uClinux NEEK BSP User Guide

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About This Document

This document describes the usage of the uClinux NEEK board support package. With the help of the bsp you can develop embedded applications using NEEK kit and uClinux.

Table below shows the revision history of the document

Version	Date	Description
1.0	July 2008	First release
1.1	July 2008	Added uClinux demo images and SLS Player images.
1.2	August 2008	Remove Chapter 7.0 – Root File System Added section 8.2 quick reference Added section 5.4 I2S Application Added section 3.1.1. 3.1.2, 3.2.1 and 3.2.2
1.3	August 2008	Added Frame buffer console section under 8.2 Quick Reference Added the section 4.5 SLS PS/2 IP Driver

How to Contact SLS

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Information Type	Email
E-mail Product literature services, SLS literature services, Non-technical customer services, Technical	support@slscorp.com

Typographic Conventions

This document uses the typographic conventions shown as below.

Visual Cue	Meaning
Bold type with initial capital letters	All headings, subheadings titles in a document are displayed in bold type with initial capital letters. E.g. **Configuring and Compiling.**
Bold	Project names, Menu commands, disk drive names, filenames, filename extensions, and software utility names are shown in bold type. Examples: **Helloworld**, project name, **Exit** menu command, **romfs/bin** directory, **sls_neek_bsp_hw_sopc.ptf** file.
Courier	Anything that must be typed exactly as it appears is shown in Courier type. For example: `cd/home/uClinux/uClinux-dist`.
1, 2	Numbered steps are used in a list of items, when the sequence of items is important. Such as steps listed in procedure.
•	Bullets are used in a list of items when the sequence of items is not important.
	The hand points to special information that requires special attention
	The caution indicates required information that needs special consideration and understanding and should be read prior to starting or continuing with the procedure or process.
	The warning indicates information that should be read prior to starting or continuing the procedure or processes.
	The feet direct you to more information on a particular topic.

Table of Contents

1. Introduction

uClinux NEEK Board support package (BSP) provides developers with the easiest and fastest way to create embedded applications on the NEEK kit (target) using the uClinux operating system. This combination of hardware, firmware, and software form a complete package for building, downloading, and testing applications developed on a host machine:

- Install the uClinux board support package (BSP) on the host machine.
- Connect Ethernet and JTAG cable between host and target for serial communication
- Build the custom Linux kernel for the NEEK board
- Start writing application code.

When ready to see your application in action, just download it to the NEEK board. Now you can test and debug the kernel and application.

1.1 Software

uClinux NEEK BSP is the combination of uClinux, IP core drivers and applications developed by SLS Corporation. Current version of the BSP supports VGA, TPC, SD Card, Ethernet, PS/2 and I^2S IP.

uClinux is a port of the Linux for MMU less processor. So many different architectures are supported by uClinux. It has almost all necessary powers as an embedded operating system. This document is based on kernel version 2.6.23. Visit www.uclinux.org for more information.

1.2 Hardware

1.2.1 Target processor

This bsp is targeted for Nios2.Nios2 is a soft core FPGA processor. It is 32 bit RISC general purpose processor. Nios II processor system is equivalent to a microcontroller or “Computer on a chip” that includes a processor and a combination of peripherals and memory on a single chip. The term “Nios II processor system” refers to a Nios II processor core, a set of on-chip peripherals, on-chip memory, and interfaces to off-chip memory, all implemented on a Single Altera device. Like a microcontroller family, all Nios II processor systems use a consistent instruction set and programming model.

1.2.2 NEEK Kit (Nios Embedded Evaluation kit)

The NEEK kit includes feature reach development board having Cyclone III EP3C25F324 FPGA, 256-Mbit DDR SDRAM, 1-Mbyte Synchronous SRAM, 16-

Mbytes Intel P30/P33 flash and LCD multimedia card. To get the details of NEEK kit, please read NEEK user guide located at */DOCS*.

1.3 Supported Devices

The NEEK board devices that are currently supported in the uClinux kernel with the uClinux NEEK BSP include:

- Flash
- SD Card IP
- 10/100 Ethernet IP
- VGA/LCD Controller IP
- PS/2 IP
- Touch Panel IP
- I^2S IP
- Audio Codec Configuration IP
- Serial UART

1.4 Development Platform Requirements

We assume that user is familiar with Altera tools. Following are Development platform requirements:

- Any Linux distribution having good hardware configuration with at least 2.5 GB free space.
- Altera Development Tools (7.2 or above).

This uClinux BSP is tested on RED Hat Fedora 7 core but it should work on other Linux Desktop distribution also. You can build the kernel and application on Linux desktop only. The images built on Linux can be downloaded and run on Windows if the Altera Development tools are installed.

This BSP will not work on Cygwin environment.

1.5 Setup

To startup and begin communicating with the board:

1. Establish communication between target (Board) and host (PC) using JTAG cable.
2. Establish a network connection using RJ45 Ethernet cable to debug the application.
3. Establish a serial connection using RS232 cable to use Serial UART as console.

4. Apply power to the NEEK board.
5. Connect VGA connector of the monitor to the VGA port of NEEK board if you want to see the images on both the VGA screen and LCD.

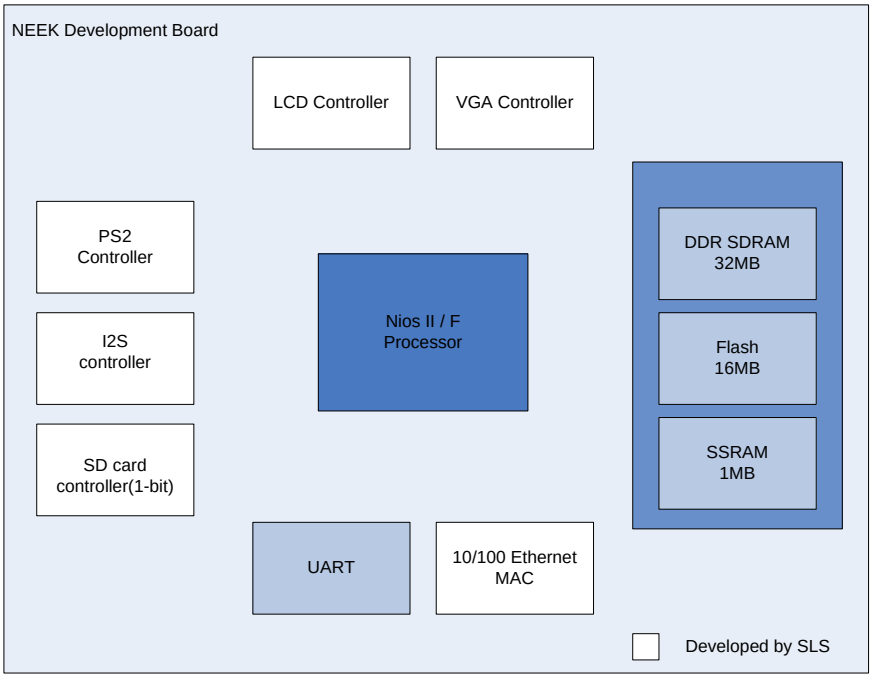
2. uClinux NEEK BSP Development Environment

This chapter provides information to help setup the development environment for the NEEK board.

2.1 NEEK BSP SOPC System

The Figure 1 below shows the block diagram of NEEK BSP SOPC system.

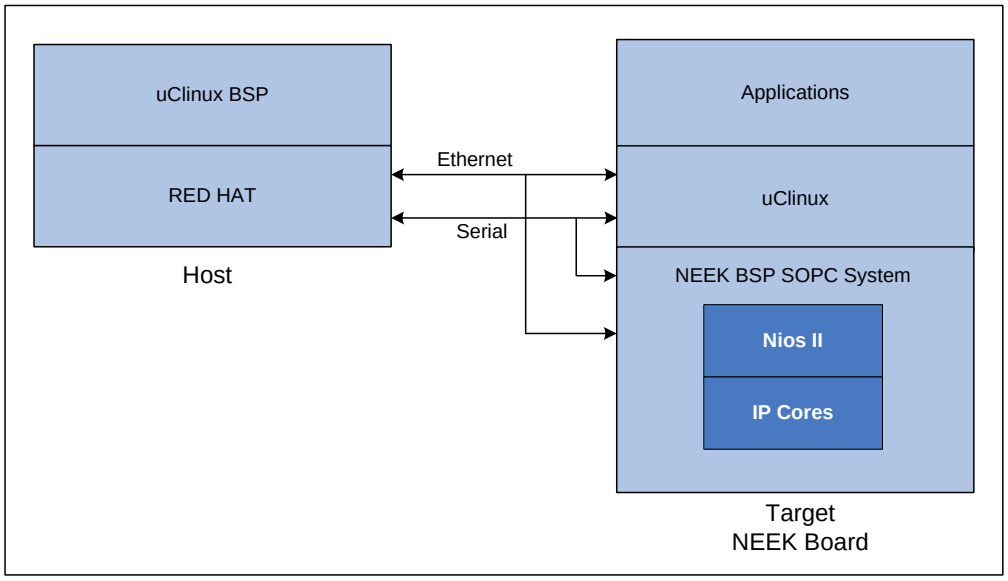
Figure 1 : NEEK BSP SOPC System



2.2 Development Environment

The Nios II embedded development environment consists of two systems: a host system and a target system. The host system is used for compiling, linking, remote debugging, and associated development activities. The target system, such as the NEEK board, is used for application development and testing (Figure 2). The board acts as a target for application development

Figure 2 : Development Environment



2.2.1 NEEK BSP Components

Table below lists the components included in the uClinux NEEK BSP.

