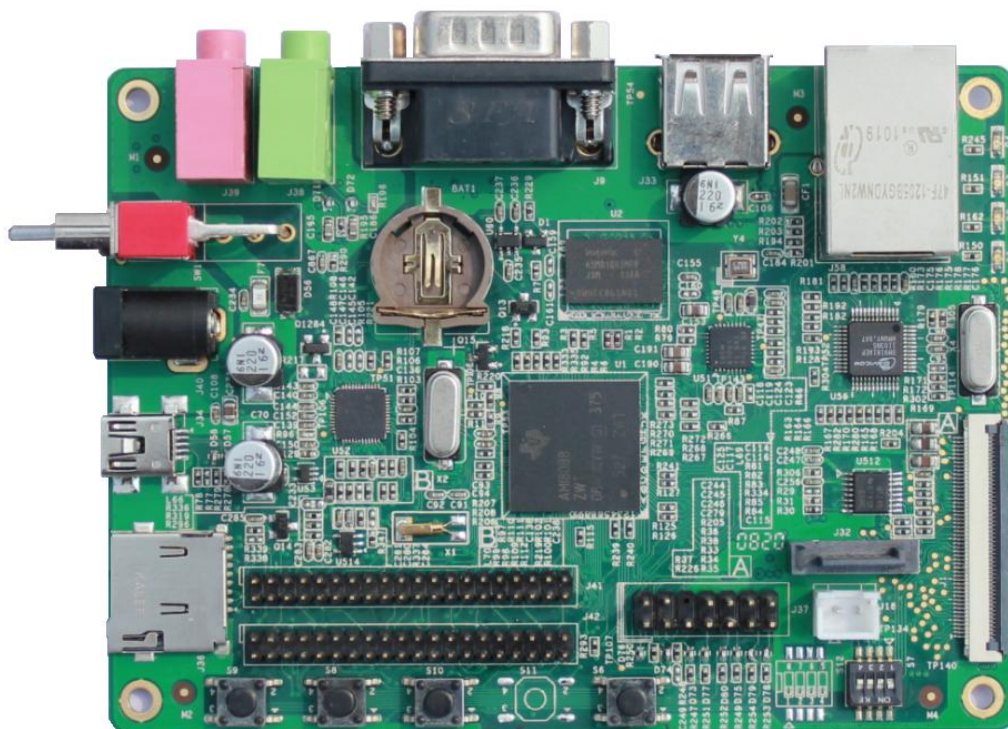


SBC8018 Evaluation Board

Integrated with SATA, TF, OTG, Audio in/out, USB, Ethernet, LCD, CCD/COMS, Serial, JTAG
interface based on 32-bit microprocessor



User Manual

Version update records:

Rev	Date	Description
1.0	2011.10.21	Initial version

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Chapter 1 Overview

1.1 Product Introduction

The SBC8018 evaluation board is a compact, low-cost with high-performance evaluation board based on Texas instruments (TI) AM1808 microprocessor. AM1808 is an integration of 375 MHz ARM9 low-power application processor with 128K-Byte On-the chip memory, and provided lots of peripheral interface. SBC8018 board expands the hardware capabilities including LAN port, audio input/output interface, USB OTG, USB HOST, SATA interface, TF slot, serial port, JTAG interface, camera interface, TFT LCD interface, touch screen interface and keyboard interface.

SBC8018 board can be used for the following applications:

- Intelligent instrument
- Service point
- Educational plant
- Portable data terminal
- Placeholder intelligent sensor
- A formal data terminal
- Industrial Control
- Home Automation

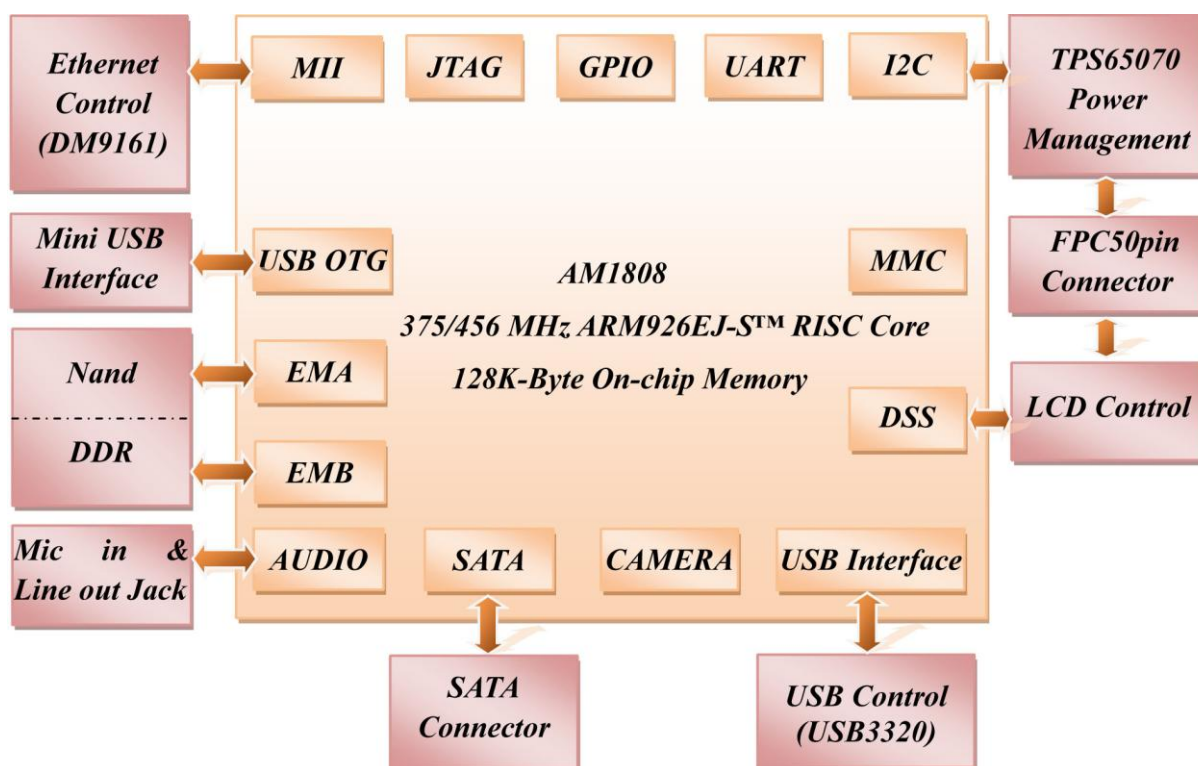


Figure 1-1 SBC8018 Evaluation Board Functional Block Diagram

1.2 Features

SBC8018 evaluation board is based on AM1808 processor and is one compact board which integrates all functions and features of TI's AM1808 ARM9 processor. Some of the board features are mentioned below:

Mechanical Parameters

- Working temperature: 0°C ~ 70°C
- Humidity Range: 20% ~ 90%, non-condensable
- Dimensions: 112.24mm x 82.29mm
- Power Consumption: [5V@0.22A](#) (working without LCD)
- Power Input: +5V/2A

Processor

- 375-MHz ARM926EJ-S™ RISC Core
- ARM926EJ-S Core

Memory

- 128MB NAND Flash

- 128MB Mobile DDR

Audio/Video Interfaces

- An audio Microphone input interface (3.5mm audio jack, red)
- A two-channel audio line output interface (3.5mm audio jack, green)
- A TFT-LCD interface (24 bit color, 1.8 V logic, with touch screen)

Data Transfer Interface

- Serial port:
 - UART1, 3 line serial port, TTL based voltage
 - UART2, 3 line serial port, TTL based voltage
 - UART3, 5 line serial port, RS232 based voltage
- 1 x USB 2.0 OTG interface (OTG connector)
- 1 x USB1.1 Interface (Type A)
- 10/100Mbps Ethernet Interface (RJ45 jack)
- 1 channel TF card slot
- 1 channel SATA interface (supports both SATA I (1.5 Gbps) and SATA II (3.0 Gbps))
- 1 channel 14-pin JTAG interface
- Multi-functional expand interface(IIC, SPI, MCBSP, UART, 1.8V, 3.3V, 5V, GPIO, EMA)

Input Interface

- 2 x Camera interfaces (8 bit, 1.8 V logic)
- 4 buttons (RESET, BACK, HOME, MENU)

LED

- 1 Power LED
- 3 User LEDs

Chapter 2 Hardware System

2.1 CPU

2.1.1 CPU Introduction

The AM1808 microprocessor contains an ARM RISC CPU for general-purpose processing and systems control. The AM1808 ARM microprocessor consists of the following primary components:

- ARM926EJ-S RISC processor core and associated memories
- A set of I/O peripherals
- A powerful DMA subsystem and SDRAM EMIF interface

2.1.2 CPU Features

Clock

The OSCIN/ OSCOUT system input clock (24 MHz) is used to generate the main source clock for the device. It also provides the DPLLs to several CPU other modules.

Reset

The function of reset is determined by the input signal on RESETN pin of the CPU, Reset is enabled when LOW level signal (high to low) is given.

ARM Subsystem

The ARM Subsystem includes the following features:

- ARM926EJ-S RISC processor
- ARMv5TEJ (32/16-bit) instruction set
- Little endian
- System Control Co-Processor 15 (CP15)
- MMU
- 16KB Instruction cache
- 16KB Data cache
- Write Buffer
- Embedded Trace Module and Embedded Trace Buffer (ETM/ETB)
- ARM Interrupt controller

ARM926EJ-S RISC CPU

The ARM Subsystem integrates the ARM926EJ-S processor. The ARM926EJ-S processor is a member of ARM9 family of general-purpose microprocessors. This processor is targeted at multi-tasking applications where full memory management, high performance, low die size, and low power are all important. The ARM926EJ-S processor supports the 32-bit ARM and 16 bit THUMB instruction sets, enabling the user to trade off between high performance and high code density. Specifically, the ARM926EJ-S processor supports the ARMv5TEJ instruction set, which includes features for efficient execution of Java byte codes, providing Java performance similar to Just in Time (JIT) Java interpreter, but without associated code overhead.

The ARM926EJ-S processor supports the ARM debug architecture and includes logic to assist in both hardware and software debug. The ARM926EJ-S processor has a Harvard architecture and provides a complete high performance subsystem, including:

- ARM926EJ -S integer core
- CP15 system control coprocessor
- Memory Management Unit (MMU)
- Separate instruction and data caches
- Write buffer
- Separate instruction and data (internal RAM) interfaces
- Separate instruction and data AHB bus interfaces
- Embedded Trace Module and Embedded Trace Buffer (ETM/ETB)

ARM Internal Memory

- 8 KB RAM
- 64 KB built-in ROM
- Embedded Trace Module and Embedded Trace Buffer (ETM/ETB)

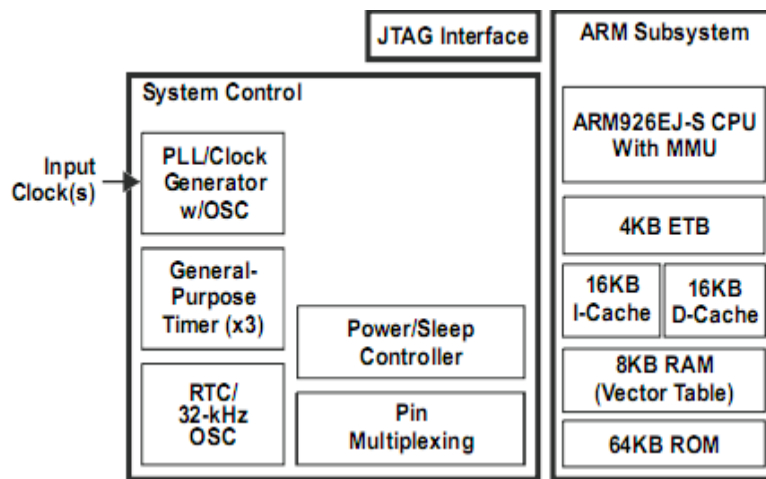


Figure 2-1 ARM Subsystem

2.2 Introduction to the Expanded Chip:

2.2.1 TPS65070

The TPS6507x are single chip Power Management IC, the charger can either be supplied by a USB port on pin USB or by a DC voltage from a wall adapter connected to pin. Three highly efficient 2.25MHz step-down converters are targeted at providing the core voltage, memory and I/O voltage in a processor based system. The step-down converters allow the use of small inductors and capacitors to achieve a small solution size.

The TPS6507x also integrate two general purpose LDOs for an output current of 200mA. These LDOs can be used to power a TF-card interface and an always-on rail, but can be used for other purposes as well. Each LDO operates with an input voltage range between 1.8V and 6.3V allowing them to be supplied from one of the step-down converters or directly from the main battery.

2.2.2 K9F1G08U0B

The K9F1G08U0B is the 128MB NAND flash memory chips used in SBC8018 evaluation board. This NAND Flash chip is directly interfaced to the CPU for faster memory access and read/write cycles.

2.2.3 H5MS1G62MFP

The H5MS1G62MFP-K3M is the 128MB DDR memory chip used in SBC8018 evaluation board, This DDR RAM is connected directly the CPU DDR/SDRAM interface for faster memory access.

2.2.4 DM9161

The DM9161 is a fully integrated and cost-effective low pin count single chip Fast Ethernet controller with a general processor interface, a 10/100M PHY and 4K DWORD SRAM. It is designed with low power and high performance process that support 3.3V with 5V I/O tolerance. SBC8018 uses 10/100M adaptive network interface of DM9161, in which, the 10/100M Ethernet module is compatible to IEEE 802.3 standard protocol. The cable interface used is a standard RJ45 cable, with a connection indicator and a transmission indicator.

2.2.5 TLV320AIC33IRGZR

The TLV320AIC33IRGZR is a low-power stereo audio codec with stereo headphone amplifier, as well as ten audio inputs and seven audio outputs programmable in single-ended or fully differential configurations. Extensive register enabling the stereo 48 kHz DAC playback as low as 15 mw from a 3.3V analog supply, making it ideal for portable battery-powered audio and telephony applications.

The playback path includes mix/mux capability from the stereo DAC and selected inputs, through programmable volume controls, to the various outputs. TLV320AIC33IRGZR has Ten Audio Input Pins and Seven Audio Output Drivers.

2.2.6 MAX3232

The function of MAX3232 is mainly to convert TTL logic level signal to RS232 logic level, which helps the board at TTL logic to interface with PC working at RS232 logic level. The SBC8018 evaluation board uses UART2 as debugger serial port; the default voltage for this UART2 is 1.8V,

it is necessary to convert this voltage from 1.8V to 3.3V in order to connect the board to the external world.

2.3 Hardware Interface

The following section provides you the detailed information on the peripherals, with the pin description, and its functionality available on SBC8018 evaluation board.

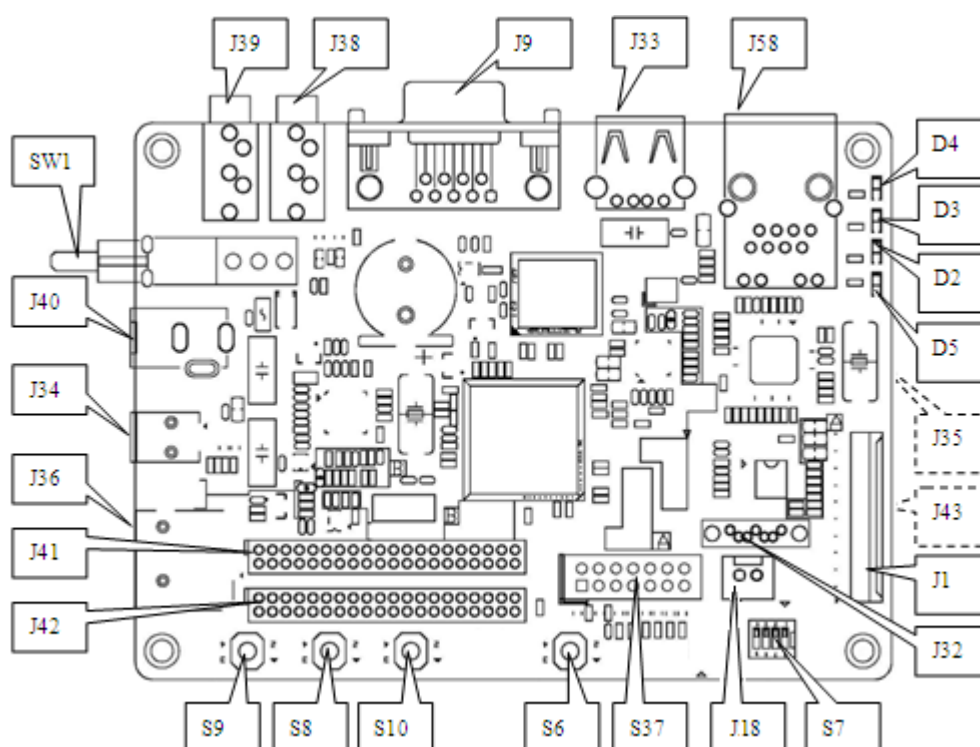


Figure 2-2 Hardware Interface chart

2.3.1 Power Input Jack

Table 2-1 power input interface

J40		
Pin	Signal	Function
1	GND	GND
2	NC	NC
3	+5V	Power supply (+5V) 2A (Type)

2.3.2 Power Output Interface

Table 2-2 power output interface

J18		
Pin	Signal	Function
1	+5V	5V output
2	GND	GND

2.3.3 Power Switch

Table 2-3 power switch

SW1		
Pin	Signal	Function
1	DC IN	VDD Input
2	+5VDC_IN	+5V
3	NC	NC

2.3.4 TFT_LCD Interface

Table 2-4 TFT_LCD interface

J1		
Pin	Signal	Function
1	B_NU0	Test Point
2	B_NU1	Test Point
3	B_NU2	Test Point
4	LCD_D0	LCD data bit0
5	LCD_D1	LCD data bit1
6	LCD_D2	LCD data bit2
7	LCD_D3	LCD data bit3
8	LCD_D4	LCD data bit4
9	GND	GND

10	G_NU0	Test Point
11	G_NU1	Test Point
12	LCD_D5	LCD data bit5
13	LCD_D6	LCD data bit6
14	LCD_D7	LCD data bit7
15	LCD_D8	LCD data bit8
16	LCD_D9	LCD data bit9
17	LCD_D10	LCD data bit10
18	GND	GND
19	R_NU0	Test Point
20	R_NU1	Test Point
21	R_NU2	Test Point
22	LCD_D11	LCD data bit11
23	LCD_D12	LCD data bit12
24	LCD_D13	LCD data bit13
25	LCD_D14	LCD data bit14
26	LCD_D15	LCD data bit15
27	GND	GND
28	R_LCD_DEN	LCD AC bias enable chip select
29	R_LCD_HSYNC	LCD vertical sync
30	R_LCD_VSYNC	LCD horizontal sync
31	GND	GND
32	R_LCD_DCLK	LCD Pixel Clock
33	GND	GND
34	TOUCH_X1	Input 1 to the x-plate for the touch screen
35	TOUCH_X2	Input 2 to the x-plate for the touch screen
36	TOUCH_Y1	Input 1 to the y-plate for the touch screen
37	TOUCH_Y2	Input 2 to the y-plate for the touch screen
38	R_LCD_SPICLK	SPI clock
39	R_LCD_MOSI	Slave data in, master data out

40	R_LCD_MISO	Slave data out, master data in
41	R_LCD_SPICS	SPI enable
42	IIC_CLK	IIC master serial clock, NC
43	IIC_DAT	IIC serial bidirectional data, NC
44	GND	GND
45	+1P8V_LDO	+1.8V
46	+3P3V	+3.3V
47	+5VDC_IN	+5V
48	+5VDC_IN	+5V
49	RESET	+1.8V
50	R_LCD_PWREN	Power on enable

2.3.5 AUDIO OUTPUT Jack

Table 2-5 Audio out interface

J38		
Pin	Signal	Function
1	GND	GND
2	LINE_OUT_LP	Left output
3	LINE_OUT_RP	Right output
4	LINE_OUT_RP	Right output
5	LINE_OUT_LP	Left output

