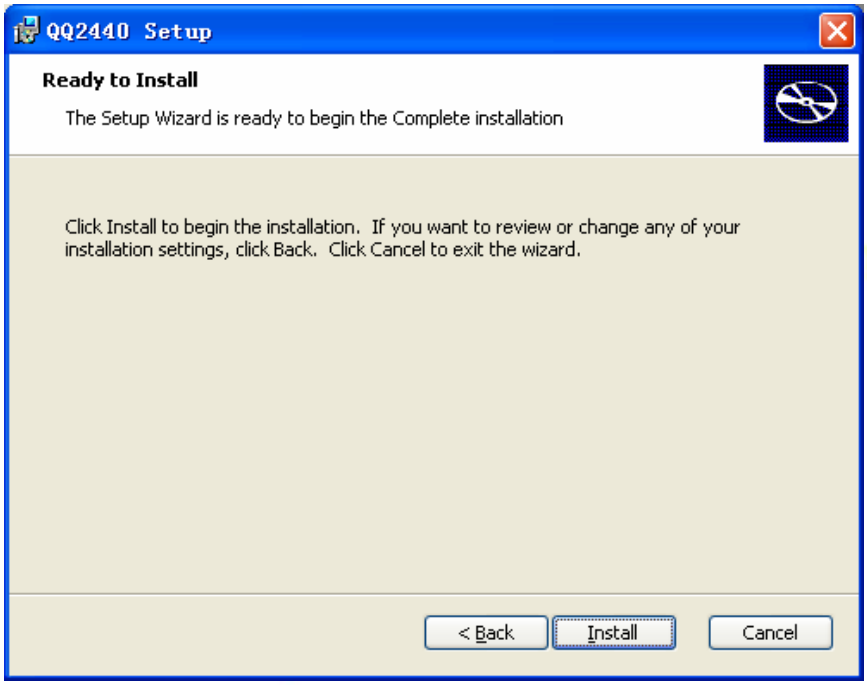
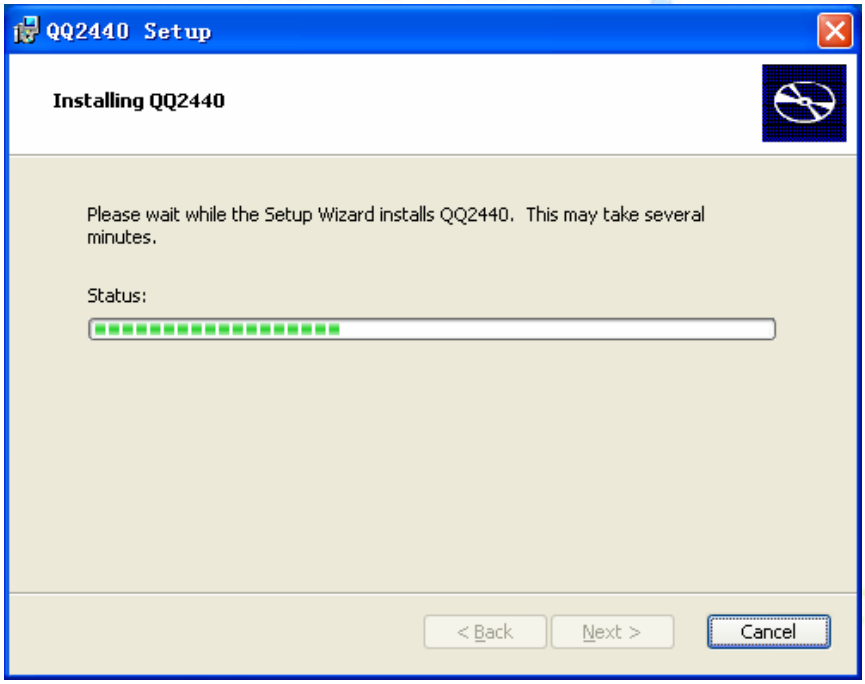


(13) Start the installation process



(14) After the installation is done, click on “Finish”

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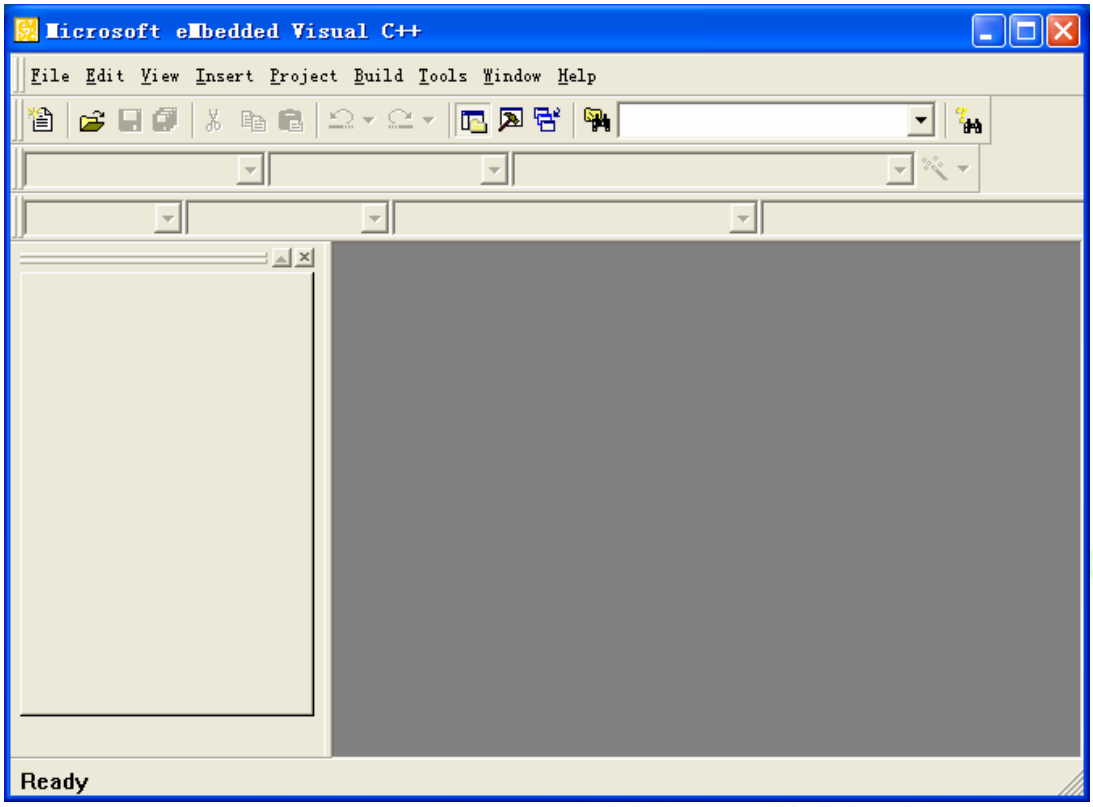
Now, the user can go to “Start” -> “Programs” -> “Microsoft eMbedded Visual C++ 4.0” -> “eMbedded Visual C++ 4.0”, and open the EVC main window



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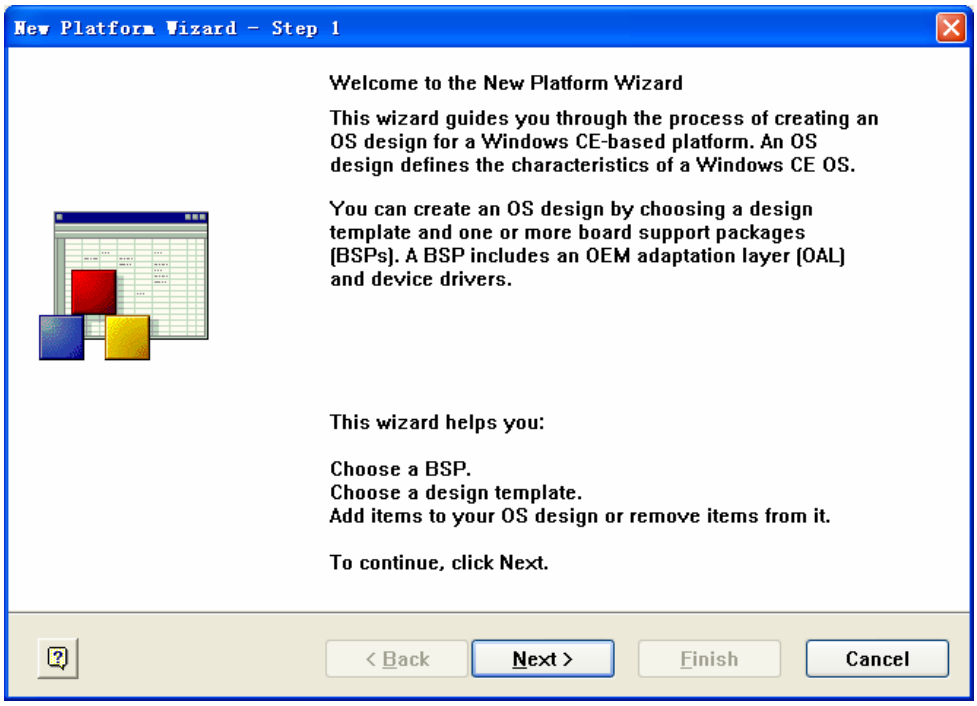
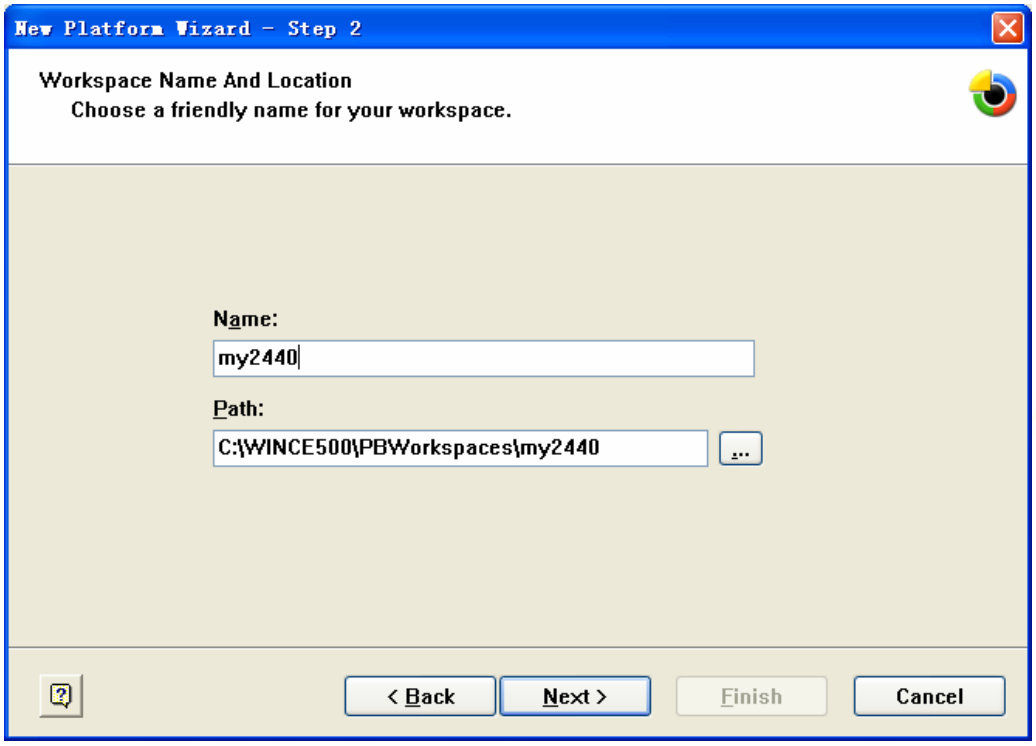
6.1.7 Configuring WinCE Kernel

This section will introduce a procedure to configure a WinCE kernel

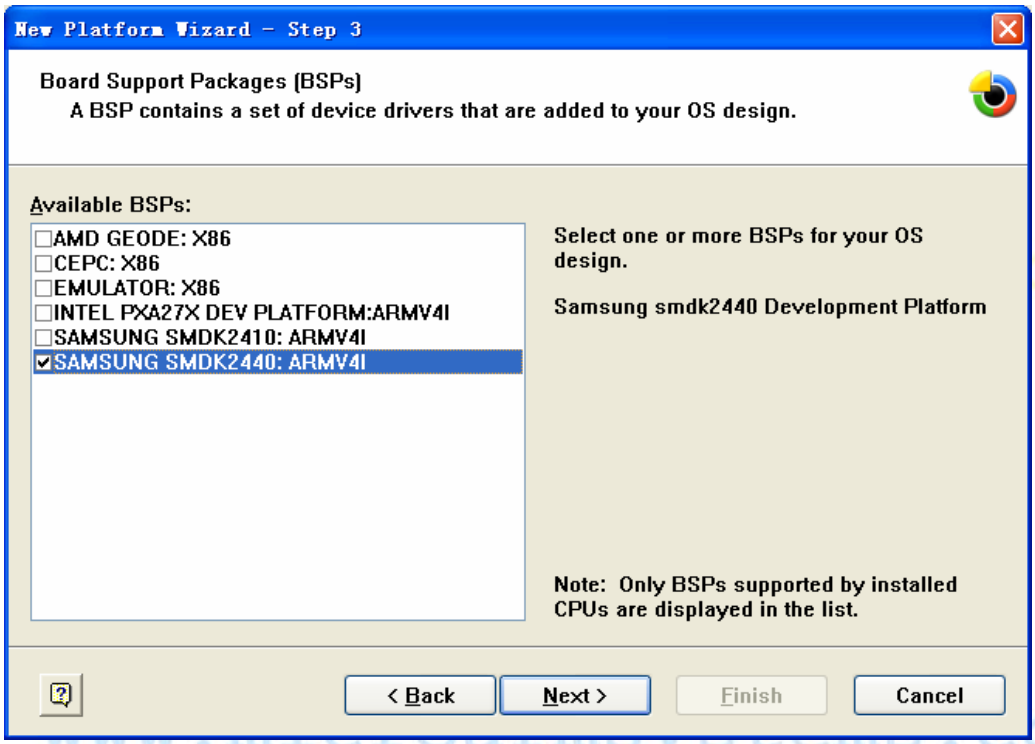
(1) Start PB5, go to “File” -> “New Platform…” and on the pop up window click on “Next”



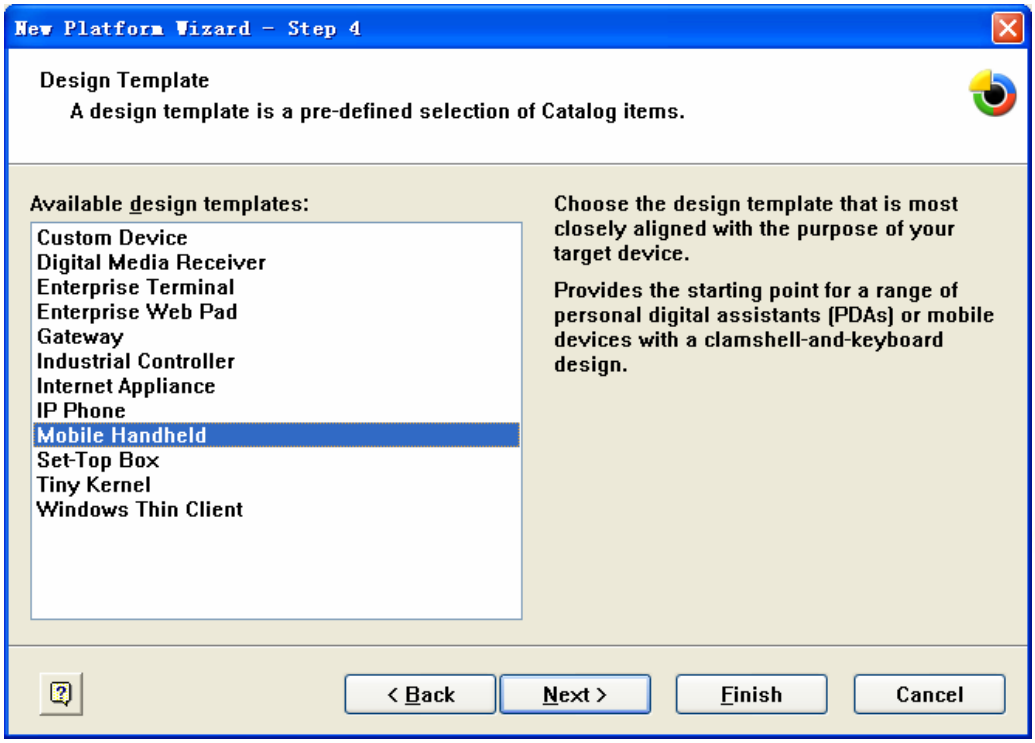
(2) On the project setup window, type “my2440”, go to “Next”



(3) check the preferred BDP, (here we chose “2440”) and go to “Next”

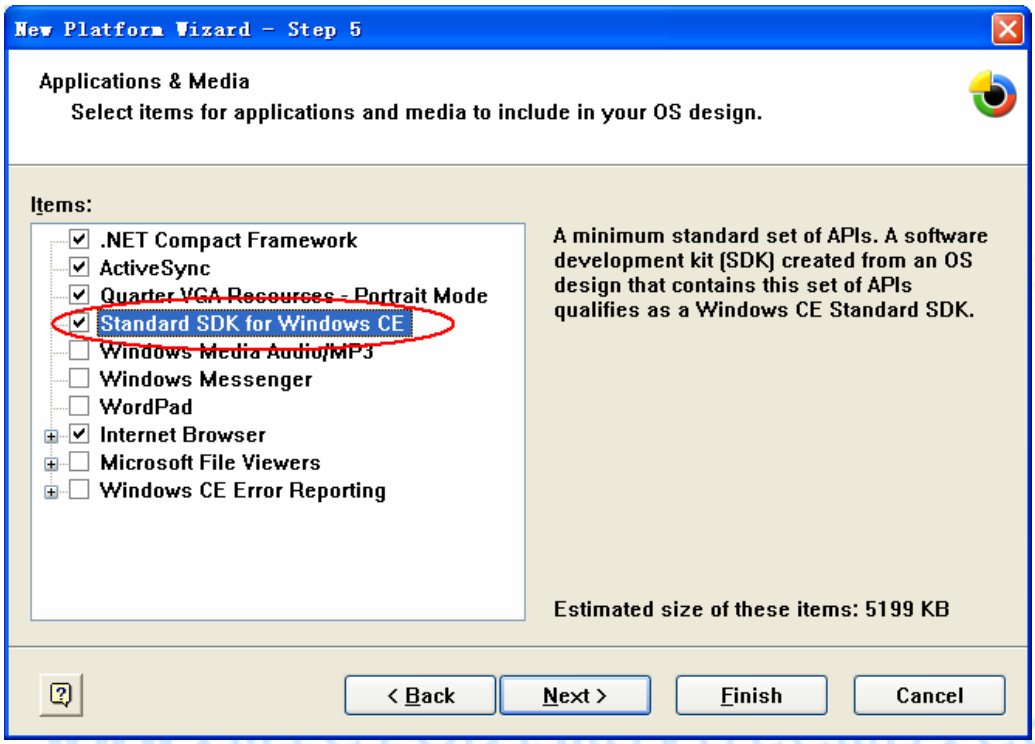


(4) On the design template window, choose a user preferred template (in this example, we chose "Mobile Handheld") and go to "Next"

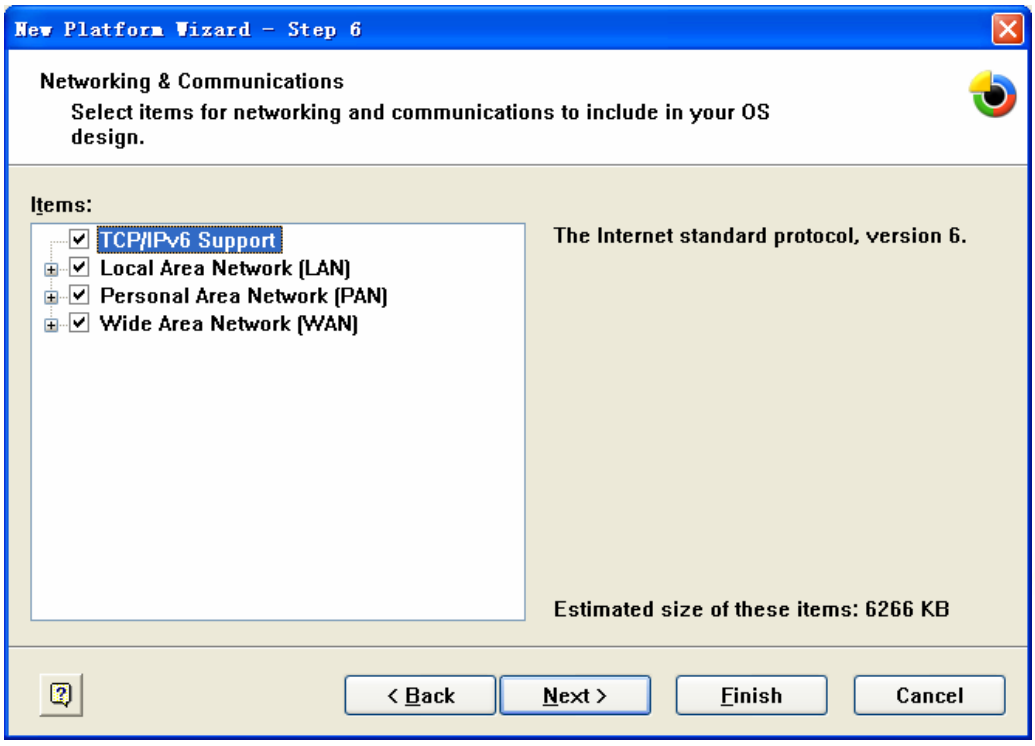


(5) On the application configuration window, the user should check the "**Standard SDK for Windows CE**" box and then go to "Next"

DO NOT COPY



(6) On the network configuration window, follow the default setting and go to "Next"



(7) On the window shown below, directly go to "Next"