Component	Description
kernel	v2.6.23
gcc	v3.4.6
Ethernet driver	Included
serial driver	Included
ps2 keyboard	Included
Touch panel controller	Included
VGA/LCD driver	Included
SDcard driver	Included
I2s driver	Included
Audio codec driver	Included
FLASH driver	Included
JFFS2 support	Included
VFAT support	Included
NFS support	Included
MP3 support	Included
JPEG support	Included

2.2.2 IP Address Used

The table below lists the IP address and port used throughout this document. It may be different for your system. Please check your network settings before applying any IP address.

IP Address	Description
192.168.0.14	Development Target IP address
192.168.0.26	Development Host and NFS server IP address
192.168.0.205	Getway IP Address
255.255.255.0	Getway Mask
9999	TCP port

2.3 Development Host

Refer to the Red Hat documentation for Red Hat Fedora 7.0 core installation and host setup information.

2.3.1 Downloading and Unpacking uClinux NEEK BSP

To download the uClinux NEEK BSP package visit: http://slscorp.com/pages/bspdownload.php.

Now, to unpack the BSP package, follow the steps mentioned below:

1. Copy the entire package in the home directory.
2. Apply **su** command to login as super user

   ```
   #su
   ```

   It will ask super user password for further process.
3. Issue

   ```
   #cd /home
   #tar jxfv uClinux.tar.bz2
   ```
4. Now go into uClinux directory using the following command

   ```
   #cd /home/uClinux
   ```

   And then

   ```
   #tar jxfv uClinux-dist.tar.bz2
   ```

   It starts extracting files and it may take some time.
5. Now, issue

```
#cd Bintools
#tar jxfv nios2gcc-20080203.tar.bz2
```

6. Return to uClinux

   ```
   #cd..
   ```

7. Issue command

   ```
   #ls
   ```

   Here you will see uClinux-dist Bintools System-files.

2.3.2 Directory Contents

You have now successfully unpacked the BSP package. You will see following directory structure:

Directory	Description
uClinux	Contains uClinux-dist, Bintool (binary tool chain) and system-files. User who is interested only in software side can start working with this directory.
docs	Contains BSP documents: uClinux NEEK BSP user guide, NEEK user guide, DRIVERSAPI.txt and boot_msg.txt.
demos	Contains SLS uClinux Demo and Format utility for SD card. In each subdirectory you will find other necessary information like quick start guide and readme.
Ref_design	Contains Quartus Archive project of SOPC system used in this BSP
Quick Reference	Pre-built zImage for ready reference.

2.4 Development Target

2.4.1 Configuring and Compiling the uClinux

NEEK BSP has two main areas of configurations. Together they define a complete uClinux platform configuration. The two areas include:

- Vendor / Product Settings
- Kernel Settings

In this section, you will learn all the above listed configurations.

Start the Configuration Menu

To configure the kernel, go to the directory “/home/uClinux/uClinux-dist” and follow the steps below:

1. Open the Linux terminal.
2. On the terminal, change into the $home/uClinux/uClinux-dist directory and change the environment path. Use one of the four main kernel configuration methods to start the configuration menu.

   ```
   #cd /home/uClinux/uClinux-dist
   ```

   ```
   #PATH=$PATH:/home/uClinux/Bintools/opt/nios2/bin
   ```

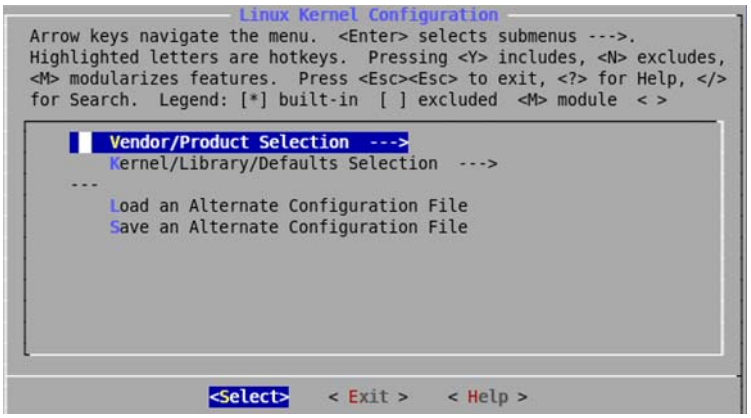
6. Configure the kernel

   ```
   #make clean
   ```

   ```
   #make menuconfig
   ```

   You will see the Kernel configuration main menu as shown in Figure 3.

Figure 3 : Linux Kenrel Configuration Main Menu



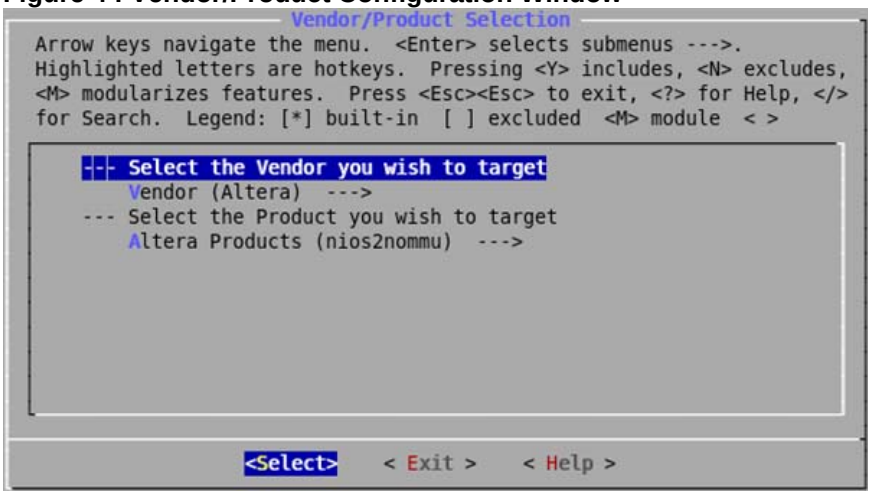
Use one of the two main kernel configuration methods to start the configuration.

Use ↑ or ↓ arrow to select the menu item and then press ↵to go into the submenu. Use ← or → and then press ↵to select the menu command “<Select>” “<Exit>” or “<Help>” throughout the configuration.

Configuring Vendor/Product Settings

1. Select the submenu **Vendor/Product Selection** ---> from the Figure 3. press **Enter**. You will see Vendor/Product Configuration window. See Figure 4

Figure 4 : Vendor/Product Configuration Window



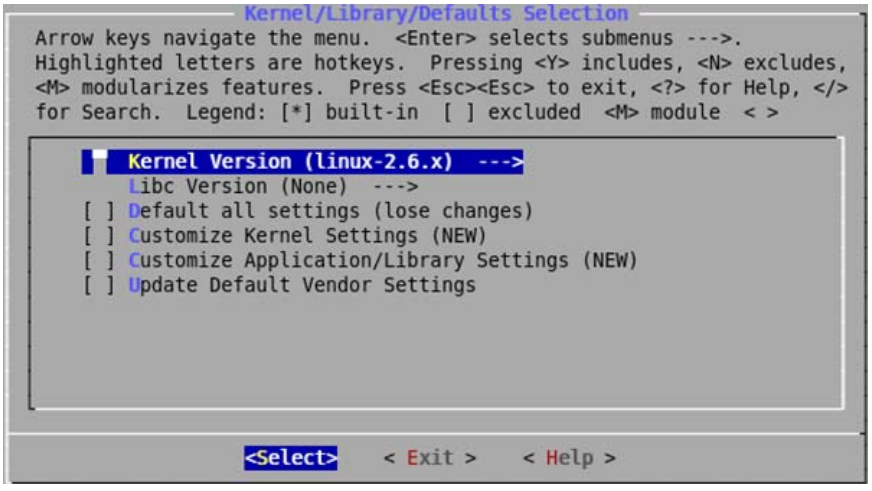
2. Select the following options:
   - Vendor: **Vendor (Altera)**
   - Target Product: **Altera Products (nios2nommu) ---->**