2.3.6 Camera Interface

Table 2-6 camera interface

J35,J43		
Pin	Signal	Function
1	GND	GND
2	D0	Test Point
3	D1	Test Point
4	R_CAM_D0	VPIF capture data bit 0
5	R_CAM_D1	VPIF capture data bit 1
6	R_CAM_D2	VPIF capture data bit 2
7	R_CAM_D3	VPIF capture data bit 3
8	R_CAM_D4	VPIF capture data bit 4
9	R_CAM_D5	VPIF capture data bit 5
10	R_CAM_D6	VPIF capture data bit 6
11	R_CAM_D7	VPIF capture data bit 7
12	D10	Test Point
13	D11	Test Point
14	GND	GND
15	PCLK	Pixel clock
16	GND	GND
17	CAM_HS_A0	Horizontal synchronization
18	+5VDC_IN	5V
19	CAM_VS_A0	Vertical synchronization
20	+3P3V	3.3V
21	CAM_XCLKA_A0	Test Point
22	CAM_XCLKB_A0	Test Point
23	GND	GND
24	CAM_FLD_A0	Test Point
25	uP_CAM_WEN0	Test Point
26	uP_CAM_STR	Test Point

27	CAM_SDA	I2C0 serial data
28	CAM_SCL	I2C0 serial clock
29	GND	GND
30	+1P8V_LDO	1.8V

2.3.7 MIC IN Jack

Table 2-7 MIC IN interface

J39		
Pin	Signal	Function
1	GND	GND
2	LINE_IN_LP	Left input
3	LINE_IN_RP	Right input
4	LINE_IN_RP	Right input
5	LINE_IN_LP	Left input

2.3.8 Serial Ports

Table 2-8 serial port

J9		
Pin	Signal	Function
1	NC	NC
2	RSA_RXD	Receive data
3	RSA_TXD	Transit data
4	NC	NC
5	GND	GND
6	NC	NC
7	RSA_RTS	Request To Send
8	RSA_CTS	Clear To Send
9	NC	NC
10	GND	GND
11	GND	GND

2.3.9 LAN Interface

Table 2-9 LAN interface

J58		
Pin	Signal	Function
1	LAN_TX+	TX+ output
2	LAN_TX-	TX- output
3	CT	Link to analog transmit power input with 0R resistance
4	4&5	Transformer
5	7&8	Transformer
6	CT	Link to analog transmit power input with 0R resistance
7	LAN_RX+	RX+ input
8	LAN_RX-	RX- input
9	YEL	Link LED
10	VDD	3.3V Power for LED
11	GRN	Speed LED
12	VDD	3.3V Power for LED
13	CHGND	GND
14	CHGND	GND
15	NC	NC
16	NC	NC

2.3.10 SATA Interface

Table 2-10 SATA interface

J32		
Pin	Signal	Function
1	GND	GND
2	SATA_TXP	SATA receive data(positive)

3	SATA_TXN	SATA receive data(negative)
4	GND	GND
5	SATA_RXN	SATA transmit data(negative)
6	SATA_RXP	SATA transmit data(positive)
7	GND	GND
8	NC	NC
9	GND	GND

2.3.11 USB OTG Interface

Table 2-11 USB OTG interface

J34		
Pin	Signal	Function
1	USB0_VBUS	+5V
2	USB0_D-	USB Data-
3	USB0_D+	USB Data+
4	ID	USB ID
5	GND	GND
6	G2	GND
7	G3	GND
8	G4	GND
9	G5	GND
10	G6	GND
11	NC	NC
12	NC	NC

2.3.12 USB HOST Interface

Table 2-12 USB HOST interface

J33		
Pin	Signal	Function
1	USB1_VBUS	+5V
2	USB1_D-	USB Data-
3	USB1_D+	USB Data+
4	GND	GND
5	CHGND	GND
6	CHGND	GND

2.3.13 TF Card Interface

Table 2-13 TF interface

J36		
Pin	Signal	Function
1	DAT2	Card data 2
2	DAT3	Card data 3
3	CMD	Command Signal
4	VDD	VDD
5	CLK	Clock
6	VSS	GND
7	DAT0	Card data 0
8	DAT1	Card data 1
9	CD	Card detect
10	PGND	GND
11	PGND	GND
12	PGND	GND
13	PGND	GND
14	NC	NC
15	NC	NC

2.3.14 JTAG Interface

Table 2-14 JTAG interface

J37		
Pin	Signal	Function
1	TMS	Test mode select
2	NTRST	Test system reset
3	TDI	Test data input
4	GND	GND
5	VIO	1.8V
6	NC	NC
7	TDO	Test data output
8	GND	GND
9	RTCK	Receive test clock
10	GND	GND
11	TCK	Test clock
12	GND	GND
13	EMU0	Test emulation 0
14	EMU1	Test emulation 1

2.3.15 Expansion Interface

Table 2-15 expansion interface

J41		
Pin	Signal	Function
1	GND	GND
2	GND	GND
3	EMA_A_16_EXP	GPIO
4	EMA_D_15_EXP	GPIO
5	EMA_A_15_EXP	GPIO

6	EMA_D_14_EXP	GPIO
7	EMA_A_14_EXP	GPIO
8	EMA_D_13_EXP	GPIO
9	EMA_A_13_EXP	GPIO
10	EMA_D_12_EXP	GPIO
11	EMA_A_0_EXP	GPIO
12	EMA_D_11_EXP	GPIO
13	EMA_BA_1_EXP	GPIO
14	EMA_D_10_EXP	GPIO
15	EPWMN1_TZ0	GPIO
16	EMA_D_9_EXP	GPIO
17	ECAP2_APWM2	GPIO
18	EMA_D_8_EXP	GPIO
19	AIC_WCLK	GPIO
20	EMA_CLK_EXP	GPIO
21	AFSR	GPIO
22	EMA_SDCKE_EXP	GPIO
23	AIC_MCLK	GPIO
24	EMA_CSn_5_EXP	GPIO
25	GND	GND
26	EMA_CSn_4_EXP	GPIO
27	AIC_BCLK	GPIO
28	EMA_CSn_2_EXP	GPIO
29	ACLKR	GPIO
30	EMA_CSn_0_EXP	GPIO
31	GND	GND
32	EMA_WAIT_1_EXP	GPIO
33	GND	GND
34	GND	GND
35	+5VDC_IN	+5V
36	GND	GND

37	+3P3V	3.3V
38	+1P8V_LDO	1.8V
39	GND	GND
40	GND	GND

Table 2-16 expansion interface

J42		
Pin	Signal	Function
1	GND	GND
2	GND	GND
3	uP_SPI1_CLK	SPI1 clock
4	uP_McBSP1_CLKR_EXP	McBSP1 receive clock
5	uP_SPI1_SOMI	SPI1 data slave-out-master-in
6	uP_McBSP1_CLKX_EXP	McBSP1 transmit clock
7	uP_SPI1_SIMO	SPI1 data slave-in-master-out
8	uP_McBSP0_CLKS_EXP	McBSP1 sample rate generator clock input
9	uP_SPI1_SCSn0	SPI1 chip selects
10	AIC_DOUT	McBSP1 receive frame sync
11	uP_SPI1_ENAN	SPI1 enable
12	AIC_DIN	McBSP1 transmit frame sync
13	GND	GND
14	uP_McBSP0_DR_EXP	McBSP1 receive data
15	UART1_RXD	UART1 receive data
16	uP_McBSP0_DX_EXP	McBSP1 transmit data
17	UART1_TXD	UART1 transmit data
18	GND	GND
19	UART1_RTSn	UART1 ready-to-send output
20	UART2_RXD	UART2 receive data
21	AIC_MCL	UART1 clear-to-send input
22	UART2_TXD	UART2 transmit data
23	GND	GND

24	I2C0_SCL	I2C0 serial clock
25	GND	GND
26	I2C0_SDA	I2C0 serial data
27	GND	GND
28	GND	GND
29	GND	GND
30	uP_SPI0_CLK	SPI0 clock
31	GND	GND
32	uP_SPI0_SOMI	SPI0 data slave-out-master-in
33	GND	GND
34	uP_SPI0_SIMO	SPI0 data slave-in-master-out
35	GND	GND
36	uP_SPI0_SCSn0	SPI0 chip selects
37	+5VDC_IN	+5V
38	uP_SPI0_ENAN	1.8V
39	+3P3V	+3.3V
40	+1P8V_LDO	+1.8V

2.3.16 DIP Switch

Table 2-17 DIP Switch

S7		
Pin		Function
1	PWR_BOOT	Link to PWR_BOOT with 1K resistor
2	GND	Link to GND with 1K resistor
3	GND	Link to GND with 1K resistor
4	PWR_BOOT	Link to PWR_BOOT with 1K resistor
5	LCD_D12	LCD data bit 12
6	LCD_D11	LCD data bit 11
7	LCD_D10	LCD data bit 10
8	LCD_D9	LCD data bit 9

2.3.17 KEY Switch

Table 2-18 KEY Switch

Key		
Pin		Function
S6	uP_RESETh	Device reset input
S8	USER_BACK	GPIO
S9	USER_MENU	GPIO
S10	USER_HOME	GPIO

2.3.18 LEDs

Table 2-19 LED

LED		
Pin	Signal	Function
D2	User_LED_1	User Definitude
D3	User_LED_2	User Definitude
D4	User_LED_3	User Definitude
D5	+3P3V	3.3V power indicator

Chapter 3 Linux Operating System

3.1 Introduction

This section is intended to provide detailed instruction on Operating System Software development for SBC8018 evaluation board:

- 1) Describes the software resources provided by SBC8018.
- 2) Describes the software feature.
- 3) Explains the software development including how to set up the development environment, the building guidance of the boot loader, kernel and file system, and the development of device driver.
- 4) Provides flashing methods with U-BOOT prompts.
- 5) Shows the usage of SBC8018
- 6) Shows the application development.



In this part, it is suggested to:

- 1) Install Ubuntu Linux in advance, please refer to [Appendix II](#) for details;
- 2) Master relative embedded Linux development technology.

3.2 Software Resources

This chapter provides an overview of software system components of SBC8018. A basic software system consists of four parts: u-boot, kernel and rootfs. The Figure 3-2 shows the structure of the system:

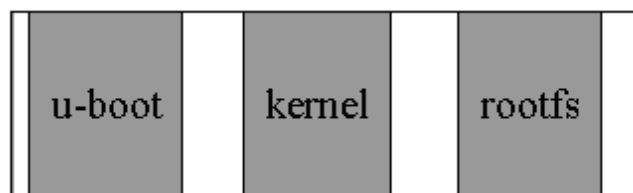


Figure 3-1

Features and functions of each part of the system are given below:

- 1) U-boot is a bootstrap program, it's used for interacting with users and updating images and loading the kernel;
- 2) The latest 2.6.x kernel is employed here and it can be customized to use on SBC8018 evaluation board.
- 3) Rootfs employs Open-source system "jffs2".

3.3 Board Support Package (BSP) Features

The SBC8018 Board Support Package (BSP) is used for customizing and generating the Linux operating system applicable to SBC8018 hardware platform. Users can conduct a secondary development on the basis of this BSP. The BSP in the CD provided with the SBC8018 evaluation kit contains as bellows:

Table 3-1 BSP Features

Item		Note
BIOS	u-boot	NAND
		MMC/SD
		FAT
		NET
Kernel	Linux-2.6.x	Supports ROM/CRAM/EXT2/EXT3/FAT/NFS/JFFS2 and various file systems
Device Driver Debug	serial	Series driver
	rtc	Hardware clock driver
	net	10/100M Ethernet card DM9000 driver
	flash	nand flash driver (supports nand boot)
	lcd	TFT LCD driver
	touch screen	Touch screen controller ads7846 driver
	tf	mmc/sd controller driver
	usb otg	usb otg 2.0 driver (can be configured as slave device currently)
	usb ehci	usb ehci driver

	audio	Audio driver
	camera	Camera driver (support CAM8000-A camera module)
	button	gpio button driver
	led	user led lamp driver
	sata	1.5-3.0G SATA driver

3.4 System Development

3.4.1 How to Setup Operating System Development Environment

Before executing software development on SBC8018, the user has to install Linux cross development environment on its computer. How to install a cross development environment will be explained below by taking Ubuntu operating system as an example.

3.4.1.1 Installation of Cross Compilation Tools

Installation of cross compilation tools is done by using the software CD provided along with this kit, to start the process insert the CD and allow it for auto run, Ubuntu will mount the disc under the directory /media/cdrom, the cross compilation tools are saved under the directory /media/cdrom/linux/tools.

```
mkdir $HOME/tools
cd /media/cdrom/linux/tools
tar -jxvf arm-2009q1-203-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2 -C
$HOME/tools
```

3.4.1.2 Installation of Other Tools

Some of the other development tools used for source code compilation are present in the directory linux/tools; the user can execute the following commands to copy them to the local folder:

```
cd /media/cdrom/linux/tools
cp mkimage $HOME/tools
cp mkfs.jffs2 $HOME/tools
```

3.4.1.3 Addition of environment variables

After all above tools are installed, it is necessary to use the following commands to add them in the temporary environment variables:

```
export PATH=$HOME/tools/arm-2009q1/bin:$HOME/tools:$PATH
```



.....
The user can write it in the .barsrc file under the user directory, such that
the addition of environment variables will be finished automatically when
the system is booted; command echo \$PATH can be used to check the
path.
.....

3.4.2 System Compilation

3.4.2.1 Preparation

Source codes for all the components of the system are available in the disc under the directory linux/source; users need to extract them to the Ubuntu system before starting the development:

```
mkdir $HOME/work
cd $HOME/work
tar xvf /media/cdrom/linux/source/uboot-03.20.00.14.tar.bz2
tar xvf /media/cdrom/linux/source/linux-03.20.00.14.tar.bz2
cp /media/cdrom/linux/source/ramdisk ./
mkdir rootfs
sudo mount -t ext2 -o loop ramdisk rootfs
```

After completing the above steps, the current directory will generate uboot-03.20.00.14, linux-03.20.00.14 and rootfs directories.

3.4.2.2 X-loader Image Generation

The SBC8018 evaluation board supports UART boot or NAND boot. The image files are different for the different boot modes, and the methods for mapping are also different.

1) To generate image file u-boot

```
cd uboot-03.20.00.14

make distclean

make da850evm_config

make
```

After completing the above steps, the current directory will generate the required u-boot file.



Copy current u-boot file to Windows system, the AISgen tool will launch on Windows.

2) To generate the u-boot-uart-ais.bin for UART start-up

- Put the new u-boot file to the folder [d:\sbc8018].
- Make sure you had installed "AISgen_d800k006_Install_v1.7.exe" under the folder [CD\linux\tools\].
- Click Windows XP -> Start -> All Programs -> Texas Instruments -> AISgen for D800K006 -> AISgen for D800K006 to open AISgen tool.
 - a) Launches the AISgen, click "File"-> "Load Configuration" to open AM1808-UART.cfg from the CD under the folder CD\linux\tools\.
 - b) Added the u-boot file under the folder [d:\sbc8018\] to the [ARM Application File:]
 - c) Sets the output file path [AIS Output File] as [d:\sbc8018\u-boot-uart-ais.bin].
 - d) Click [Generate AIS], "u-boot-uart-ais.bin" will be generated under the folder [d:\sbc8018].

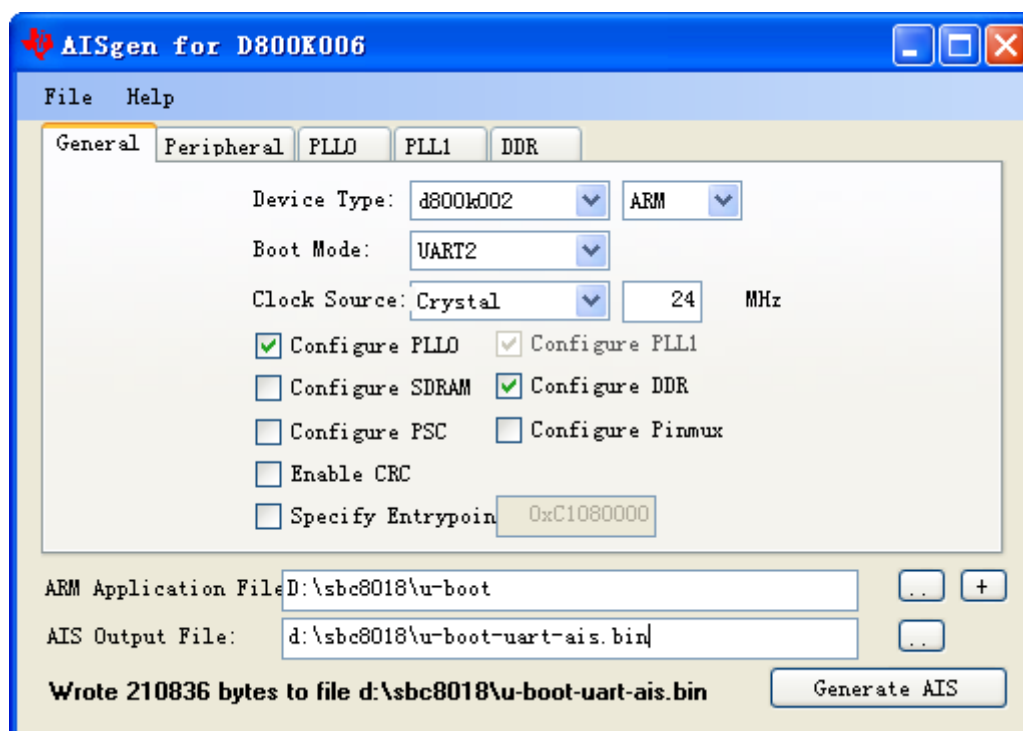


Figure 3-2 AISgen for D800K006

3) To generate u-boot-nand-ais.bin for NAND Flash boot up

- Launches the AISgen, click "File" -> "Load Configuration" to open AM1808-NAND.cfg under the folder CD\linux\tools\.
- Added the u-boot file under the folder [d:\sbc8018] to the [ARM Application File:]
- Sets the output file path [AIS Output File] as [d:\sbc8018\u-boot-nand-ais.bin].
- Click [Generate AIS], "u-boot-nand-ais.bin" will be generated under the folder [d:\sbc8018].

3.4.2.3 Kernel compilation

1) Choose the Display Device

Modify the lines as below according to the display screen size in the file:

[linux-03.20.00.14/arch/arm/mach-davinci/board-da850-evm.c]

For 4.3-inch LCD:

```
#define LCD_4_3INCH          1
#define LCD_7INCH           0
```

For 7-inch LCD:

```
#define LCD_4_3INCH          0
```

```
#define LCD_7INCH
```

```
1
```

2) Kernel compilation

```
cd linux-03.20.00.14
make distclean
make sbc8018_defconfig
make ulmage
```

After completing the above steps, the required ulmage file will be generated under the directory arch/arm/boot.

3.4.2.4 Generation of File System

```
cd $HOME/work
sudo $HOME/tools/mkfs.jffs2 -r rootfs -o jffs2.img
```

After completing the above steps, the current directory will generate the the required “jffs2.img” file.