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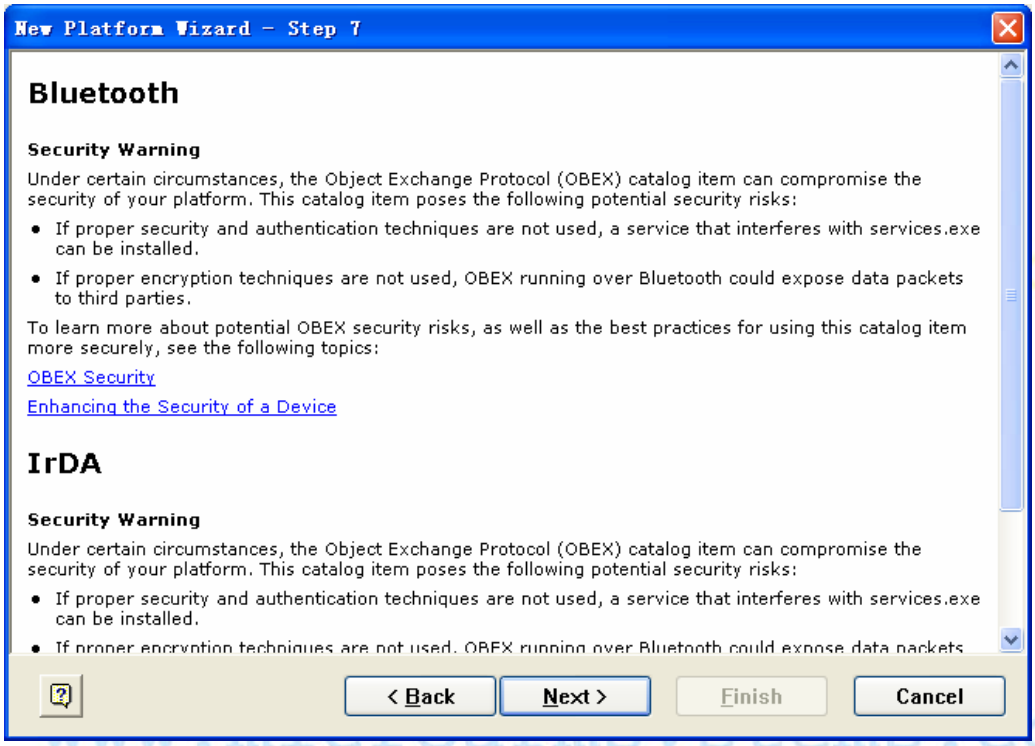
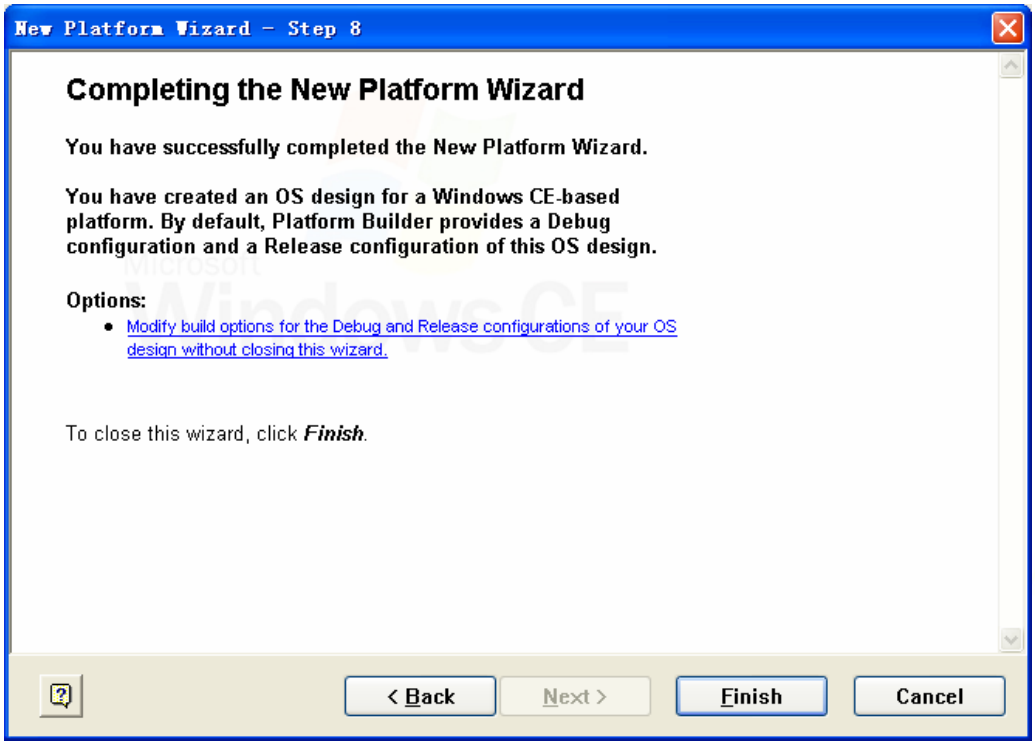


(8) On the window shown below, click on "Finish"



(9) Go back to the PB5 main window, a new project has been created, the following steps show how to configure the compilation options

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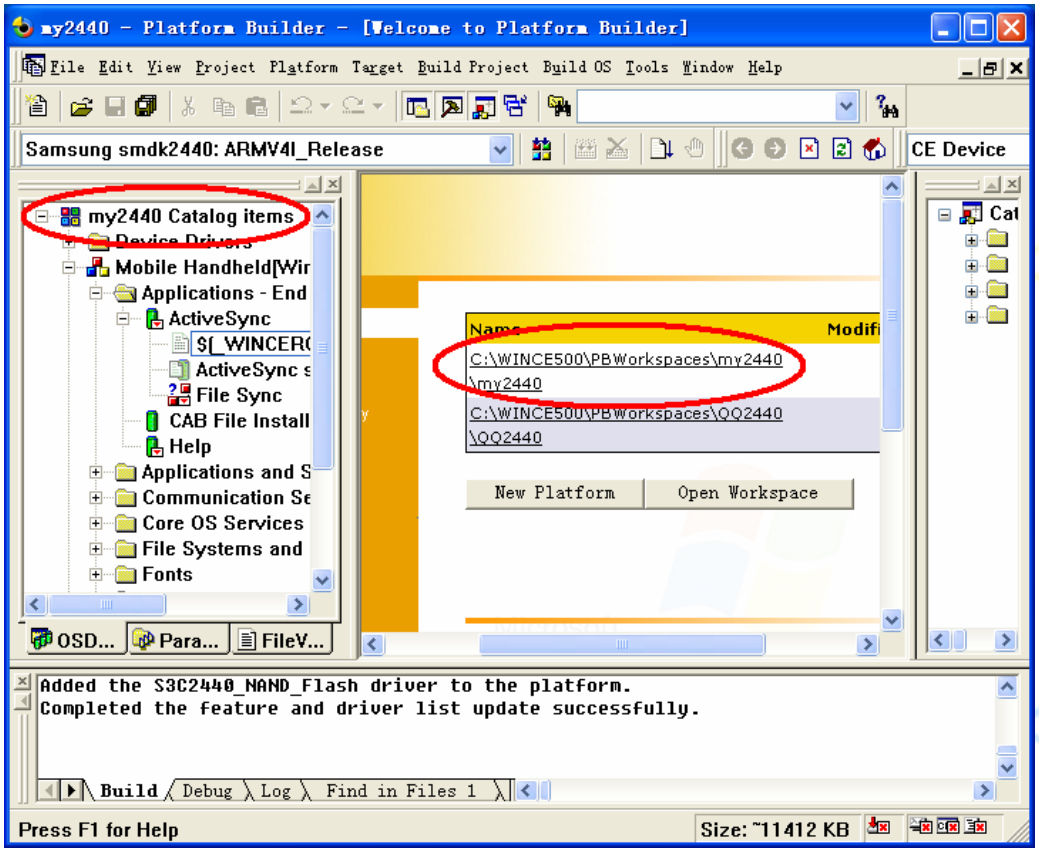
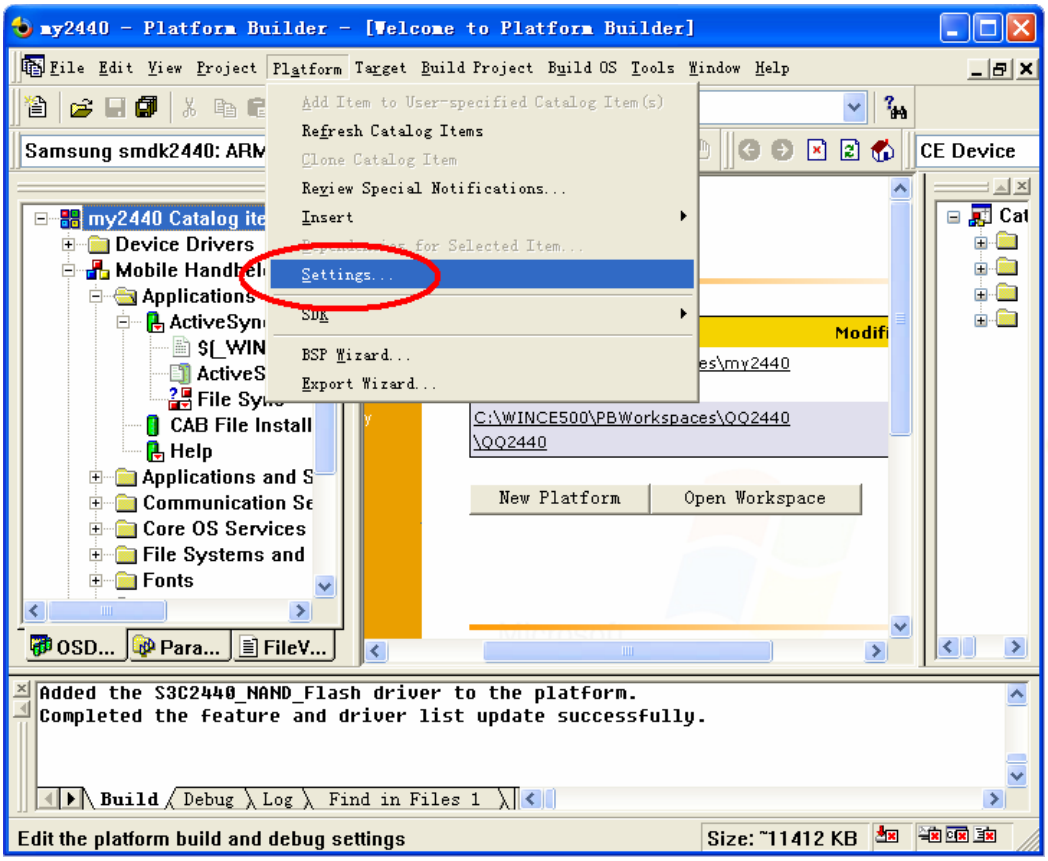
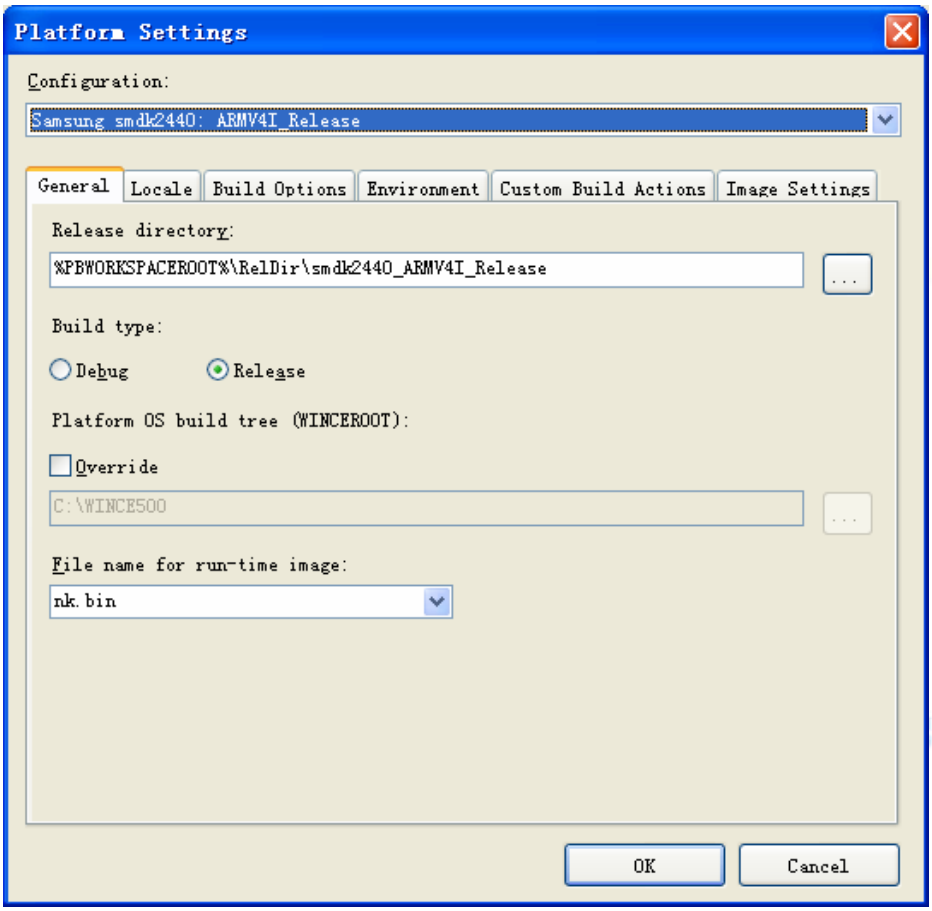


(10) Go to “Platform” -> “Setting…” to open a project configuration window





(11) On the setup window, click on the “Locale” tab to set up the kernel language, here we chose the simplified Chinese.

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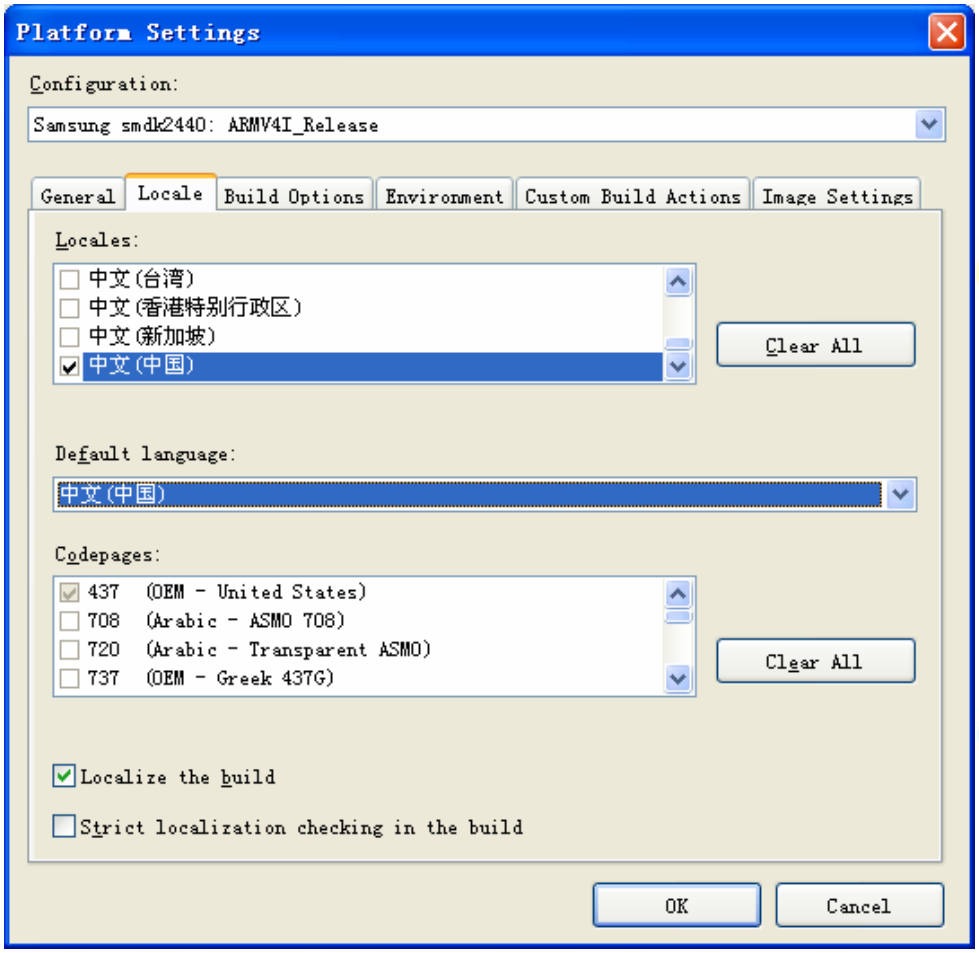

(12) Click on the “Build Options” tab, uncheck the “Enable CE Target Control Support” and the “Enable KITL”, keep the other options as what they are and click on “OK”

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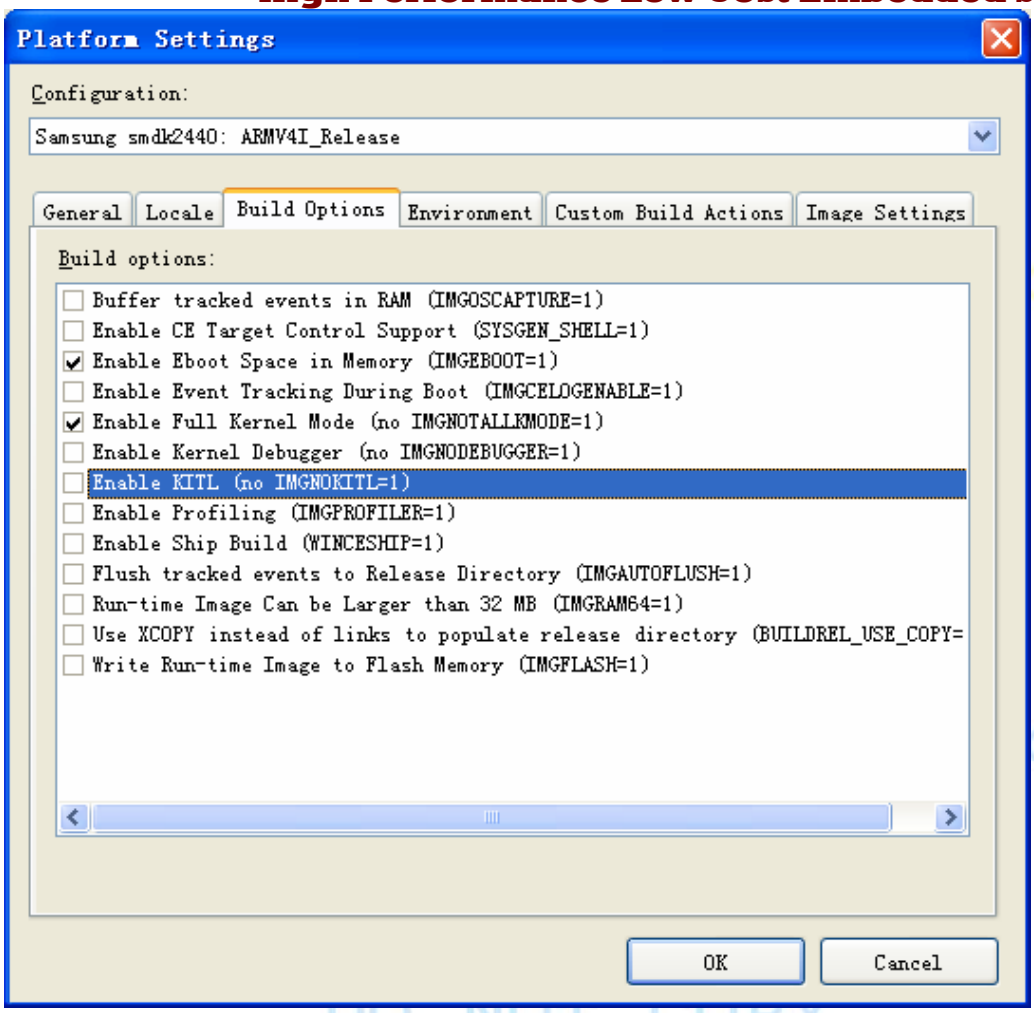

(13) Add support for a USB mouse and keyboard, expand the "Catalog" tree, the "Core OS" subtree -> "Windows CE device" -> "Core OS Services" -> "USB Host Support" -> "USB Human Input Device(HID) Class Driver", right click on "Add to OS Design" to check "USB HID Keyboard and Mouse" shown as below

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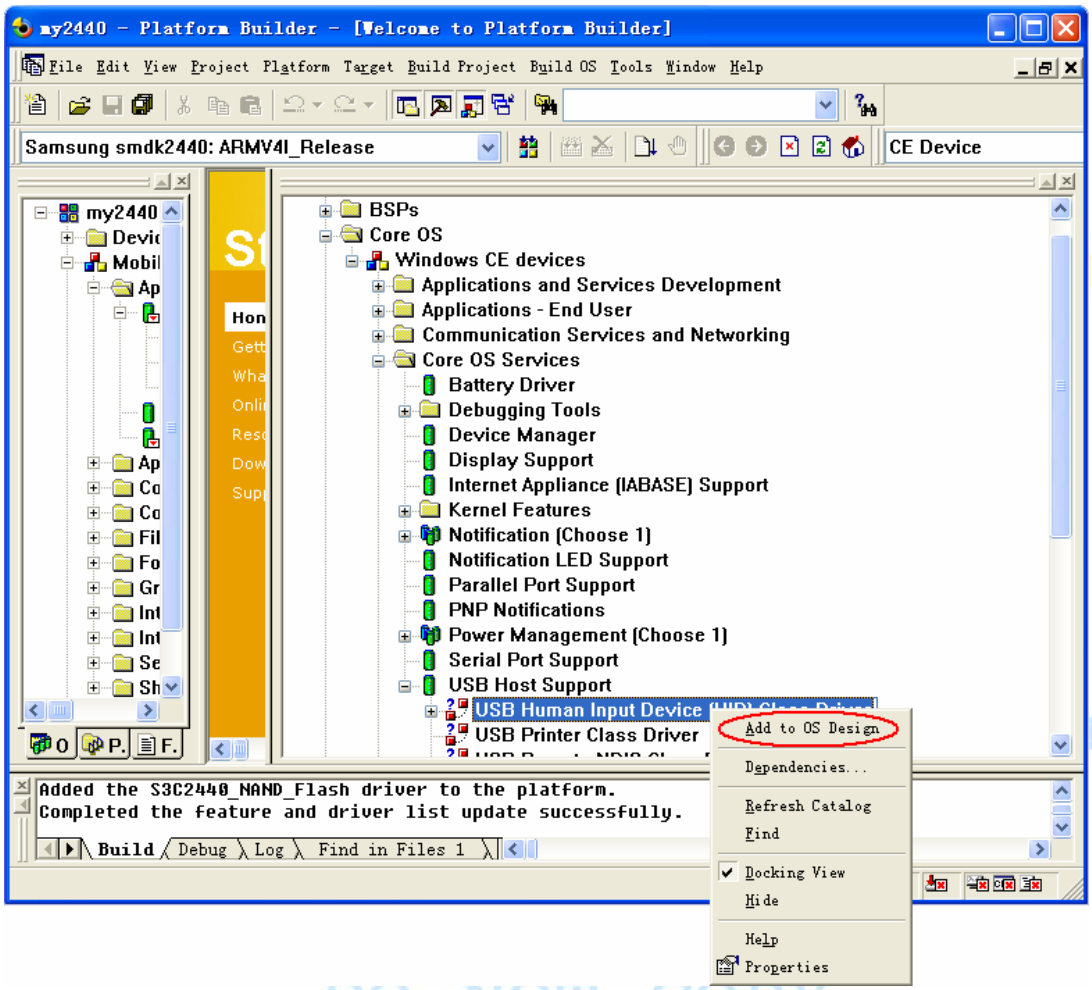