3. Select **<Exit>.** You will return to Kernel configuration menu Figure 3.

Configuring Kernel/Library/Defaults Settings

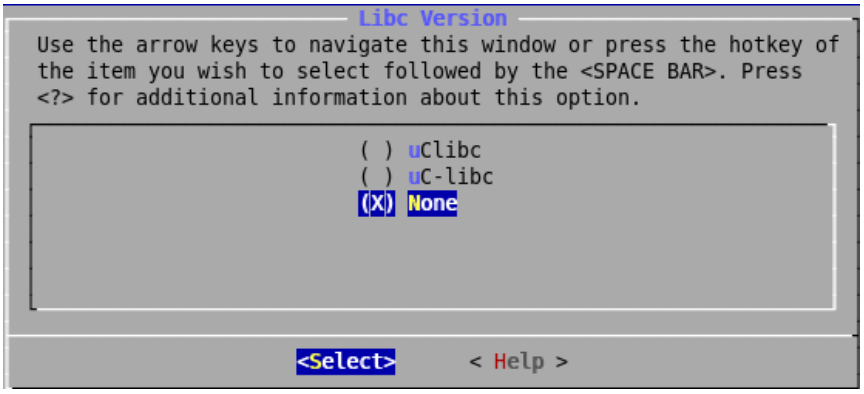
1. Select the option **Kernel/Library/Defaults Selection --->** from the Kernel Configuration Menu Figure 3. You will see the Kernel/Library/Defaults Selection submenu as shown in Figure 5

Figure 5 : Kernel/Library/Defaults Selection Window



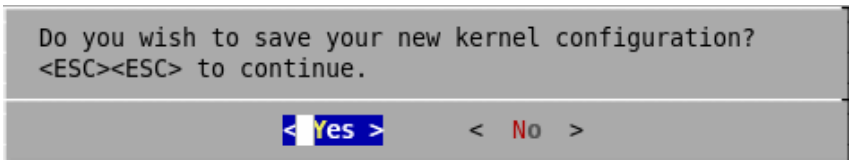
2. Select **Libc Version (None) ----> .**You will see the as shown in Figure 6.

Figure 6 Libc Version Settings



3. Press **Enter** to select **None.**
4. Select <**Exit**>
5. Select <**Exit**>
6. You will be asked to save the kernel configuration. See Figure 7

Figure 7 : Save Option



7. Select <**Yes**> and press **Enter**.

   You have now finished Kernel/Library/Defaults settings.

DO NOT change any other settings until first successful boot.

8. You will be backed to Linux Terminal.

2.4.2 Set System.ptf

Generate a system header file with the **sls_neek_bsp_hw_sopc.ptf .** This file is located at **"/home/uClinux/System-files**" directory. You will be prompted to select the hardware from the available list.

1. Type the following command and press **Enter**.

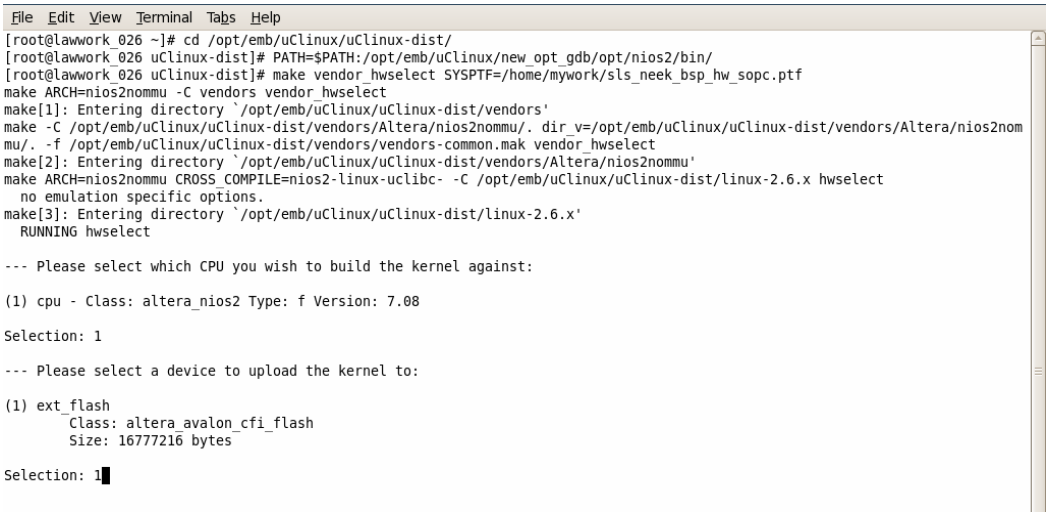
   ```
   #make vendor_hwselect SYSPTF=/home/uClinux/
   System-files/sls_neek_bsp_hw_sopc.ptf
   ```

   You will be asked to select the CPU. See Figure 8

Figure 8 : CPU Selection

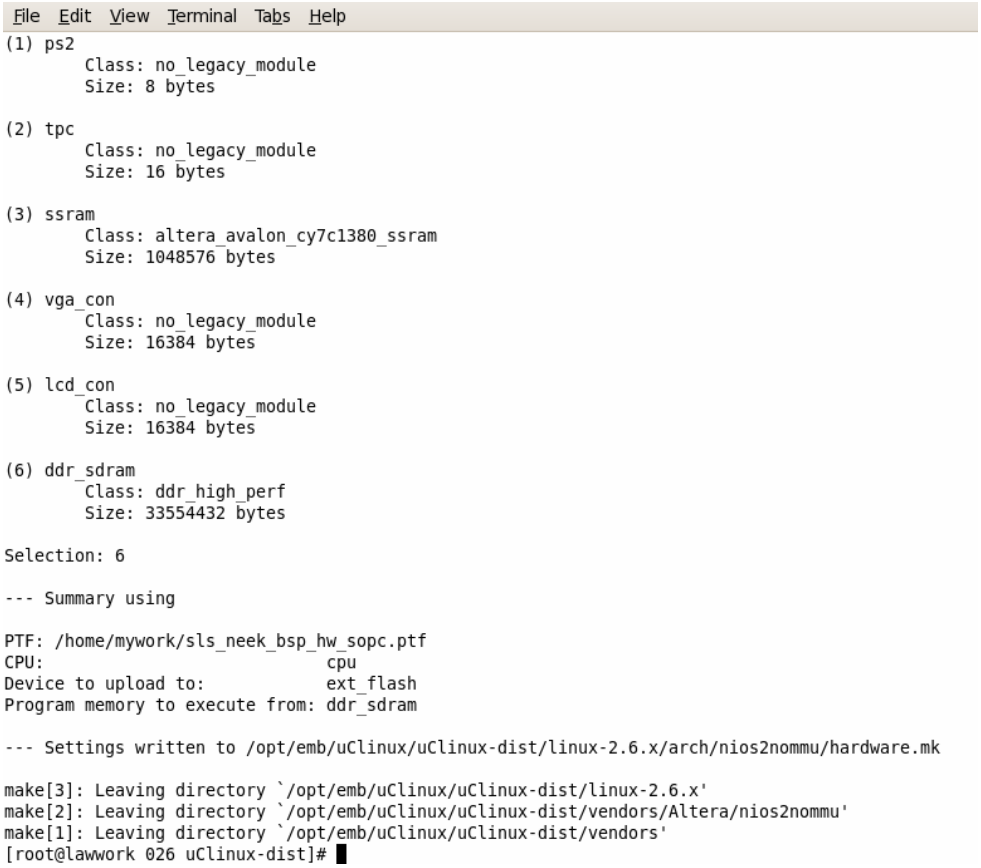
2. Type **(1)** and press **Enter**. It will ask for the device to upload the kernel to. See Figure 9.

Figure 9 : Select a Device to Upload the Kernel To



3. Enter the choice **(1).** It will ask to select a device to execute kernel from: See Figure 10

Figure 10 : Select a Device to Execute Kernel From



7. To select DDR SDRAM, enter:

   `Selection:6`

8. Now create romfs directory by issuing following command.

   `#make romfs`

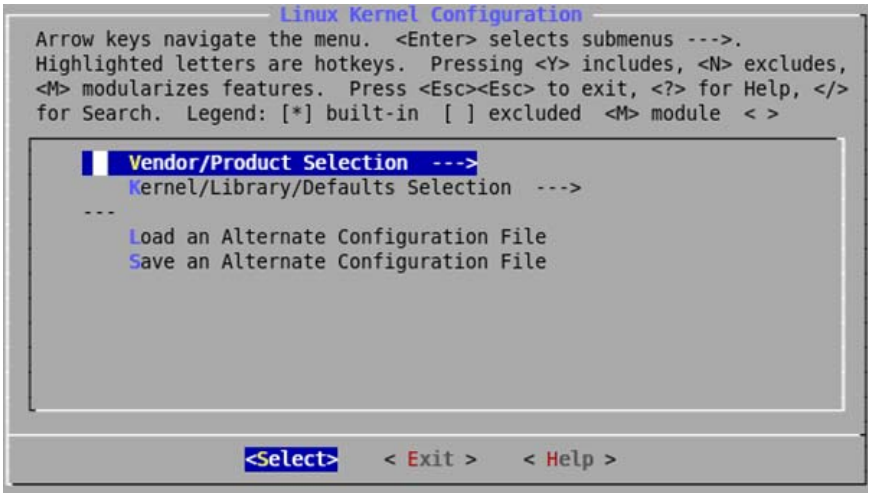
   You may get error. Ignore it.