3.4.3 System Customization

As Linux kernel has many configuration options, the user can increase or reduce the kernel features by using available default kernel configurations according to their best requirements. The general process of system customization is described with examples below;

3.4.3.1 Modification of Kernel Configuration

The source code for factory default kernel configuration is provided in the below directory:

[linux-03.20.00.14/arch/arm/configs/sbc8018_defconfig]

User can carry out system customization on this basis:

```
cd linux-03.20.00.14
cp arch/arm/configs/sbc8018_defconfig .config
make menuconfig
```



If an error occurs in the system when make menuconfig is input, it is necessary to install ncurses in the Ubuntu system; ncurses library is a character graphic library, used for make menuconfig of kernel; the specific installation instruction is:

```
sudo apt-get install ncurses-dev
```

How do perform the system customization is described below using USB gadget and USB mass storage device as an example:

1) Select Device driver

```

General setup --->
[*] Enable loadable module support --->
[*] Enable the block layer --->
System Type --->
Bus support --->
Kernel Features --->
Boot options --->
CPU Power Management --->
Floating point emulation --->
Userspace binary formats --->
Power management options --->
[*] Networking support --->
Device Drivers --->
File systems --->
Kernel hacking --->
Security options --->
-* Cryptographic API --->
Library routines --->
---
Load an Alternate Configuration File
Save an Alternate Configuration File

```

< Select > < Exit > < Help >

Figure 3-3

2) Select USB support

```
[ ] ISDN support --->
  Input device support --->
    Character devices --->
<*) I2C support --->
[*) SPI support --->
-*) GPIO Support --->
<> Dallas's 1-wire support --->
<> Power supply class support --->
<> Hardware Monitoring support --->
<> Generic Thermal sysfs driver --->
[ ] Watchdog Timer Support --->
  Sonics Silicon Backplane --->
  Multifunction device drivers --->
  Multimedia devices --->
  Graphics support --->
<*) Sound card support --->
[*) HID Devices --->
[*) USB support --->
<*) MMC/SD/SDIO card support --->
<> Sony MemoryStick card support (EXPERIMENTAL) --->
[ ] Accessibility support --->
[*) LED Support --->
<*) Real Time Clock --->
[ ] DMA Engine support --->
[ ] Voltage and Current Regulator Support --->
<> Userspace I/O drivers --->
  CBUS support --->
```

<Select> < Exit > < Help >

Figure 3-4

3) Select USB Gadget Support

```
<> EMI 6|2m USB Audio interface support
<> EMI 2|6 USB Audio interface support
<> ADU devices from Ontrak Control Systems
<> USB 7-Segment LED Display
<> USB Diamond Rio500 support
<> USB Lego Infrared Tower support
<> USB LCD driver support
<> USB BlackBerry recharge support
<> USB LED driver support
<> Cypress CY7C63xxx USB driver support
<> Cypress USB thermometer driver support
<> USB Phidgets drivers
<> Siemens ID USB Mouse Fingerprint sensor support
<> Elan PCMCIA CardBus Adapter USB Client
<> Apple Cinema Display support
<> USB 2.0 SVGA dongle support (Net2280/SiS315)
<> USB LD driver
<> PlayStation 2 Trance Vibrator driver support
<> IO Warrior driver support
<> USB testing driver
<> iSight firmware loading support
<> USB VST driver
<*) USB Gadget Support --->
  *** OTG and related infrastructure ***
<> GPIO based peripheral-only VBUS sensing 'transceiver'
<> Philips ISP1301 with OMAP OTG
<*) TWL4030 USB Transceiver Driver
```

<Select> < Exit > < Help >

Figure 3-5

4) The configuration of USB Gadget Support can be changed as showed in the following:

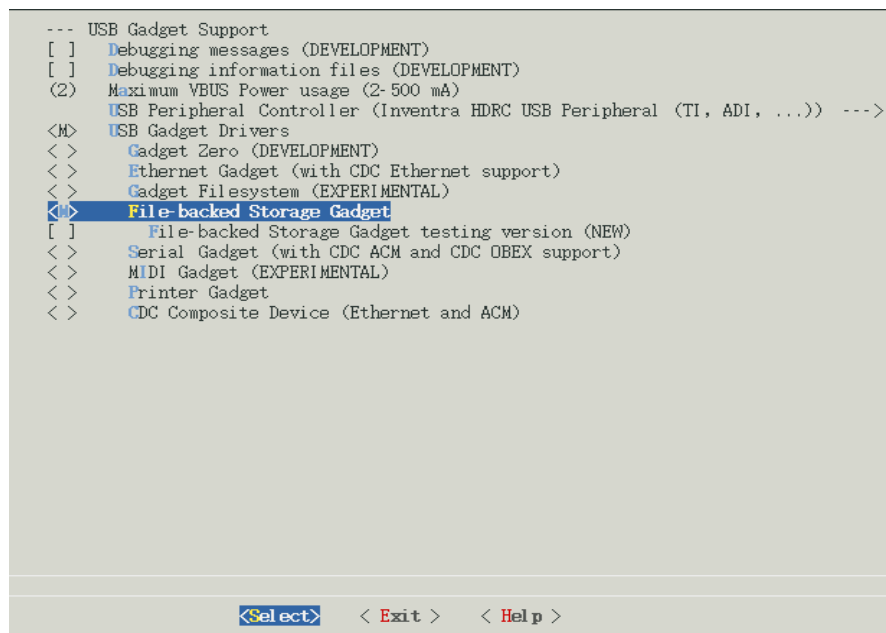


Figure 3-6

3.4.3.2 Compilation

Save the configuration made and execute the following commands to recompile the kernel:

```

make ulmage
make modules

```

After completing the above steps, a new kernel image ulmage and a module file g_file_storage.ko will be generated under the directory “arch/arm/boot” and “drivers/usb/gadget” respectively.

3.4.3.3 Test

To perform the test first you need to update the kernel image ulmage file, after that copy the g_file_storage.ko file to the TF card and reboot the system. Now execute the following commands to stimulate the TF card into USB mass storage device to use with PC:

```

root@sbc8018:~# cd /media/mmcblk0p1/
root@sbc8018:/media/mmcblk0p1# insmod g_file_storage.ko file=/dev/mmcblk0p1 stal
l=0 removable=1

g_file_storage gadget: File-backed Storage Gadget, version: 20 November 2008
g_file_storage gadget: Number of LUNs=1
g_file_storage gadget-lun0: ro=0, file: /dev/mmcblk0p1
musb_hirc musb_hirc: MUSB HIRC host driver

```

```

musb_hdrc musb_hdrc: new USB bus registered, assigned bus number 3
hub 3-0:1.0: USB hub found
hub 3-0:1.0: 1 port detected
musb_g_file_storage gadget disconnected.
root@sbc8018:/media/mmcblk0p1# g_file_storage gadget: high speed config #1

```

Use the USB cable (USB mini B to USB A) to connect the development board and PC, PC will prompt a message to indicate USB mass storage device is found; a new portable hard disk is found and now users is ready to use the disk.



.....

Please make sure that the kernel image has been updated, otherwise,
module g_file_storage.ko will fail to load and the similar tips will show:
insmod: cannot insert '/media/mmcblk0p1/g_file_storage.ko': Device or
resource busy

.....

3.5 How to Update the System Image

The SBC8018 evaluation board NAND Flash by default comes with the installed Linux + 4.3-inch screen display. It can be booted without connecting TF card once it's powered ON or RESET and input "root" to enter Linux system. Please make sure the DIP switch [S7] settings are as below:

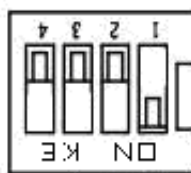


Figure 3-7 Boot-up from NAND Flash

3.5.1 Boot-up From Serial Port

- 1) First setup the hardware environment, make sure the DIP switch [S7] settings are as below:

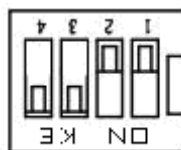


Figure 3-8 Boot-up from Serial port

- 2) Now open the AISgen_d800k006_Install_v1.7.exe:

Windows XP -> Start -> All Programs -> Texas Instruments -> AISgen for D800K006 -> UART Boot Host

Add u-boot-uart-ais.bin [Directory: CD\linux\image\] to the "AIS-File" as below:

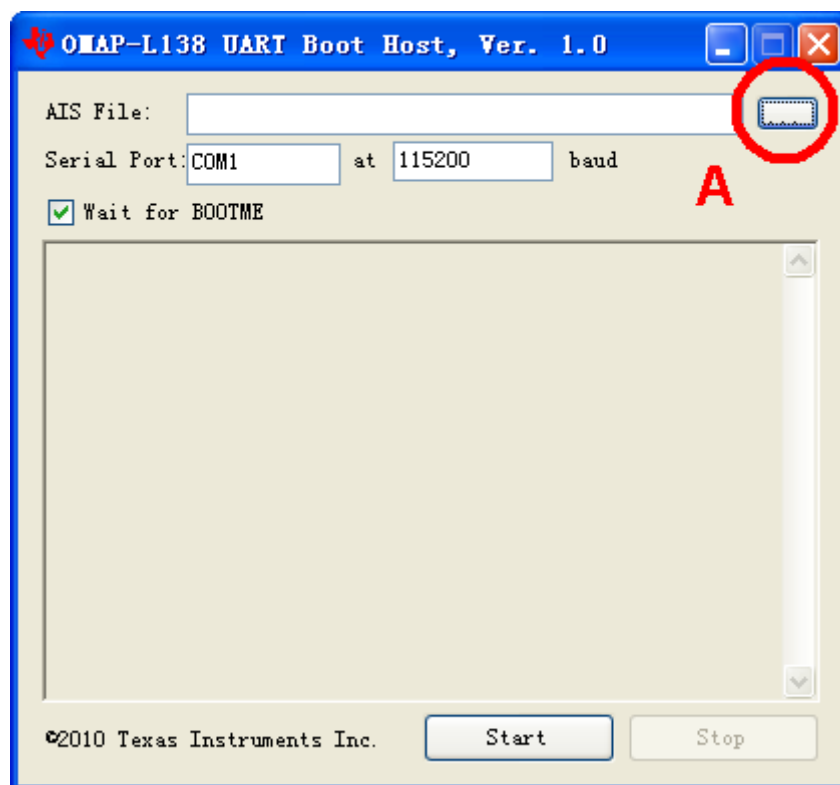


Figure 3-9

- 3) Click the "Start" and power ON the evaluation board to boot-up from serial port.
- 4) Wait for moment, the target window will display "(Serial Port): Closing COM1.", close the tool and open the Hyperterminal to catch the serial port information.



User should open Hyperterminal and Input any key to enter U-BOOT prompts in three seconds, or else U-BOOT will load default parameter.

3.5.2 How Update Images From Ethernet

The SBC8018 evaluation board image can be updated through Ethernet port as well, in thi section we will explain how to update the image using Ethernet port.

Below IP will be taken as an example;

PC: 192.192.192.154

Evaluation board: 192.192.192.215

1) PC TFTP service

- a) Launch the “tftpd32.exe” from the CD under the folder CD\linux\tools, and click “Browse” to set the sharing space, the directory will be giving an example as “d:\sbc8018”.

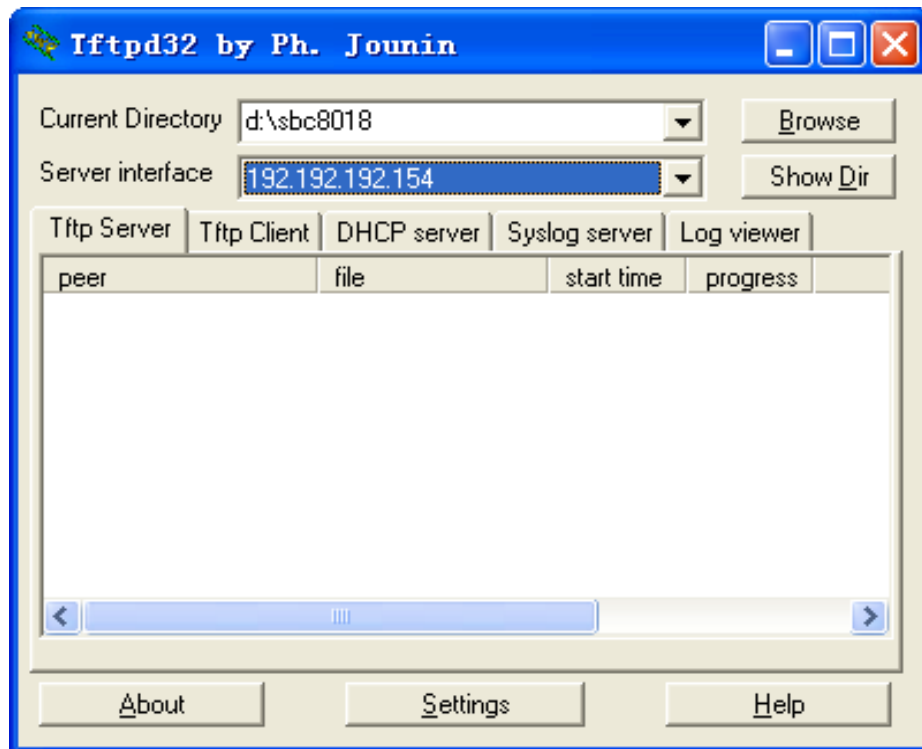


Figure 3-10 tftpd32 tool

- b) Copy “u-boot-nand-ais.bin”, “ulmage_4.3”, “ulmage_7”, “jffs2.img” from the CD under the folder [CD\linux\image\] to the folder [d:\sbc8018]
- c) According to your LCD size (4.3" or 7"), **rename** the ulmage_xx as ulmage.

2) U-BOOT prompts

Input the below commands with U-BOOT prompts as below:

- a) Set the environment with “ipaddr” and “serverip”:

```
U-Boot > setenv ipaddr 192.192.192.215
```

```
U-Boot > setenv serverip 192.192.192.154
```

- b) Erase the NAND Flash

```
U-Boot > nand erase
```

```
NAND erase: device 0 whole chip
```

```
Skipping bad block at 0x0ff80000
```

```
Skipping bad block at 0x0ffa0000
```

```
Skipping bad block at 0x0ffc0000
```

Skipping bad block at 0x0ffe0000

OK

c) Write U-BOOT

```
U-Boot > tftp 0xc0700000 u-boot-nand-ais.bin;nand write.i 0xc0700000 0x20000
${filesize}
```

Using device

TFTP from server 192.192.192.154; our IP address is 192.192.192.215

Filename 'u-boot-nand-ais.bin'.

Load address: 0xc0700000

Loading: #####

done

Bytes transferred = 210860 (337ac hex)

NAND write: device 0 offset 0x20000, size 0x337ac

210944 bytes written: OK

U-Boot > nandecc sw

SW ECC selected

d) Write kernel

```
U-Boot > tftp 0xc0700000 ulimage;nand write.i 0xc0700000 0x200000 ${filesize}
```

Using device

TFTP from server 192.192.192.154; our IP address is 192.192.192.215

Filename 'ulimage'.

Load address: 0xc0700000

Loading: #####

#####

done

Bytes transferred = 2299460 (231644 hex)

NAND write: device 0 offset 0x200000, size 0x231644

2299904 bytes written: OK

e) Write file system

U-Boot > **tftp 0xc2000000 jffs2.img;nand write.i 0xc2000000 0x600000 \${filesize}**

Using device

TFTP from server 192.192.192.154; our IP address is 192.192.192.215

Filename 'jffs2.img'.

Load address: 0xc2000000

Loading: #####

#####T

#####

#####

#####T #T

#####

#####

done

Bytes transferred = 3889116 (3b57dc hex)

NAND write: device 0 offset 0x600000, size 0x3b57dc

3889152 bytes written: OK

3) NAND Flash boot-up

For NAND flash boot up make sure the DIP switch [S7] settings are as below:

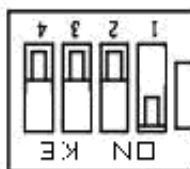


Figure 3-11 Boot-up from NAND Flash

3.6 Test Procedures

3.6.1 Various Tests Scenario

3.6.1.1 LED Testing

The SBC8018 evaluation board is having following LEDs:

D5 is power LED

D2 is heartbeat LED

D3 and D4 are user's LED

The following operation can be carried out using HyperTerminal:

1) Control D3

```
root@sbc8018:~# echo 0 > /sys/class/leds/led2/brightness
root@sbc8018:~# echo 1 > /sys/class/leds/led2/brightness
```

2) Control D4

```
root@sbc8018:~# echo 0 > /sys/class/leds/led3/brightness
root@sbc8018:~# echo 1 > /sys/class/leds/led3/brightness
```

3.6.1.2 Key Switch Testing

The SBC8018 evaluation board is having three users key switches S8, S9 and S10; users can perform the following testing:

First, enter the following command, and then press the S9, S8, S10 keys

```
root@sbc8018:~# hexdump /dev/input/event0
00000000 06f5 49e5 206f 0001 0001 0100 0000 0000
00000010 06f5 49e5 208d 0001 0000 0000 0000 0000
00000020 06f5 49e5 1c89 0003 0001 0100 0001 0000
00000030 06f5 49e5 1ca9 0003 0000 0000 0000 0000
00000040 07b5 49e5 d3fd 0008 0001 0101 0000 0000
00000050 07b5 49e5 d41d 0008 0000 0000 0000 0000
00000060 07b5 49e5 63d9 000b 0001 0101 0001 0000
00000070 07b5 49e5 63fc 000b 0000 0000 0000 0000
```

```
0000080 07b6 49e5 2569 000c 0001 0102 0000 0000
0000090 07b6 49e5 2586 000c 0000 0000 0000 0000
00000a0 07b6 49e5 a922 000e 0001 0102 0001 0000
00000b0 07b6 49e5 a941 000e 0000 0000 0000 0000
```



Press CONTROL+C to quit the test. The back of the test is the same.

3.6.1.3 Touch Screen Testing

- 1) Run the following command to start the calibration process:

```
root@sbc8018:~# ts_calibrate
```

Then follow the LCD prompt, click the "+" icon 5 times to complete the calibration

- 2) Calibration is complete, now enter the following commands for Touch Panel Test:

```
root@sbc8018:~# ts_test
```

Follow the LCD prompts to choose draw point OR draw line test.

3.6.1.4 RTC Testing

The development board contains the hardware clock for save and to synchronize the system time.

User can perform the RTC test by following steps below:

- 1) Set the system time as Mon Dec 05 20:00:00 2011

```
root@sbc8018: # date 120520002011
```

```
Mon Dec 08 20:00:00 UTC 2011
```

- 2) Write the system clock into RTC

```
root@sbc8018:~# hwclock -w
```

- 3) Read the RTC

```
root@sbc8018: # hwclock
```

```
Mon Dec 08 20:00:00 UTC 2011
```

Now the RTC clock has been set as Dec 05 2011; the system clock will be saved in the hardware clock.

- 4) Restart the system, enter the following commands to renew the system clock

```
root@sbc8018: # hwclock -s
root@sbc8018: # date
Mon Dec 08 20:00:00 UTC 2011
```

Now the system time has been set as hardware time.



The SBC8018 Development board RTC battery can use model CR1220, user needs to prepare themselves.

3.6.1.5 TF Card Testing

- 1) First insert the TF card in the board, the system will automatically mount the file system of the TF card under the directory /media:

```
root@sbc8018:~# cd /media/
root@sbc8018:/media# ls
card      hdd      mmcblk0p1  ram      union
cf        mmc1     net        realroot
```

- 2) Enter the following command to see the TF card content:

```
root@SBC80root@sbc801818:/media# ls mmcblk0p1/
flash-uboot.bin      u-boot.bin          x-load.bin.ift_for_NAND
mlo                  ulmage
ramdisk.gz           ubi.img
```

3.6.1.6 USB Devices Testing

In the USB DEVICE testing, a USB cable is used to connect the miniUSB interface of the development board and the USB interface of the PC; for the computer end, the development board is recognized as a network device.

- 1) The computer needs to be installed with Linux USB Ethernet driver, please refer to Appendix III for detailed installation procedure.