(14) Go through the same procedure to enable the support for USB storage devices

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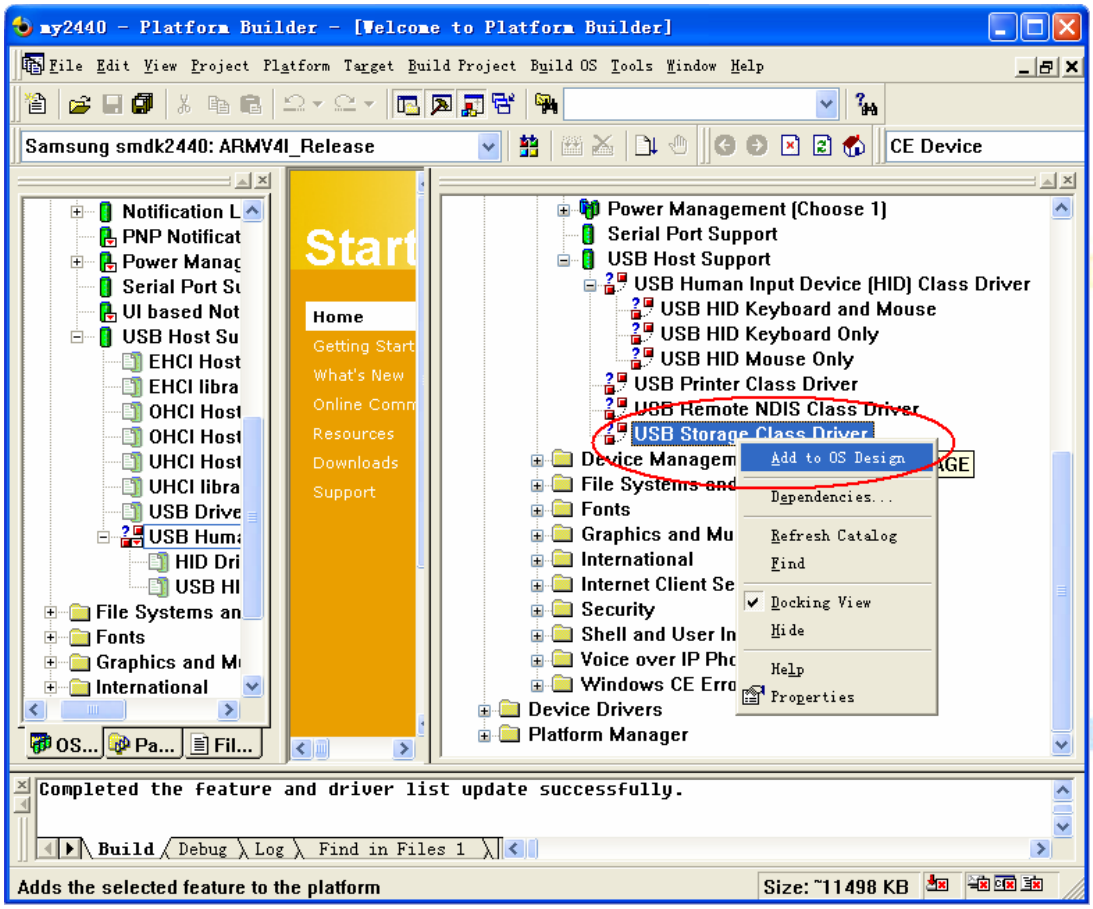
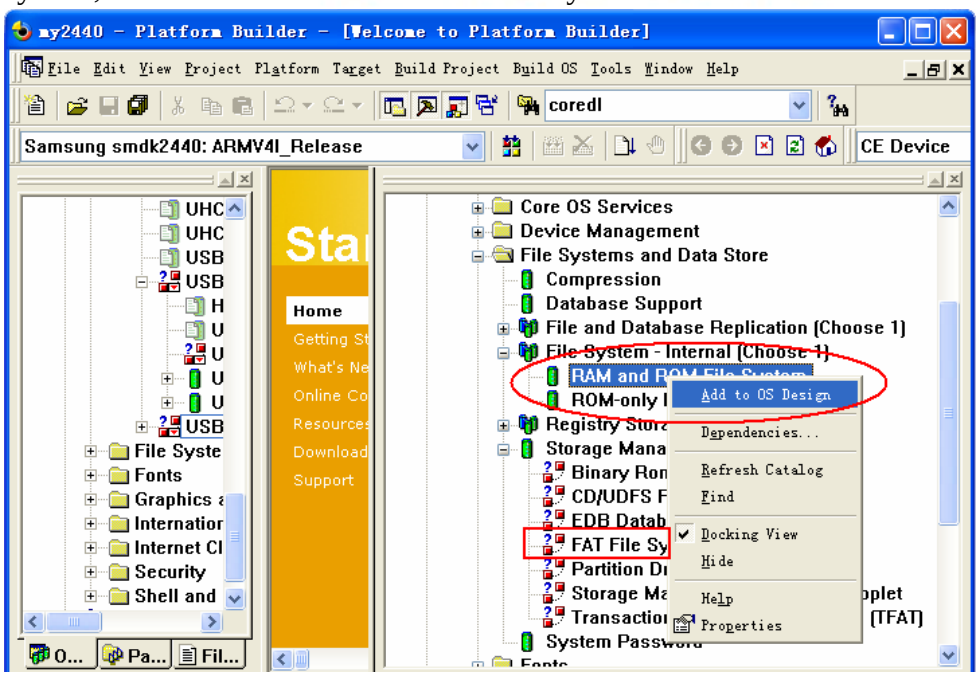
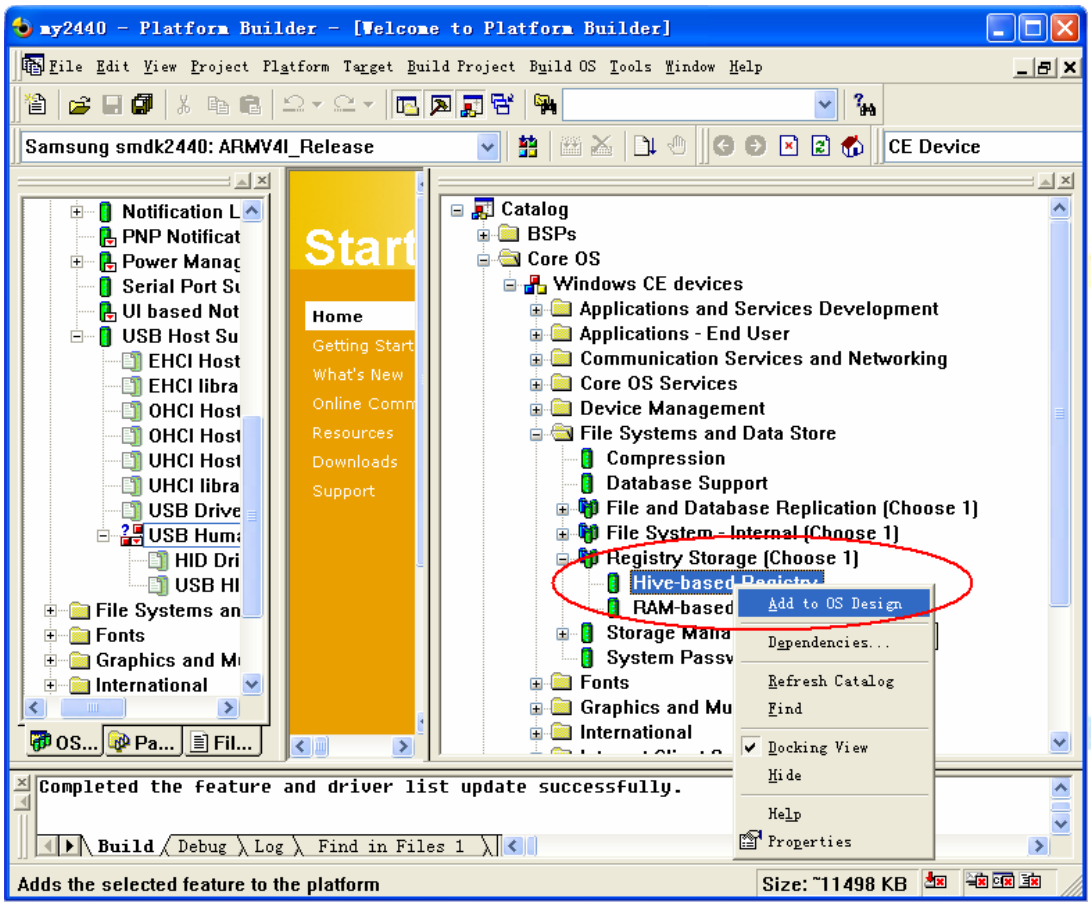


(15) Add support for file systems. Go to “Core OS” -> “File Systems and Data Store” -> “File System – Internal (Choose I)” -> “RAM and ROM File System”, to enable the support for the FAT32 system, the user needs to check “FAT File System” shown below



(16) Add support for registry storage, go to “Core OS” -> “File Systems and Data Store” -> “Registry Storage (Choose I)” -> “Hive-based Registry”



(17) Change the default IP. Open the "platform.reg" file and locate the items red depicted in the screen shot below. The user can change the default IP, gateway and DNS settings.

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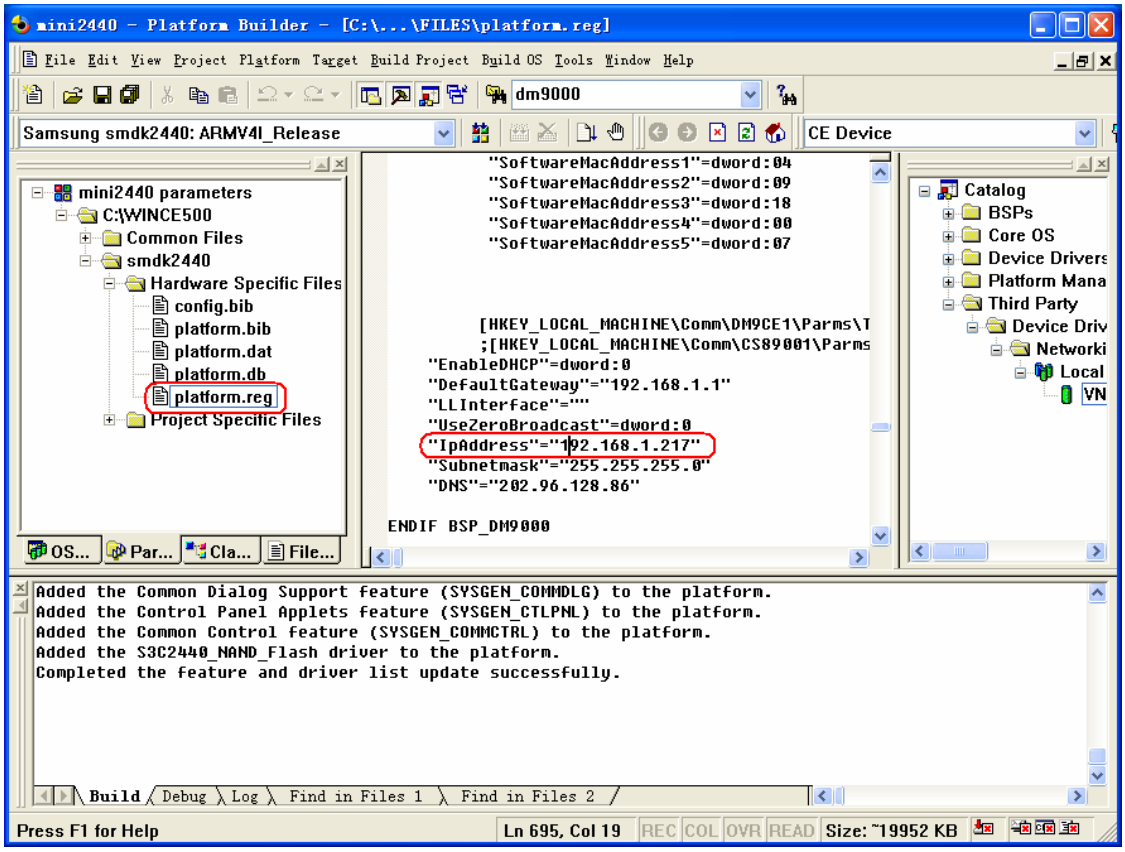
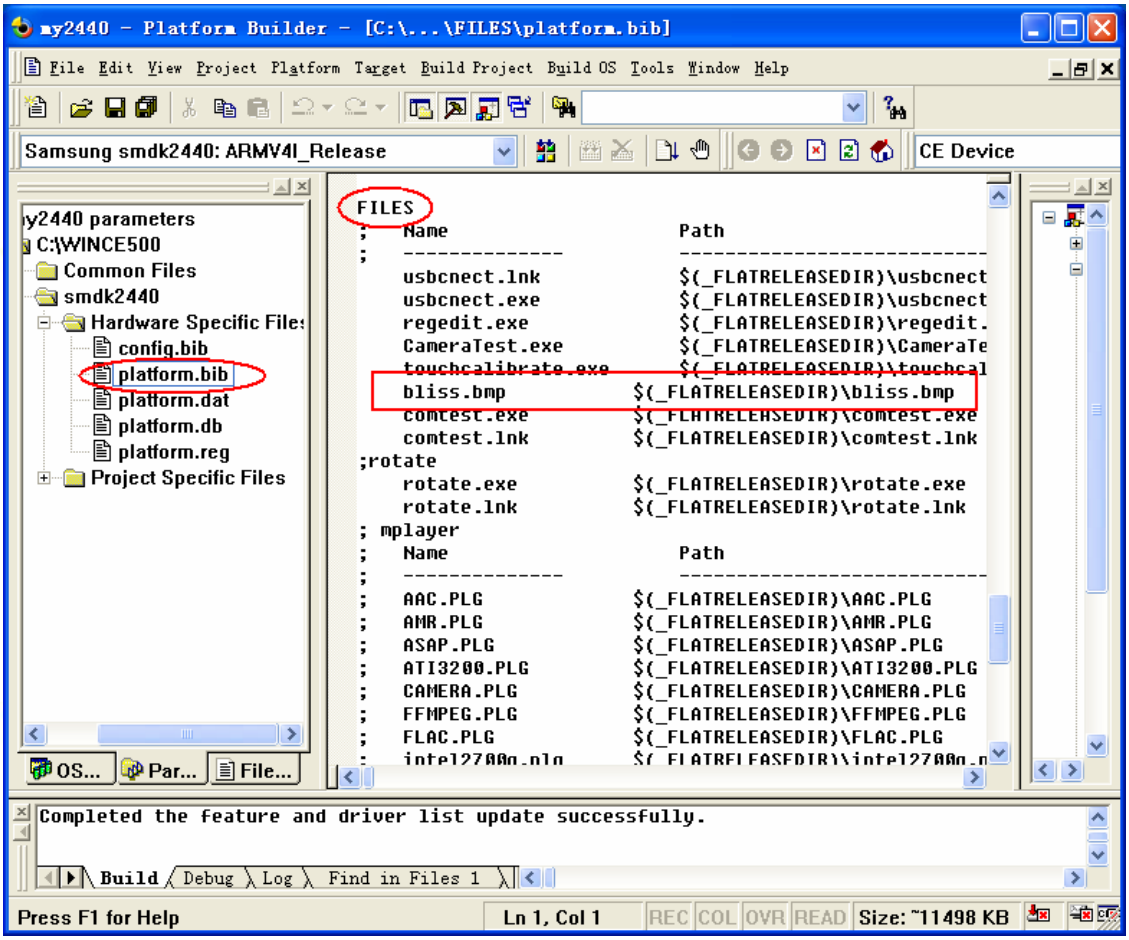


(18) Change the background. Copy a bmp file to the "C:\WINCE500\Platform\SMDK2440\Files" directory, and name it "bliss.bmp"

Open the "platform.bib" file, add "bliss.bmp" in the "FILES" section



(19) Save the changes. Go to “File” -> “Save” to save the changes. Go to “Build OS” -> “Sysgen” or click on the  icon to compile the kernel:

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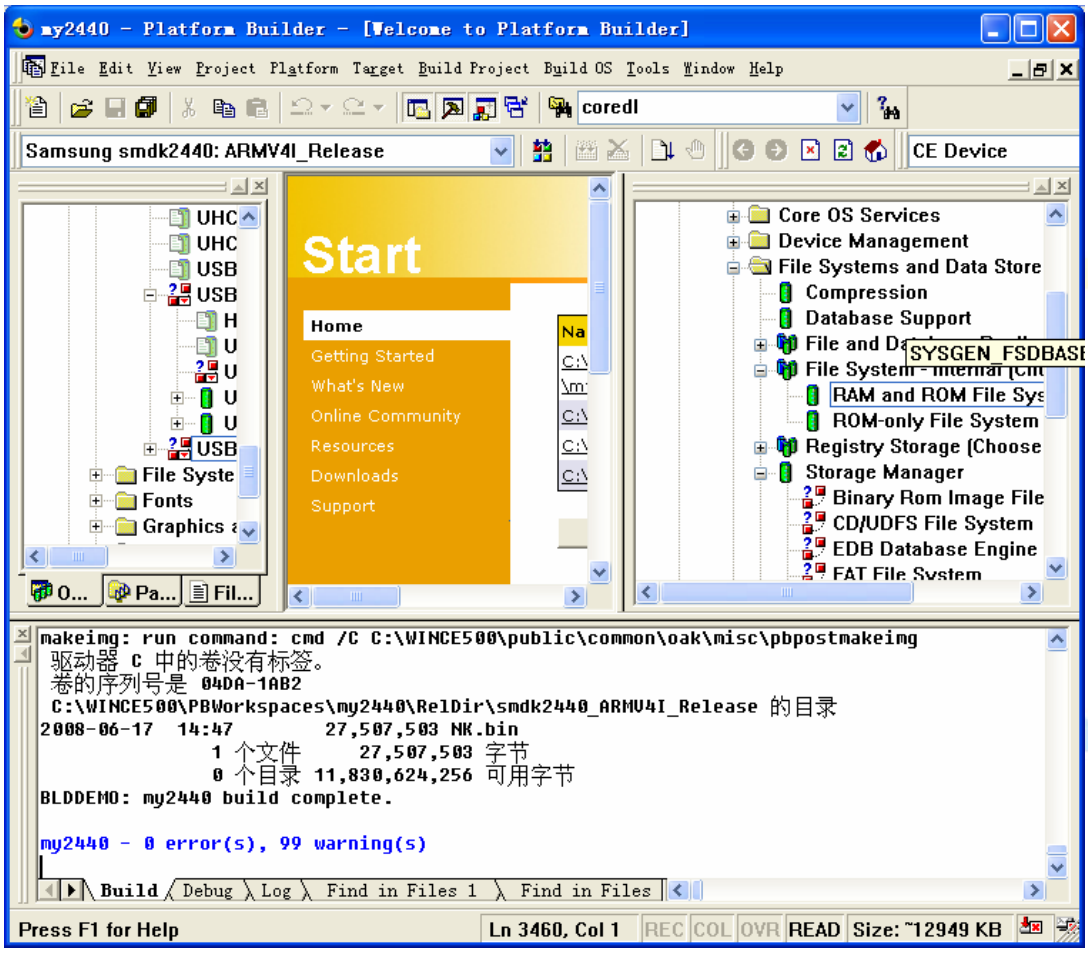

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For more details on how to configure a customized kernel, the user can search the internet for more information.

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Chapter 7 System Backup and Reinstallation

7.1 System Backup and Reinstall

7.1.1 System Backup

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Note: this section assumes the system has already been installed a USB driver and boots from Nor Flash.

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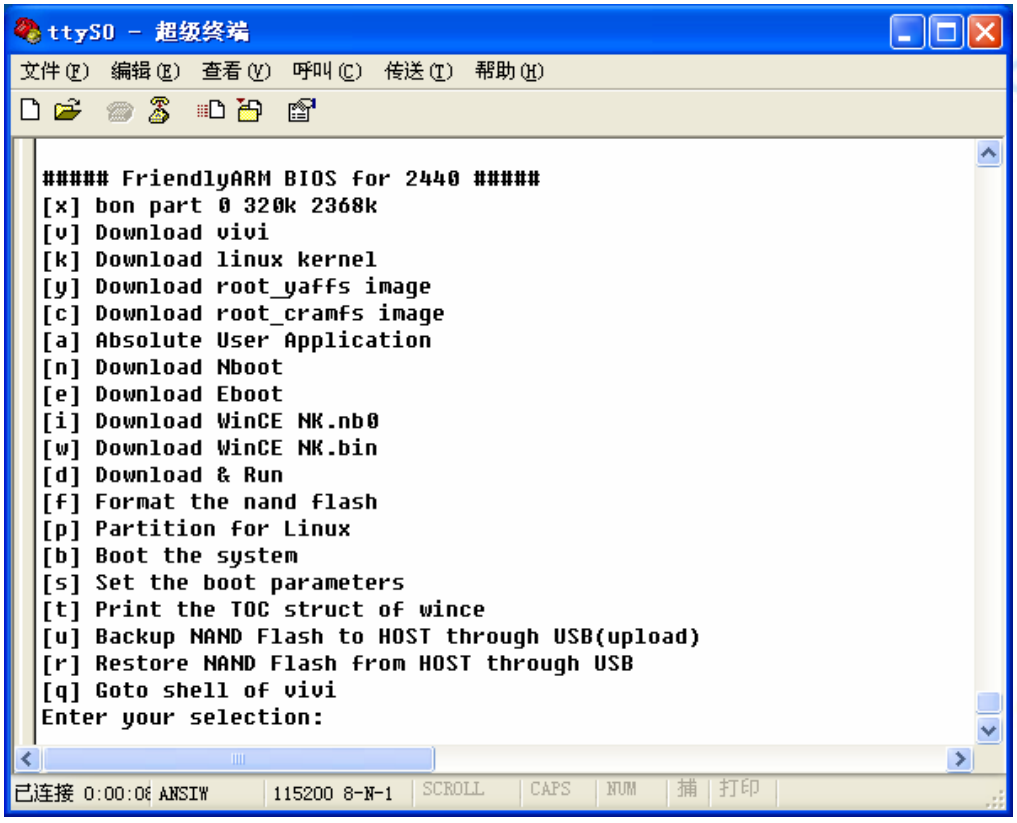
The backup procedure will not hurt any flash data. Before backup, please check whether the system can run normally.