2.4.3 Customization of Kernel Settings

1. To customize the Kernel Settings, type on the terminal:

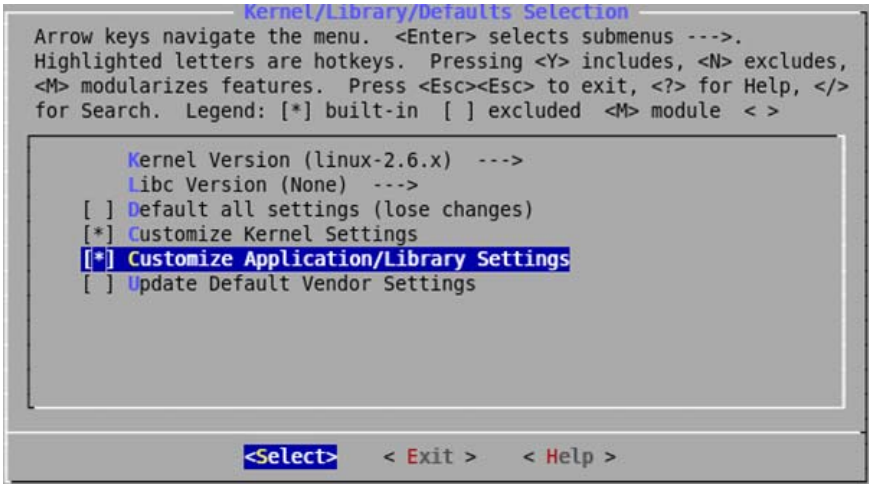
   `#make menuconfig`

Figure 11 : Linux Kernel Configuration Window



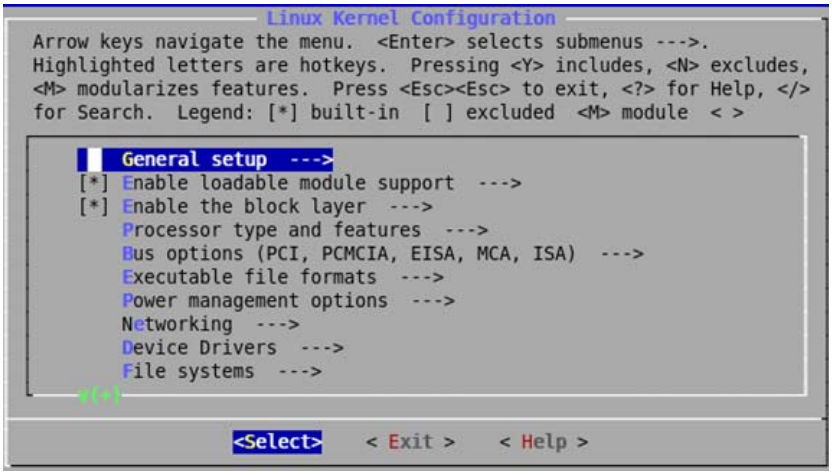
2. Select **Kernel/Library/Defaults** Selection and press **Enter.** You will see the more kernel configuration settings as shown in Figure 12.

Figure 12 : Customize Kernel/Library/Defaults Selection Window



3. Press **"Y"** to select the following options:
   - Customize Kernel Settings
   - Customize Application/Library Settings
4. Select **<exit>**.
5. Select **<exit>**
6. Select **<yes>** for saving all changed settings. The final kernel configuration window you will see as shown in Figure 13.

Figure 13 : Final Kernel Configuration Window



Configuring General Setup

Select General Setup option from Figure 13. Press Enter. You will see the following submenu. Press Y to select the options. Configure the General Setup as shown below.

```
[*] Prompt for development and/or incomplete
code/drivers

()  Local version - append to kernel release

[*] Automatically append version information to
the version string

[ ] System V IPC

[ ] POSIX Message Queues

[ ] BSD Process Accounting

[ ] Export task/process statistics through netlink
(EXPERIMENTAL)

[ ] User Namespaces (EXPERIMENTAL)
```

```
[ ] Auditing support

[ ] Kernel .config support

(14) Kernel log buffer size (16 => 64KB, 17 =>
128KB)

[*] Create deprecated sysfs files

[ ] Kernel->user space relay support (formerly
relayfs)

[*] Initial RAM filesystem and RAM disk
(initramfs/initrd) support

(../romfs../vendors/ Altera/ nios2nommu/ romfs_list)
Initramfs source file(s)

(500)User ID to map to 0 (user root)

(500)Group ID to map to 0 (group root)

[*] Optimize for size (Look out for broken
compilers!)

[*] Configure standard kernel features (for small
systems) --->

[ ] Enable eventpoll support

[*] Enable signalfd() system call

[*] Enable eventfd() system call

[ ] Enable VM event counters for /proc/vmstat

Choose SLAB allocator (SLAB) --->
```

Select and press **Exit**. You will return to the Kernel Configuration Window.

Configuring Loadable Module

Press **Y** to select Enable Loadable Module Support option from Figure 13.

```
[*] Enable loadable module support --->
```

Configuring Block Layer

Press **Y** to select Enable the block layer option from Figure 13.

```
[*] Enable the block layer --->
```

Configuring Processor Type and Features

Don’t change any settings for this option.

```
[ ] Processor type and features --->
```

Configuring Bus Options

Don’t change any settings for this option.

```
[ ] Bus options (PCI, PCMCIA, EISA, MCA, ISA) --->
```

Configuring Executable File Formats

Don’t change any settings for this option.

```
[ ] Executable file formats --->
```

Configuring Power Management Options

Don’t change any settings for this option.

```
[ ] Power management options --->
```

Configuring Networking

Don’t change any settings:

```
Networking --->
   [ ] Networking support --->
```

Configuring Device Drivers

Make the Device Driver settings as shown below. Keep all the options as default except the **character driver**> **Serial driver**.

```
Device Drivers --->
   Generic Driver Options --->
   [ ] Memory Technology Device (MTD) support --->
   [ ] Parallel port support --->
   [ ] Block devices --->
   [ ] Misc devices --->
   [ ] ATA/ATAPI/MFM/RLL support --->
   SCSI device support --->
   [ ] Serial ATA (prod) and Parallel ATA
   (experimental) drivers --->
   [ ] Multiple devices driver support (RAID and LVM) -
   -->
   [ ] Network device support --->
   [ ] ISDN support --->
   [ ] Telephony support --->
   Input device support --->
   Character devices --->
      [ ] Virtual terminal
      [ ] Non-standard serial port support
      [ ] Nios LCD 16207 device support
      [ ] Nios PIO buttons support
      [ ] SLS TPC support
      [ ] LED Manager support
      [ ] SnapGear Watchdog Support
      [ ] Fast Timer
      [ ] Reset switch support
      Serial drivers --->
         [ ] 8250/16550 and compatible serial port
         --- Non-8250 serial port support
         [ ] Nios serial support
```

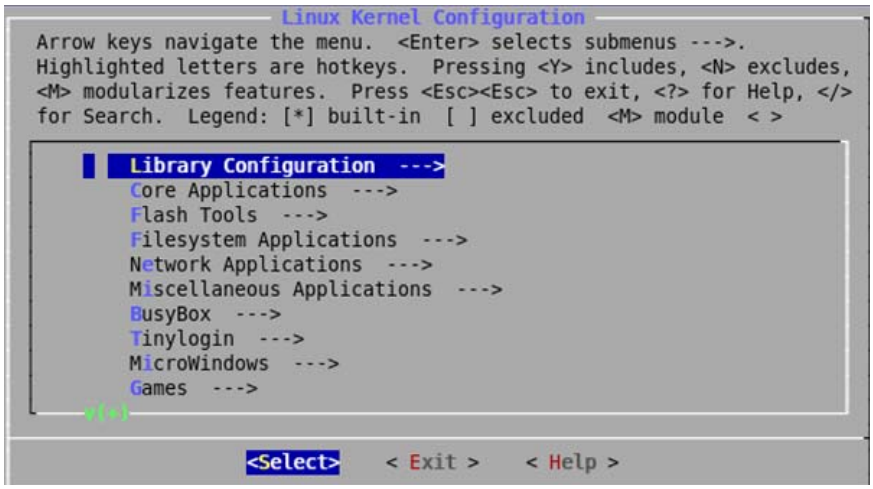
```
        [*] Altera JTAG UART support
        [*] Support for console on Altera JTAG uart
    [ ] Unix98 PTY support
    [ ] Legacy (BSD) PTY support
    [ ] IPMI top-level message handler --->
    [ ] Watchdog Timer Support --->
    [ ] Hardware Random Number Generator Core
    support
    [ ] Enhanced Real Time Clock Support
    [ ] Generic /dev/rtc emulation
    [ ] Siemens R3964 line discipline
    [ ] RAW driver (/dev/raw/rawN)
    [ ] TPM Hardware Support --->
    [ ] M41T11M6 Real Time Clock (RTC) support
[ ] I2C support --->
SPI support --->
[ ] Dallas's 1-wire support --->
[ ] Power supply class support --->
[ ] Hardware Monitoring support --->
Multifunction device drivers --->
Multimedia devices --->
Graphics support --->
Sound --->
[ ] USB support --->
[ ] MMC/SD card support --->
[ ] LED Support --->
[ ] Real Time Clock --->
DMA Engine support --->
Userspace I/O --->
```

Save all the settings and **Exit**. You will get the application setting window as shown in Figure 14.