2) After booting the system, please configure the system using the below commands through HyperTerminal:

```
root@Sbc8018:~# ifconfig usb0 192.168.1.115
root@Sbc8018:~# ifconfig

lo          Link encap:Local Loopback
            inet addr:127.0.0.1  Mask:255.0.0.0
            UP LOOPBACK RUNNING  MTU:16436  Metric:1
            RX packets:26 errors:0 dropped:0 overruns:0 frame:0
            TX packets:26 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:0
            RX bytes:2316 (2.2 KiB)  TX bytes:2316 (2.2 KiB)

usb0       Link encap:Ethernet  HWaddr 5E:C5:F6:D4:2B:91
            inet addr:192.168.1.115  Bcast:192.168.1.255  Mask:255.255.255.0
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:253 errors:0 dropped:0 overruns:0 frame:0
            TX packets:43 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:35277 (34.4 KiB)  TX bytes:10152 (9.9 KiB)
```

3) After the development board is configured, please click My Computer>>Network Neighborhood>>Check Network Connection; you can see a virtual network adapter is added at the PC end.

4) Now go to the virtual network adapter properties and select “Internet Protocol (TCP/IP)” to configure the IP address of the virtual network adapter:

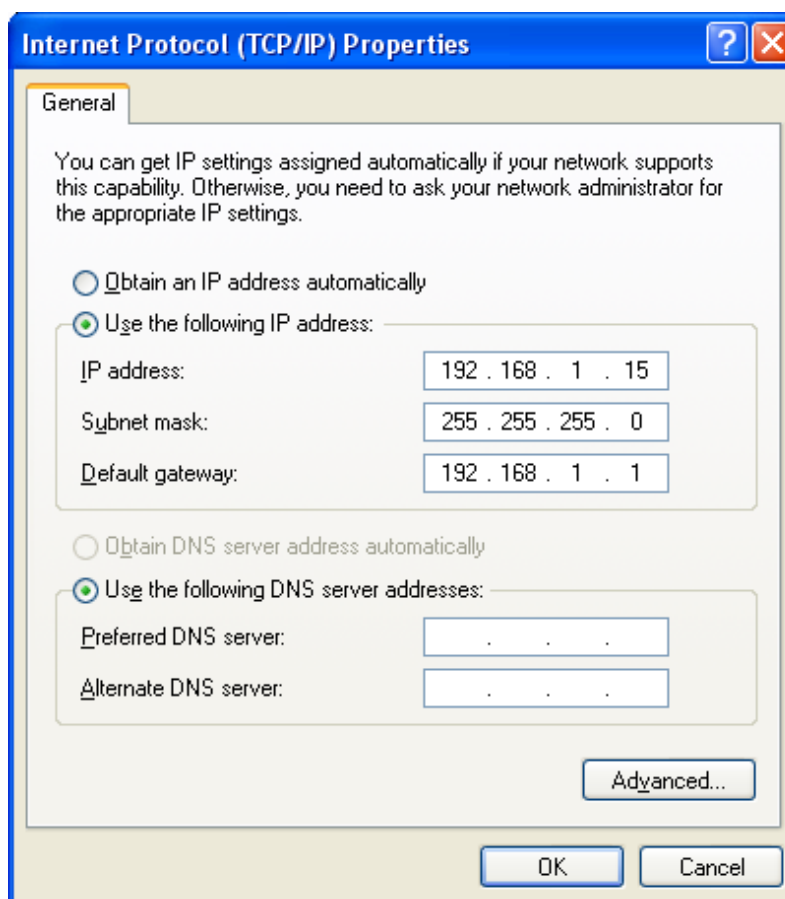


Figure 3-12

- 5) Now use the ping command from the HyperTerminal to test whether the development board IP address has been configured successfully.

```
root@Sbc8018:~# ping 192.168.1.15

PING 192.168.1.15 (192.168.1.15): 56 data bytes

64 bytes from 192.168.1.15: seq=0 ttl=128 time=0.885 ms

64 bytes from 192.168.1.15: seq=1 ttl=128 time=0.550 ms
```

- 6) If you receive ping response like above, indicates the successful communication between the board and the PC.



IP address of the network adapter configured in OTG cannot be the same as that of Ethernet interface.

3.6.1.7 USB HOST Testing

- 1) Connect the USB flash disk, the system will automatically mount the file system of the USB flash disk under the directory /media:

```
root@sbc8018:~# cd /media/

root@sbc8018:/media# ls

card      hdd      mmcblk0p1  ram      sda1
cf        mmc1     net        realroot union
```

- 2) You can see the USB flash disk contents using the below command:

```
root@sbc8018:/media# ls sda1/

flash-uboot.bin      u-boot.bin      x-load.bin.ift_for_NAND
mlo                  ulmage
ramdisk.gz           ubi.img
```

3.6.1.8 Audio Testing

The board has multiple audio input and output interface, we can use the “alsa-utils” utility available in the file system to test the board audio, in order to test the audio please follow the below steps;

1) Recording Test:

To test the recording functionality, first plug-in the microphone and use the below command to start the recording:

```
root@Sbc8018:~# arecord -t wav -c 1 -r 44100 -f S16_LE -v k

Recording WAVE 'k' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
Plug PCM: Hardware PCM card 0 'omap3evm' device 0 subdevice 0

Its setup is:

stream      : CAPTURE
access      : RW_INTERLEAVED
format      : S16_LE
subformat   : STD
channels    : 2
rate       : 44100
```

```

exact rate   : 44100 (44100/1)
msbits       : 16
buffer_size  : 22052
period_size  : 5513
period_time  : 125011
tstamp_mode  : NONE
period_step  : 1
avail_min    : 5513
period_event : 0
start_threshold : 1
stop_threshold : 22052
silence_threshold: 0
silence_size : 0
boundary     : 1445199872
appl_ptr     : 0
hw_ptr       : 0

```

2) Playback Testing:

To playback, plug-in the headphones and enter the below command to hear what you have just recorded;

```

root@Sbc8018:~# aplay -t wav -c 2 -r 44100 -f S16_LE -v k
Playing WAVE 'k' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
Plug PCM: Hardware PCM card 0 'omap3evm' device 0 subdevice 0
Its setup is:
  stream      : PLAYBACK
  access      : RW_INTERLEAVED
  format      : S16_LE
  subformat   : STD
  channels     : 2
  rate        : 44100

```

```

exact rate   : 44100 (44100/1)
msbits      : 16
buffer_size  : 22052
period_size  : 5513
period_time  : 125011
tstamp_mode  : NONE
period_step  : 1
avail_min    : 5513
period_event : 0
start_threshold : 22052
stop_threshold : 22052
silence_threshold: 0
silence_size : 0
boundary     : 1445199872
appl_ptr     : 0
hw_ptr       : 0

```

3.6.1.9 Network Testing

1) The board is having a 10/100M self-adapting DM9000 network card, users can directly connect the board to the LAN network and enter the following commands for network testing:

```

root@sbc8018:~# ifconfig eth0 192.192.192.203
root@sbc8018:~# # ifconfig

eth0      Link encap:Ethernet  HWaddr 00:11:22:33:44:55

          inet addr:192.192.192.203  Bcast:192.192.192.255  Mask:255.255.255.0

          UP BROADCAST MULTICAST  MTU:1500  Metric:1

          RX packets:0 errors:0 dropped:0 overruns:0 frame:0

          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0

          collisions:0 txqueuelen:1000

          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

          Interrupt:185 Base address:0x2000

```

```
root@sbc8018:~# ping 192.192.192.154
PING 192.192.192.154 (192.192.192.154): 56 data bytes
64 bytes from 192.192.192.154: seq=0 ttl=128 time=4.486 ms
64 bytes from 192.192.192.154: seq=1 ttl=128 time=0.336 ms
64 bytes from 192.192.192.154: seq=2 ttl=128 time=0.336 ms
```

- 2) If you receive ping response like above, indicates the successful network communication.



.....

The IP address in the network card of development board and PC should be in the same network segment, for example: 192.192.192.x. Press CONTROL+C to quit the test.

.....

3.6.1.10 Camera Testing

If you have bought the specific camera module for SBC8018 evaluation board, first connect the CAMERA module and LCD screen to the board. To install the camera please use the camera drivers from [drivers/media/video/tvp514x.c]. After installation of camera module enter the following command:

```
root@Sbc8018:~# camera_test -i 0 -n 3 -f nv16 -S -s 720x576 /dev/video0
The framebuffer device was opened successfully.
fscreen line_length : 960
vscreen 480x272, 16bpp, xoffset=0, yoffset=0
The framebuffer device mapped successfully.
Device /dev/video0 opened: DA850/OMAP-L138 Video Capture.
```

Once the above commands are executed you should be able to see the captured images from the camera module on your LCD screen.

3.6.1.11 SATA Testing

- 1) Connect SATA device to the SATA connector marked with J32, and connect the SATA device power cable to the J37 connector on the evaluation board.
- 2) Now power ON the evaluation board, you can see the SATA device contents by using the

following command:

```
root@sbc8018:~# ls -l /media/
drwxr-xr-x    2 root    root        1024 Apr 15  2009 mmc1
drwxr-xr-x    2 root    root        4096 Jan  1  1970 mmcblk0p1
drwxr-xr-x    2 root    root        4096 Jan  1  1970 sda5

root@sbc8018:~# ls -l /media/sda5/
-rwxr-xr-x    1 root    root           6 Apr 14 20:25 hello.txt
-rwxr-xr-x    1 root    root    30781440 Jul 28  2011 taobeini.WAV

root@sbc8018:~#
```

3.7 Application Development

This section will introduce you to the various steps involved in application development process:

Step 1: Code Editing

Source Code: led_app.c

Application: Blinking D3 and D4 LEDs

```
#include <stdio.h>

#include <unistd.h>

#include <fcntl.h>

#define LED_D3 "/sys/class/leds/led2/brightness"
#define LED_D4 "/sys/class/leds/led3/brightness"

int main(int argc, char *argv[])
{
    int i;

    int f_led1, f_led2;

    unsigned char dat1, dat2;

    if((f_led1 = open(LED_D3, O_RDWR)) < 0){
        printf("error in open %s", LED_D3);
```

```

        return -1;
    }
    if((f_led2 = open(LED_D4, O_RDWR)) < 0){
        printf("error in open %s",LED_D4);
        return -1;
    }

    for(i = 0; i < 100; i++) {
        dat1 = (i & 0x1)? '1': '0';
        dat2 = (i & 0x2)? '1': '0';

        write(f_led1, &dat1, sizeof(dat1));
        write(f_led2, &dat2, sizeof(dat2));

        usleep(300000);
    }

    return 0;
}

```

Step 2: Cross-compilation

```
arm-none-linux-gnueabi-gcc led_app.c -o led_app
```

Step 3: Download and run

Now download the compiled code into the evaluation board through TF card, USB flash disk or network, locate the the directory with the led_app file and enter the following commands and press Enter, to run led_app in the background.

```
chmod a+x ./led_app
./led_app
```

Chapter 4 WinCE Operating System

4.1 Introduction

This section will introduce you to the SBC8018 evaluation board application development using Windows Embedded CE 6.0 R3, software resources on the disc, software features, installation of development environment, and how to “sysgen” and build BSP (board support package).

4.2 Software Resources

BSP (Board Support Package)

CD\WINCE600\BSP\OMAPL138_AM18X.rar

CD\WINCE600\BSP\OMAPL13X_TI_V1.rar

Windows Embedded CE 6.0 R3 sample project

CD\WINCE600\sample project\OMAPL138_AM18X_SAMPLE.rar

Pre-compile image

CD\WINCE600\Image\

EBOOTNANDFLASH.nb0	Eboot for NAND boot
NK.bin	WinCE runtime image (packed)
NK.nb0	WinCE runtime image

4.3 Software Features

Resources of BSP:

Table 4-1

Catalog	Item	Source code / binary
EBOOT	NAND	Source
	NOR	source
	SPI	Source
OAL	KILT(EMAC)	Source
	Boot parameter	Source
	Watchdog	Source
	RTC	Source
	System timer	Source
	Interrupt controller	Source
	MMU	Source
	Serial Debug Port	Source
	Kernel Profiler-use timer0, high 32 bits	Source
	Library Abstractions (PSC, PLL, GPIO, abstractions)	Source
	Power management: CPU idle support (ARM wait for interrupt in OEMIdle()) This BSP release implements support for some basic power management (PM). The drivers support D0 and D4 states and system suspend / resume support is implemented. There is no support for voltage or frequency scaling.	Source
Driver	EDMA driver	Source

	I2C driver	Source
	SPI driver	Source
	MCASP driver	Source
	AIC3106 Audio driver	Source
	USB 1.1 OHCI HOST driver	Source
	USB OTG 2.0 HOST driver	Source
	USB OTG 2.0 FUNCTION driver	Source
	USB OTG driver	Source
	USB CDMA driver	Source
	Raster LCD Display driver	Source
	Character LCD Display driver	Source
	NDIS Ethernet driver	Source
	NAND FLASH driver	Source
	Serial driver	Source
	UPP driver	Source
	SD/MMC HOST controller driver	Source
	PWM driver	Source
	Notification LED driver	Source
	Touch Screen driver	Source
	McBSP driver	Source
	VPIF driver	Source

4.4 System Development

4.4.1 Installation of IDE(Integrated Development Environment)

Please install items below to windows XP/Vista:

- 1) Visual Studio 2005
- 2) Visual Studio 2005 SP1
- 3) Visual Studio 2005 SP1 Update for Vista (vista system require)
- 4) Windows Embedded CE 6.0 Platform Builder
- 5) Windows Embedded CE 6.0 SP1
- 6) Windows Embedded CE 6.0 R2
- 7) Windows Embedded CE 6.0 Product Update Rollup 12/31/2008
- 8) Windows Embedded CE 6.0 R3
- 9) Windows Embedded CE 6.0 Product Update Rollup 12/31/2009
- 10) ActiveSync 4.5
- 11) Windows Mobile 6 Professional SDK



CD does not provide WinCE development environment tools, please down

from: <http://www.microsoft.com/download/en/default.aspx>

4.4.2 Extract BSP and project files to IDE

The following preparations should be made:

- 1) Extract [CDROM\WINCE600\bsp\OMAPL138_AM18X.rar] to [C:\WINCE600\PLATFORM] directory.
- 2) Extract [CDROM\WINCE600\bsp\OMAPL13X_TI_V1.rar] to [C:\WINCE600\PLATFORM\COMMON\SRC\SOC].
- 3) Copy CD directory [CDROM\WINCE600\ sample project \ OMAPL138_AM18X_SAMPLE] to [C:\WINCE600\OSDesigns] directory.
- 4) Please modify the LCD module type before sysgen and build BSP:

For 4.3" LCD

If you are using 4.3" LCD screen modify the line as shown below at

[platform/SBC8018/SBC8018.bat]

```
set BSP_LCD43INCH=1
```

For 7" LCD

If you are using 7" LCD screen modify the line as shown below at

[platform/SBC8018/SBC8018.bat]

```
set BSP_LCD43INCH=
```



The default installation path of the Windows Embedded CE 6.0 in this context is [C:\WINCE600].

4.4.3 Sysgen & Build BSP

For "sysgen" and to build the BSP please follow the below steps:

- 1) Open the existing project file OMAPL138_AM18X_SAMPLE.sln located at [C:\WINCE600\OSDesigns\OMAPL138_AM18X_SAMPLE].
- 2) Click [Build-> Build Solution] in vs2005 to "sysgen" and build BSP.
- 3) Once you finish "sysgen" and build process, "EBOOTNANDFLASH.nb0", "NK.bin", "NK.nb0" will be created at the directory location [C:\WINCE600\OSDesigns\OMAPL138_AM18X_SAMPLE\OMAPL138_AM18X_SAMPLE\RelDir\OMAPL138_AM18X_ARMV4I_Release]. Now copy "EBOOTNANDFLASH.nb0" to the directory [D:\sbc8018\bin] and copy "NK.bin", "NK.nb0" to the TF card (FAT/FAT32 format).
- 4) Now to update the system image please refer to the section 4.5 below "How to Update the System Image"

4.4.4 Source code path of all drivers in BSP

Table 4-2

EDMA driver	bsp\OMAPL138_AM18X\SRC\DRIVERS\EDMA
I2C driver	bsp\OMAPL138_AM18X\SRC\DRIVERS\I2C bsp\OMAPL13X_TI_V1\I2C
SPI driver	bsp\OMAPL13X_TI_V1\SPI bsp\OMAPL138_AM18X\SRC\DRIVERS\SPI
McASP driver	bsp\OMAPL13X_TI_V1\MCASP
AIC3106 Audio driver	bsp\OMAPL138_AM18X\SRC\DRIVERS\WAVEDEV2
USB 1.1 OHCI Host driver	OMAPL138_AM18X\SRC\DRIVERS\USB\OHCI
USB 2.0 OTG Host driver	bsp\OMAPL13X_TI_V1\USB\USBH bsp\OMAPL138_AM18X\SRC\DRIVERS\USB\USBH
USB 2.0 OTG Function Driver	bsp\OMAPL13X_TI_V1\USB\USBFN bsp\OMAPL138_AM18X\SRC\DRIVERS\USB\USBFN
USB 2.0 OTG driver	bsp\OMAPL13X_TI_V1\USB\USBOTG bsp\OMAPL138_AM18X\SRC\DRIVERS\USB\USBOTG
USB CDMA driver	bsp\OMAPL13X_TI_V1\USB\USBCDMA bsp\OMAPL138_AM18X\SRC\DRIVERS\USB\USBCDMA
Raster LCD Display driver	bsp\OMAPL13X_TI_V1\DISPLAY bsp\OMAPL138_AM18X\SRC\DRIVERS\DISPLAY

Character LCD Display driver	bsp\OMAPL138_AM18X\SRC\DRIVERS\CHARLCD bsp\OMAPL13X_TI_V1\LIDD
NDIS Ethernet driver	bsp\OMAPL13X_TI_V1\EMAC bsp\OMAPL138_AM18X\SRC\DRIVERS\EMAC
NAND Flash driver	bsp\OMAPL138_AM18X\SRC\COMMON\NAND bsp\OMAPL138_AM18X\SRC\DRIVERS\NAND
Serial driver	bsp\OMAPL13X_TI_V1\SERIAL bsp\OMAPL138_AM18X\SRC\DRIVERS\SERIAL
UPP driver	bsp\OMAPL13X_TI_V1\UPP bsp\OMAPL138_AM18X\SRC\DRIVERS\UPP
SD/MMC Host Controller driver	bsp\OMAPL13X_TI_V1\SDHC bsp\OMAPL138_AM18X\SRC\DRIVERS\SDHC bsp\OMAPL13X_TI_V1\SDBUS
PMW driver	bsp\OMAPL13X_TI_V1\PWM bsp\OMAPL138_AM18X\SRC\DRIVERS\PWM
Notification LED driver	bsp\OMAPL138_AM18X\SRC\DRIVERS\NLED
Touch Screen driver	bsp\OMAPL138_AM18X\SRC\DRIVERS\TOUCH
McBSP driver	bsp\OMAPL13X_TI_V1\MCBSP bsp\OMAPL138_AM18X\SRC\DRIVERS\MCBSP
VPIF drive	bsp\OMAPL138_AM18X\SRC\DRIVERS\CAMERA\LAYER ED

For more information on WinCE driver development please refer to below location for more documents for Windows Embedded CE 6.0:

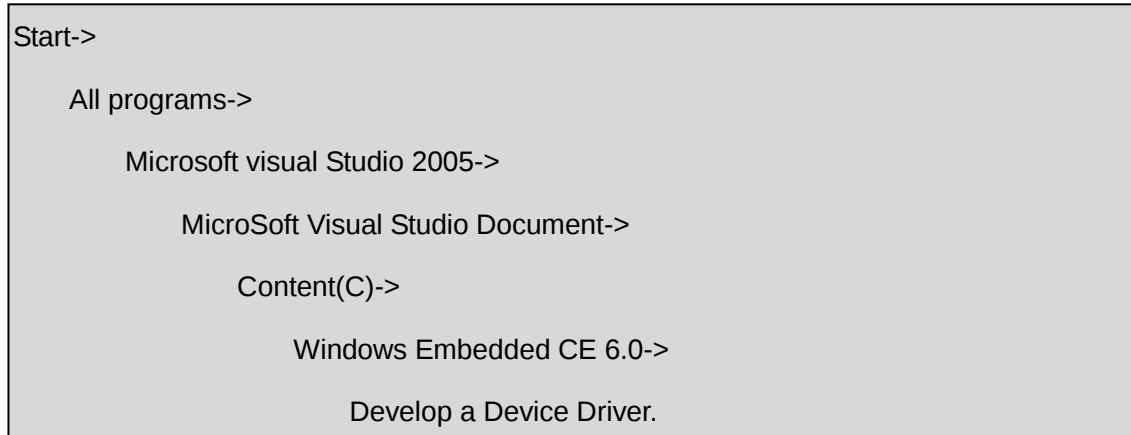


Figure 4-1

4.5 How to Update System Image

The SBC8018 evaluation board supports “NK.bin” or “NK.nb0” boot from TF Card and NAND flash, this chapter will introduce you to the both of these system boot methods.