(1) Connect the MINI2440 board to a host PC via a serial cable. Open a super terminal, power up the board and enter the BIOS main menu



(2) Select item [u] to start system backup. This process will backup a complete copy of Nand Flash data to a file

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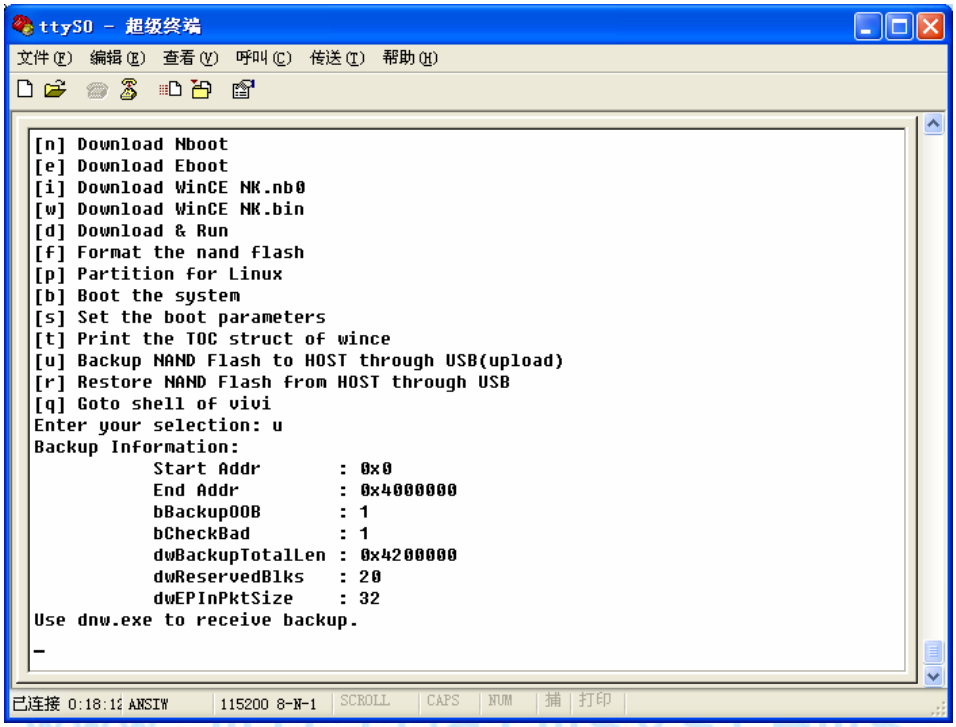
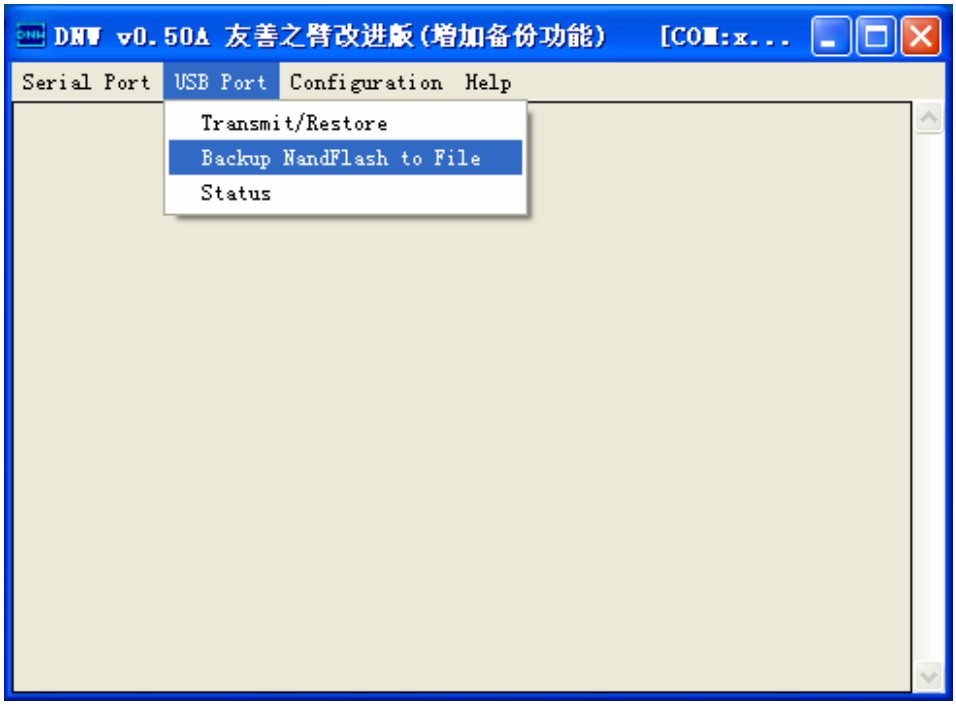


(3) Start the DNW application. Connect the board to the PC via a USB cable. If the DNW's title bar shows "USB:OK", it indicates the USB connection is a success. Go to "USB Port" -> "Backup NandFlash to File"



On the pop up window shown below, pick up a destination folder and name a file that will store the data. In this example, we saved the data in a "backup.bin" file

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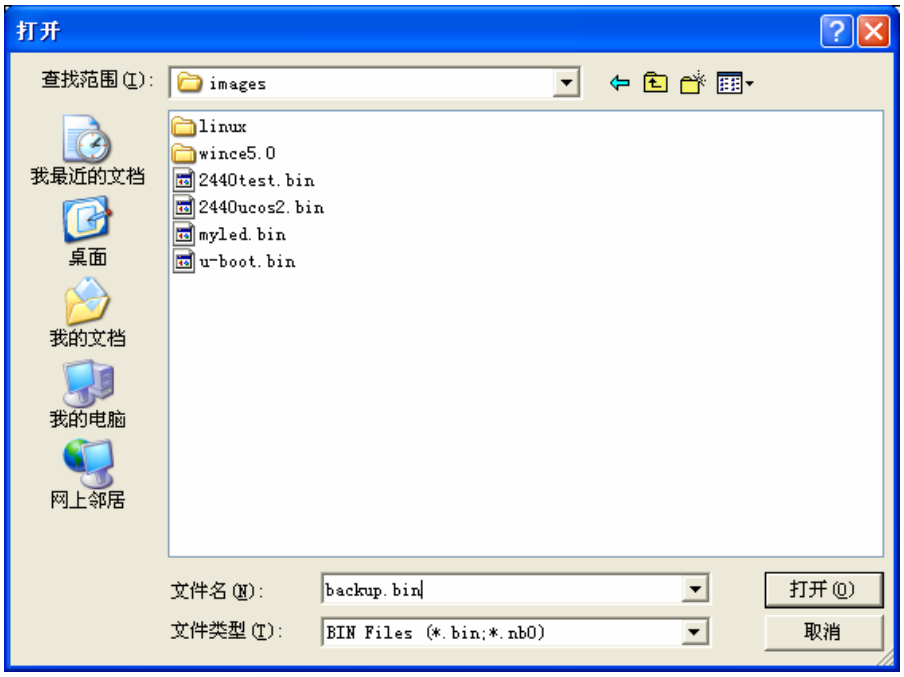
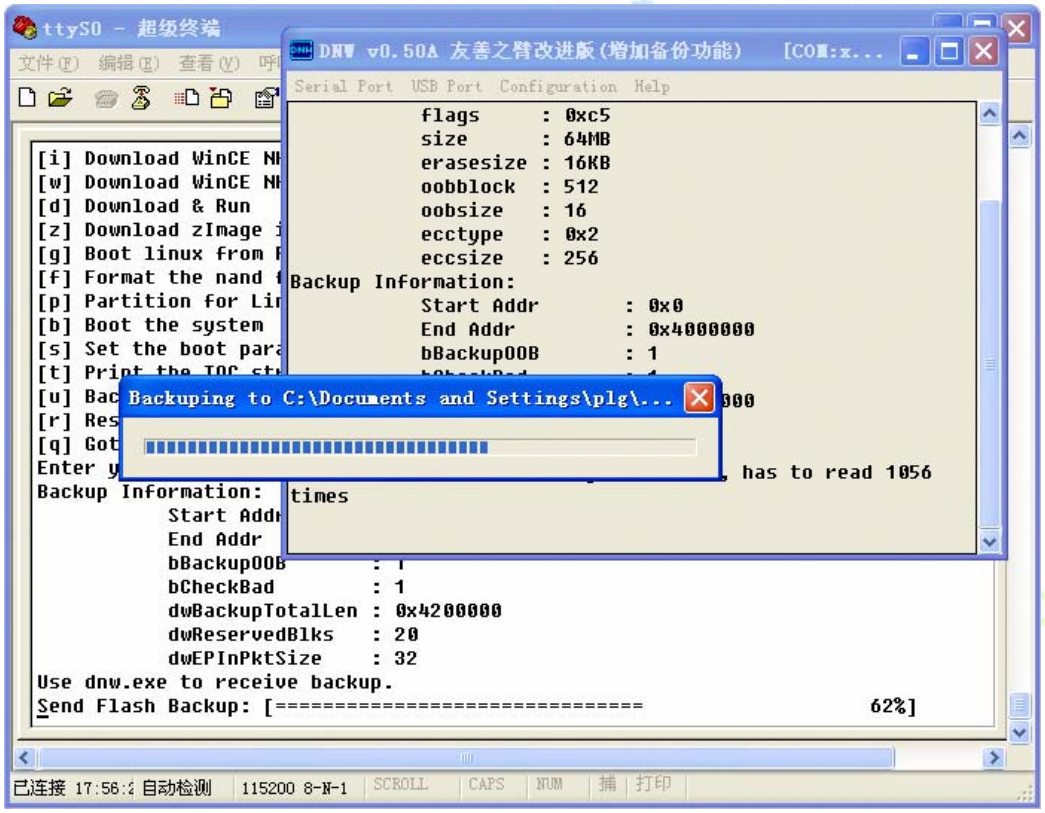


The backup process begins:



After it is done, the DNW window will show the information below

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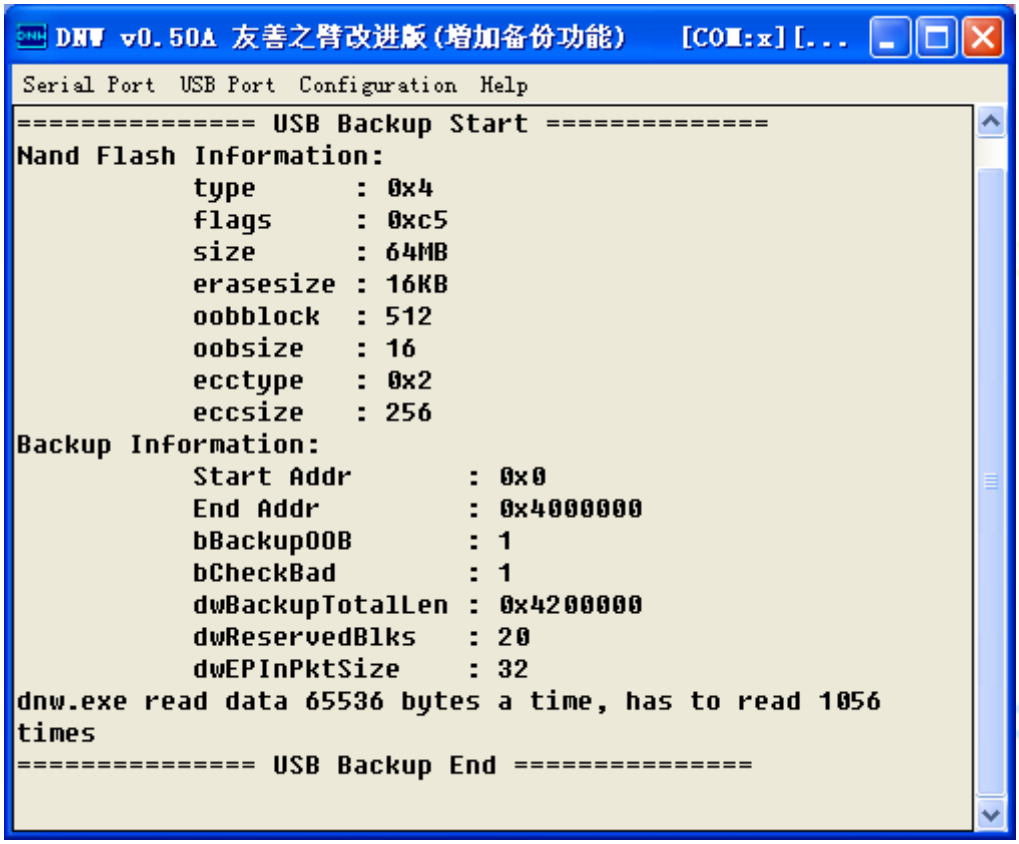
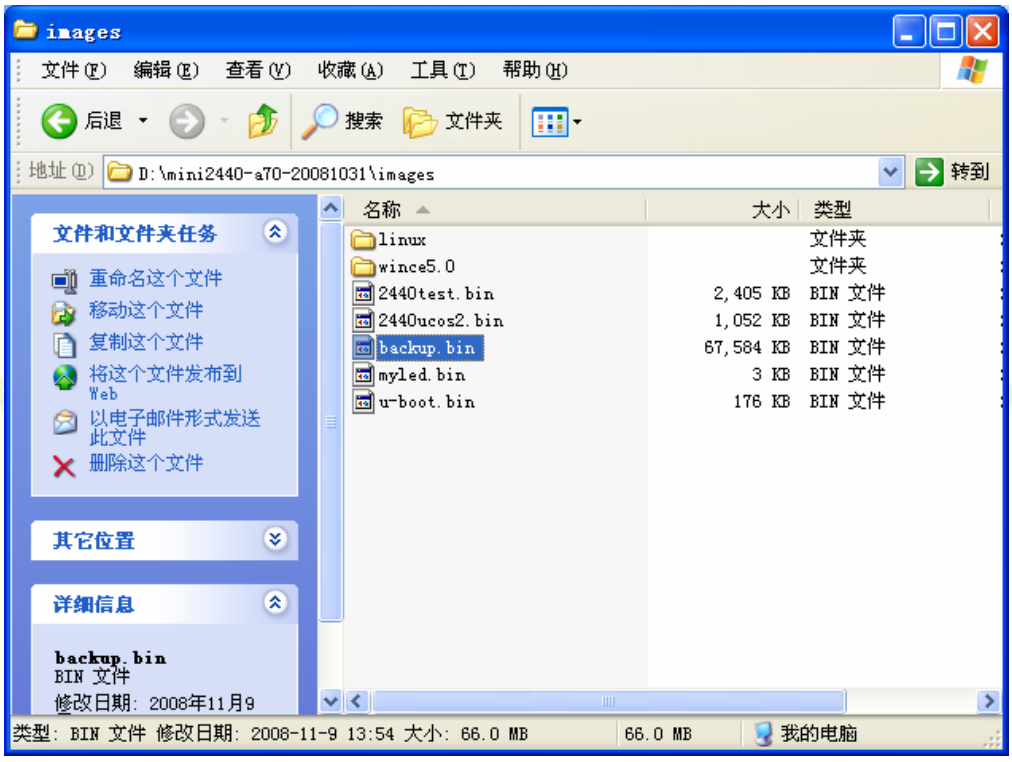


In this example, the generated file was 66M bytes. It contained all the information of Nand Flash, for more details about Nand Flash, please refer to its data file.



7.1.2 System Restore

Note: this section assumes the system has already been installed a USB driver and boots from Nor Flash.

Make sure you have a backup file ready. This restore procedure will overwrite all the data in Nand Flash!

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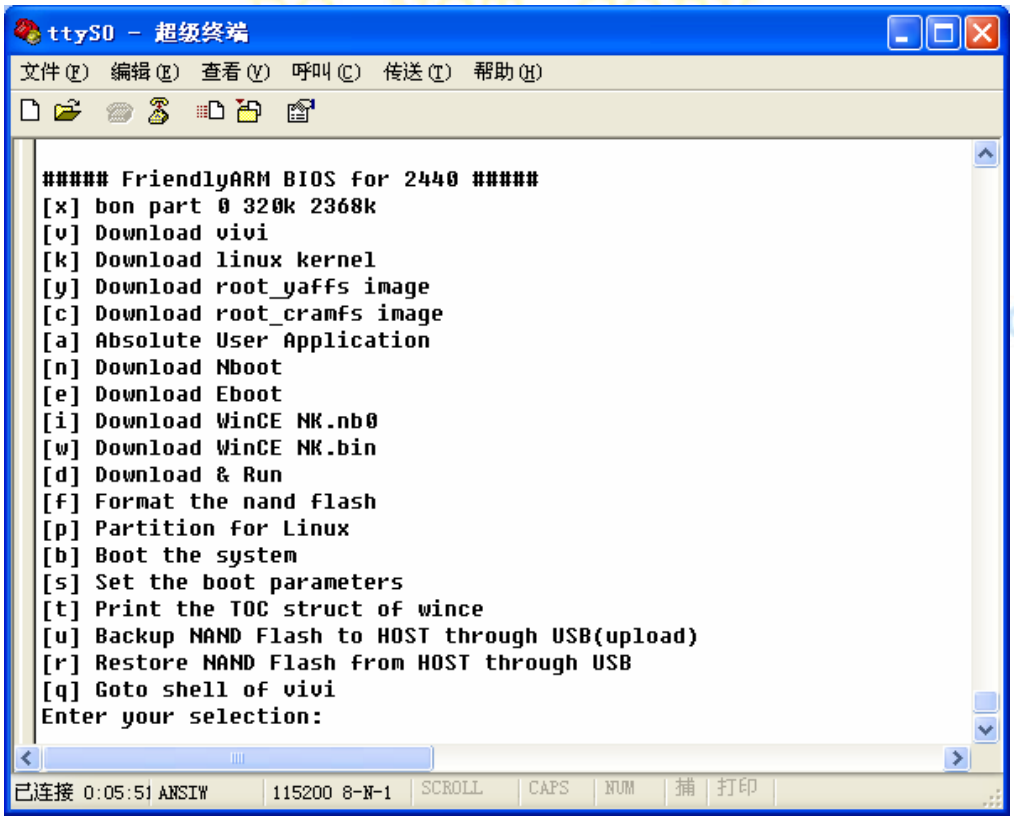
The following steps show how to restore a system with a backup file

(1) Connect the MINI2440 board to a host PC via a serial cable, power up the board and enter the BIOS main menu:



(2) Select item [r] to start the procedure

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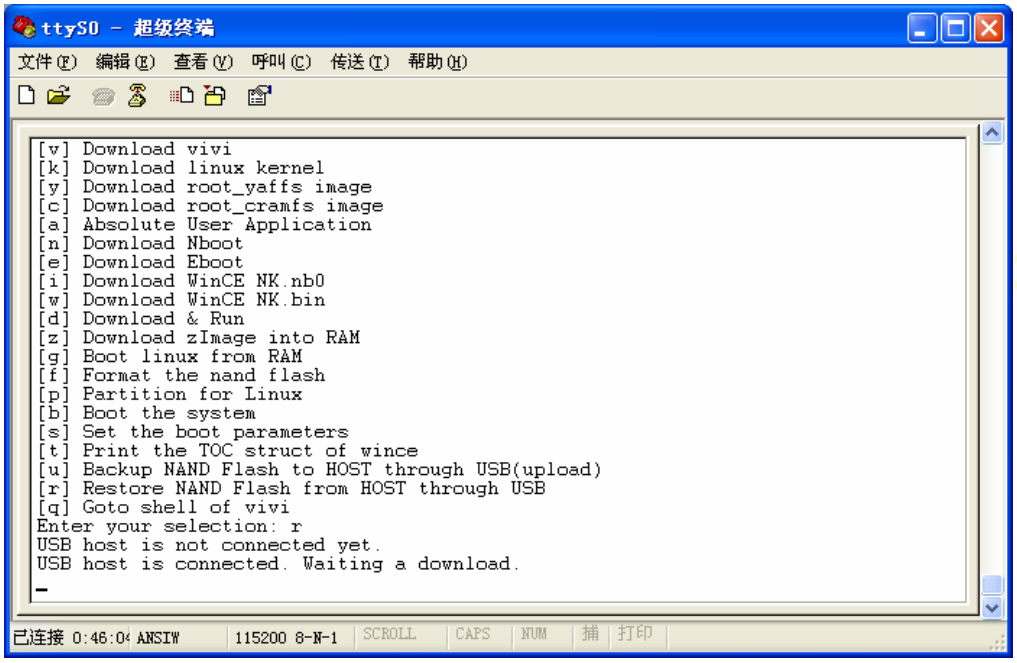
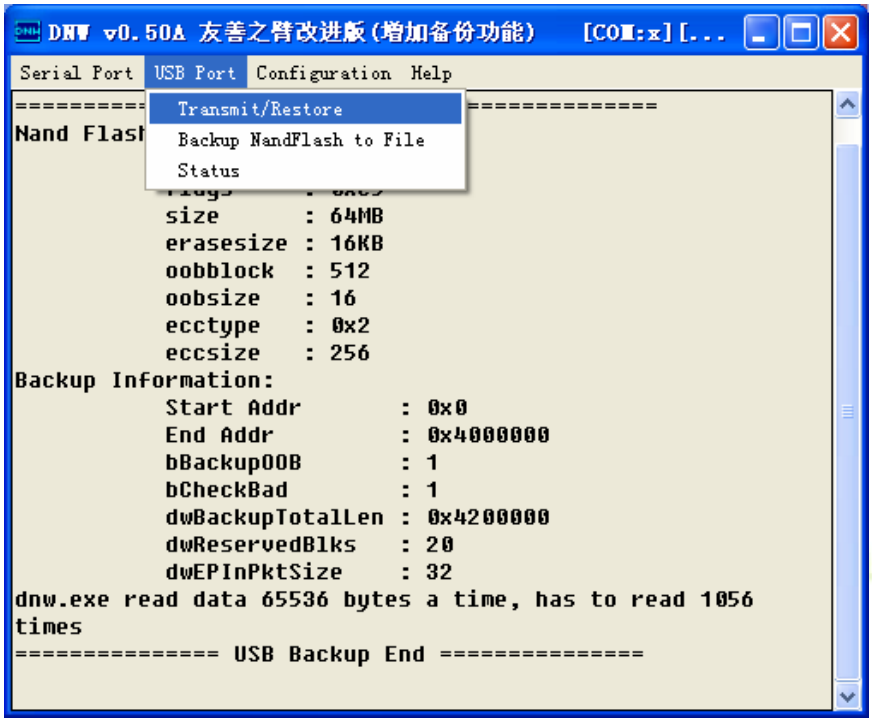


(3) Start the DNW application, connect the board to the host PC via a USB cable. If the DNW's title bar shows "USB:OK", it indicates the USB connection is a success. Go to "USB Port" -> "Transmit/Restore"



Select a backup file and click on "Open"

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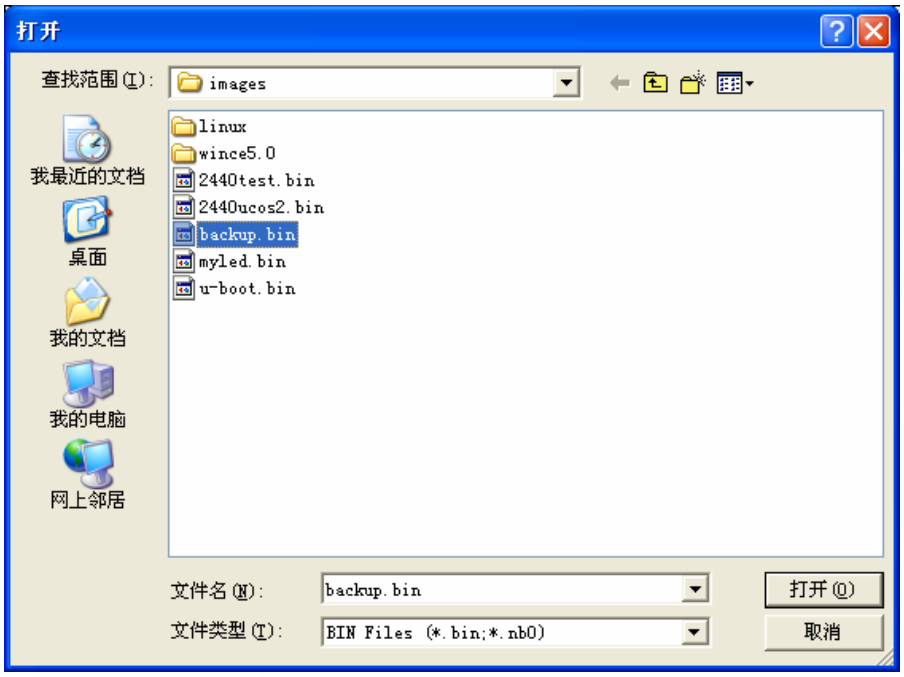

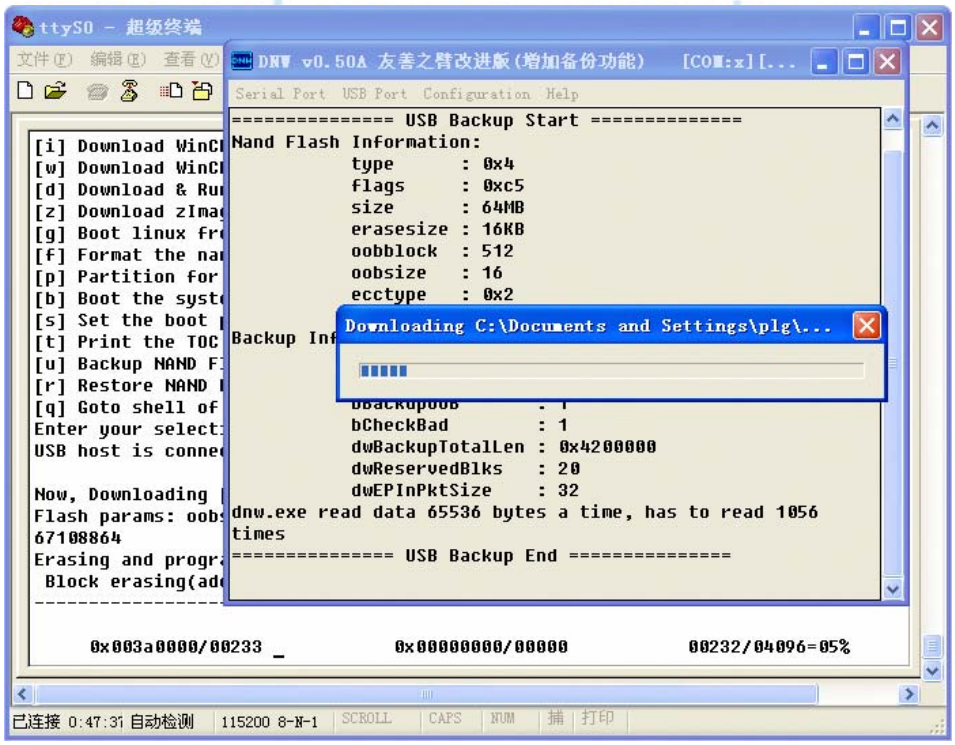

After the process is done, switch the boot mode to the Nand Flash side, and reset or power on the board.