If you want to use Serial UART as a console, then select the following options. Make sure you have not selected Altera JTAG UART support.

```
Device Drivers --->
   Character devices --->
      Serial drivers --->
         [*]Nios serial support
         [*]Support for console on Nios UART
         [ ] Altera JTAG UART support
         [ ] Support for console on Altera JTAG UART
```

Figure 14 : Linux Kernel Configuration



Configuring Customize Application/Library Settings

Configure **Customize Application/Library Settings** menu as shown below:

```
Library Configuration --->
Core Applications --->
Flash Tools --->
Filesystem Applications --->
Network Applications --->
Miscellaneous Applications --->
BusyBox --->
   [*] BusyBox
         Coreutils --->
            [*] cp
            [*] dd
            [*] Enable DD signal handling for status
            reporting
         Linux System Utilities --->
            [*] mount
            [*] Support mounting NFS file systems
Tinylogin --->
MicroWindows --->
Games --->
Miscellaneous Configuration --->
Debug Builds --->
---
Load an Alternate Configuration File
Save Configuration to an Alternate File
```

Save all the settings and exit.

2.4.4 Building uClinux zImage

Once you have configured the kernel, build uClinux Image by issuing following commands.

```
#make
#make linux image
```

Here you will get **zImage** (elf file) *at /home/uClinux/uClinux-dist/image*

3. Downloading and Running zImage

zImage is one type of elf file which contains compress kernel image and romfs image. Given below are the steps for downloading a running zImage in to the NEEK hardware platform.

3.1 Running zImage on Linux

3.1.1 Using JTAG UART Console

To run zImage on Linux, you should have Nios2 EDS installed on your pc with properly set environmental variables. We will use utilities from Nios2 EDS. This description is for JTAG UART console only.

First configure .sof

```
#nios2-configure-sof/home/uClinux/System-
files/sls_neek_bsp_hw.sof
```

To download zImage, open the terminal

```
#nios2-download –g /home/uClinux/uClinux-dist/images/zImage
```

Run the command

```
#nios2-terminal
```

Here you will see booting.

3.1.2 Using Serial UART Console

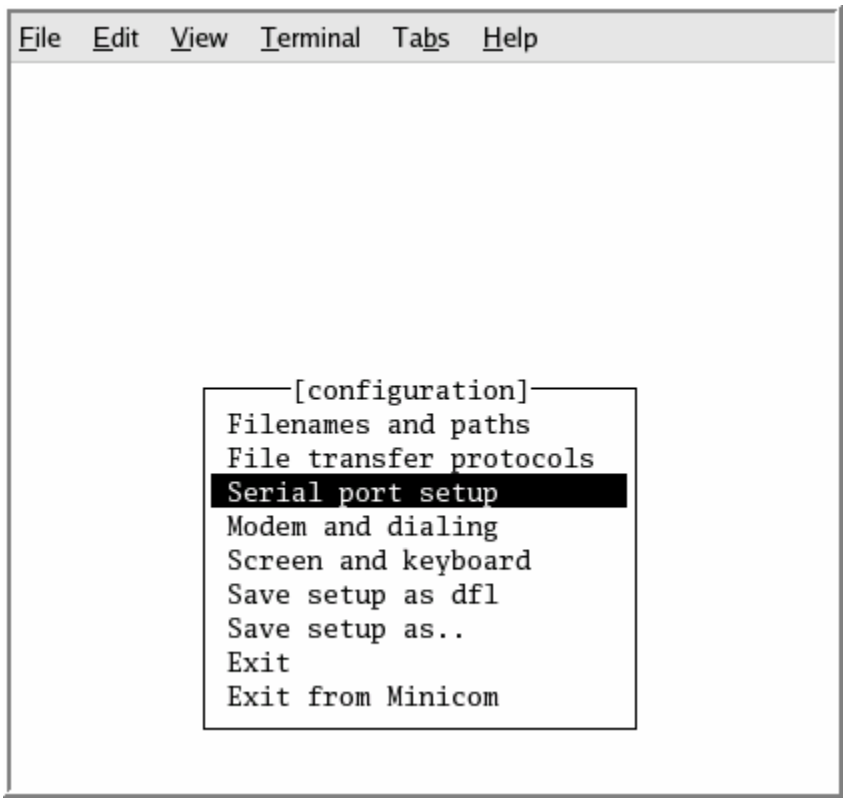
Use Minicom as serial terminal emulator. First of all configure Minicom to use it with zImage. Follow the steps below to configure Minicom.

1. On your terminal type,

   # minicom -s

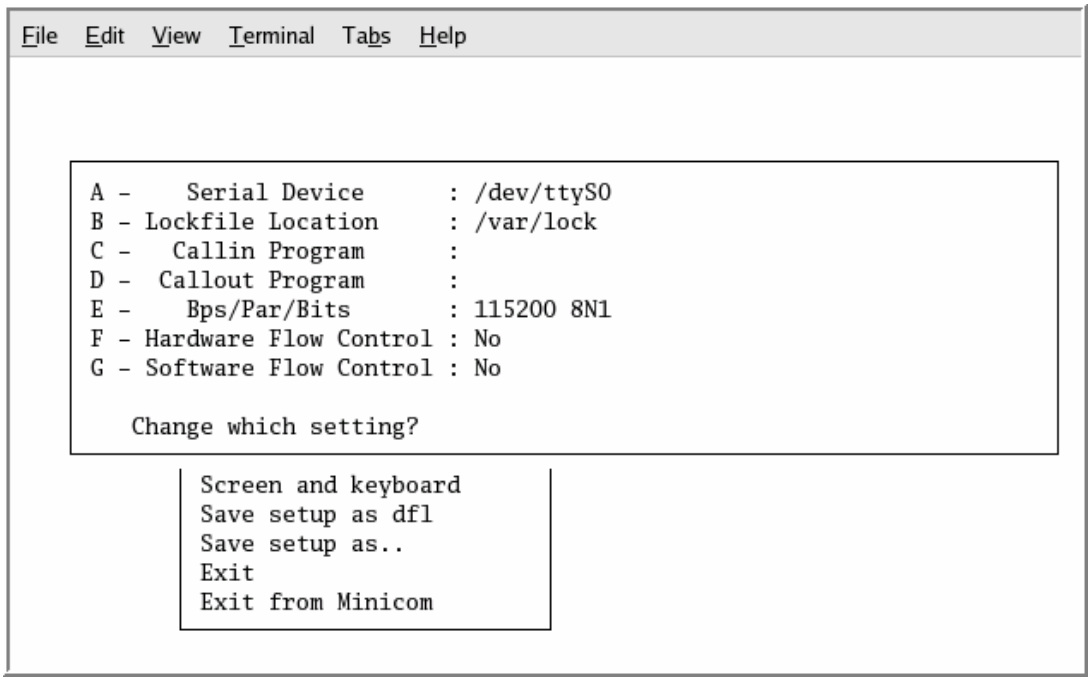
   The Minicom configuration window opens. See Figure 15 . Select **Serial port setup** and press **Enter** key.