4.5.1 Downloading EBOOT to NAND Flash

EBOOT can be downloaded to NAND Flash by using “sfh_OMAP-L138.exe” tool (.net framework is require to run this utility; you can download.net framework “dotNetFx40_Full_x86_x64.exe” from Microsoft).

- 1) Make sure you have connected the evaluation board to the PC using serial cable.
- 2) DIP Switch settings; S7-3 and S7-4 should be ON, other switch should be OFF.

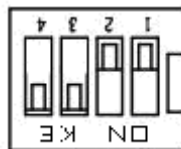


Figure 4-2

- 3) Copy the folder “bin” from the CD folder [CD\WINCE600\tools] to the folder [D:\sbc8018].
- 4) Now according to your LCD screen size, copy the “EBOOTNANDFLASH.nb0” from the CD folder [WINCE600\image\4_3INCH or WINCE600\image\7INCH] to the folder [D:\sbc8018\bin].
- 5) Now start the Windows Command Prompt; Click Start -> All Programs -> run, and input “CMD” on the pop-up dialog to enter Windows Command Prompt(cmd.exe), now enter the

below commands in command prompt.:

```
d:
cd \sbc8018
```

- 6) Run the flash tool to erase the NAND Flash: (change COM port if required)

```
sfh_OMAP-L138.exe -erase -targetType AM1808 -flashType NAND -p COM1
```

- 7) Power ON the Kit. You should see the erase cycle in progress, wait until it completes, and then power OFF the kit. Note: If the erase sequence does not complete after 30 seconds press a key to terminate the “sfh_OMAP-L138.exe” program and start the process again.

- 8) Run the flash tool to write an appropriate UBL(First Bootloader) and EBOOT to flash (change COM port if required).

```
sfh_OMAP-L138.exe -flash -targetType AM1808 -flashType NAND -v -p COM1
-appStartAddr 0xc7f60000 -appLoadAddr 0xc7f60000 arm-nand-ais-456mhz.bin
EBOOTNANDFLASH.nb0
```

- 9) Power ON the Kit. You should see write cycle in progress, wait until it completes.

```

Flashing UBL arm-nand-ais-456mhz.bin (13776 bytes) at 0x00000000

Target: SENDING
Target: BEGIN
100% | 
      Image data transmitted over UART.

Target: DONE
100% | 
      UBL programming complete

Target: SENDING
Target: DONE

Flashing application EBOOTNANDFLASH.nb0 (262144 bytes) at 0x00010000

Target: SENDING
Target: BEGIN
100% | 
      Image data transmitted over UART.

Target: DONE
100% | 
      Application programming complete

Target: Number of blocks needed for header and data: 0x0x00000003
Target: Attempting to start in block number 0x0x00000006.
Target: Magicnum: 0x0x55424CBB
Target: Entrypoint: 0x0xC7F60000
Target: Numpage: 0x0x00000080
Target: Writing header and image data to Block 0x00000006, Page 0x000000
00

Target: DONE
Target: DONE

Operation completed successfully.

```

Figure 4-3

- 10) Power OFF the Kit and set DIP switches as; S7-1 to ON, all others to OFF.

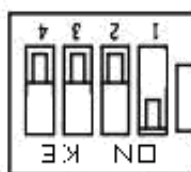


Figure 4-4

- 11) Start your serial terminal application, Hyper Terminal (115200 baud, 8N1)
- 12) Now power ON the evaluation board and you will see the system boot up with the new EBOOT image.

4.5.2 Update TF Card NK runtime images

1) Format TF card

Format the TF Card in FAT/FAT32 file system.

2) Copy NK runtime image

- a) Navigate to the directory [WINCE600/image/lcd7inch] or [WINCE600/image/lcd4.3inch], according to the LCD size.
- b) Copy "NK.nb0/NK.bin" to TF card.

3) Change the EBOOT settings to boot NK from TF Card

Insert the TF card into the evaluation board, turn the power ON and press space key to enter into the EBOOT menu.

- a) Press the key [2] -> [2] -> [2] step by step to select boot NK from TF card as shown below:

```

Booting with TI UBL
Device OPP (456MHz, 1.3V)01
Microsoft Windows CE Bootloader Common Library Version 1.4 Built Sep 23 2011 15:29:43
INFO:OALLogSetZones: dpCurSettings.ulZoneMask: 0xb
Microsoft Windows CE EBOOT 1.0 for AM1808 OMAPL138/AM18X EVM. Built Sep 23 2011 at
15:30:38

BSP version 1.3.0, SOC version 1.3.0
CODE : 0xC7F60000 -> 0xC7FA0000
DATA : 0xC7FA0000 -> 0xC7FE0000
STACK : 0xC7FE0000 -> 0xC8000000

Enabled OAL Log Zones : ERROR, WARN, INFO,
Platform Init done
System ready!
Preparing for download...
Predownload...
FMD: ReadID (Mfg=0x2c, Dev=0xda)
WARN: Invalid boot configuration found (using defaults)
Lan MAC: 00:08:ee:00:00:00
    
```

INFO: MAC address: 00:08:ee:00:00:00

WARN: Invalid BSP_ARGS data found (using defaults)

WARN: Unable to get hardware entropy

Hit space to enter configuration menu 2

Main Menu

- [1] Show Current Settings
- [2] Boot Settings
- [3] Network Settings
- [5] Video Settings
- [6] Save Settings
- [7] Peripheral Tests
- [R] Reset Settings To Default Values
- [0] Exit and Continue

Selection: 2

Boot Settings

- [1] Show Current Settings
- [2] Select Boot Device
- [3] Select Boot Delay
- [4] Select Debug Device
- [5] Force Clean Boot
- [6] Write Download RAM NK to Flash
- [7] Set Device ID String

[8] Allow DSP to Boot

[0] Exit and Continue

Selection: 2

Select Boot Device

[1] EMAC

[2] NK from SD

[3] NK from NAND flash

[0] Exit and Continue

Selection (actual NK from SD): 2

Boot device set to NK from SD

- b) Press the key [0] -> [0] by step by step to start the system from SD card, and you would see the following message on your PC Hyper Terminal:

Boot Settings

[1] Show Current Settings

[2] Select Boot Device

[3] Select Boot Delay

[4] Select Debug Device

[5] Force Clean Boot

[6] Write Download RAM NK to Flash

[7] Set Device ID String

[8] Allow DSP to Boot

[0] Exit and Continue

Selection: 0

Main Menu

- [1] Show Current Settings
- [2] Boot Settings
- [3] Network Settings
- [5] Video Settings
- [6] Save Settings
- [7] Peripheral Tests
- [R] Reset Settings To Default Values
- [0] Exit and Continue

Selection: 0

Device ID set to AM1808-0

BLFlashDownload: LogicalLoc - 0x01C40000

Loading from SD card

+ReadNKFromSDMMC

ReadFileFromSDMMC: reading file 'nk.bin'

SDBootPDD: PDD_SDInitializeHardware: MMCS

SDBootMDD: SDInitializeHardware: SD card detected

SDBootMDD: SDInitializeHardware: V2.0 card detected

SDBootMDD: SDInitializeHardware: timeOut = 0

SDBootMDD: SDInitializeHardware: timeOut = 1

SDBootMDD: SDInitializeHardware: timeOut = 2

SDBootMDD: SDInitializeHardware: timeOut = 3

SDBootMDD: Card address is 1234

SDBootMDD: 4-bit data bus selected

InitMasterBootRecord: Partition 0, type 12

InitMasterBootRecord: Partition 0, FAT32, start 0x7e00, length 0x753f8200

InitPartition: Offset 0x7e00, length 0x753f8200

ReadFileFromSDMMC: file size = 16138467 bytes

UnpackBINImage: unpacking binary from 0xc2000000

UnpackBINImage: Image start = 0x80000000

UnpackBINImage: Image length = 0x102fd2c

UnpackBINImage: record 0, start=0x80000000, length=0x4, checksum=0x1eb

.....

UnpackBINImage: record 296, start=0x0, length=0x80001000, checksum=0x0

CheckCEImage: checking image at 0xc0000000

ROMHDR (pTOC = 0xc102de3c) -----

DLL First : 0x4001c001

DLL Last : 0x40b5c097

Physical First : 0x80000000

Physical Last : 0x8102fd2c

Num Modules : 181

RAM Start : 0x81030000

RAM Free : 0x8103f000

RAM End : 0x8373f800

Num Copy Entries : 2

Copy Entries Offset : 0x804f4fd4

Prof Symbol Length : 0x00000000

Prof Symbol Offset : 0x00000000

Num Files : 73

Kernel Flags : 0x00000000

FileSys RAM Percent : 0x30303030

Driver Glob Start : 0x00000000

Driver Glob Length : 0x00000000

CPU : 0x01c2

```
MiscFlags          :    0x0002
Extensions         : 0x80001070
Tracking Mem Start : 0x00000000
Tracking Mem Length : 0x00000000
```

Image Start: 0x00000000

Image Size: 0x00000000

Image Launch Addr .: 0x00000000

Image ROMHDR: 0x00000000

Boot Device/Type ..: 3 / 6

ADEhellounch Windows Embedded CE by jumping to 0xc0000000...

Windows CE Kernel for ARM (Thumb Enabled) Built on Oct 20 2009 at 18:39:19

OEMInit: init.c built on Sep 28 2011 at 15:51:27.

BSP version 1.3.0, SOC version 1.3.0

INFO:OALLogSetZones: dpCurSettings.ulZoneMask: 0xf

WARN: Updating local copy of BSP_ARGS

Intr Init done...

Timer Init done...

+OALDumpClocks

Clock Configuration :

Reference Clock 0 .. 24000000 Hz

PLL0 456000000 Hz

PLL0:SYSCLK1 456000000 Hz (DSP Subsystem)

PLL0:SYSCLK2 228000000 Hz

(UART,EDMA,SPI,MMC/SD,VPIF,LCDC,SATA,uPP,USB2.0,HPI,PRU)

PLL0:SYSCLK3 91200000 Hz (EMIFA)

PLL0:SYSCLK4 114000000 Hz (INTC, SYSCFG, GPIO, PSC, I2C1, USB1.1,
EMAC/MDIO, GPIO)

PLL0:SYSCLK5 152000000 Hz (reserved)

```

PLL0:SYSCLK6 ..... 456000000 Hz (ARM Subsystem)
PLL0:SYSCLK7 ..... 76000000 Hz (EMAC)
PLL0:AUXCLK ..... 24000000 Hz (I2C0, Timers, McASP0 serial clock, RTC, USB2.0
PHY)
PLL1 ..... 264000000 Hz
PLL1:SYSCLK1 ..... 264000000 Hz (DDR2/mDDR PHY)
PLL1:SYSCLK2 ..... 132000000 Hz (Optional for: McASP0,McBSP,ePWM,eCAP,SPI1)
PLL1:SYSCLK3 ..... 88000000 Hz (PLL0 input)
-OALDumpClocks
-OEMInit
    PINMUX14=0x00000000
    PINMUX15=0x00000000
    PINMUX16=0x22222200
    PINMUX17=0x22222222
    PINMUX18=0x22000022
    PINMUX19=0x02000022
OEMGetExtensionDRAM: Added 0x84400000 -> 0x88000000
OEM: Cleaning system hive
OEM: Cleaning user profiles
WARN: Updating local copy of BSP_ARGS
OEM: Not cleaning system hive
FMD: ReadID (Mfg=0x2c, Dev=0xda)
MICBIASHardwareContext::Init 555
Adapter's MAC address is 00:08:EE:00:00:00
SDHC +Init
    SDHC Active RegPath: Drivers\Active\21
                                +SDHCPDD_Init: Ctrl 0, Entry
SDHC -Init
    SDHC +Open
        SDHC +Open

```

SDHC_CARD_DETECT = 1

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

SDHC CommandCompleteHandler: Command response timeout

4.5.3 Downloading NK.bin to NAND flash

This section will introduce you how to download “NK.bin” to NAND flash via Ethernet using VS2005 utility:

- 1) Confirm you have performed the release build in
C:\WINCE600\OSDesigns\OMAPL138_AM18X_SAMPLE\
OMAPL138_AM18X_SAMPLE.sln.
- 2) Connect PC and SBC8018 evaluation board using with RJ45 Cable.
- 3) DIP switch position: S7-1 to ON position, other switches to OFF position:

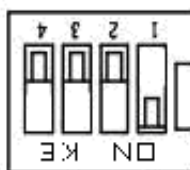


Figure 4-5 Boot up from NAND Flash

- 4) Select EMAC as boot media in EBOOT menu, press key [2]->[2]->[1] , steps by step as below:

```
-----
Select Boot Device
-----
```

- ```
[1] EMAC
[2] NK from SD
[3] NK from NAND flash
[0] Exit and Continue
```

```
Selection (actual NK from SD): 1
```

```
Boot device set to EMAC
```

- 5) Press [6] -> [y], this will enable the NK download to NAND Flash in EBOOT menu:

```

Boot Settings

```

- ```
[1] Show Current Settings
```

```
[2] Select Boot Device
[3] Select Boot Delay
[4] Select Debug Device
[5] Force Clean Boot
[6] Write Download RAM NK to Flash
[7] Set Device ID String
[8] Allow DSP to Boot
[0] Exit and Continue

Selection: 6

Enable Write Download RAM NK to Flash (actually disabled) [y/-]: y

Write Download RAM NK to Flash enabled
```

- 6) Press key [0] to return to EBOOT main menu, now press key [3] to set the network property. Setting the DHCP, IP, NETMASK according to your network environment, confirm that the IP, NETMASK of evaluation board is in the same sub network of your PC.
- 7) Press key [0] to return to EBOOT main menu. Now press key [0] to prepare the “NK.bin” download process from PC to the NAND flash. You will see the below message on your PC Hyper Terminal window:

```
INFO: Boot device uses MAC 00:08:ee:ff:ff:ff
+EbootSendBootmeAndWaitForTftp
Sent BOOTME to 255.255.255.255
Sent BOOTME to 255.255.255.255
Sent BOOTME to 255.255.255.255
Sent BOOTME to 255.255.255.255
Sent BOOTME to 255.255.255.255
Sent BOOTME to 255.255.255.255
Sent BOOTME to 255.255.255.255
```

- 8) Click [Target->Connectivity Options] in VS2005 Menu, you will see a Connectivity Options pop up window like below, select Ethernet from Download drop down menu:

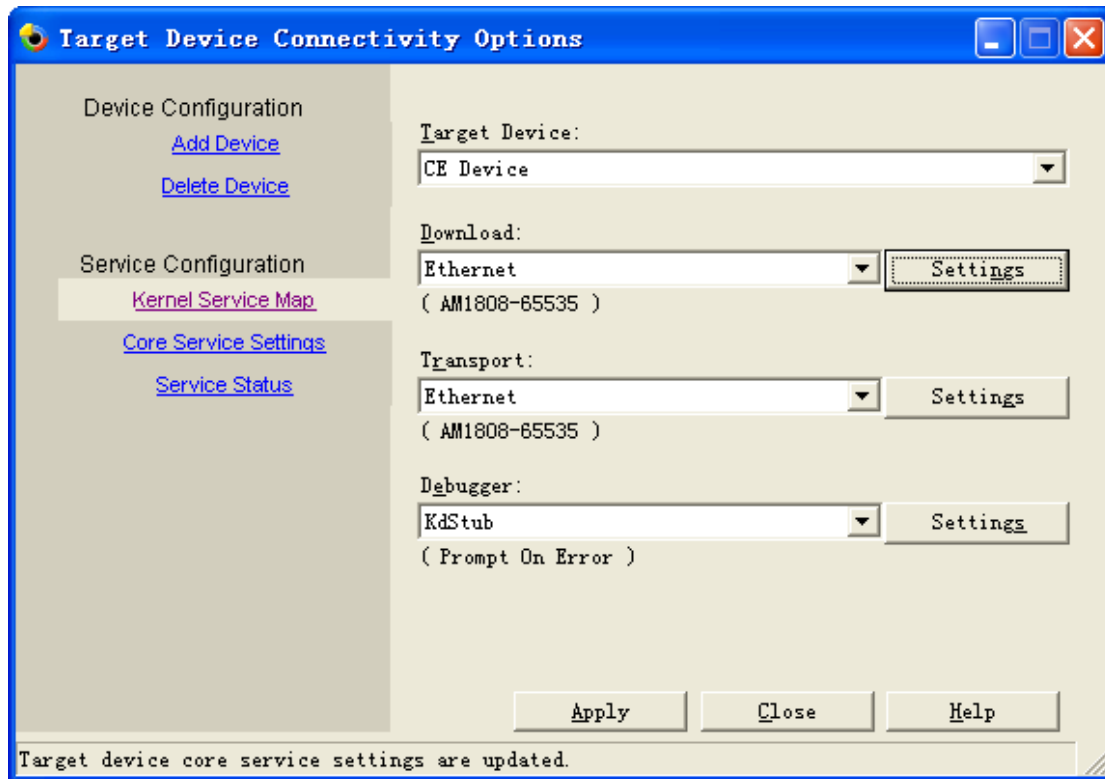


Figure 4-6

- 9) Now click on Settings button (located in the right of Download drop down menu), this will pop up another window as shown below. If the network settings are correct and network cable OK, you would see AM1808-65535 in Active target devices edit box, select device AM1808-65535 and click [OK] button to go back to Connectivity Options dialog, click [Apply->Close->finish] under Connectivity Options setting.

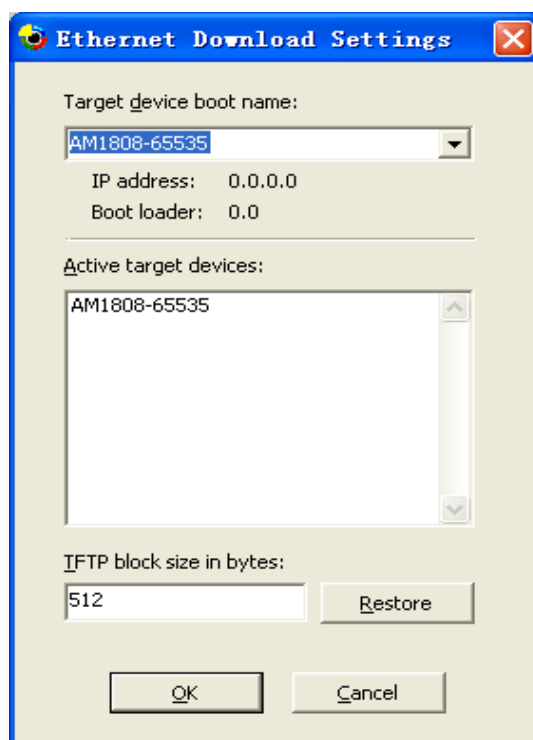


Figure 4-7

10) Now go to [Target] -> [Attach Device] in VS2005 menu and click on Start to download “NK.bin”.