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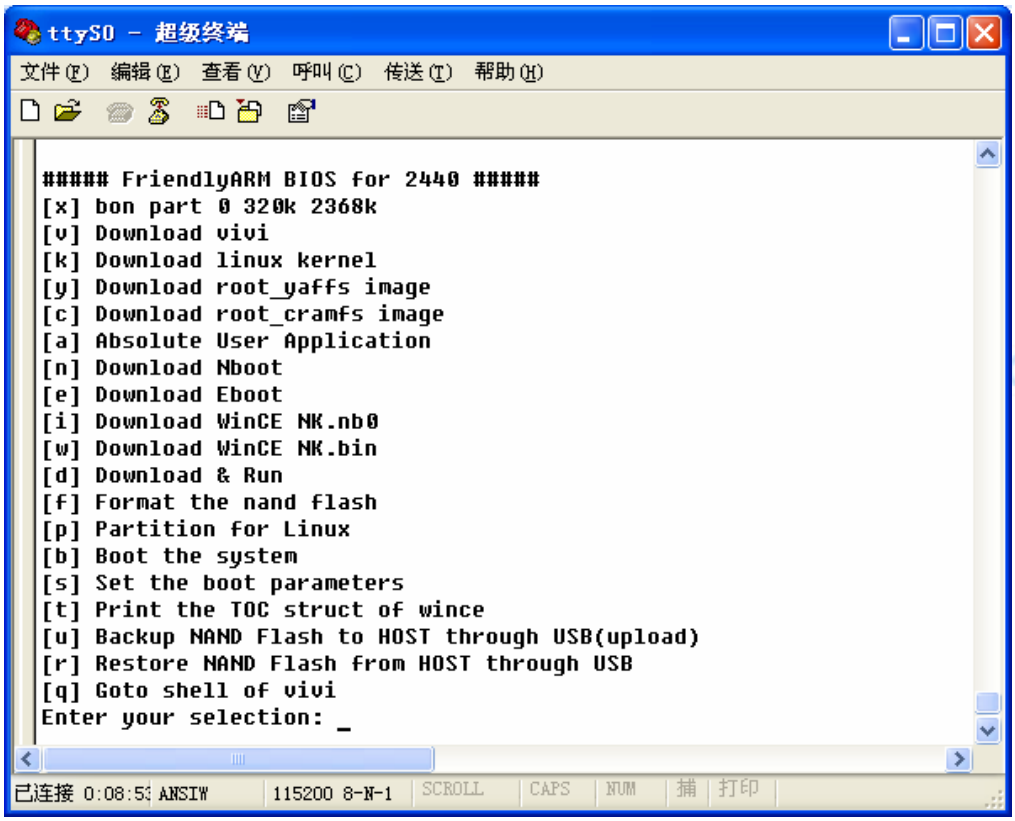
7.2 Installing Linux

7.2.1 Partition

Note: partitioning will delete all the data in Nand Flash

(1) Connect the MINI2440 board to a host PC, open a super terminal, power up the board and enter the BIOS main menu



(2) Select item [x] to start partitioning the Nand Flash

Note: in this process, some Nand Flash might report bad data sections but this doesn't matter.

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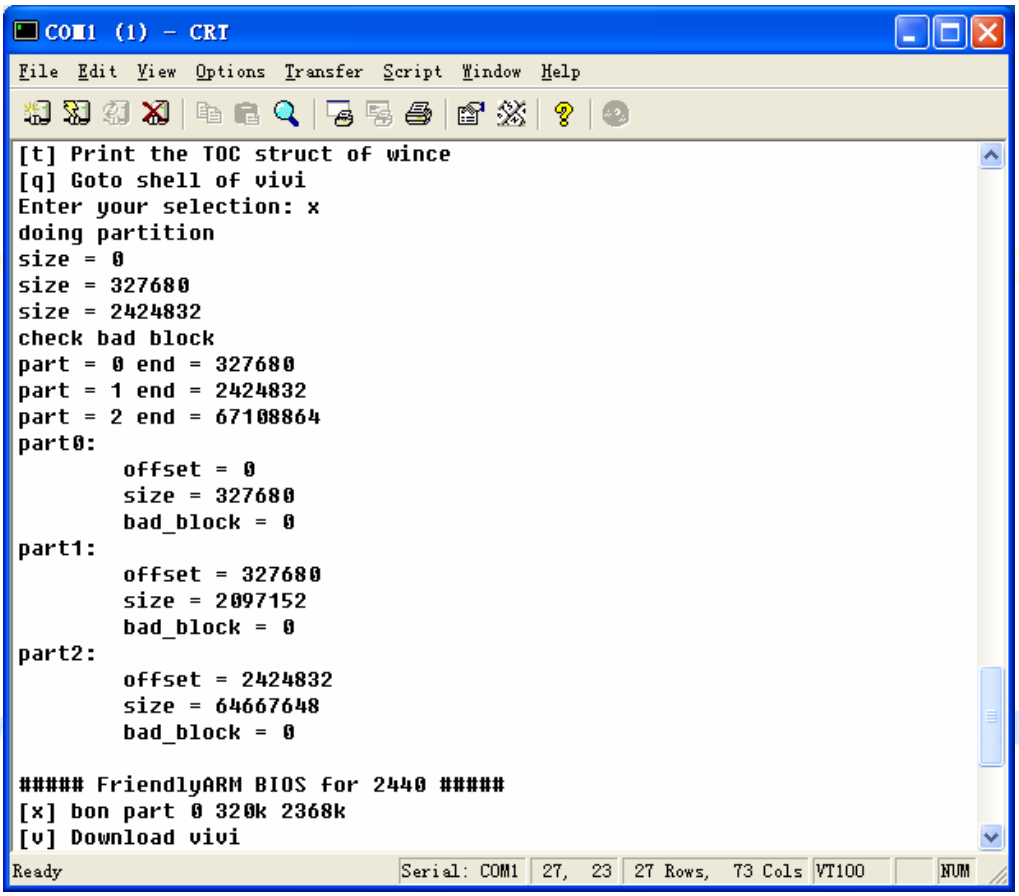

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7.2.2 Installing Bootloader

(1) Start the DNW application, connect the MINI2440 board to a host PC via a USB cable. If the DNW's title bar shows "USB:OK", it indicates that the USB connection is a success. Select item **[v]** to start downloading a supervivi

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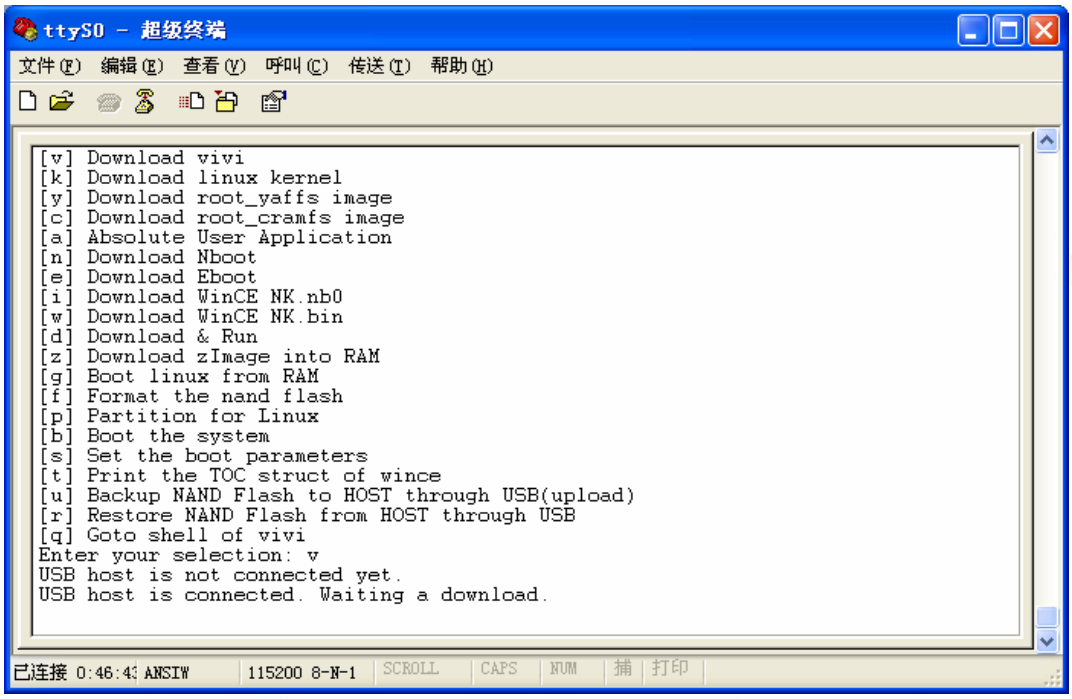
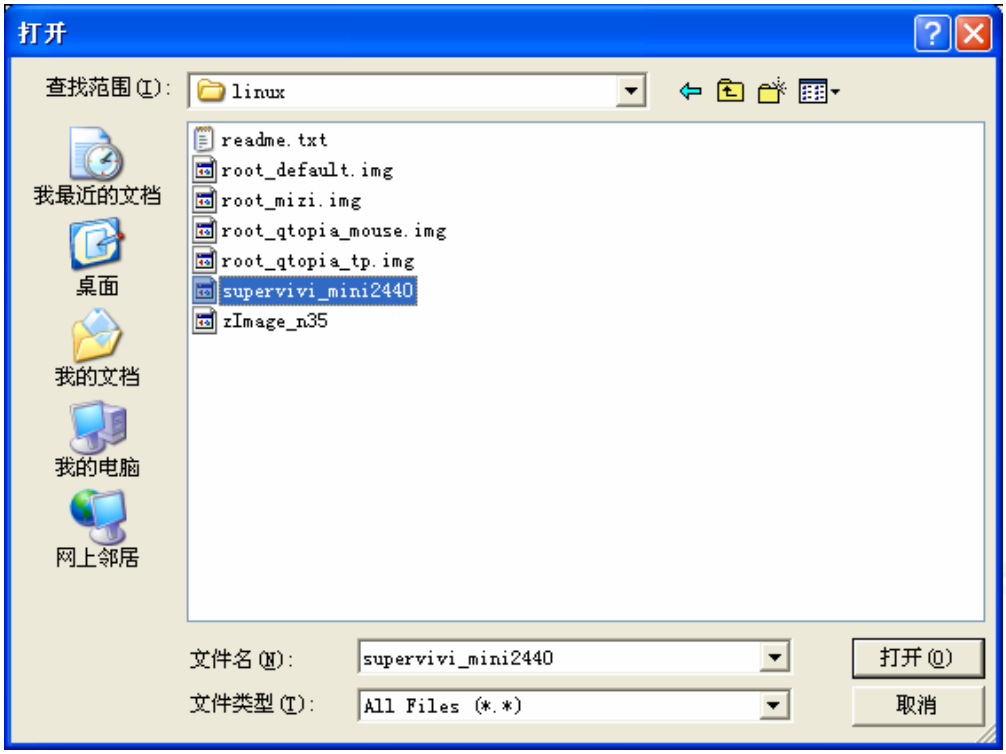


(2) Go to "USB Port" -> "Transmit/Restore", select a supervivi (it is in the "images/linux/" directory) file



(3) Once the download is finished, BIOS will automatically write this supervivi to Nand Flash's corresponding section and return to the main menu

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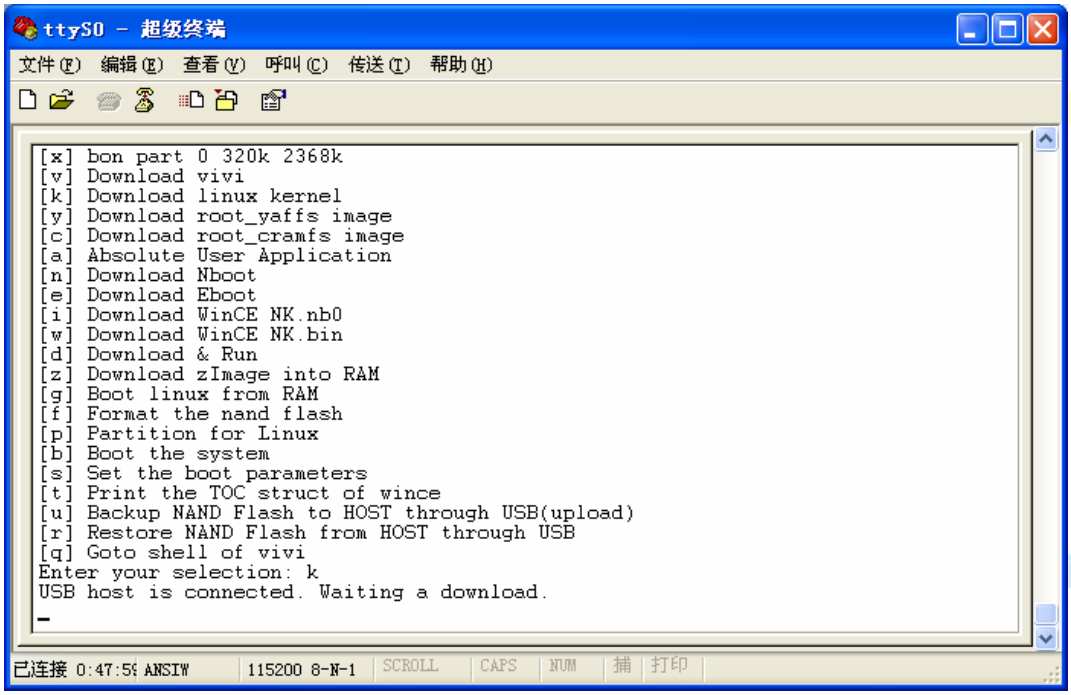
7.2.3 Installing Linux Kernel

(1) In the BIOS main menu, select item **[k]** to download a Linux kernel zImage



(2) Go to “USB Port” -> “Transmit”, select a zImage file (it is in the “images/linux/” directory) and begin to download

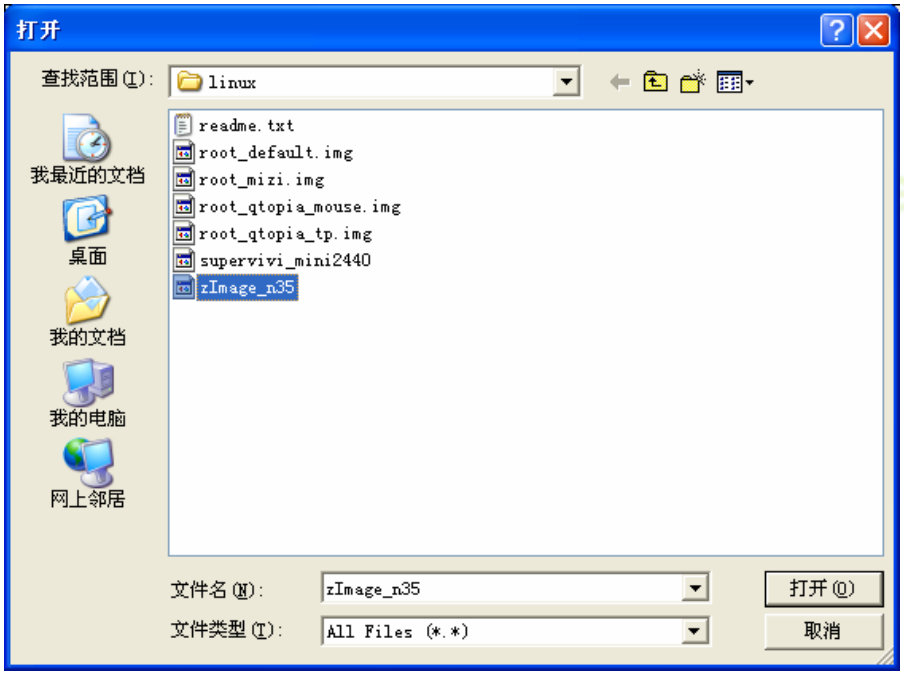
In the shipped CD:

zImage_n35 – for NEC 3.5 LCD

zImage_a70 – for 7-inch true color touch screen，800x480

zImage_VGA1024x768 – for VGA , 1024x768

For other cases please refer to the “readme.txt” file in the “images/linux/” directory



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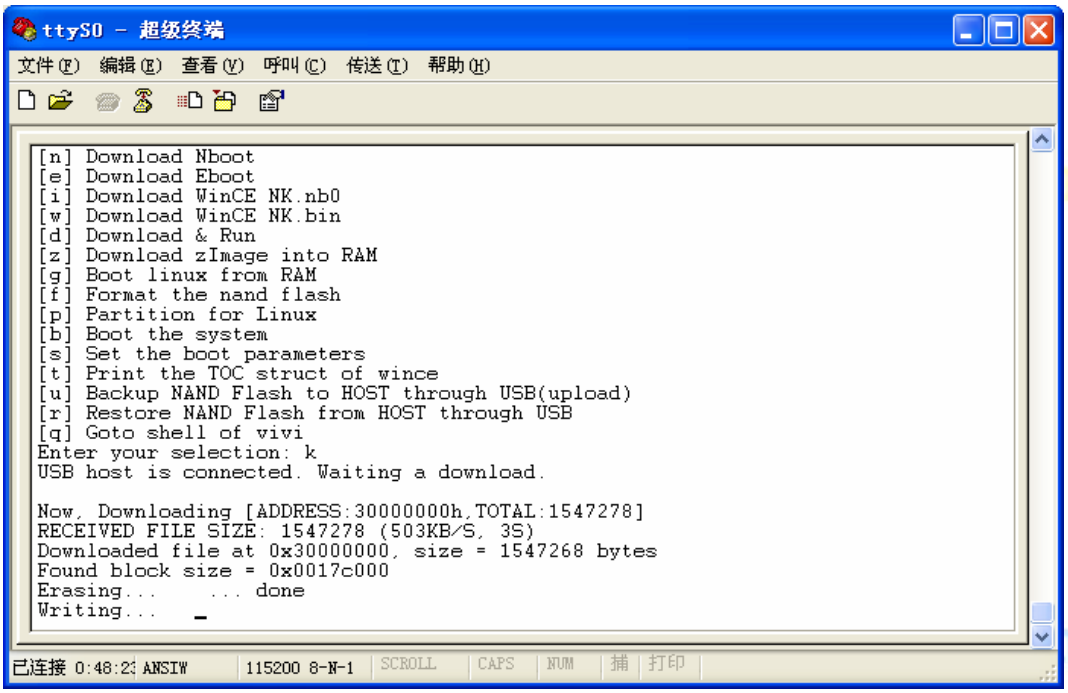
(3) Once the download is finished, BIOS will automatically write the kernel in Nand Flash's corresponding section and return to the main menu



7.2.4 Installing Root File System

(1) In the BIOS main menu select item **[y]** to start downloading a yaffs root file system image

(2) Go to "USB Port" -> "Transmit/Restore", select a file system image file and start to download. In this example, we chose the root_default.img file (it is in the "images/linux" directory)

In the shipped CD:

root_default.img

- default image file, based on the arm-linux-gcc-3.4.1 library

root_mizi.img

- provided by mizi, it has Chinese hand writing recognizing and browsing functions

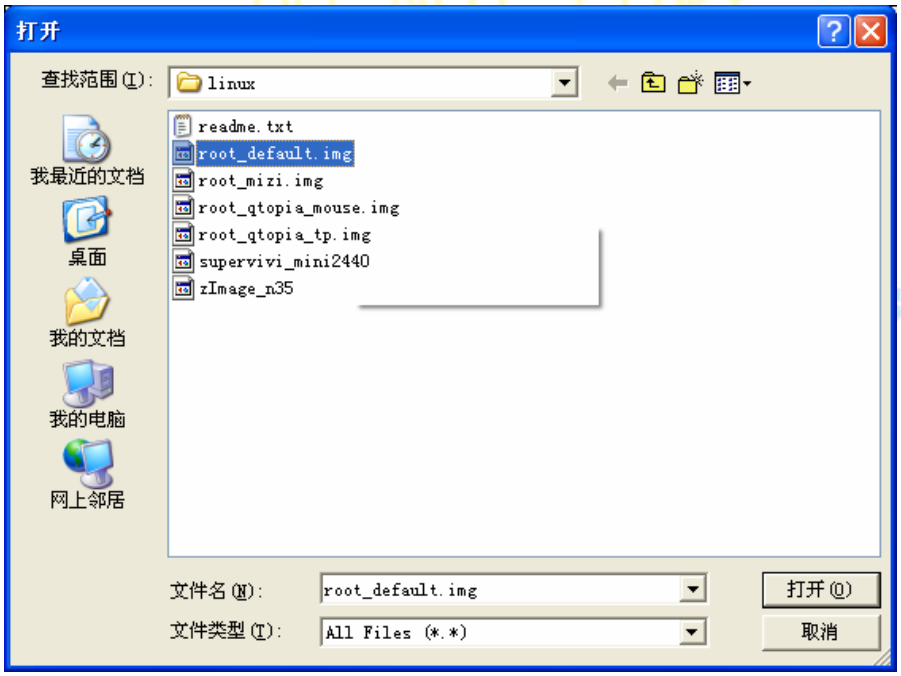
root_qtopia_mouse.img

- standard qtopia, mouse supported, based on arm-linux-gcc-3.4.1 library

root_qtopia_tp.img

- standard qtopia, touch screen supported, based on arm-linux-gcc-3.4.1 library

For other cases, please refer to the readme.txt in the “images/linux/” directory.



(3) After the download is done, BIOS will automatically write it in Nand Flash’s corresponding section and return to the main menu:

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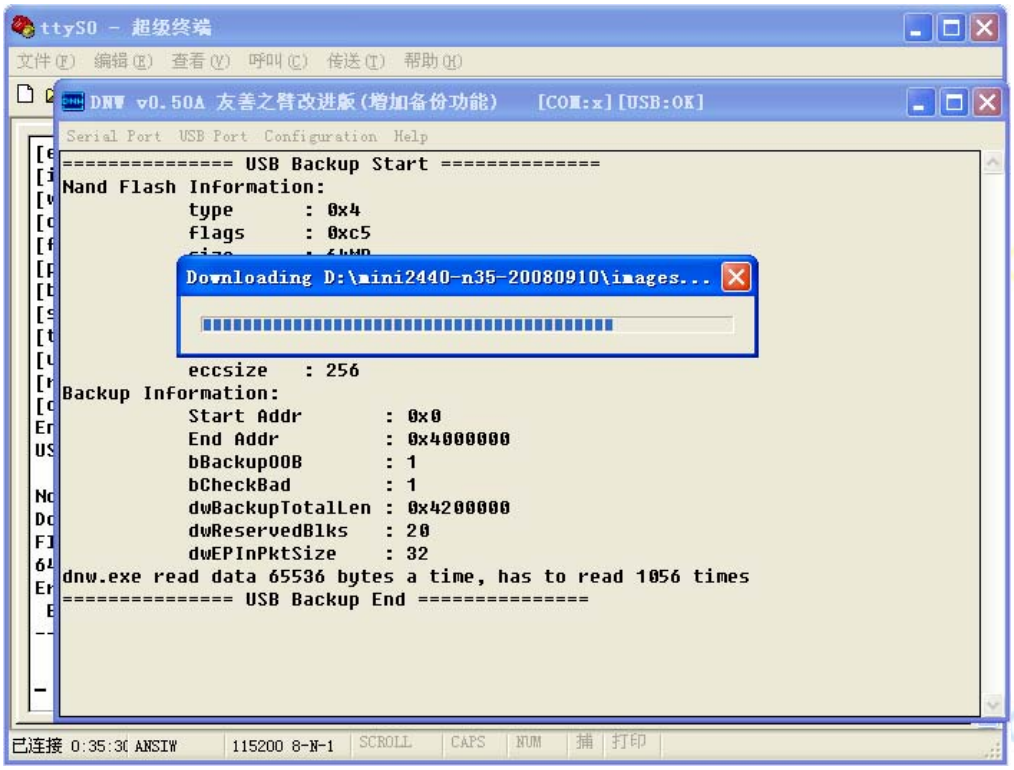

Note: the process takes at least 2 to 3 minutes, the bigger the file is, the longer it takes

After the download is done, please disconnect the USB connection, otherwise it could cause system crash on reset or power-on.