Figure 15 Minicom Configuration Window1



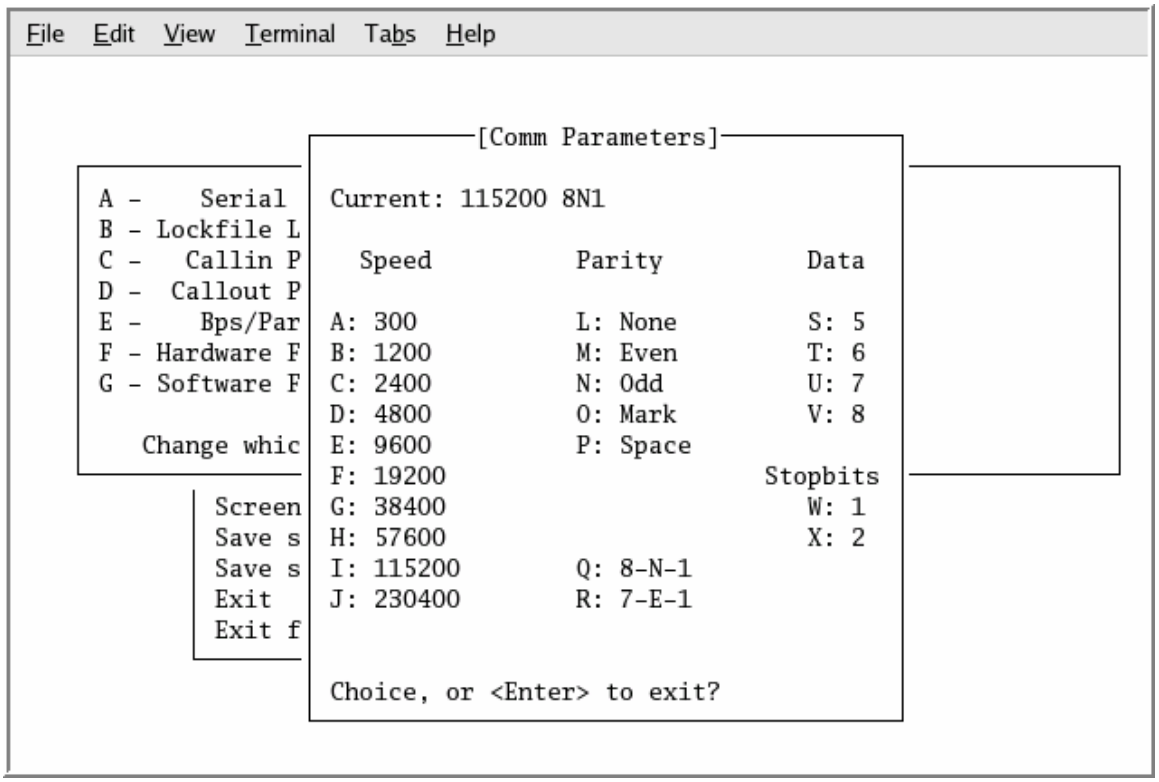
2. Select the Serial Device, baud rate and other parameters as shown in Figure 16. Here, we have selected Serial device as **/dev/ttyS0** but it may differ as per your development machine.

Figure 16 : Minicom Configuration Window 2



3. Set the baud rate 115200, 8 bit, no parity and one stop bit. See the Figure 17

Figure 17 : Minicom Configuration Window3



4. You may set this configuration as default by selecting **Save Setup as dfl** option after all configurations.
5. Now, download .sof and zImage from other terminal and you will see booting on Minicom.

3.2 Running zImage on windows

3.2.1 Using JTAG UART Console

If you have selected **JTAG** UART as console while building the zImage then follow the steps:

```
[SOPC Builder]$ nios2-configure-sof
sls_neek_bsp_hw.sof

[SOPC Builder]$ nios2-download -c USB-Blaster[USB-0]
zImage –g

[SOPC Builder]$ nios2-terminal
```

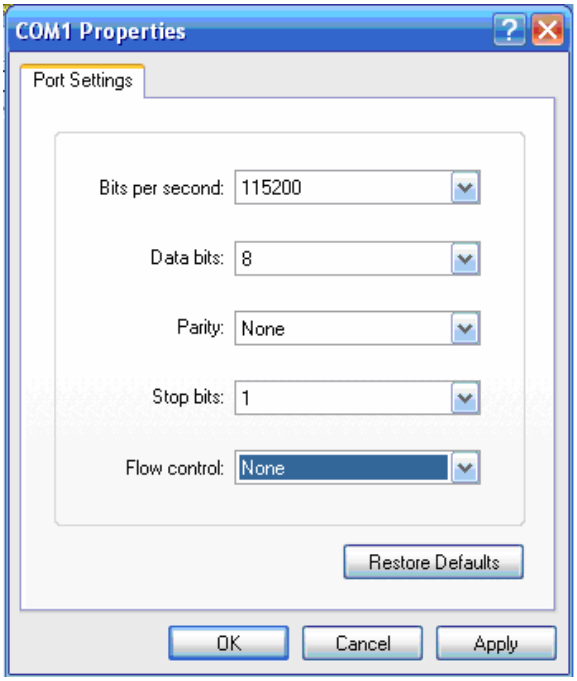
Here you can see Linux booting messages on same shell.

3.2.2 Using Serial UART Console

You can build zImage on Linux and run it on windows. This is the description for serial UART console. Go to the "/home/uClinux/uClinux-dist/images" directory. Copy the file named "zImage" and paste it in to your windows PC (make sure your zImage absolute path doesn't contain a white character i.e. space).also copy **sls_neek_bsp_hw.sof** from */home/uClinux/System-files* into *windows* directory.

1. Open the HyperTerminal with the following configuration.

Figure 18 : COM1 Properties



2. Download **sls_neek_bsp_hw.sof** file into the NEEK either Quartus programmer or with command.

3. Open the Nios II Command Shell. Navigate to the directory where you have put the zImage and sof files.

```
[SOPC Builder]$ cd /(your directory containing zImage)

[SOPC Builder]$ nios2-configure-sof
sls_neek_bsp_hw.sof

[SOPC Builder]$ nios2-download -c USB-Blaster[USB-0]
zImage -g
```

Here you can see Linux booting messages on the hyper terminal window.

4. Configuring Device Drivers and File Systems

If more functions need to be supported on kernel, then before the kernel rebuild, it needs to do the selected kernel configuration, the following sessions describe the procedures to do configurations.

To know more about peripherals and hardware available on the NEEK kit, refer the NEEK Kit Getting Started User Guide located at <BSP Installation Path>/Docs.

4.1 Flash Memory (MTD) Driver

To include the Flash Memory (Memory Technology Device) driver in compilation, the following options should be enabled:

```
Device Drivers --->
   Memory Technology Devices (MTD) --->
      [*] Memory Technology Device (MTD) support
      [*] MTD partitioning support
      [*] Direct char device access to MTD devices
      [*] Caching block device access to MTD devices
         RAM/ROM/Flash chip drivers --->
            [*] Detect flash chips by Common Flash
            Interface (CFI) probe
            [*] Support for Intel/Sharp flash chips
         Mapping drivers for chip access --->
            [*] Maps for Altera Nios Development Kit
```

4.1.1 JFFS2 File System Configuration

JFFS2 is a log-structured file system designed for use on flash devices in embedded systems. Rather than using a kind of translation layer on flash devices to emulate a normal hard drive, as is the case with older flash solutions, it places the file system directly on the flash chips.

If you want to use JFFS2 file system on Flash Memory then you have to configure both the Flash Memory driver and JFFS2 file system. First do the Flash Memory Driver configuration as described above. And then follow the procedure below to configure the JFFS2 File system.

```
File systems --->
      [*] Journaling Flash File System v2 (JFFS2)
      support
      (0) JFFS2 debugging verbosity (0 = quiet, 2 =
      noisy)
      [*] JFFS2 write-buffering support
```

4.2 SLS SD Card IP Driver

To include the SD Card Driver in compilation, the following options should be enabled:

```
Device Drivers --->
   [*] MMC/SD card support --->
   --- MMC/SD card support
   --- MMC/SD Card Drivers
   [ ] MMC block device driver
   --- MMC/SD Host Controller Drivers
   [*] SLS SD card device driver
```

4.2.1 VFAT

Virtual File Allocation Table (VFAT) is the part of the Windows 95 and later operating system that handles long file names, which otherwise could not be handled by the original file allocation table file allocation table (FAT) programming.

If you want to use VFAT file system on SD Card then you have to configure both the SD Card driver and VFAT file system. First do the SD Card Driver configuration as described above. And then follow the procedure below to configure the VFAT File system.

```
File systems --->
   DOS/FAT/NT File systems --->
      [*] MSDOS fs support
      [*] VFAT (Windows-95) fs support
      (850) Default codepage for FAT
      (Iso8859-1) Default iocharset for FAT
      Native Language Support

   --- Base native language support
      (iso8859-1) Default NLS Option
      [*] Codepage 437 (United States, Canada)
      [*] Codepage 850 (Europe)
      [*] NLS ISO 8859-1 (Latin 1; Western European
      Languages)
      [*] NLS UTF-8
```

4.3 SLS Ethernet IP Driver

To include the SLS Ethernet IP Driver in compilation, the following options should be enabled:

```
Networking --->
   [*] Networking support
   --- Network device support
   [ ] Network packet debugging (NEW)
   [*] Packet socket
   [ ] Packet socket: mmapped IO (NEW)
   [*] UNIX domain sockets
   [ ] PF_KEY sockets (NEW)
   [*] TCP/IP networking
Device Drivers --->
   [*] Network device support --->
      Ethernet (10 or 100Mbit) --->
         [*] SLS MAC support
```

4.3.1 NFS

NFS is a network file system protocol originally developed by Sun Microsystems in 1984, allowing a user on a client computer to access files over a network as easily as if the network devices were attached to its local disks.