A dialog will pop up to indicate the download progress, once the download process completed the serial terminal would display the below message:

```
OEMWriteFlash: NK written
ROMHDR at Address 80000044h
Image Start .....: 0x80000000
Image Size .....: 0x00ff9a74
Image Launch Addr .: 0x80001000
Image ROMHDR .....: 0xc0ff7be0
Boot Device/Type ..: 2 / 6
Got EDBG_CMD_JUMPIMG
Got EDBG_CMD_CONFIG, flags:0x00000000
BLFlashDownload: LogicalLoc - 0x62000000
Load NK image from flash memory (NAND)
FMD: ReadID (Mfg=0x2c, Dev=0xda)
BLFlashDownload: cp1
```

- 11) Now power OFF the board and power ON and press the space key to enter into the EBOOT menu. From EBOOT menu press key [2]->[2]->[3] step by step to select NK from NAND flash, and press [0] -> [0] to start the system from NAND flash.

4.6 User Instructions

4.6.1 How to use Power Management

- 1) This BSP release implements support for some basic power management states and system suspend / resume. There is no support for voltage or frequency scaling.

- 2) Power Management Configuration

The sample PM configuration is enabled by default in platform.reg. The configuration can be disabled by setting the BSP_POWERMAN variable in:

[...\<BSPFolder>\OMAPL138_AM18X.bat].

Notes:

- 1) *When the sample PM configuration is disabled the default CE 6.0 PM configuration is used.*
- 2) *When entering the suspend state the CE Power Manager powers down all the peripherals (sets all drivers to D4 state).*
- 3) *On L138/AM18x the SDRAM is put into self-refresh mode and powered down, the PLL controllers are powered down and the SOC is put into Deep Sleep mode.*
- 4) *On L138/AM18x there are two wake sources supported:*
 - *Internal source – RTC alarm*
 - *External source via the DEEPSLEEP pin – connected to UART2 CTS*
- 5) *The “pmsuspend” tool can be used to enter the system suspend state. The wake source can be specified on the command line.*
- 6) *On L138 / AM18x when resuming the SDRAM and PLL controllers are powered up.*
- 7) *On resume the CE Power Manager powers up all the peripherals (sets all drivers to D0 state).*

Power Management Tools

When power management is enabled a number of tools are available:

- pmtimeout – Sets the idle timeouts used for transition between PM states
- pmsuspend – Sets an RTC alarm and puts the platform into suspend
- pmset – Sets the system power state
- pmget – Gets the current system power state
- pmsetd – Sets the power state for a device
- pmgetd – Gets the power state for a device
- pmreq – Sets a device power requirement
- pmmon – Monitors and reports on power state changes

Most of the tools display help if run without command line parameters. Some example usage as follows.

e.g. Go into suspend with a 1 min RTC alarm:

CE device->Start->CMD prompt->pmsuspend -t 1

4.6.2 How to use CAM8000-A module

- 1) Select [Third Party->BSP->OMAPL138_AM18x: ARMV4I->Device Drivers->Camera->VPIF Capture Driver] from the VS2005 catalog menu.
- 2) Make sure that “DirectShow” items are selected in catalog items view, as shown in below picture:

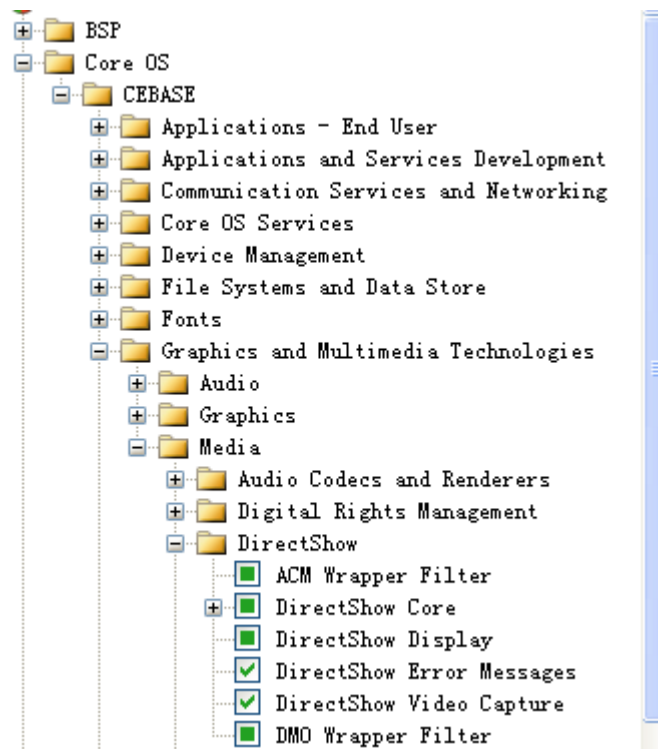


Figure 4-8

- 3) Click [Build-> Rebuild Solution] in VS2005 to perform “sysgen” and build BSP.
- 4) Update “NK.bin” and “NK.nb0” after sysgen and build BSP completed.
- 5) Confirm CAM8000-A module is connect to SBC8018 correctly, boot system with updated NK, copy [C:\WINCE600\PLATFORM\SBC8018\files\CameraDshowApp_analog.exe] to run Windows CE OS on the kit and click “CameraDshowApp_analog.exe” to view camera preview.



The VPIF driver support PAL(720*576) and NTSC (720*480) camera, and the drivers is default set to support the PAL camera, some parameter in VPIF drivers should be change with NTSC camera, if you want to view the whole of picture in LCD, please use 7inch LCD connect to SBC8018.

4.7 SBC8018 Windows CE 6.0 win32 API application development Demo

For SBC8018 Windows CE 6.0 win32 API development demo please refer to [bsp\OMAPL138_AM18X\SRC\TESTAPPS].

Appendix

Appendix I: Hardware Dimensions

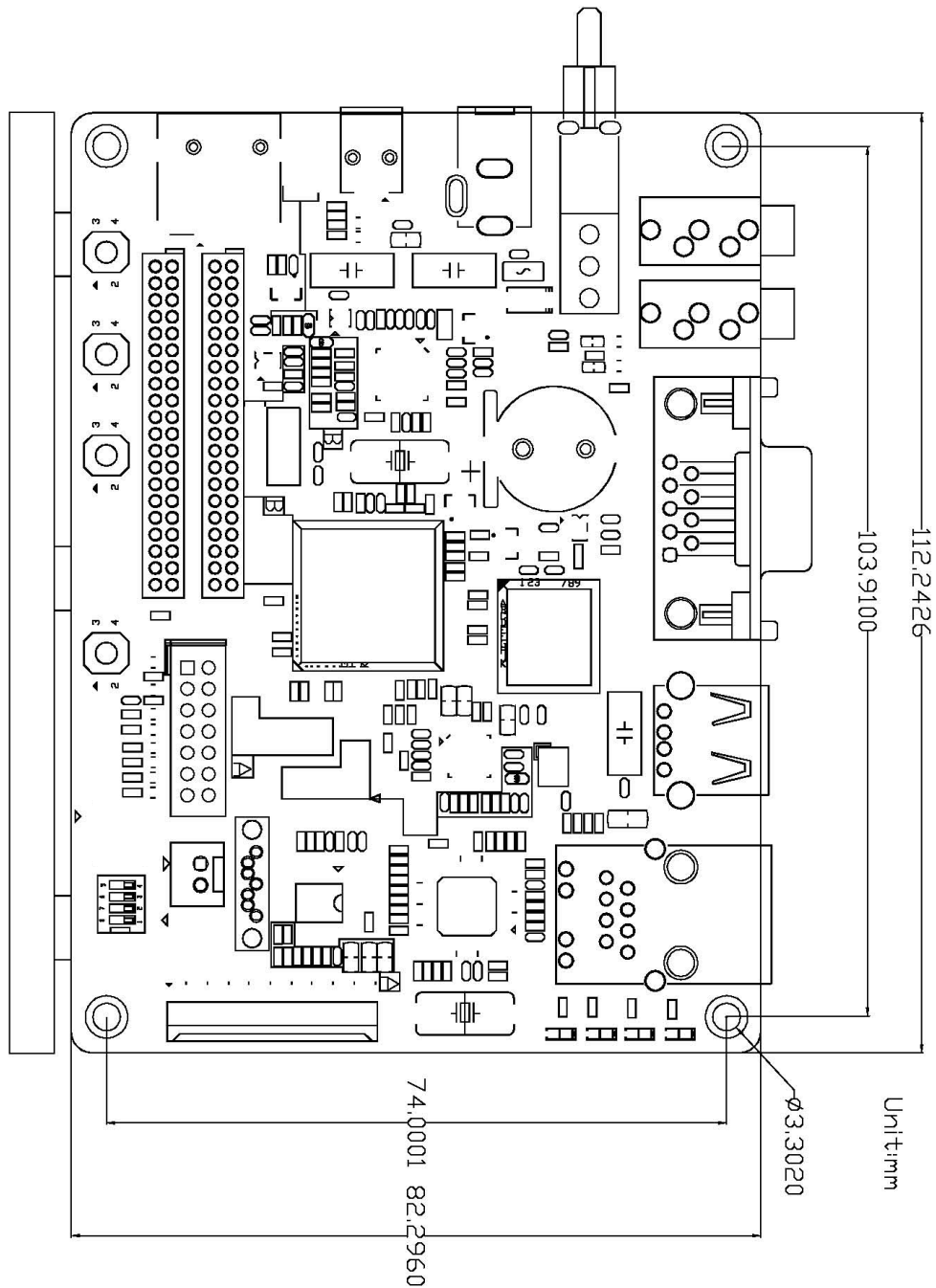


Figure Appendix 1-1 Hardware Dimensions Diagram

Appendix II: The Installation Of Ubuntu

How to install Ubuntu in Windows environment using VirtualBox.

The screenshots in this tutorial use Ubuntu 11.04, but the same principles also applies to Ubuntu 10.10, 11.04, and any future version of Ubuntu. Actually, you can install pretty much any Linux distribution this way.

VirtualBox allows you to run an entire operating system inside another operating system. Please be aware that you should have a minimum of 512 MB of RAM. For better performance 1 GB of RAM or more is recommended.

Installation Process

1. Download software

Before installing Ubuntu, you must get VirtualBox software and Ubuntu disk image (ISO file). Both can be downloaded from [VirtualBox download page](#) (VirtualBox-4.0.10-72479-Win.exe) and [Ubuntu download page](#) (ubuntu-11.04-desktop-i386.iso).

2. Create New Virtual machine

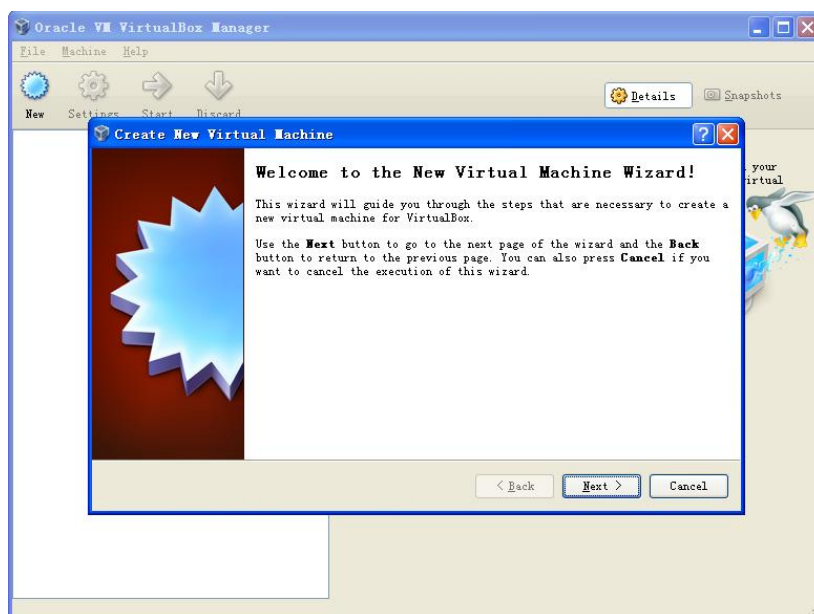


Figure Appendix 2-1

After you launch VirtualBox from the Windows Start menu, click on **New** to create a new virtual machine. When the New Virtual Machine Wizard appears, click **Next**.

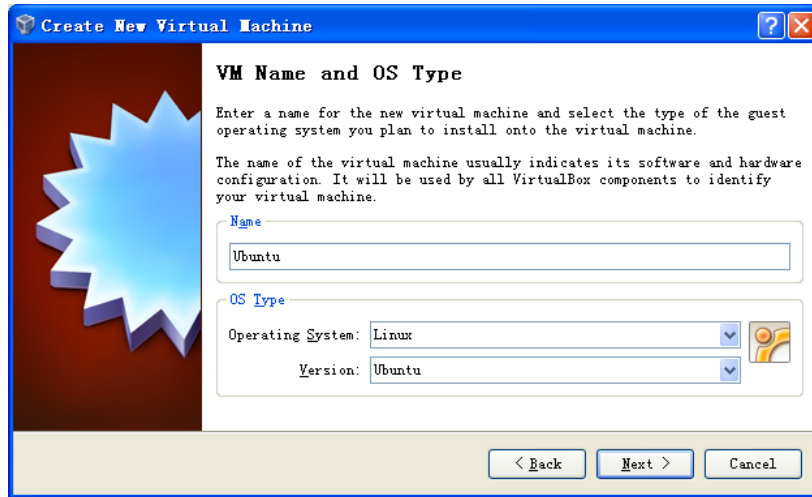


Figure Appendix 2-2

You can name the machine whatever you want to name it, we are installing Ubuntu so it makes sense to name it as **Ubuntu**. Otherwise you can name it as what you like:

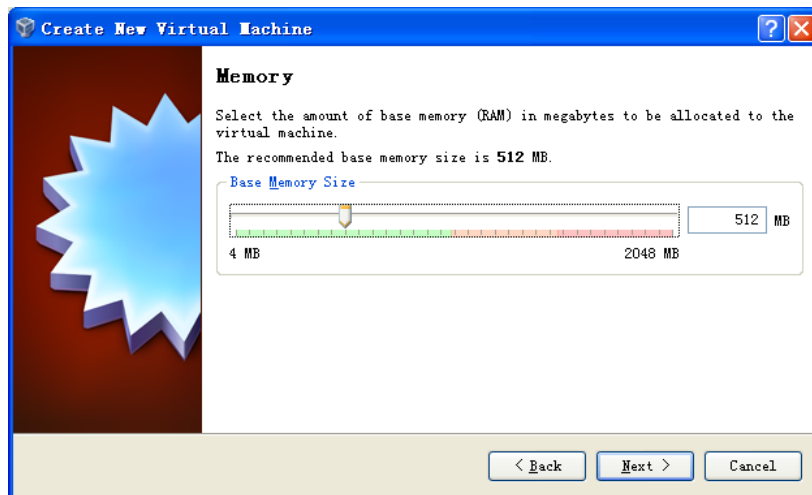


Figure Appendix 2-3

VirtualBox will try to guess how much of your memory (or RAM) to allocate for the virtual machine. If you have 1 GB or less of RAM, I would advise you stick with the recommendation. If, however, you have over 1 GB, about a quarter of RAM or less should be fine. For example, if you have 2 GB of RAM, 512 MB is fine to allocate. If you have 4 GB of RAM, 1 GB is fine to allocate. If you have no idea what RAM is or how much of it you have, just go with the default.

Click **Next**.

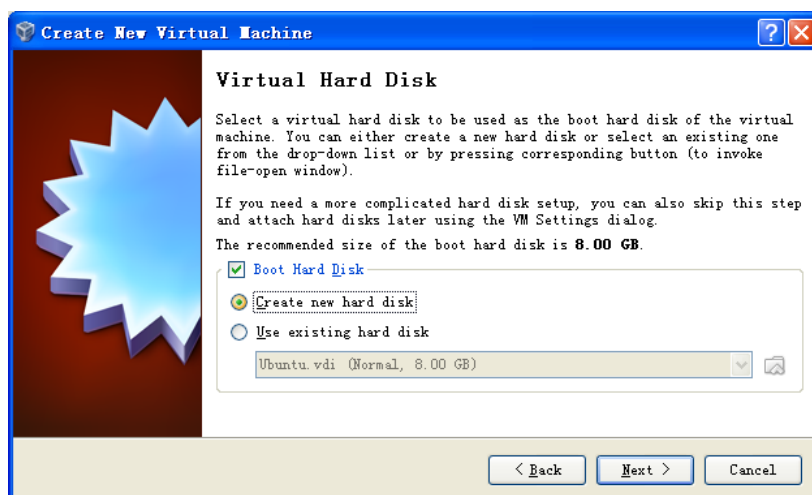


Figure Appendix 2-4

If this is your first time using VirtualBox (which it probably is if you need a tutorial on how to use it), then you do want to create new hard disk and then click **Next**.

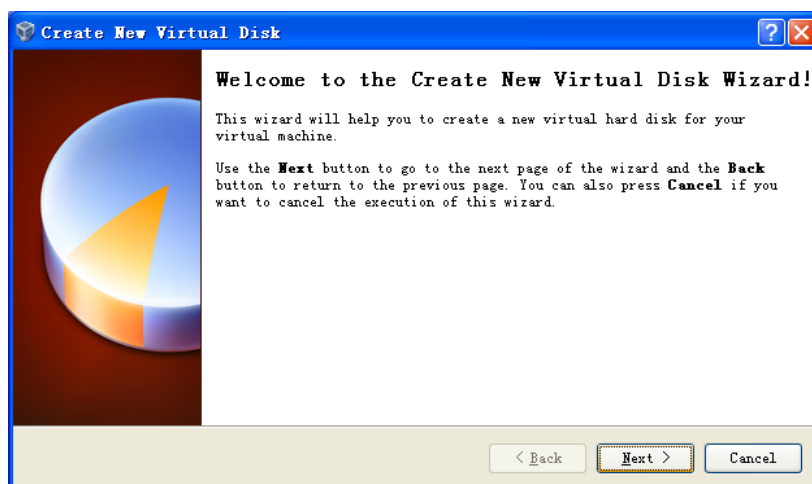


Figure Appendix 2-5

Click **Next** again.

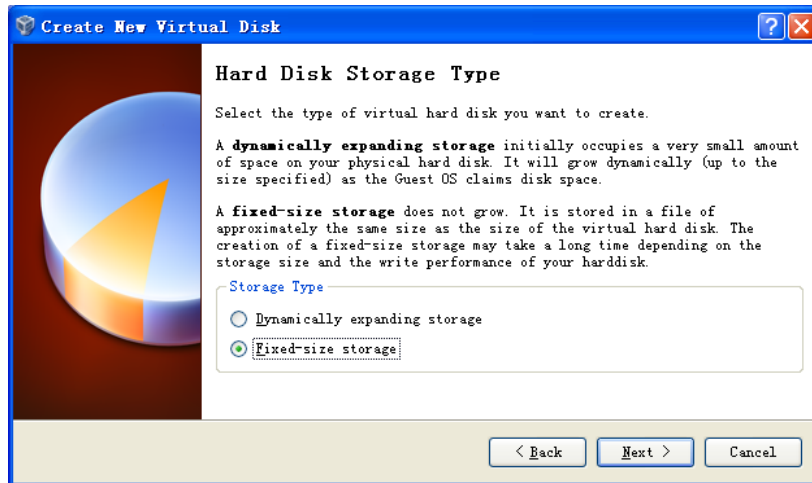


Figure Appendix 2-6

Select **Fixed-size storage** and click **Next** again.