In the BIOS main menu, select item **[b]** to reboot the board

If the boot mode is switched to the Nand Flash side, the system will automatically boot on power on

7.3 Installing WinCE

7.3.1 Partition

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Note: partitioning will delete all the data in Nand Flash

(1) Connect the board to a host PC, open a super terminal, power on the board and enter the main menu

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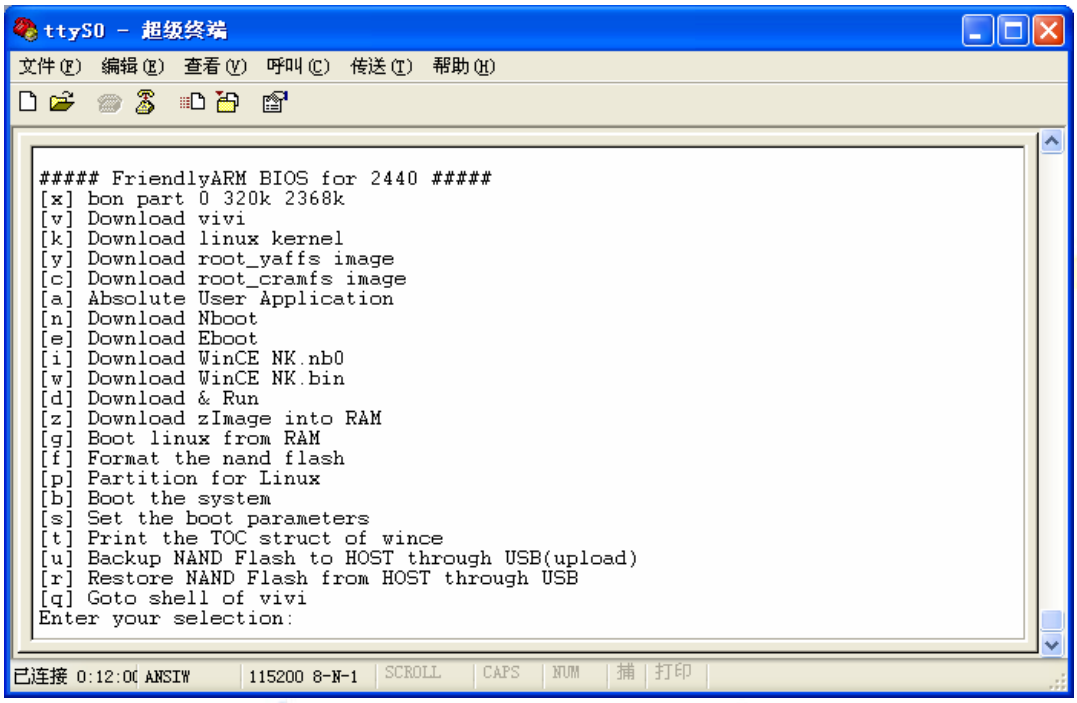
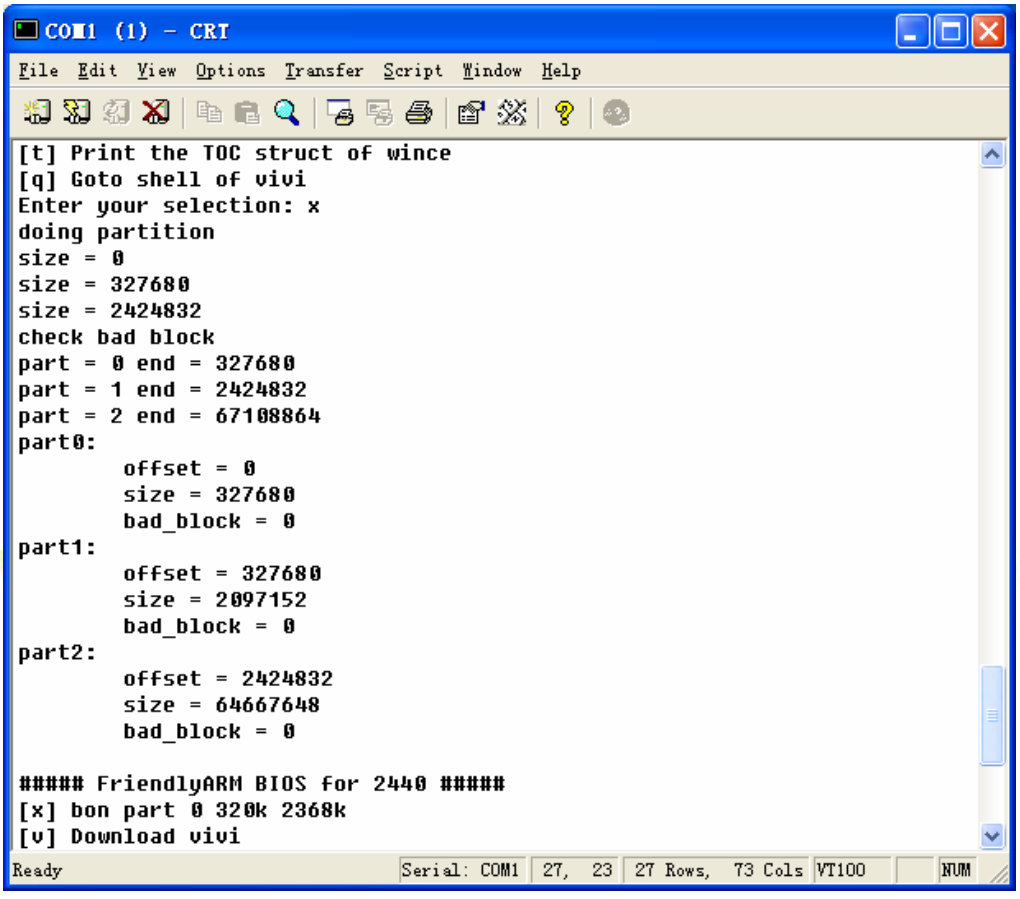


(2) Select item [x] to start partitioning Nand Flash

Note: in this process, some Nand Flash might report bad data sections but this doesn't matter.



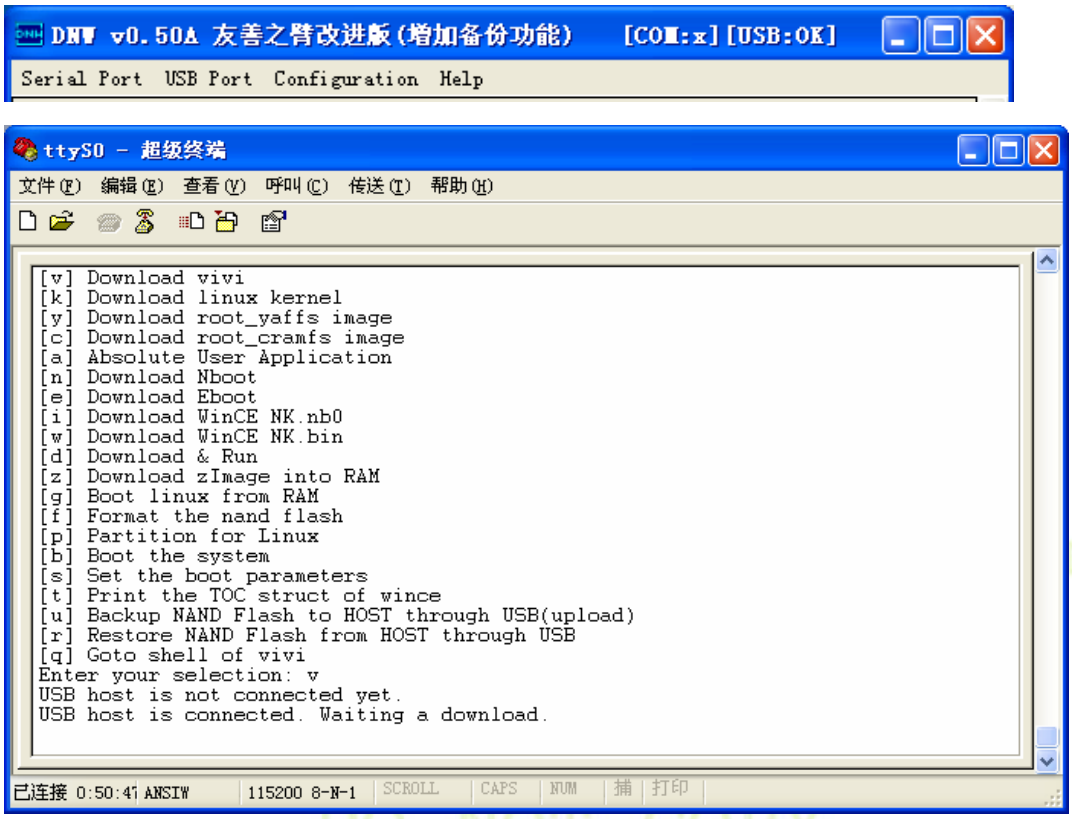
7.3.2 Installing Bootloader

The MINI2440 system has two bootloaders for WinCE: supervivi and nboot.bin, their differences are listed in the table below:

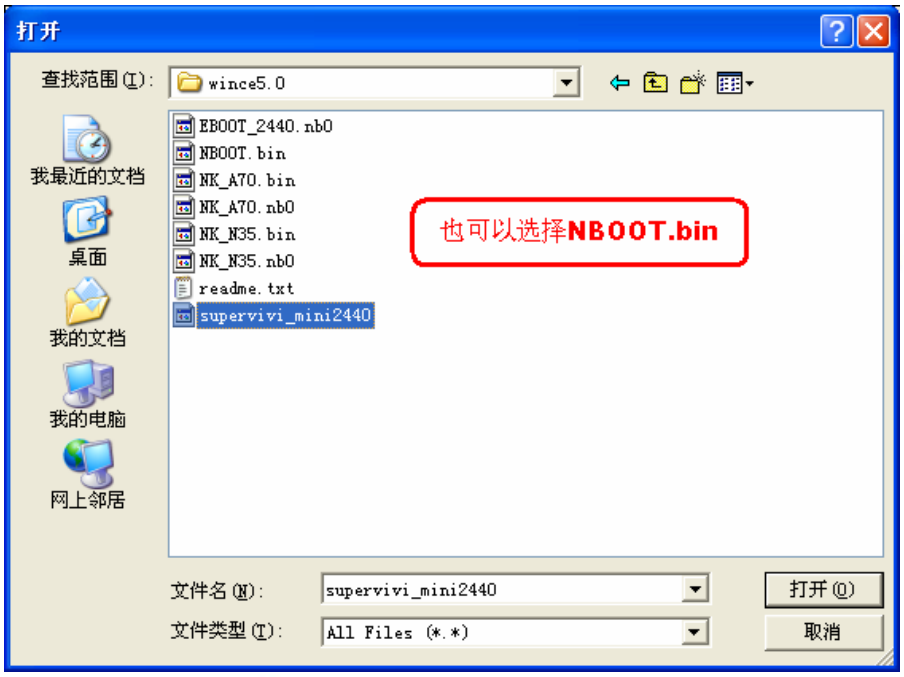
	supervivi	Nboot
Image location	\images\wince5.0	\images\wince5.0
Source code location	No	WindowsCE5.0\NBOOT
Project file	No	Nboot.mcp
Compiler	Arm-linux-gcc	ADS1.2
Note: ● Supervivi is maintained and developed by Friendly Arm, it is not open source ● NBOOT is open source		

The following steps show how to download and write a supervivi to the MINI2440 board

(1) Start the DNW application, connect the board to a host PC via a USB cable. If the DNW's title bar shows "USB:OK" it indicates that the USB connection is a success. Select item **[v]** to download a supervivi



(2) Go to "USB Port" -> "Transmit", select a supervivi file (it is in the "\images\wince5.0" directory in the installation CD) to start downloading

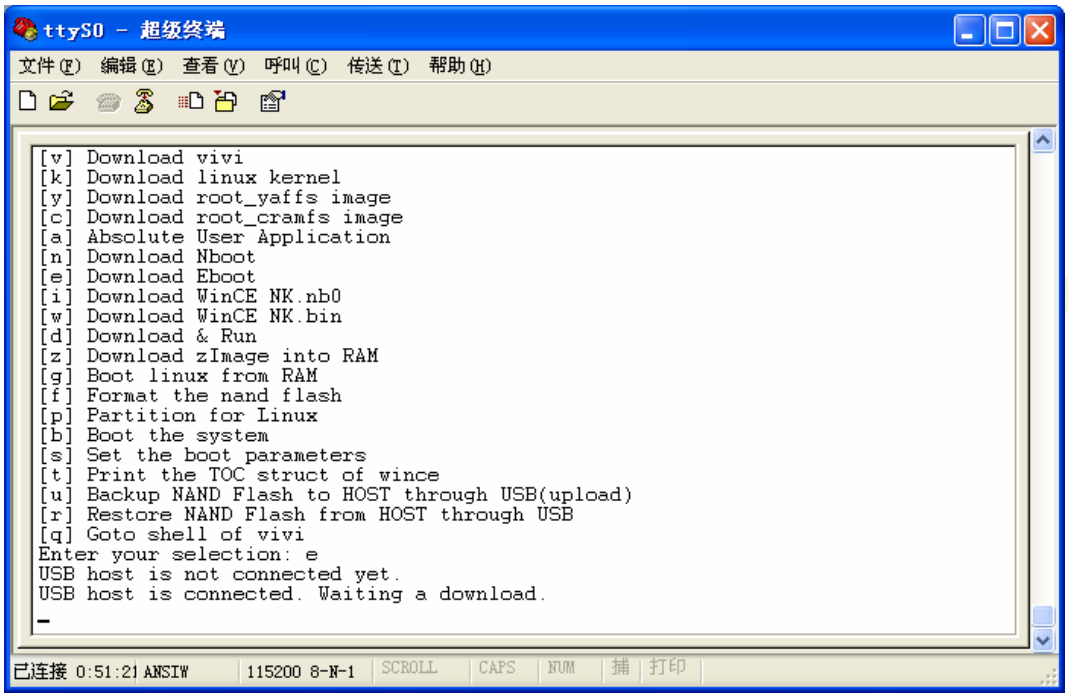


(3) After the download is done, BIOS will automatically write to Nand Flash's corresponding section and return to the main menu

7.3.3 Installing Eboot

Note: Eboot is only for writing an "nk.bin"

(1) In the BIOS main menu, select item **[e]** to start downloading an Eboot



(2) Go to "USB Port" -> "Transmit/Restore", select the Eboot_2440.nb0 file.

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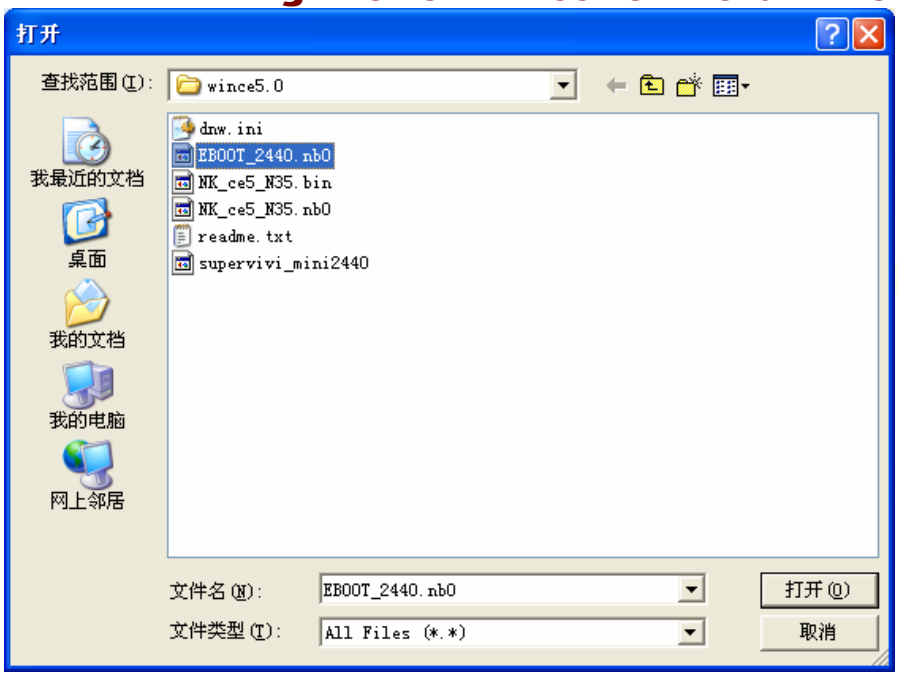
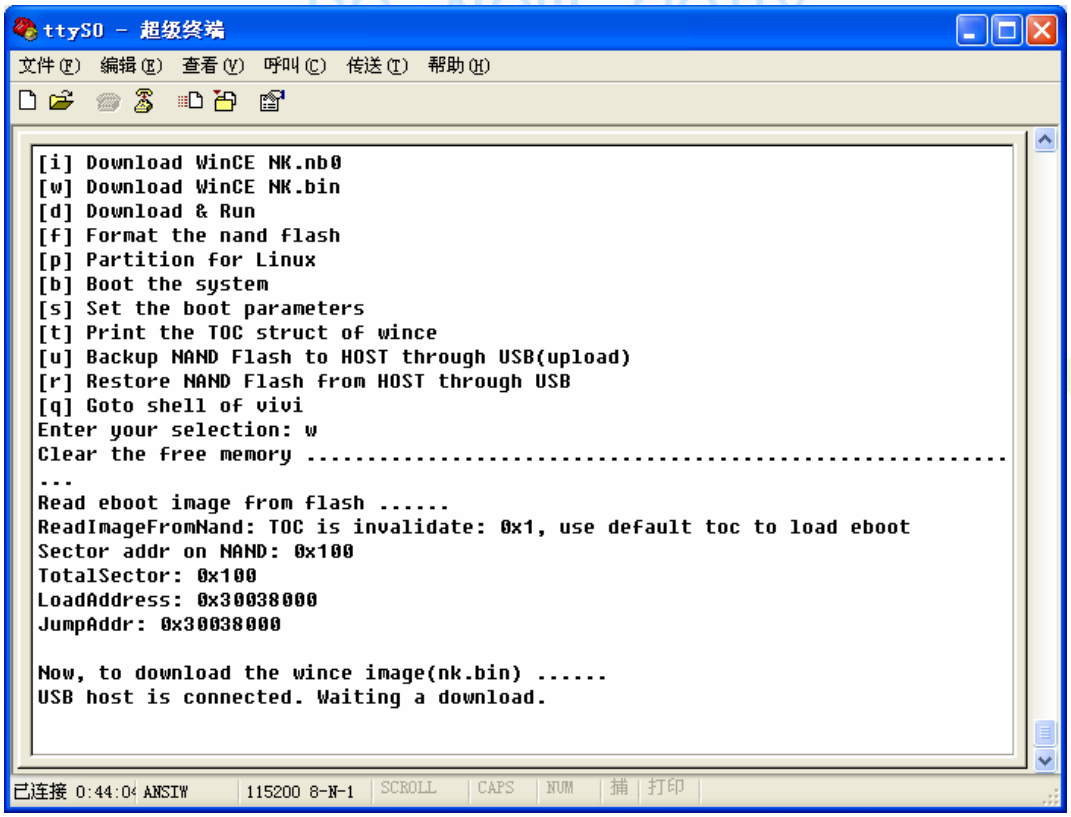


(3) After the download is done, BIOS will automatically write this eboot to Nand Flash's corresponding section and return to the main menu

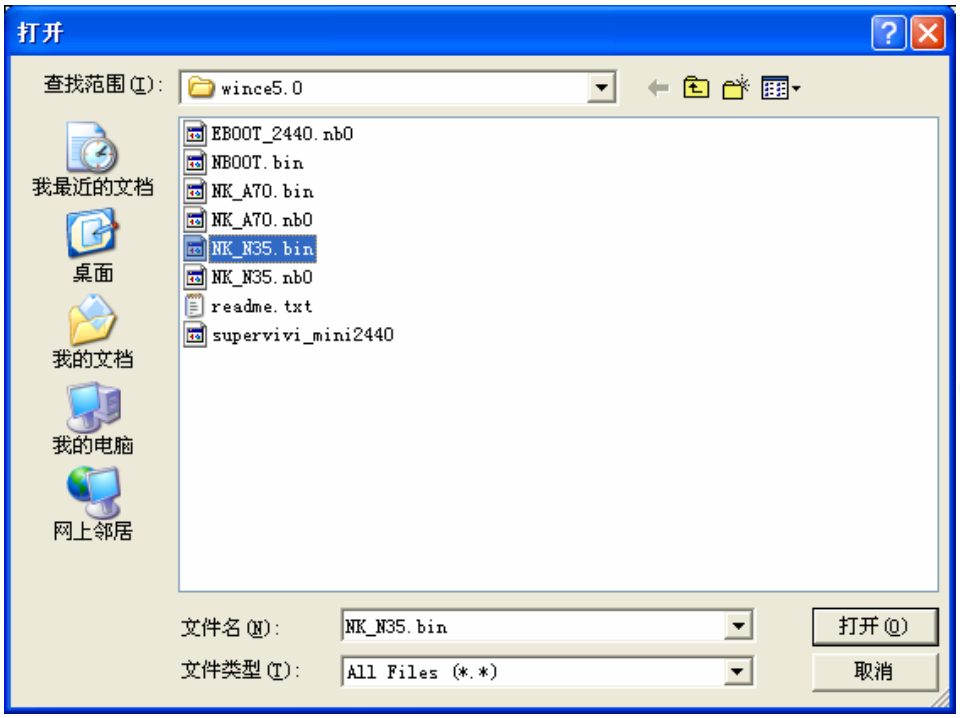
7.3.4 Installing WinCE Kernel

(1) In the BIOS main menu, select item **[w]** to stard downloading a WinCE kernel



(2) Go to “USB Port” -> “Transmit/Restore”, select a kernel image file, in this example we chose an NK.bin file (It is located in the “\images\wince5.0” directory in the installation CD) and start downloading

In the shipped WinCE CD
NK_N35.bin – for NEC 3.5" LCD
NK_A70.bin – for 7-inch true color screen
NK_VGA1024x768.bin – for VGA, 1024x768
For other cases, please refer to the readme.txt in the “images/wince5.0” directory



After the download is done, BIOS will automatically call Eboot’s write function starting to format Nand Flash and write a WinCE kerne into it.