If you want to use NFS file system on Ethernet then you have to configure both the Ethernet IP driver (as described above) and NFS file system. Then follow the procedure below to configure the NFS File system

```
File systems -->
   Network File Systems -->
      [*] NFS file system support
      [*] Provide NFSv3 client support
```

4.4 SLS VGA IP Driver

To include the SLS VGA IP Driver in compilation, the following options should be enabled:

```
Device Drivers --->
   Graphics support --->
      [ ] Enable firmware EDID
      [*] Support for frame buffer devices
      --- Frame buffer hardware drivers
      [*] SLS VGA IP support
```

4.5 SLS PS/2 IP Driver

To include the SLS PS/2 IP Driver in compilation, the following options should be enabled:

```
Device Drivers --->
   Input device support --->
      [*] Generic input layer (needed for keyboard,
      mouse…)
      --- Input Device Drivers
      [*] Keyboards --->
         --- Keyboards
         [*] SLS PS2 Keyboard --->
```

4.6 SLS Touch Panel Controller (TPC) IP Driver

To include the SLS TPC IP Driver in compilation, the following options should be enabled:

```
Device Drivers --->
   Character devices --->
      [*] SLS TPC support
```

4.7 SLS I^2S IP Driver

To include the SLS I^2S IP driver in compilation, the following options should be enabled:

```
Device Drivers --->
   Character devices --->
      [*] SLS I2S support
```

4.8 UART Driver

To include the UART Driver in compilation, the following options should be enabled:

```
Device Drivers --->
   Character devices --->
      Serial support --->
         [*] Nios serial support
```

5. User Applications

Using the User Applications you can access the drivers, file systems and peripherals available on the board. This chapter describes the following user applications.

5.1 Flash and JFFS2 Application

To access Flash and JFFS2 application, include its driver and file system as described in the section: Flash Memory (MTD) Driver and JFFS2 File System Configuration.

5.1.1 Flash Tools

Select **Customize Application/Library Settings>Flash tools**. Select the options as shown below.

```
Flash Tools --->
   --- MTD utils
   [*] mtd-utils
   [*] erase
   [*] eraseall
   [*] unlock
   [*] lock
   [*] mkfs.jff2
```

Build the kernel as explained in the section Development Target.

5.1.2 Accessing Flash and JFFS2 Applications

To access the Flash and JFFS2 in your application use the required commands as described in the table below:

Table below lists Flash and JFFS2 commands along with the description.

Command	Description
`cat /proc/mtd`	Displays flash partitions.
`cat /proc/mounts`	Displays already mounted files.
`ls -l /dev/mtd*`	Lists mtdblocks and other details.
`unlock /dev/mtdx`	Unlocks all the sectors of mtd device. e.g.: unlock /dev/mtd0, this will unlock all sectors in mtd device0.

`erase device offset number_of_blocks`	Erases number of blocks of a device starting from the given address. e.g. : erase /dev/mtd0 0x00000 5 .This command would erase 5 blocks of mtdblock0 starting from the offset address 0x00000.
`eraseall /dev/mtdx`	Erases all the contents of mtd device. e.g. : eraseall /dev/mtd0. This would erases all the content from mtd device 0. ***Note:*** here mtd0 means mtd device0 and not mtdblock0. If you are not able to erase the content and get the message "**read only file system**" then use the unlock command mentioned above and after that use eraseall.
`mount -t jffs2 dev/mtdblockx /mnt`	Mounts mtdblockx partition on the /mnt directory. You can also use other directory than /mnt e.g. : mount –t jffs2 /dev/mtdblock2 /mnt This would mount mtdblock2 on the mnt directory. ***Note:*** Erase entire flash before mounting JFFS2 file system.
`mkfs.jffs2 –d jffs2 –o jffs2.img`	Creates jffs2.img file from input file jffs2.
`mkdir new`	Creates a new directory
`cp /new /dev/mtdx`	Copies a new directory to mtdx. e.g. : cp /new /dev/mtd0
`lock /dev/mtdx`	Locks all sectors of the mtd device. e.g. : lock /dev/mtd0 This would locks all sectors of mtd device0.
Note: (1). Where x=0, 1, 2.. mtd device or mtdblocks in the system. (2). By default sectors of flash device are locked. So you can not write anything before unlocking the flash device. Use unlock command to write on flash device.	

5.1.3 Configuring Flash Partition

To configure the flash partition, either you can create your own mapping driver or modify the partition with **altera.c** file. Here **altera.c** is the mapping driver for mtd device. It is located at *uClinux-dist/linux-2.6.x/drivers/mtd/maps/*.

5.2 VGA, LCD and SD Card Application

To access the VGA, LCD and SD Card applications, select necessary drivers and file systems for SD Card, VGA and LCD as mentioned in the SLS SD Card IP Driver, VFAT and SLS VGA IP Driver.sections.

Before going further, copy .jpg images from your PC in the SD Card and make the following selection.

```
Miscellaneous Applications --->
   ---video tools
   [*] jpegview
```

5.2.1 Viewing the SD Card Images on the VGA and LCD

1. To mount the SD Card on mnt directory, Issue the following command on the target when the system is up and running.

   ```
   />mount -t vfat /dev/hda /mnt ↵
   ```

   Sometimes, when the user uses this command on the console, it is failed to mount and returns with following error message.

   ```
   FAT: bogus number of reserved sectors
   VFS: Can't find a valid FAT file system on dev SLS_SD
   ```

   This is due to the problem in the file system formatted on the SD Card, which is supported in windows but is not supported in uClinux. To solve this problem, please download Quick Reference.

   When you extract Quick Reference, you will find following files:

   - zImage
   - sls_neek_bsp_hw.sof
   - readme.txt

   Download .sof and zImgae respectively. You will get console on serial UART. When zImage is up and running, plug the SD card into socket of the NEEK board. Issue following command to format the SD card.

   ```
   />mkdosfs –I –F 16 /dev/hda
   ```

   After formatting the SD card, you have to copy the JPG file from your PC through card reader in the NEEK board. Once again mount the SD card with VFAT file system.

3. Go to the mnt directory and see the contents of the SD card by Issuing the following command.

   ```
   />cd mnt ↵
   ```

```
/mnt>ls ↵
```

You will see on the console, the list of images contained in the SD card.

```
10036828.jpg
10176026.jpg
dho13v.jpg
```

4. View the images contained in the SD card on VGA monitor connected to VGA port of NEEK board and NEEK board LCD screen by issuing the following command.

```
/mnt>jpegview -S1 –f 10036828.jpg 10176026.jpg ↵
```

The console displays:

```
SLS_VGA Driver is opened
800 480 800 480 0 0 16 0 -1 -1
framebase = 0x5000000 err=0
ImageWidth=732 ImageHeight=480
read 10036828.jpg OK
ImageWidth=719 ImageHeight=480
read 10176026.jpg OK
```

5.3 Touch Panel Controller (TPC) Application

To access the Touch Panel Controller applications, select TPC driver as mentioned in section SLS Touch Panel Controller (TPC) IP Driver.

Select the user application as shown below:

```
Miscellaneous Applications --->
   [*] userapp
```

Build the kernel with this application. When the kernel is up and running, execute the command:

```
/>touchpanel & ↵
```

Now touch any part of LCD screen and you will see its co-ordinates get printed on the console.

5.4 I²S Application (To Play MP3 Songs)

To play MP3 songs with I²S IP core, please select SLS I2S IP Driver. In miscellaneous application, select following:

```
miscellenieous application -->
   --- Audio tools
   [*] mp3play
```

Build the zImage with these options. To test this application, copy the MP3 songs in SD card and run the zImage, when it is up and running. Mount the SD card as explained in Viewing the SD Card Images on the VGA and LCD. Issue following command:

```
/> cd mnt
mnt> ls
sample.mp3
.......
........
mnt>mp3play sample.mp3
```

Connect the headphone with the board and you will hear an mp3 song now. You can play any mp3 song with its name as explained above.

5.5 Adding New User Application

This section explains you of adding a user application named **hello** in uClinux. Follow the steps below to add a new user application.

1. Create **hello** directory in the */home/uClinux/uClinux-dist/user* directory.
2. Copy source file (C file) to the hello directory
3. Add the configuration variable **hello** to the *user/Kconfig* file:

   ```
   config USER_HELLO
   bool "hello"
   help
   help_words_here.....
   ```

   This adds the **hello** menu option to the userland configuration menu.
4. Add following lines to the *user/Makefile* to add the hello directory in compilation.