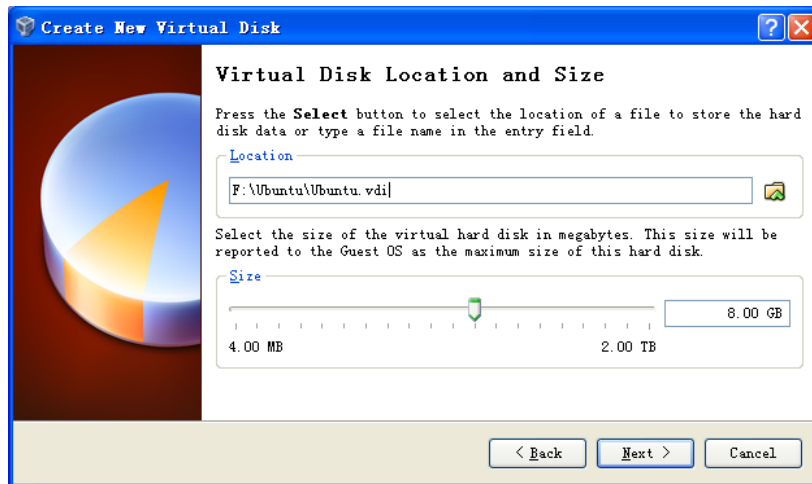


Figure Appendix 2-7

Ubuntu's default installation is less than 8 GB. If you plan on adding software or downloading large files in your virtualized Ubuntu, you should select more space accordingly.

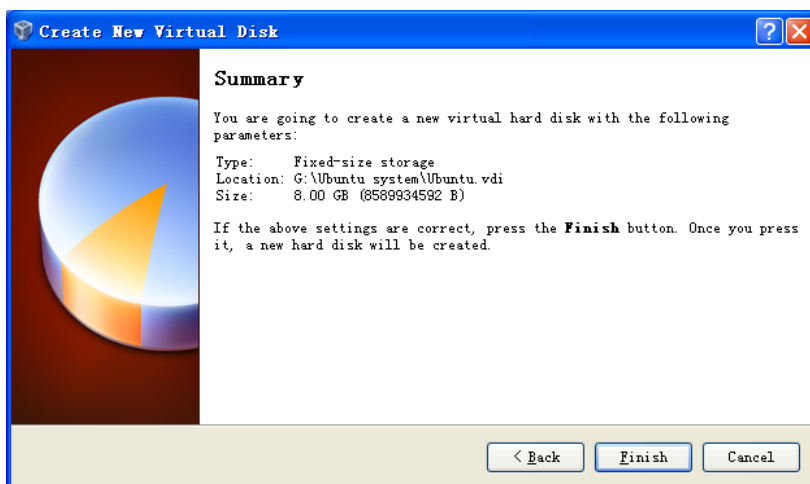


Figure Appendix 2-8

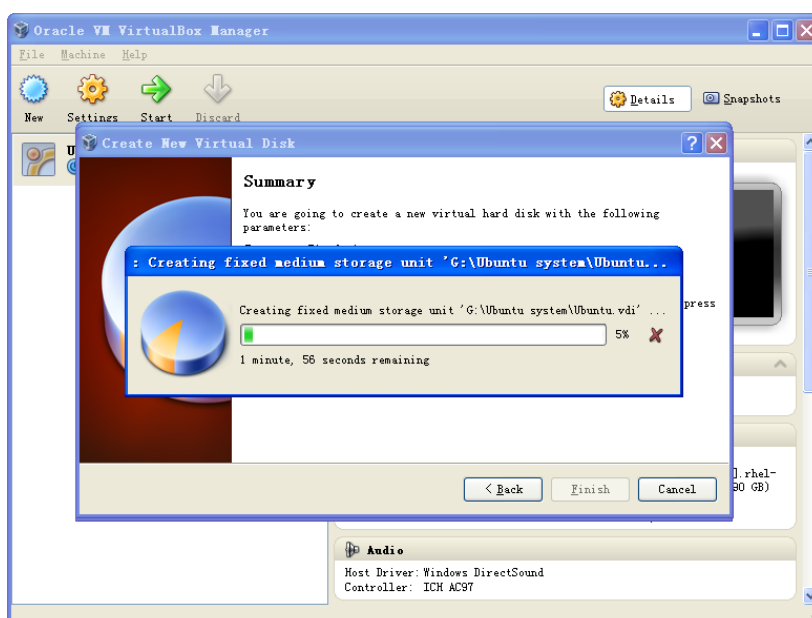


Figure Appendix 2-9

Click **Finish** and wait for the virtual hard drive to be created. This is actually just a very large file that lives inside of your Windows installation.

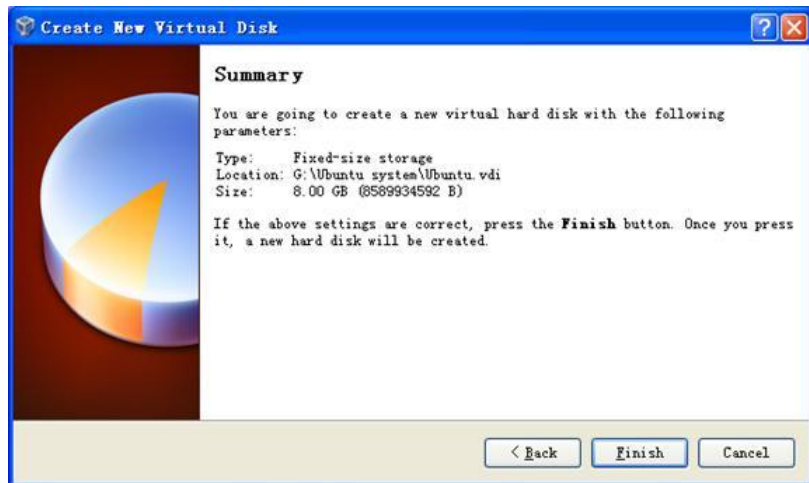


Figure Appendix 2-10

Click **Finish**. The virtual hard drive is successfully created.

3. Installing Ubuntu

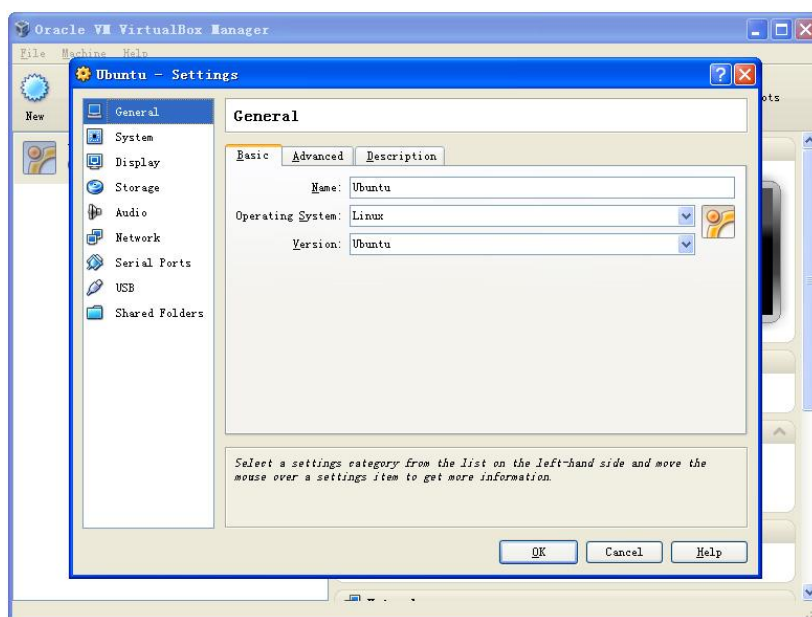


Figure Appendix 2-11

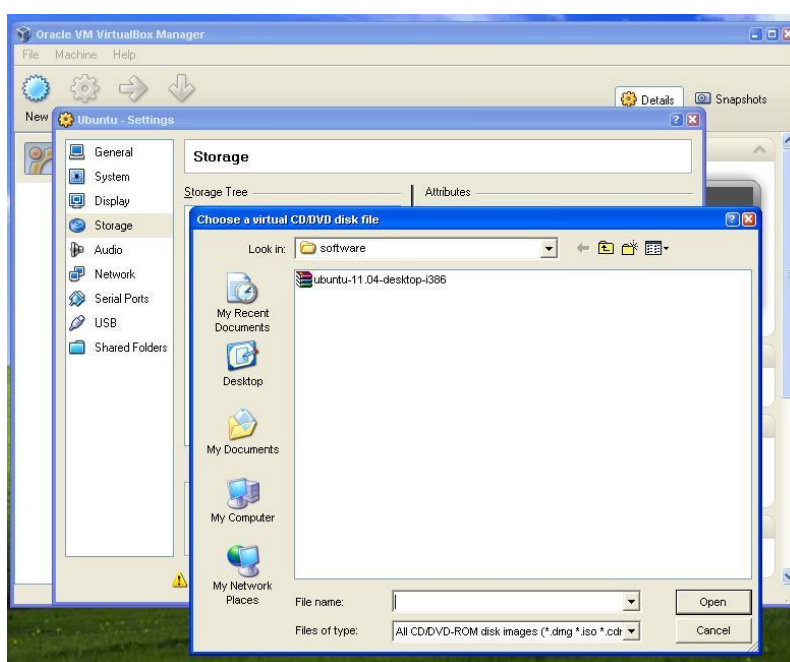


Figure Appendix 2-12

Before Installing Ubuntu in a virtual machine, the first thing to make the (currently blank) virtual hard drive useful is to add the downloaded Ubuntu disk image (the .iso) boot on your virtual machine. For that, click on Settings and Storage, then under CD/DVD Device select the Ubuntu .iso you downloaded earlier.

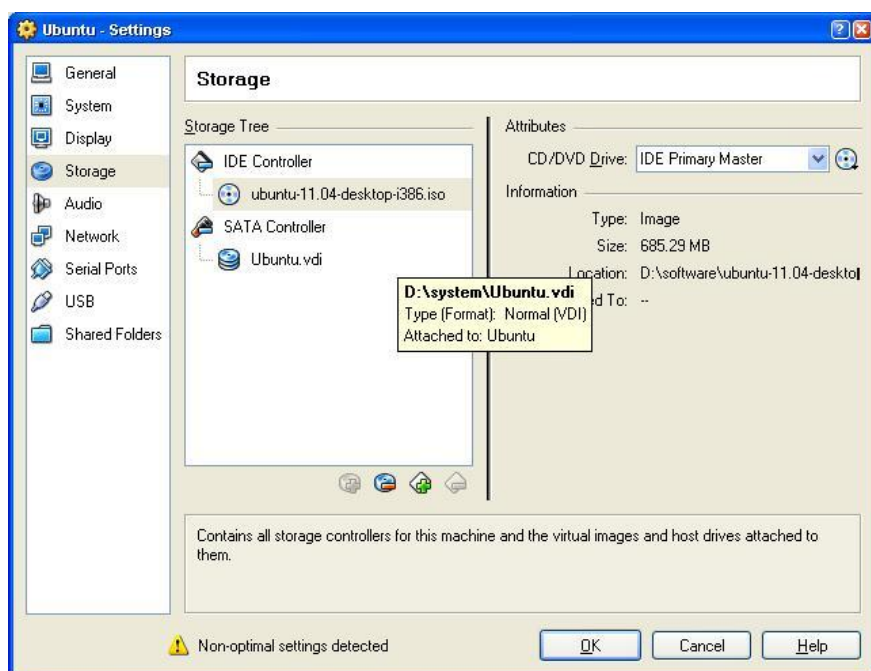


Figure Appendix 2-13

Once you've selected it, click **OK**.

Then double-click your virtual machine to start it up.

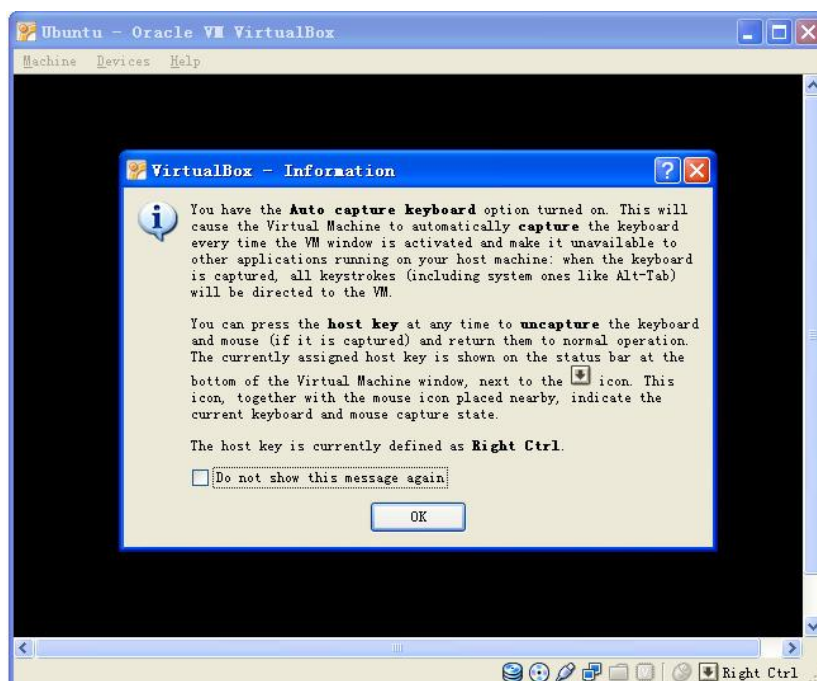


Figure Appendix 2-14

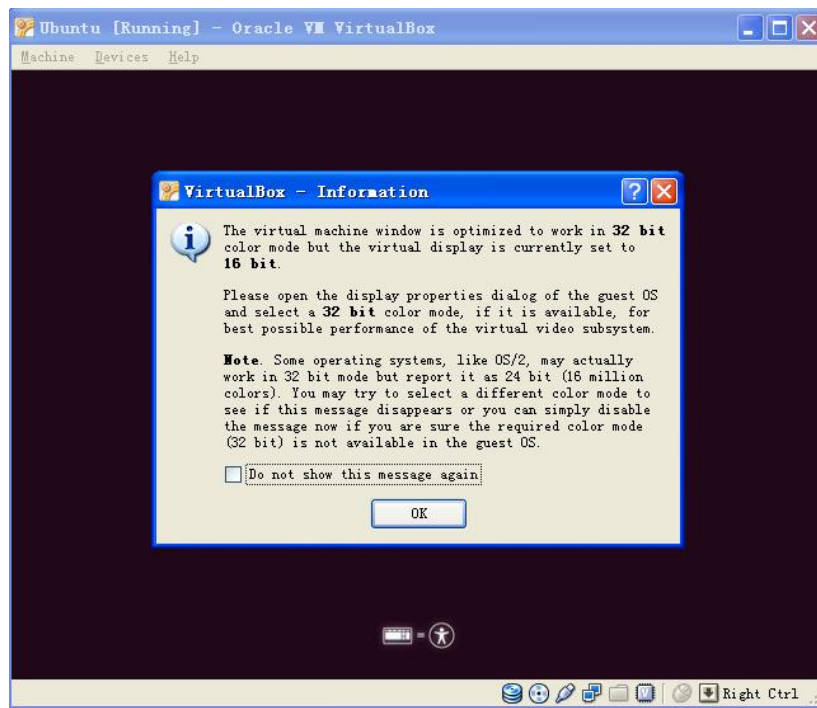


Figure Appendix 2-15

Click OK

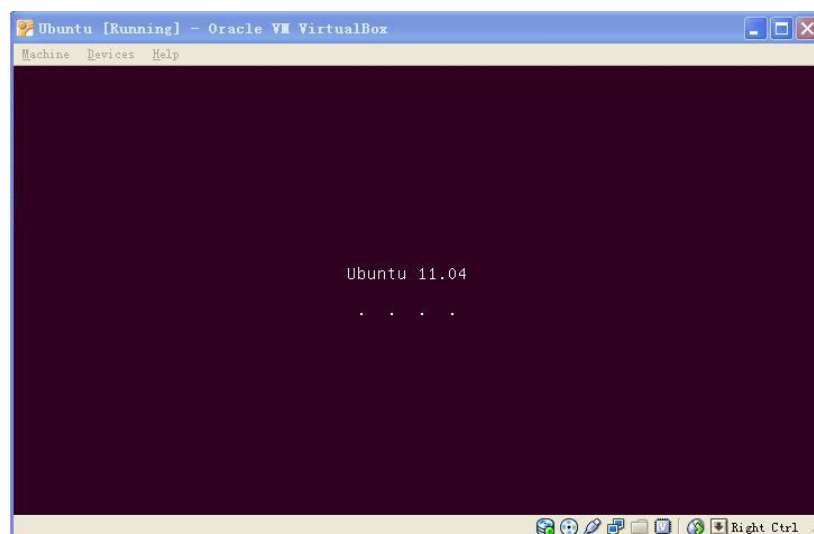


Figure Appendix 2-16

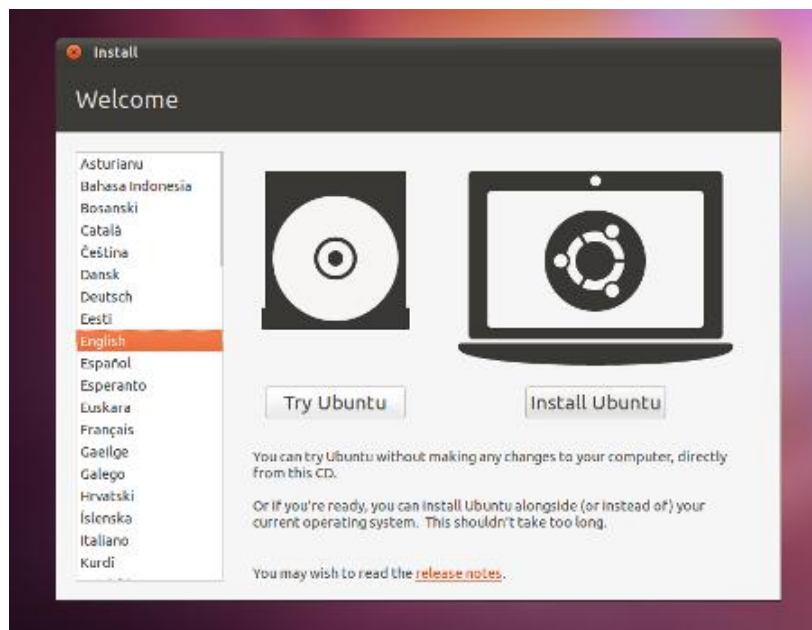


Figure Appendix 2-17

Select language and click **Install Ubuntu**.



Figure Appendix 2-18

Click **Forward**.

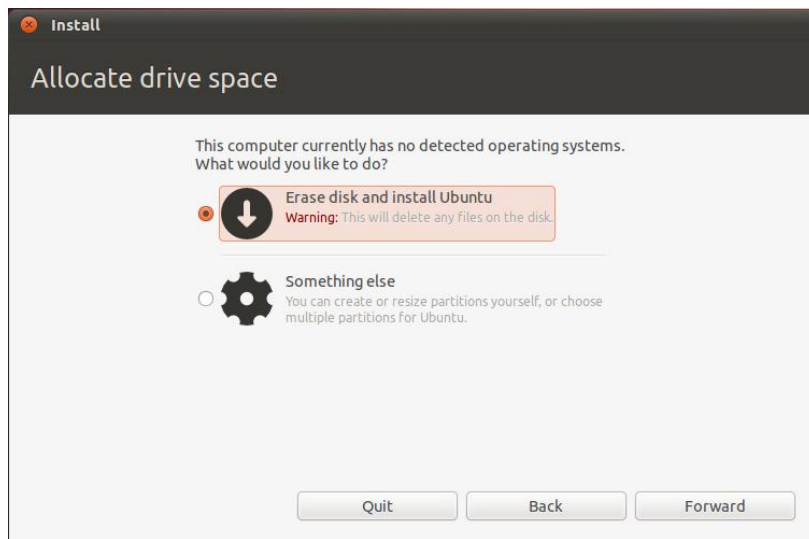


Figure Appendix 2-19

Click **Forward**.