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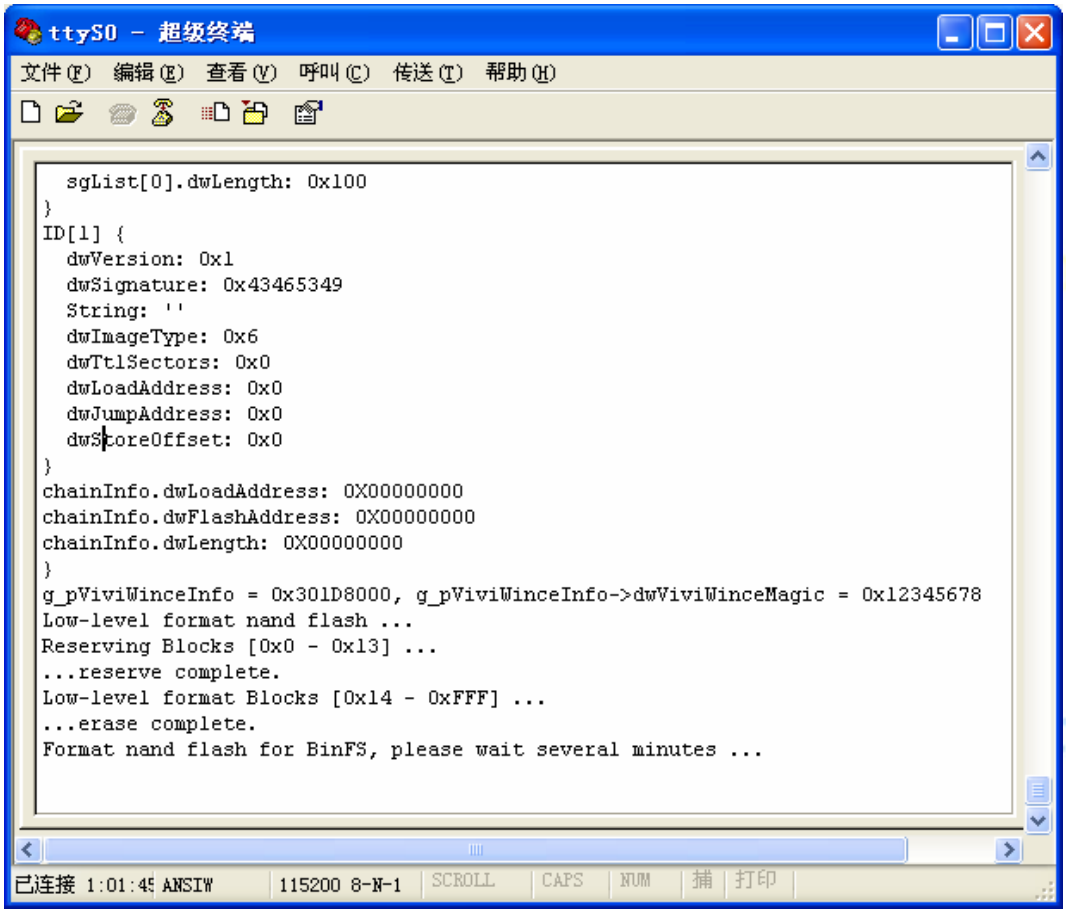

(3) After the kernel has been burned to Nand Flash, WINCE will auto run as below

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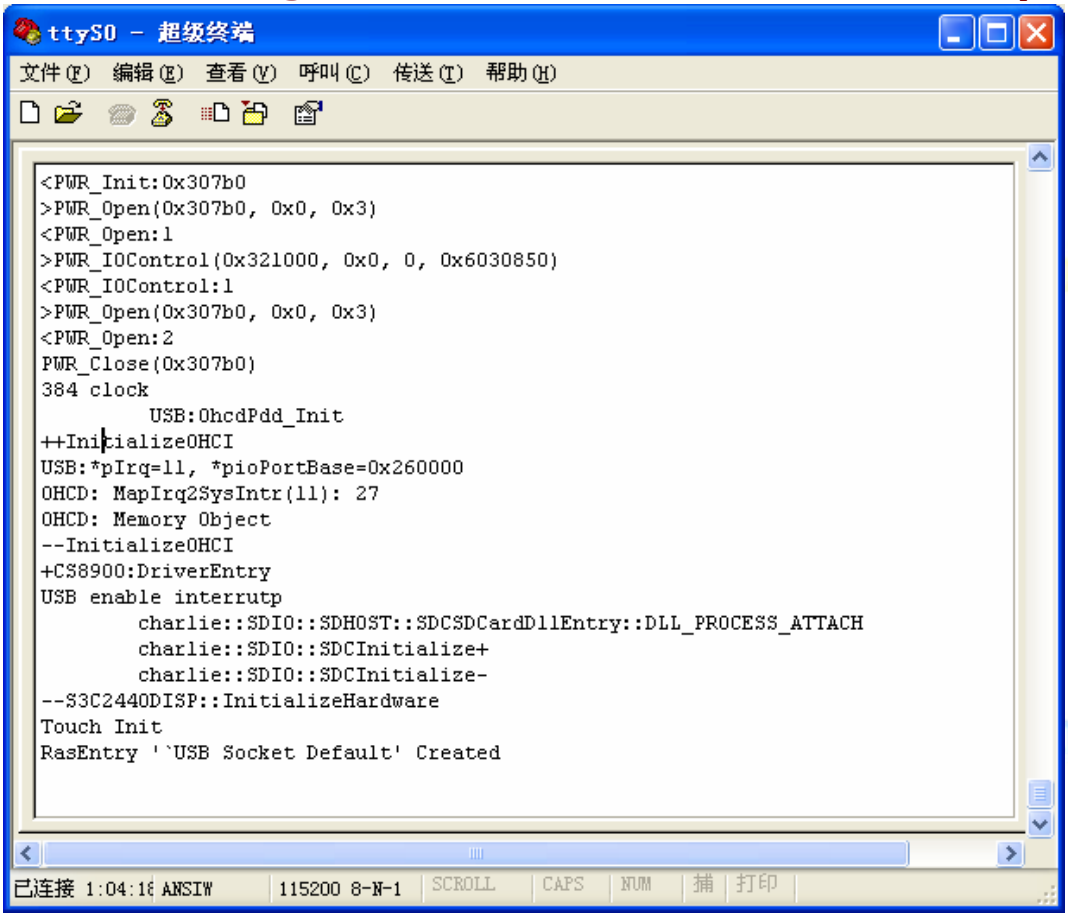

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Appendix A: Resources in Shipped CD

(1) SJF2440 flash burning tool for Windows
(2) JFLASH-2440 flash burning tool for Linux, source code included
(3) Serial Port utilities: CRT and DNW
(4) Utility to translate an image file to a C language array.
(5) USB driver for WindowXP/2000
(6) VIVI source code: bootloader for Linux
(7) Independent LED test utility (including ADS1.20 project file)
(8) 2440test utility (including ADS1.20 project file and source code). It can be used to test keyboard interrupts, RTC real time clock, ADC conversion, IIS audio playing of wav files, IIS audio recording, touch screen, I2C bus write/read to and from AT24C08, SAMSUNG 3.5inch LCD, 640x480 true color LCD.
(9) WinCE BSP and sample project files
(10) Linux development toolkit and kernel source code including:
- Cross compiler: arm-linux-gcc-4.3.2 with EABI
- YAFFS2 file system image maker: mkyaffs2image
- Linux-2.6.29 kernel source code (including DM9000 driver, true color LCD drivers, audio input/output driver, touch screen driver, YAFFS2 source code, SD driver that supports high speed read/write and huge storage, RTC driver, watchdog driver, drivers for on board serial ports, drivers for USB camera, mouse, keyboard and flash drive)
(11) Source code of embedded graphic interface Qtopia-2.2.0 and embedded internet browser
(12) Development board schematic (Protel99SE format/PDF format)
(13) User's manual (PDF format)

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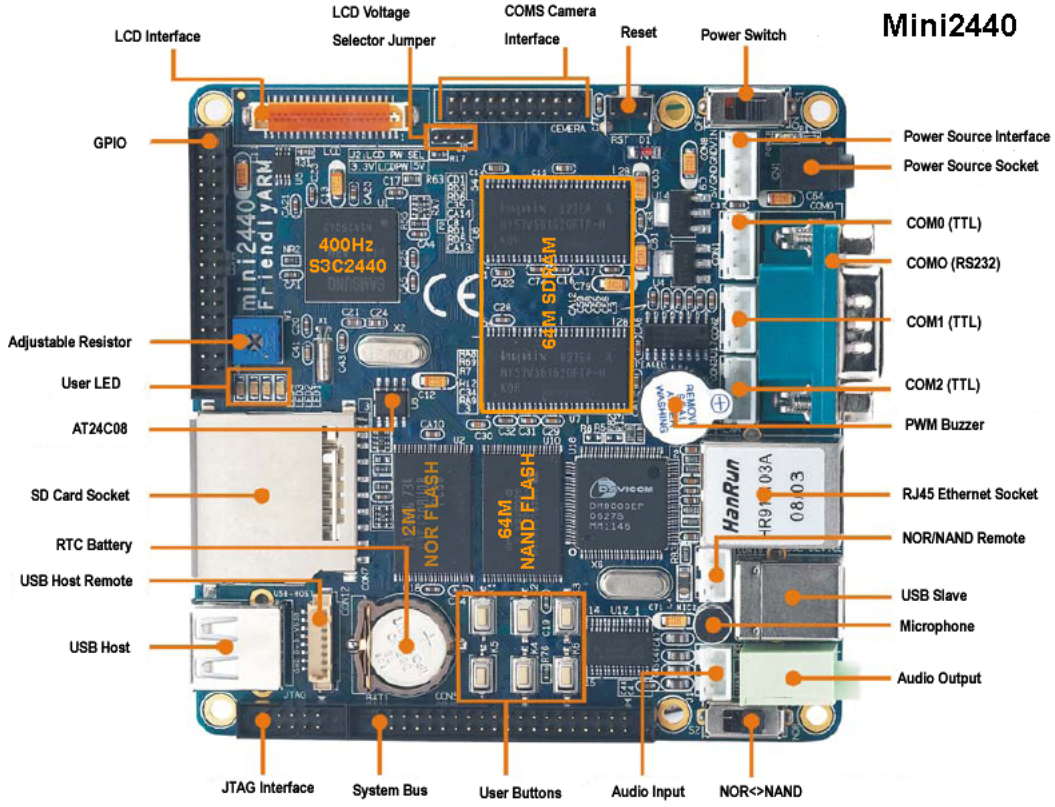
Appendix B: Schematics and Device Details

Board Schematic



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Address Space

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The left drawing is the memory allocation diagram when the system is set to the Nor Flash boot mode with nGCS0 being set.

The right drawing is the memory allocation diagram when the system is set to the Nand Flash boot mode.

Note: SFR Area is reserved for special registers

nGCS0 will map its address space to different devices when the system boots in different modes

- When the system boots from the Nand Flash, its 4K Bytes BootSram will be mapped to nGCS0's address space;
- When the system boots from the Nor Flash (not the Nand Flash boot mode), the Nor Flash which is connected to nGCS0 will be mapped to nGCS0's address space.

SDRAM address space: 0x30000000 ~ 0x34000000

SDRAM

The mini2440 has two 32M bytes（64M bytes in total) SDRAMs (HY57V561620FTP), commonly known as memory. They are deployed in parallel to form a 32-bit data bus which speeds up data transmission. To work this way, both use nGCS6. According to section 5-2 of the CPU manual this configuration implies their physical addresses start at 0x30000000. The following SDRAM diagram is extracted from the mini2440 schematic.

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FLASH

The mini2440 is equipped with two types of Flash: one Nor Flash of type SST39VF1601, 2M bytes memory, and one Nand Flash of type K9F1208, 64M bytes memory. The S3C2440 supports system boot from either Flash. You can boot systems from either the Nor or the Nand flash by toggling the S2 switch. In fact most systems only have a Nand Flash. For the sake of users especially developers we add a Nor Flash, that way, you can have more control over the system. The Nand Flash doesn't have address lines. It has dedicated control interfaces connected to CPU. Its data bus is 8-bit, but this does not necessarily mean the Nand Flash writes or reads slowly. Most USB drives and SD cards are made of Nand Flash.

The diagram below presents that the Nor Flash has 22 address lines A1-A22 and 16 data lines connected to CPU. The address starts from A1 implying that the minimum amount of data read/write is always 2-byte. Based on this diagram, the maximum size of the Nor Flash is 8Mbyte. In our system, only A1-A20 are active, A21 and A22 that are connected to SST39V1601 are idle.

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Power System

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The mini2440's power system is simple. It should be connected to an external 5V power supply, and utilizes a voltage step-down chip to generate three kinds of voltages: 3.3V, 1.8V and 1.25V.
This system is not for hand-held devices, therefore it does not have a full-featured power management circuit. The system is turned on or off by toggling switch S1. It is not under software control.

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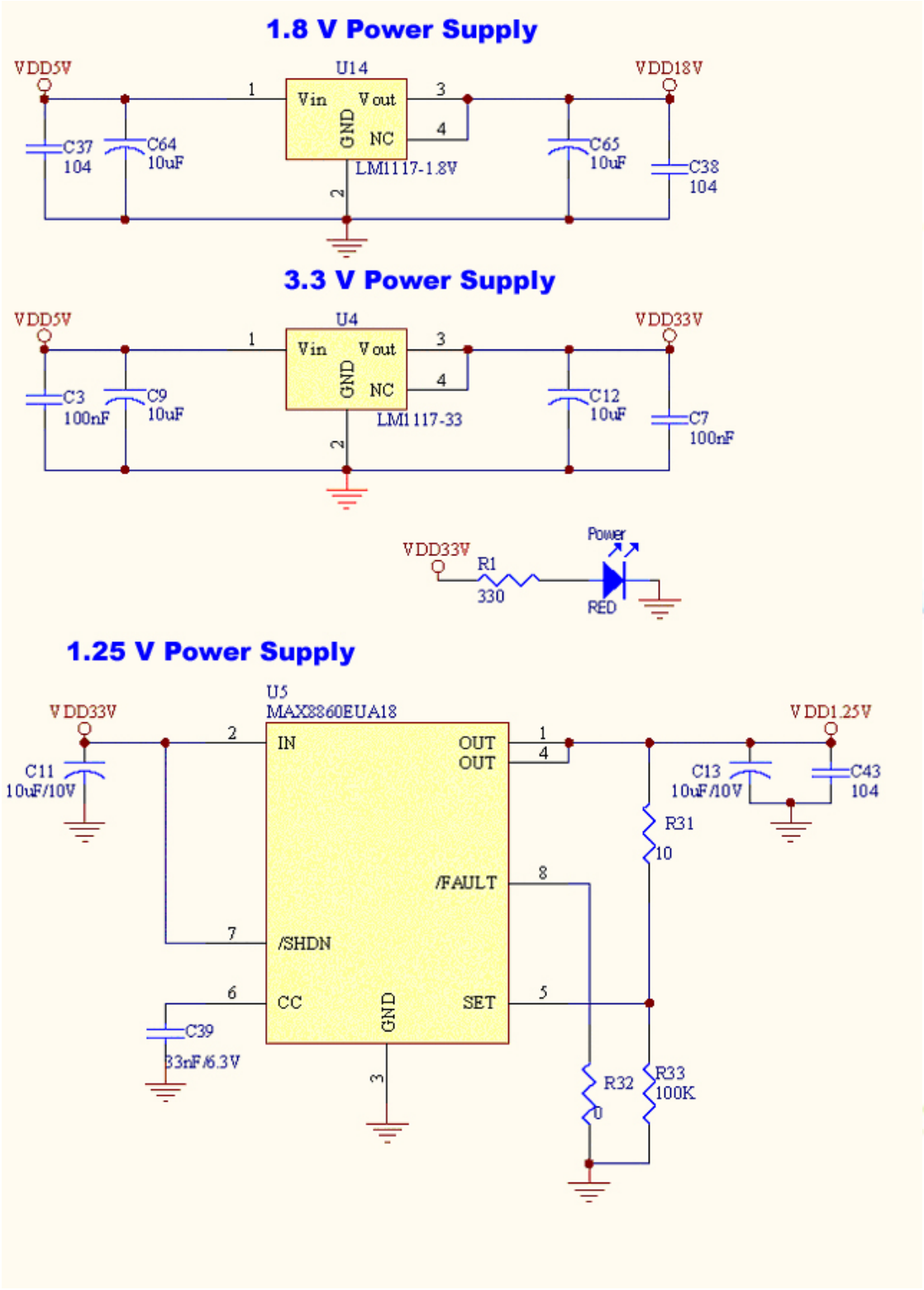

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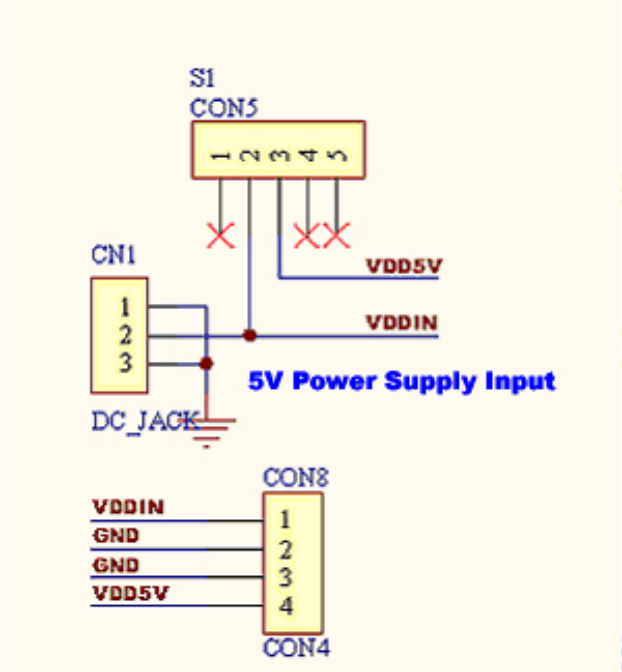
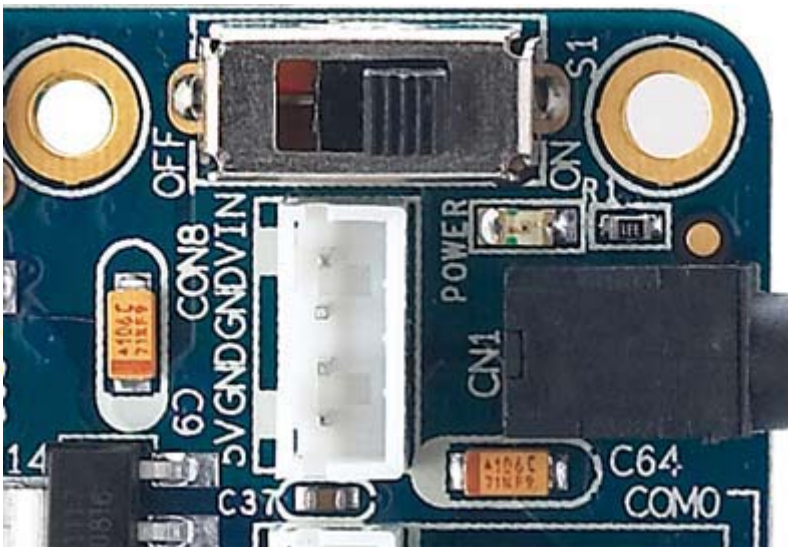
You can connect the mini2440 to other power supplies too. The mini2440 has a power inlet CON8, which is a white 2.0mm single row connector. 5V is applied to both ends and ground to the middle. One end can be connected to an external 5V power supply, and the other can be connected to a 5V power supply by toggling switch S1.

The diagram is presented below:





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Reset System

The mini2440 utilizes a microprocessor supervisory circuit MAX811 to reset its CPU:

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User LED

A LED is commonly used as a status indicator. The mini2440 has 4 user programmable LEDs which are directly connected to GPIO. The LEDs will be on at a low level voltage. Detailed information is as follows:

	LED1	**LED2**	**LED3**	**LED4**
GPIO	GPB5	GPB6	GPB7	GPB8
Multiplexing	nXBACK	nXREQ	nXDACK1	nDREQ1
Name in the schematic	nLED_1	nLED_2	nLED_3	nLED_4

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User Test Keys

The mini2440 has 6 test keys. They all are CPU interrupt input signals and will be triggered at a low level voltage. They can also be multiplexed to GPIO and other function interfaces. To multiplex them users can extend them through CON12. These 6 keys and CON12 are defined as follows:

	K1	K2	K3	K4	K5	K6
Interrupt	EINT8	EINT11	EINT13	EINT14	EINT15	EINT19
Multiplexing GPIO	GPG0	GPG3	GPG5	GPG6	GPG7	GPG11
Special Function	N/A	nSS1	SPIMISO1	SPIMOSI1	SPICLK1	TCLK1
Corresponding CON12 pin	CON12.1	CON12.2	CON12.3	CON12.4	CON12.5	CON12.6

Notes: CON12.7 is the power supply (3.3V). CON12.8 is ground (GND)

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A/D Input Test

The mini2440 has 4 A/D conversion channels. They reside on the CON4-GPIO interface (please refer to the GPIO introduction). AIN0 is connected to the adjustable resistor W1, the schematic is shown below:

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PWM Buzzer

The on-board SPEAKER is controlled by PWM, the diagram is shown below. GPB0 can be set to PWM output via software control.

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Serial Port

The S3C2440 has three serial ports: UART0, 1 and 2. UART0 can be used in conjunction with UART1 as a full functioned serial port. In most applications, we only need very simple features of these three serial ports,(the Linux and WinCE drivers that are shipped with our system are set this way by default), i e. TXD and RXD. They correspond to CON1, CON2 and CON3 which are all TTL levels. Among them UART0 is RS232 level converted, corresponds to COM0 and can communicate with a PC.

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CON1, CON2 and CON3's positions are presented below

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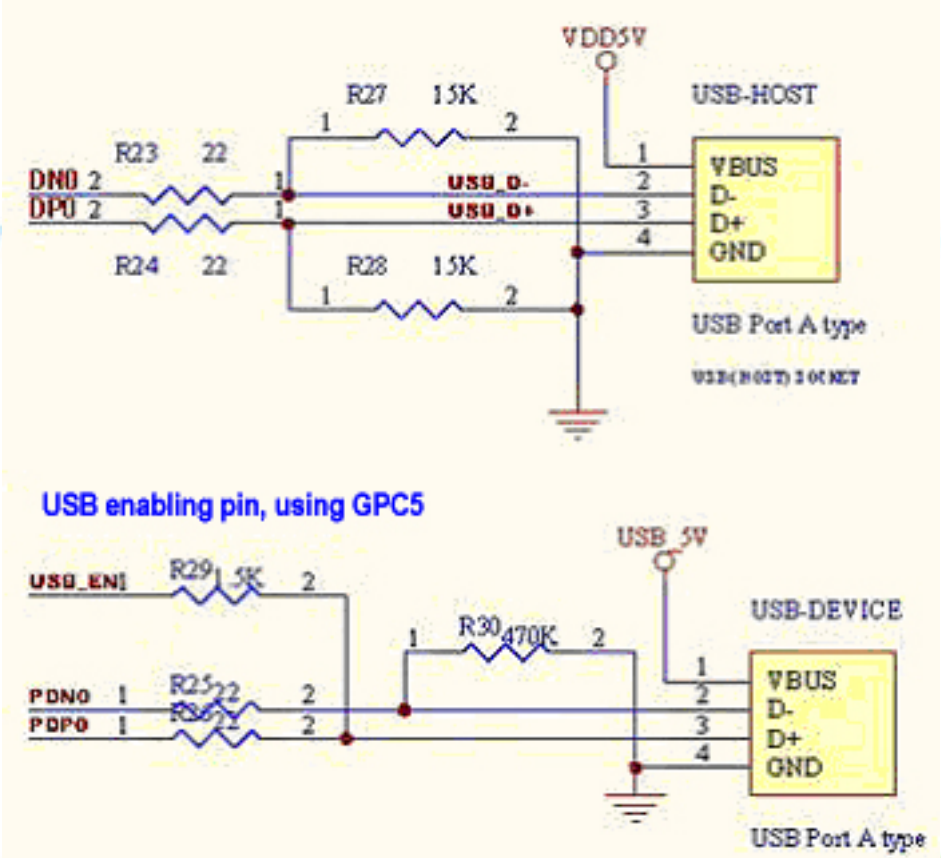
USB Interface

The mini2440 has two USB ports: USB Host and USB Slave. The USB Host is the same as a USB port in a PC and can be directly connected to and works with a USB camera, USB keyboard, USB mouse, USB drive and other USB devices. The USB Slave is used to download programs to a target board. When the board is running WinCE, it can synchronize with Windows through ActiveSync. Because there are no proper drivers or applications for Linux, there is no way for the board to synchronize with Linux now. The mini2440 has a USB_EN pin which is for users to control the communication between the USB Slave and a PC via software. It uses CPU's GPC5.



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LCD Interface

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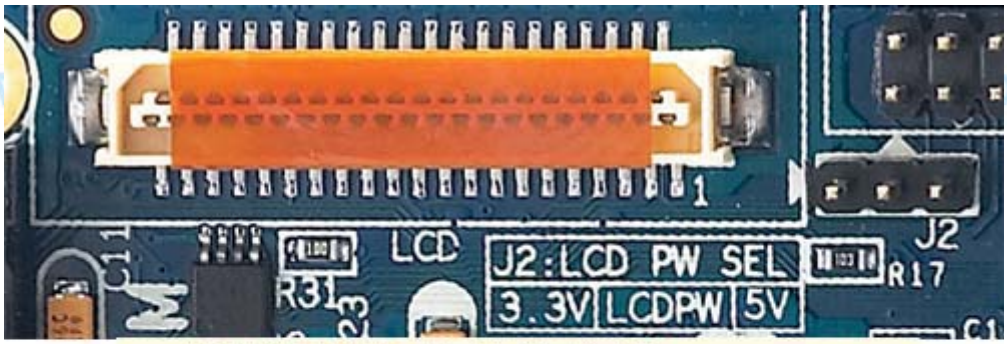
The mini2440's LCD interface is a 41-pin 0.5mm white connector. It has what a common LCD needs: control signals (line scan, clock, enable / disable) and complete RGB signals (RGB output is 8：8：8 and supports maximum 16000k color LCD). For test purposes, it has a PWM output (GPB1 can be configured as PWM) and a reset signal (nRESET). The LCD_PWR is the backlight control signal. In addition, 37, 38, 39 and 40 are a 4 wire touch screen interface which can be directly connected to a touch screen.

In the schematic below, J2 supplies power for LCD. It uses 5V power supply.



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EEPROM

The mini2440 has a EEPROM AT24C08 connected to CPU's I2C. It has 256 bytes memory and is mainly for testing I2C bus.

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Network Interface

The mini2440 incorporates the DM9000 chip and can communicate with 10/100M networks. The RJ45 connector includes coupling filters and does not need transformers. With a common network cable, you can connect a router or switch to the mini2440.

Notes: all our mini2440 boards have the same MAC address, which can be set via software. For Linux users, please refer to section 3.1.1 of this user's manual. For WinCE users, please refer to the BSP's DM9000 driver and registry file (platform.reg).

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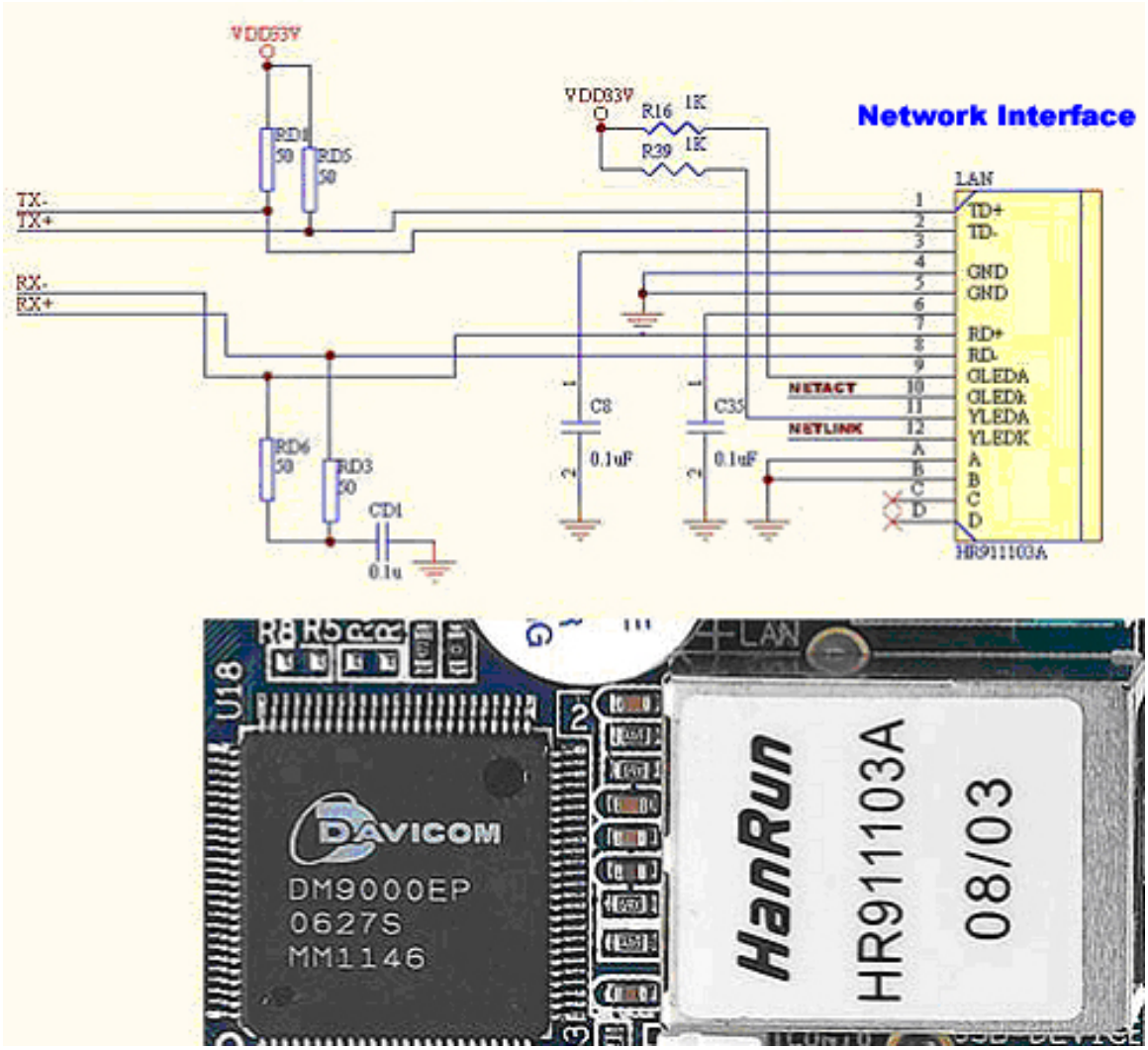

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Audio Interface

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The S3C2440 has an I2S bus interface, it can be connected to an external 8/16 bit stereo CODEC. The mini2440 uses the I2S based UDA1341 chip to implement audio decode/encode system. This chip's registers' setting and initialization are controlled by the L3-bus. Here we adopted SAMSUNG's design by using CPU's GPB2, GPB3 and GPB4 to simulate the L3-Bus's standard L3MODE, L3DATA, L3CLOCK. After they initialize the UDA1341 they will be idle. What these three control lines do can be implemented by a common single chip computer too. The audio system's output is a 3.5 mm phone plug.

The input has two channels, one is an on-board microphone, the other is extended through CON10's 2.0mm white phone plug. These two audio input channels are driven by different drivers. Currently only the CON10 channel can be used to record audio.

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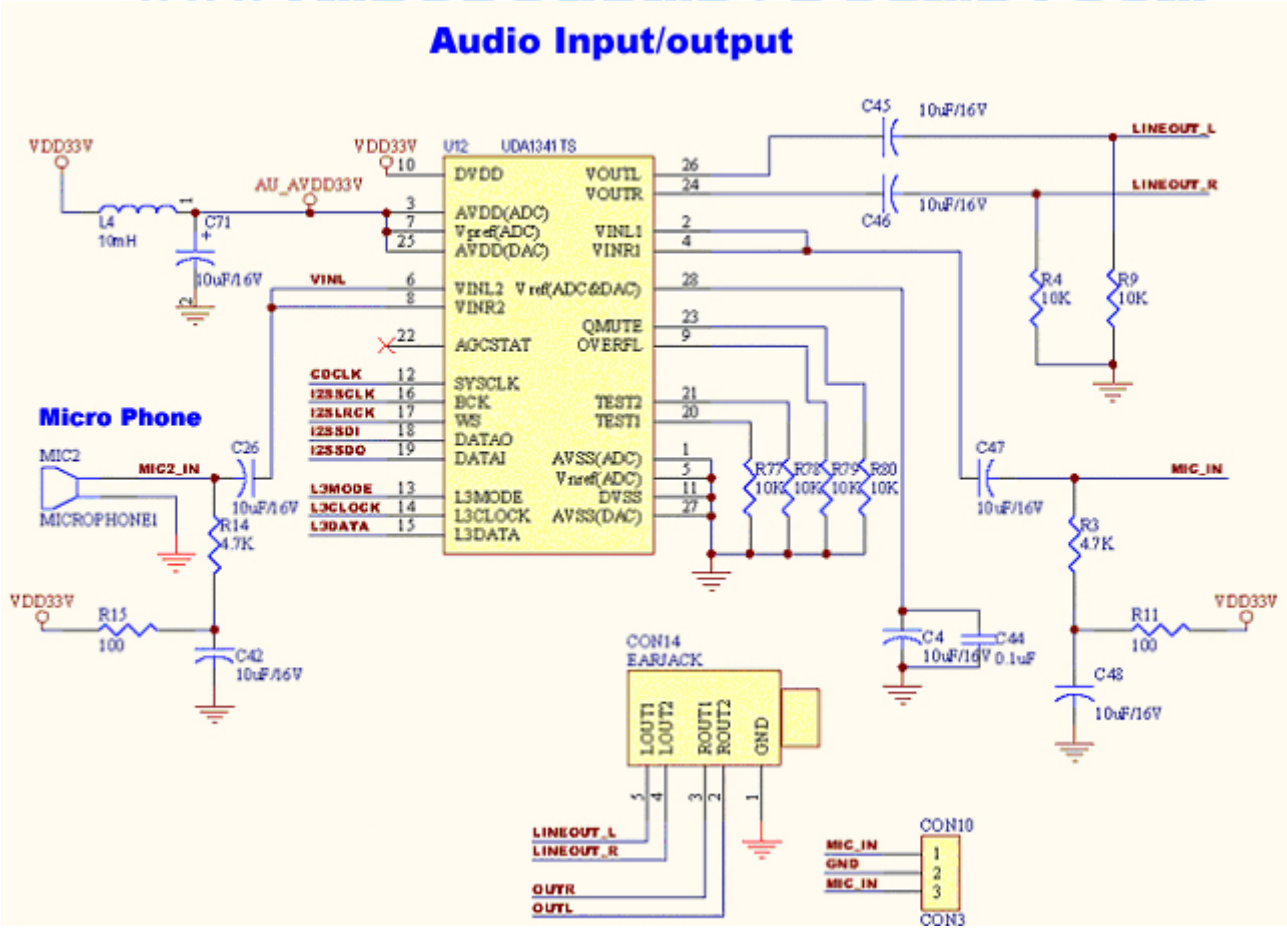
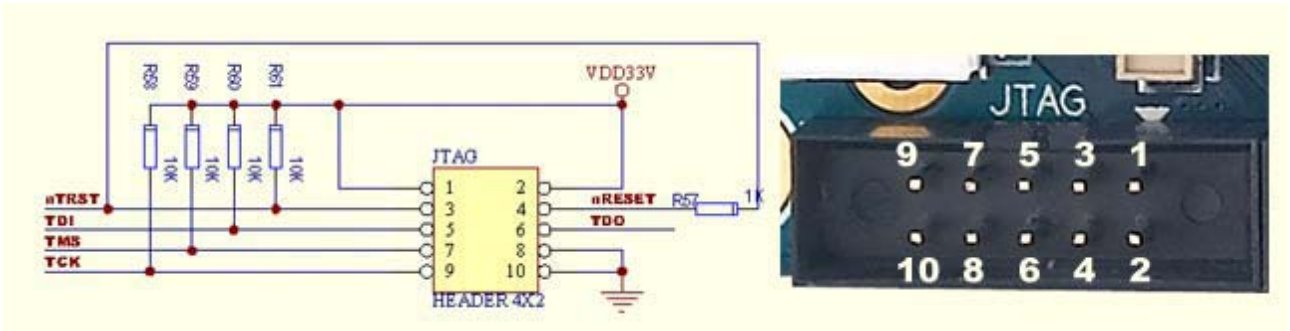


JTAG Interface

When a development board just comes off from production lines, it is just a bare board without any data. We will burn the first program to it through the JTAG interface, which is SUPERVIVI. With SUPERVIVI, we can download more programs and utilities to the board via USB further. In addition, the JTAG is more often used for debugging. In fact, most of the widely used utilities in markets like JLINK, ULINK and other simulators actually work via the JTAG interface. A standard JTAG has 4 signals :TMS, TCK, TDI and TDO which are test mode select input, test clock, test data input and test data output. These 4 signal lines plus a power line and a ground line form 6 lines in total. In order for testing, most simulators even have a reset signal. Therefore, a standard JTAG is meant to have those signal lines, and it does not mean whether it is 20Pin or 10Pin. As long as a JTAG interface has those signal lines, it will be a standard JTAG interface. The mini2440 has a 10Pin JTAG interface which has complete standard JTAG signals.

Notes: for beginners who just want to focus on Linux or WinCE development, a JTAG interface has no significance because most development boards already have a complete BSP which includes commonly needed serial ports, network port and USB port. When a board runs with Linux or WinCE installed, users can fully utilize more convenient functions and utilities provided by the operating system to debug. They do not need a JTAG. Even if you can trace your programs it will be extremely tough to step debug because it will go into the operating system. A JTAG interface might only be usable for users who do not need to run a complicated operating system or just need a simple operating system (such as uCos2). Most development boards which already have a Bootloader or BIOS are completely functional and do not need to be debugged.



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GPIO

GPIO is the abbreviated form of General Purpose Input Output. The mini2440 has a 34 Pin 2.0mm GPIO interface, i.e. CON4. In fact, CON4 has not only quite a few GPIO pins but also some CPU pins such as AD0-AIN3, CLKOUT and so on. The SPI interface, I2C interface, GPB0 interface and GPB1 in the schematic are all GPIO, but they are marked as special function interfaces. They can be configured for other purposes too by setting related CPU registers.

CON4	Name	Notes	CON4	Name	Notes
1	VDD5V	5V Power (Input or Output)	2	VDD33V	3.3V Power (Output)
3	GND	GND	4	nRESET	Reset (Output)
5	AIN0	AD Input Channel 0	6	AIN1	AD Input Channel 1
7	AIN2	AD Input Channel 2	8	AIN3	AD Input Channel 3
9	EINT0	EINT0/GPF0	10	EINT1	EINT1/GPF1
11	EINT2	EINT2/GPF2	12	EINT3	EINT3/GPF3
13	EINT4	EINT4/GPF4	14	EINT5	EINT5/GPF5
15	EINT6	EINT6/GPF6	16	EINT8	EINT8/GPG0
17	EINT9	EINT9/GPG1	18	EINT11	EINT11/GPG3/nSS1
19	EINT13	EINT13/GPG5/SPIMISO1	20	EINT14	EINT14/GPG6/SPIMOSI1
21	EINT15	EINT15/GPG7/SPICLK1	22	EINT17	EINT17/GPG9/nRST1
23	EINT18	EINT18/GPG10/nCTS1	24	EINT19	EINT19/GPG11
25	SPIMISO	SPIMISO/GPE11	26	SPIMOSI	SPIMOSI/EINT14/GPG6
27	SPICLK	SPICLK/GPE13	28	nSS_SPI	nSS_SPI/EINT10/GPG2
29	I2CSCL	I2CSCL/GPE14	30	I2CSDA	I2CSDA/GPE15

31	GPB0	TOUT0/GPB0	32	GPB1	TOUT1/GPB1
33	CLKOUT0	CLKOUT0/GPH9	34	CLKOUT1	CLKOUT1/GPH10

CMOS Camera Interface

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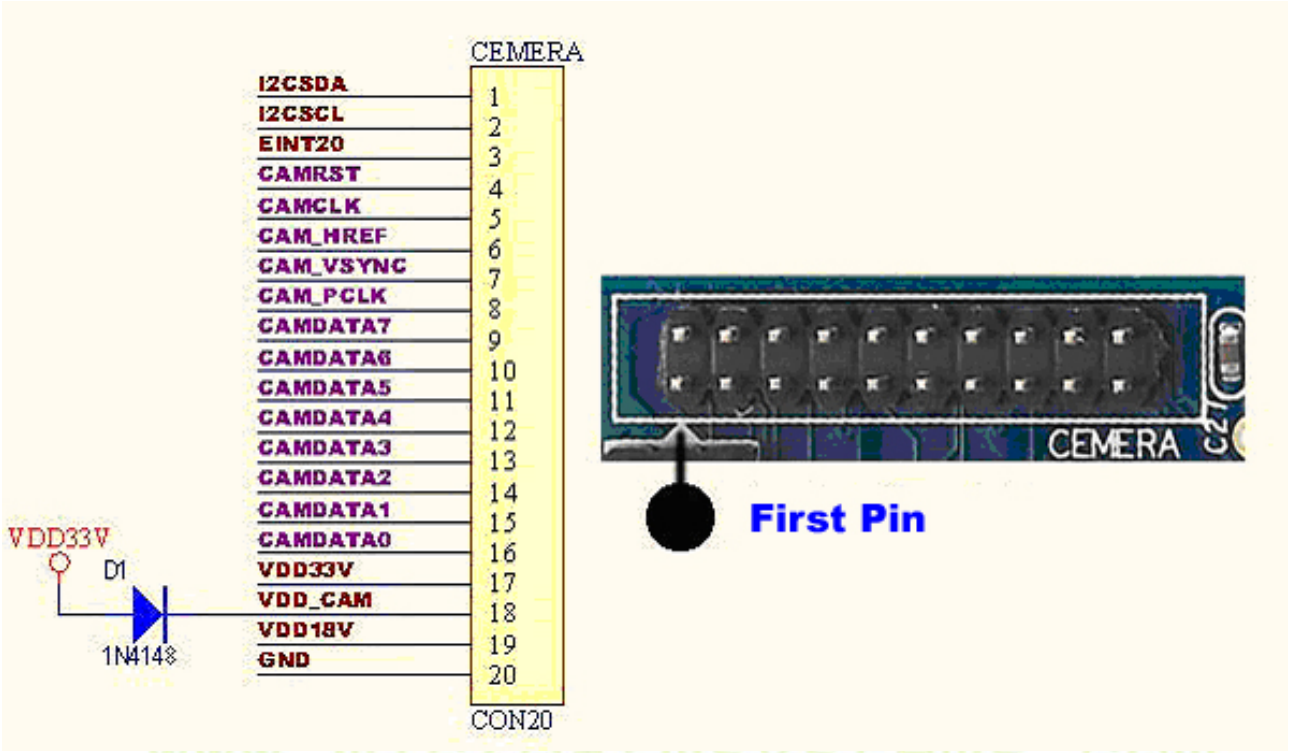
The S3C2440 has a CMOS camera interface. It is marked as CAMERA on the schematic. It is a 20 pin 2.0mm connector, users can directly use the CAM130 module we provide. The CAM130 module does not have any circuits. It is basically just a converter and directly connects to a ZT130G2 camera module.

Notes: the camera interface is a multiplexed port. It can be used as GPIO by setting corresponding registers. The schematic below presents its pin details.



CAMERA	Name	Multiplex	CAMERA	Name	Multiplex
1	I2CSDA	GPE15	2	I2CSCL	GPE14
3	EINT20	GPG12	4	CAMRST	GPJ12
5	CAMCLK	GPJ11	6	CAM_HREF	GPJ10
7	CAM_VSYNC	GPJ9	8	CAM_PCLK	GPJ8
9	CAMDATA7	GPJ7	10	CAMDATA6	GPJ6
11	CAMDATA5	GPJ5	12	CAMDATA4	GPJ4
13	CAMDATA3	GPJ3	14	CAMDATA2	GPJ2
15	CAMDATA1	GPJ1	16	CAMDATA0	GPJ0
17	VDD33V	3.3V Power	18	VDD_CAM	VDD_CAM

19	VDD18V	1.8V Power	20	GND	GND

System Bus

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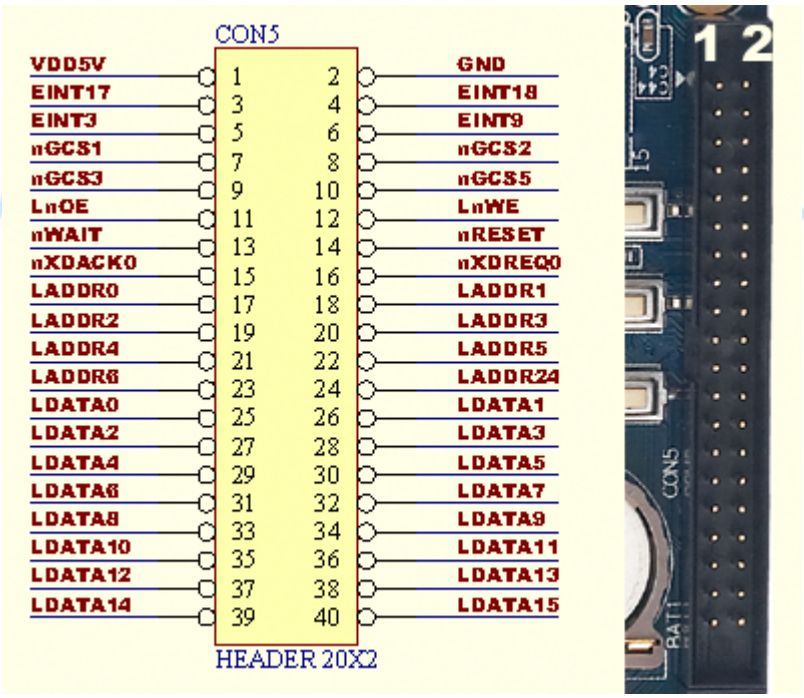
The system bus is CON5. It contains 16 data lines (D0-D15), 8 address lines (A0-A6, A24), and some control signal lines (such as chip select, read/write, reset and so on). CON5 can provide 5V output. In fact very few users would extend interfaces through system bus. Below is the detailed information about CON5's pins.



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CON5	Name	Notes	CON5	Name	Notes
1	VDD5V	5V Power (Input or Output)	2	GND	Ground
3	EINT17	Interrupt 17 (Input)	4	EINT18	Interrupt 18 (Input)
5	EINT3	Interrupt 3 (Input)	6	EINT9	Interrupt 9 (Input)
7	nGCS1	Chip Select 1 Physical Address: 0x08000000	8	nGCS2	Chip Select 2 Physical Address: 0x10000000
9	nGCS3	Chip Select 3 Physical Address: 0x18000000	10	nGCS5	Chip Select 5 Physical Address: 0x28000000
11	LnOE	Read Enable Signal	12	LnWE	Write Enable Signal
13	nWAIT	Wait Signal	14	nRESET	Reset Signal
15	nXDACK0	nXDACK0	16	nXDREQ0	nXDREQ0
17	LADDR0	Address 0	18	LADDR1	Address 1
19	LADDR2	Address 2	20	LADDR3	Address 3
21	LADDR4	Address 4	22	LADDR5	Address 5
23	LADDR6	Address 6	24	LADDR24	Address 24
25	LDATA0	Data Line 0	26	DATA1	Data Line 1
27	LDATA2	Data Line 2	28	DATA3	Date Line 3
29	LDATA4	Data Line 4	30	DATA5	Data Line 5
31	LDATA6	Data Line 6	32	DATA7	Data Line 7
33	LDATA8	Data Line 8	34	DATA9	Data Line 9
35	LDATA10	Data Line 10	36	DATA11	Data Line 11
37	LDATA12	Data Line 12	38	DATA13	Data Line 13
39	LDATA14	Data Line 14	40	DATA15	Data Line 15

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