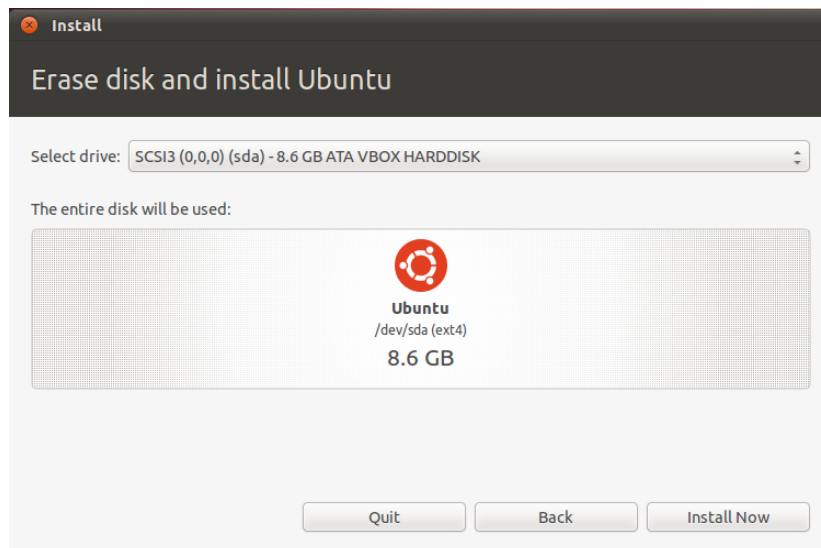


Figure Appendix 2-20

This is the no-turning-back point. If you decide to do this, your hard drive will be repartitioned and part or all of it will be formatted. Before you click this button “Install Now” to continue, make sure you have everything backed up.

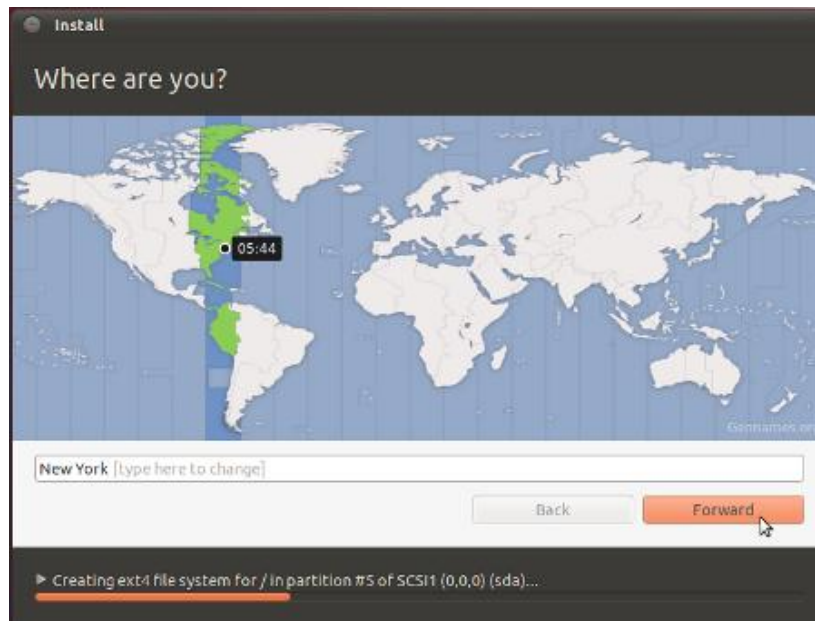


Figure Appendix 2-21

While Ubuntu is preparing files to copy over for installation, it'll ask you some questions. They're self-explanatory.

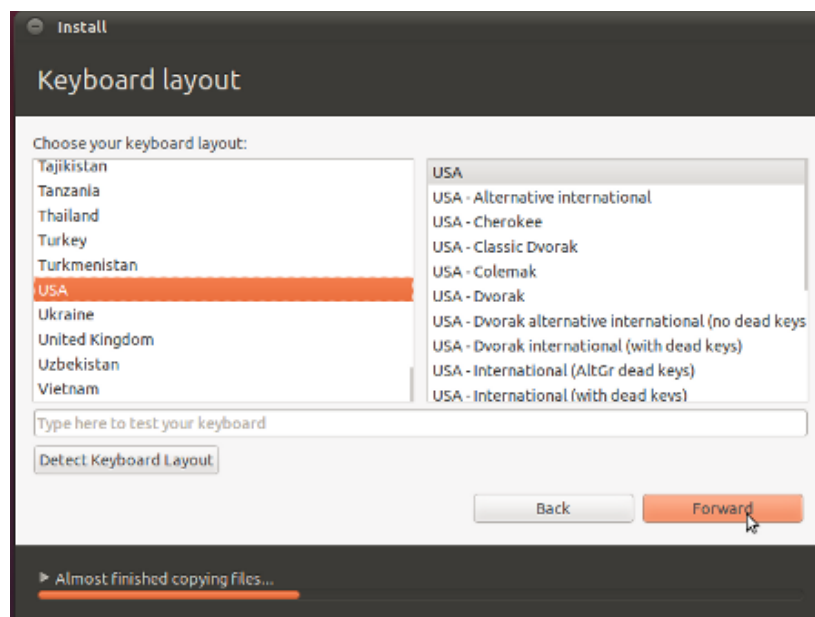


Figure Appendix 2-22

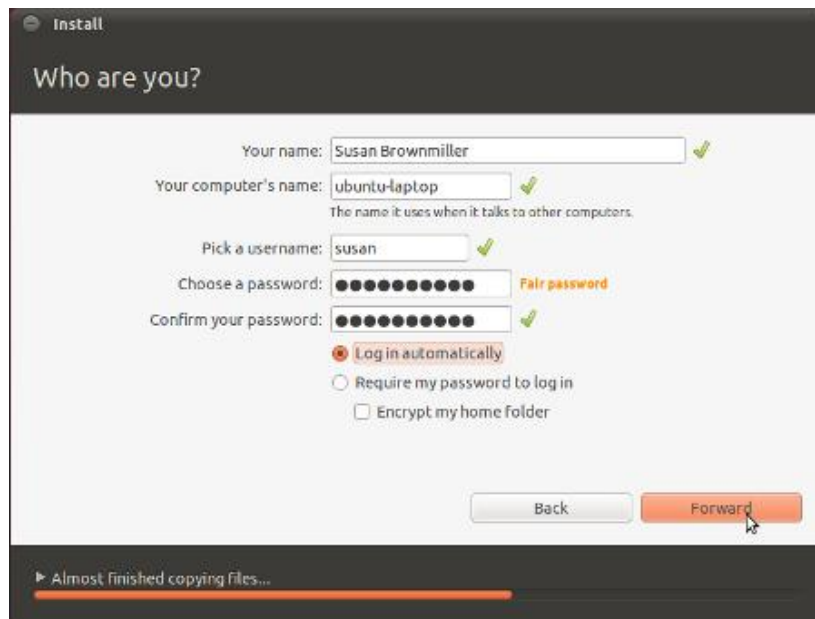


Figure Appendix 2-23



Figure Appendix 2-24

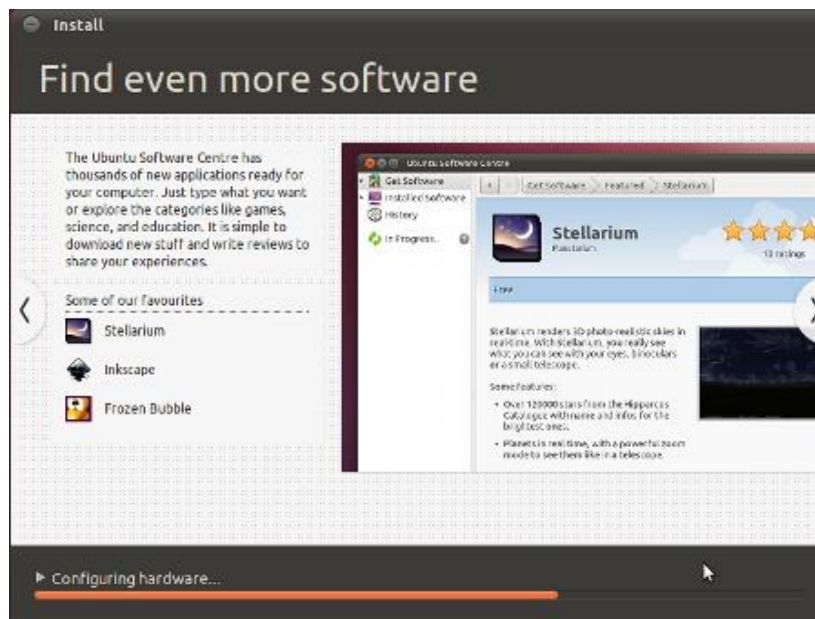


Figure Appendix 2-25



Figure Appendix 2-26

The installation will finish (the whole thing can take anywhere between 15 minutes and an hour, depending on the speed of your computer).

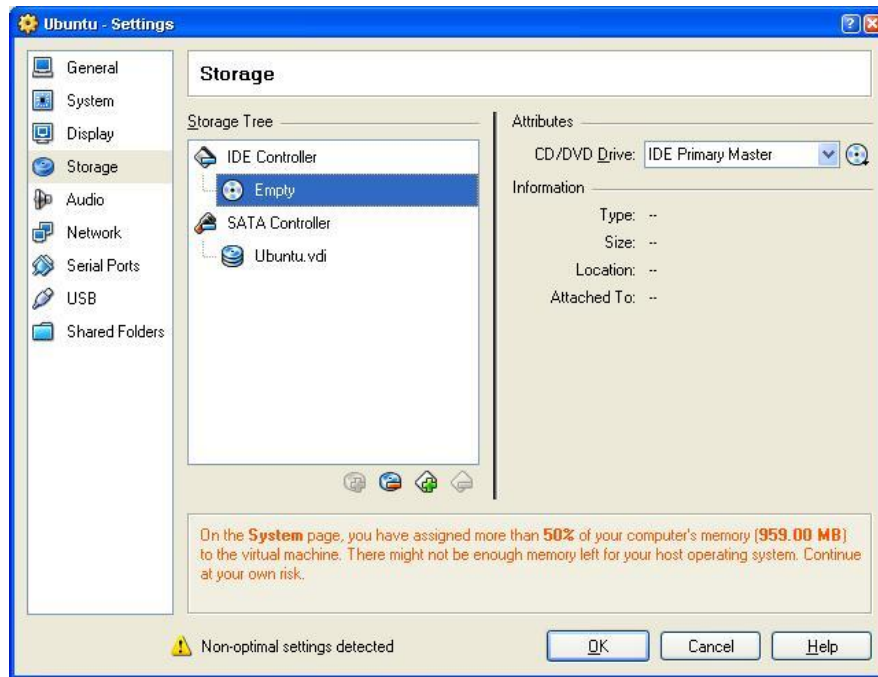


Figure Appendix 2-27

Afterwards, in order to use your virtualized installation (instead of continually booting from the live CD), you have to change the CD/DVD Device entry to be **Empty** again.

Appendix III: Driver Installation for Linux USB

Ethernet/RNDIS Gadget

1. If you haven't install the driver for Linux USB Ethernet/RNDIS Gadget, when you connect the device, PC will find the new hardware and pops up a window on the screen, please select "From list or designated location", then click "Next"

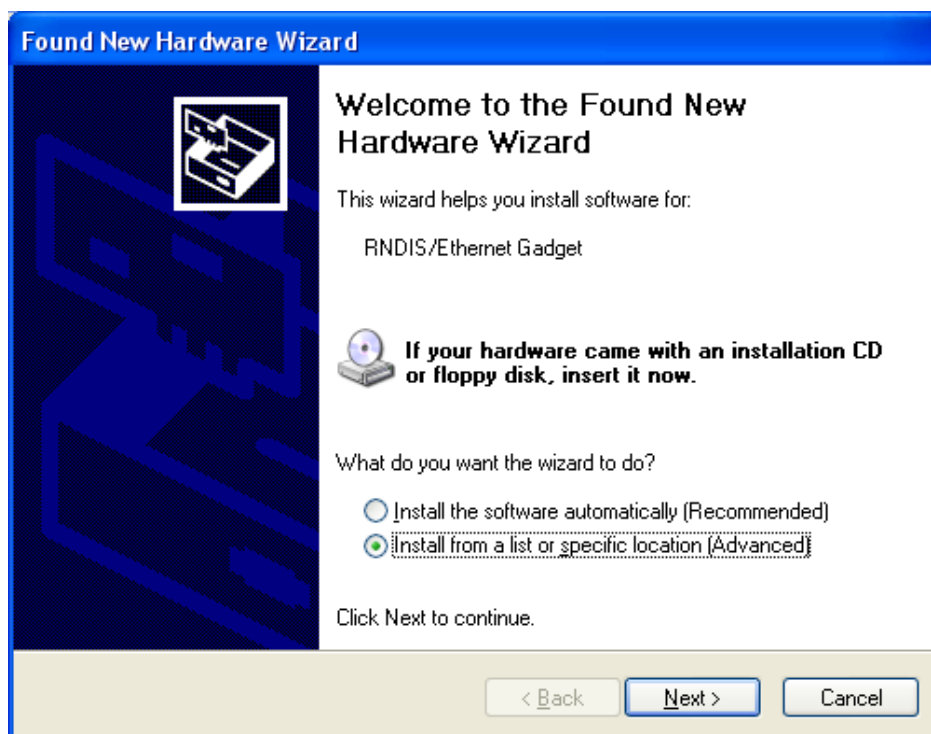


Figure Appedix 3-1

2. Designate a path for the USB driver, and the USB driver directory is [disk\linux\tools], then click "Next"

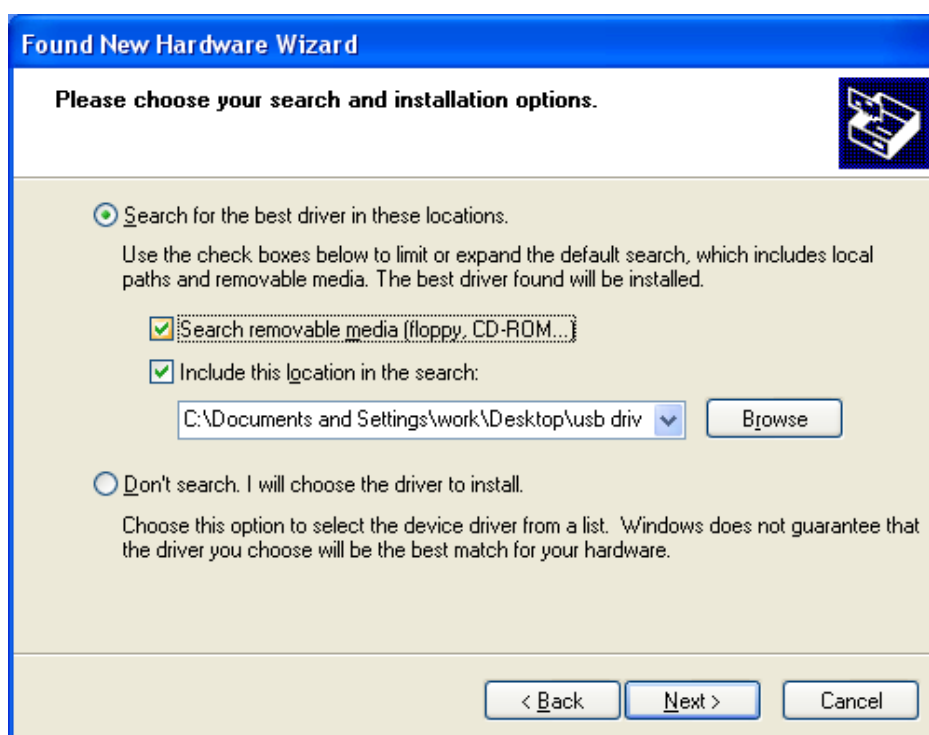


Figure Appendix 3-2

3. When the following appears, select "Continue"



Figure Appendix 3-3

4. Please wait until the installation is completed

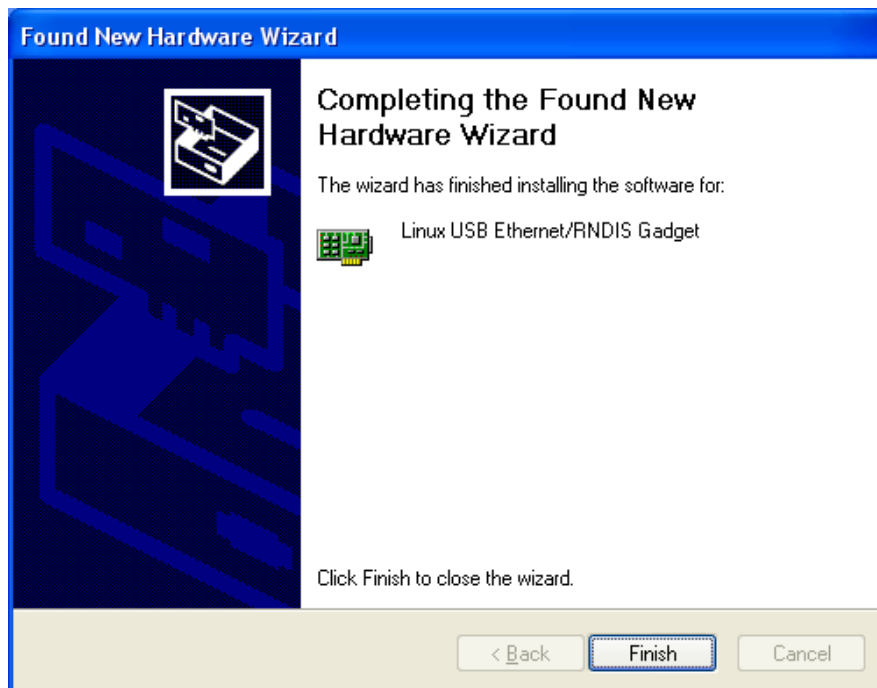


Figure Appendix 3-4

Appendix IV: The Setup Of TFTP Server

1. Install client

```
$>sudo apt-get install tftp-hpa
$>sudo apt-get install tftpd-hpa
```

2. Install inet

```
$>sudo apt-get install xinetd
$>sudo apt-get install netkit-inetd
```

3. Configure the server

First, create “tftpboot” under root directory, and set the properties as “a random user can write and read”

```
$>cd /
$>sudo mkdir tftpboot
$>sudo chmod 777 tftpboot
```

Secondly, add in /etc/inetd.conf:

```
$>sudo vi /etc/inetd.conf //copy the follow word to this file
tftpd dgram udp wait root /usr/sbin/in.tftpd /usr/sbin/in.tftpd -s /tftpboot
```

Then, reload inetd process:

```
$>sudo /etc/init.d/inetd reload
```

Finally, enter directory /etc/xinetd.d/, and create a new file TFTP and put the designated content into the TFTP file:

```
$>cd /etc/xinetd.d/
$>sudo touch tftp
$>sudo vi tftp ///copy the follow word to tftp file
service tftp
{
    disable = no
    socket_type = dgram
    protocol = udp
    wait = yes
    user = root
    server = /usr/sbin/in.tftpd
```

```
server_args    = -s /tftpboot -c
per_source     = 11
cps            = 100 2
}
```

4. Reboot the server:

```
$>sudo /etc/init.d/xinetd restart
$>sudo in.tftpd -l /tftpboot
```

5. Test the server

Conduct a test; create a file under folder /tftpboot

```
$>touch abc
```

Enter into another folder

```
$>tftp 192.168.1.15 (192.168.1.15was the server IP)
$>tftp> get abc
```

That download can be made means the server has been installed.

Customer Service & Technical support

Customer Service

Please contact Premier Farnell local sales and customer services staffs for the help.

Website: <http://www.farnell.com/>

Technical Support

Please contact Premier Farnell local technical support team for any technical issues through the telephone, live chat & mail, or post your questions on the below micro site, we will reply to you as soon as possible.

Centralized technical support mail box: knode_tech@element14.com

Community: <http://www.element14.com/community/docs/DOC-41892>

Notes

This board was designed by element14's design partner- Embest, you can contact them to get the technical support as well.

Marketing Department:

Tel: +86-755-25635656 / 25636285

Fax: +86-755-25616057

E-mail: market@embedinfo.com

Technical Support:

Tel: +86-755-25503401

E-mail: support@embedinfo.com

URL: <http://www.armkits.com>