   ```
   ...
   ```

```
dir_$(CONFIG_USER_HELLO) += hello
...
```

5. Create the **Makefile** under *user/hello* directory as mentioned below to compile the hello application.

```
EXEC = hello

OBJS = hello.o

all: $(EXEC)

   $(EXEC): $(OBJS)

   $(CC) $(CFLAGS) $(LDFLAGS) -o $@ $(OBJS) $(LDLIBS)

romfs:

   $(ROMFSINST) /bin/$(EXEC)


clean:

   -rm -f $(EXEC) *.elf *.gdb *.o
```

6. Build the kernel with this application and issue the following command to view the output of this application.

```
/>hello ↵
```

   Here, you will see the output of your application.

5.6 Build New User Application Using SLS IP Drivers

To build a new user application using SLS IP drivers refer **DRIVERSAPI.txt** located at /*Docs*.

5.7 Shell Commands

Using Shell commands you can perform operations on the uClinux on the NEEK board. Shell is the basic application on the Linux system, default shell provided in BSP is “sh”. “sh” uses the current directory as the prompting string. Commands can be executed under shell. (It works the same way as PC Linux). Key in help under shell will display the internal commands provided by shell.

Table below lists the shell commands useful while debugging:

Command	Definition	Description
cat	cat filename	Shows file on screen
cd	cd [directory]	Change current directory
chgrp	chgrp GROUP FILE…	Change the group membership of each

		FILE to GROUP
chmod	chmod mode file/dir	Change file/directory mode
chown	chown group:user file/dir	Change file/directory own
cmp	cmp file1 file2	Compares two files
date	date [MMDDhhmm[YYYY]]	Get/set date
cp	cp file1 file2	Copy source to destination
df	df [device]	Shows information about the filesystem on which each FILE resides, or all filesystems by default
echo	echo arguments [>filename]	Output the ARGs or redirect to file
exec	exec file	Exec FILE, replacing this shell with the specified program
exit	exit [N]	Exit the shell with a status of N. If N is omitted, the exit status is that of the last command executed
free	free	Shows memory status
help	help	Shows help message
hexdump	hexdump file	Hex dump file
hostname	hostname	Shows host name
Kill	kill [-s sigspec | -n signum | -sigspec] [pid | job]…\n or kill -| [sigspec]	Sends signal to process
ln	ln –s file1 file2	Creates a link to the specified TARGET
ls	ls [options]	List information about the FILES
mkdir	mkdir dirname	Creates the DIRECTORY
mknod	mknod type major minor	Creates device file
more	more filename	File perusal filter
mount	mount –t type device dir	Mount file system
mv	mv source dest	Rename SOURCE to DEST,or move SOURCE(S) to DIRECTORY
printenv	printenv	Print environment variables
pid	pid	Shows current process
ps	ps	Shows process information
pwd	pwd	Show current dirctory
quit	quit	Quit current process
rm	rm file	Remove file
rmdir	rmdir dir	Remove dir
sleep	sleep number	sleep several seconds

setenv	setenv var value	Set environment varable
source	source file	Run command in file
sync	System sync	sync
touch	touch [option] file	Update the access and modification times of each FILE to the current time
umask	umask octal number	The user file-creation mask is set to MODE
umount	umount dir	Umount file system

6. Configuring Network utilities and NFS (Client)

This chapter introduces you about the network utilities ftp, dhcpcd, telnet, boa, and inetd. First of all follow all steps for Ethernet driver mentioned in the section SLS Ethernet IP Driver.

6.1 Configuring DHCP Client

1. Select **Customize Application/Library Settings.** Do the following settings for Network Application and Busybox.

```
Network Applications ---->
   [*] dhcpcd-new (2.0/2.4)
   [*] ntpdate
   [*] route
BusyBox ---->
   [*] ifconfig
   [*] ifconfig: status reporting
   [*] netstat
   [*] ping
```

2. To configure the IP address of the board dynamically (automatically), issue the following command on the target.

   `/>dhcpcd ↵`

3. To know the IP address received from the above command and to know the Ethernet port configuration, Issue following command on the target.

   `/>ifconfig ↵`

   You will find IP assigned to your board by ifconfig command

4. Ping your board from the host with the IP address (xx.xx.xx.xx) that you got from step 3.

   `#ping xx.xx.xx.xx ↵`

   Make sure that DHCP server is available in your network and there is enough space for new IP allocation.

6.2 Static IP Allocation

To configure the Static IP, do the following settings:

```
BusyBox ---->
   [*] ifconfig
   [*] ifconfig: status reporting
```

To allocate static IP to the board, issue following command on the target.

```
/>ifconfig eth0 192.168.0.14 ↵
```

6.3 Mounting NFS on NEEK

Before mounting NFS on NEEK, select the options as mentioned in SLS Ethernet IP Driver and NFS. Then go to the user application and select the following.

```
Network Applications --->
   [*] portmap
BusyBox --->
   [*] BusyBox
      Linux System Utilities --->
         [*] mount
         [*] Support mounting NFS file systems
      Networking Utilities --->
         [*] ifconfig
         [*] Enable status reporting output (+7k)
```

Now build the kernel.

6.3.1 NFS Server (Host) Set Up

To set up the NFS server follow the steps below:

1. Login as a **super user** on your server on the host pc in your network.
2. Create a directory called **nfs** in the */home* directory.

   ```
   #mkdir /home/nfs
   ```

3. Edit the file named **exports** under */etc* directory and add the following line:

   /home/nfs 192.168.0.0/255.255.255.0(sync,no_root_squash,rw)

   This setting may differ as per your network

5. Restart NFS server.

   ```
   #service nfs restart
   ```

6. Verify it by issuing the following command.

   ```
   #showmount –e
   ```

6.3.2 NFS Client (NEEK) Setup

When the **zImage** is up and running, issue the following command:

```
/>portmap &
```

```
/>mount -t nfs -n -o nolock,rsize=1024,wsize=1024
192.168.0.26:/home/nfs /mnt
```

After successful mounting, you can access the */home/nfs* directory on the NFS server (host PC) using */mnt* directory on the NFS client (NEEK board- target).

6.4 Configuring inetd, telnetd, ftpd Server

To configure inetd, telnettd, ftpd, follow the steps below:

1. First of all follow all steps for Ethernet driver mentioned in NEEK BSP driver chapter.

   ```
   Network Applications ---->
   [*] ftpd
   [*] inetd
   [*] telnetd
   ```

2. When the kernel is up and running run write the following command on console:

   ```
   />inetd & ↵
   ```

   This would run inetd server in the background which in turn will run the telnet and ftp server.

3. Now connect FTP client on HOST to the server running on the Board.Here Board IP is configured as 192.168.0.14 so issue:

```
#ftp 192.168.0.14 ↵
```

You will see following on the host terminal. Enter the ftp user name and password

```
Connected to 192.168.0.14
220- Welcome to the uClinux ftpd!
220 uClinux FTP server (GNU inetutils 1.4.1)ready
User (192.168.0.14 :( none)): ftp
331 Guest login ok, type your name as password.
Password: ↵
230 Guest login ok, access restrictions apply.
ftp>
```

4. Now connect Telnet client on HOST to the server running on the Board. Here Board IP is configured as 192.168.0.14 so issue:

   ```
   #telnet 192.168.0.14 ↵
   ```

   Target command shell will be opened.

6.5 Configuring boa Server

To configure the boa server on the board, follow the steps below:

1. Do the following selection.

   ```
   [*] Customize Vendor/User Settings (NEW) ---->
        Network Applications ---->
           [*] boa
   ```

2. Issue following command on the target.

   ```
   />boa &  ↵
   ```

3. On host PC, go to your web browser, search for **board_ip** in the address bar. uClinux default webpage opens.

7. Debugging Kernel and User Application

To debug the user application you will require following software and hardware:

- Cross/Straight Network cable
- JTAG cable
- Eclipse IDE for C/C++ developers. You can download Eclipse IDE from the

  http://www.eclipse.org/downloads/download.php?file=/technology/epp/downloads/release/20071103/eclipse-cpp-europa-fall2-linux-gtk.tar.gz

7.1 Debugging uClinux kernel using nios2-elf-insight over JTAG

To debug the uClinux kernel using nios2-elf-insight over JTAG, first build the zImage by using the following steps:

Before debugging, configure the kernel as explained below:

```
#make menuconfig ↵
```

The menu configuration window opens:

```
Kernel hacking ---->
   [*] Full Symbolic/Source Debugging support
```

Save and exit. Go to the user application:

```
Debug Builds ---->
   [*] build debugable libraries
   [*] build debugable applications
```

Following are the steps to debug uClinux kernel using JTAG.

1. Download the .sof file to your board using command:

   ```
   #nios2-configure-sof/home/uClinux/System-files/
   sls_neek_bsp_hw.sof ↵
   ```

2. In your Linux pc, open the terminal and write the command:

   ```
   #nios2-gdb-server - -tcpport 2342 – tcppersist ↵
   ```

Here 2342 is an example; you can select your own port no.

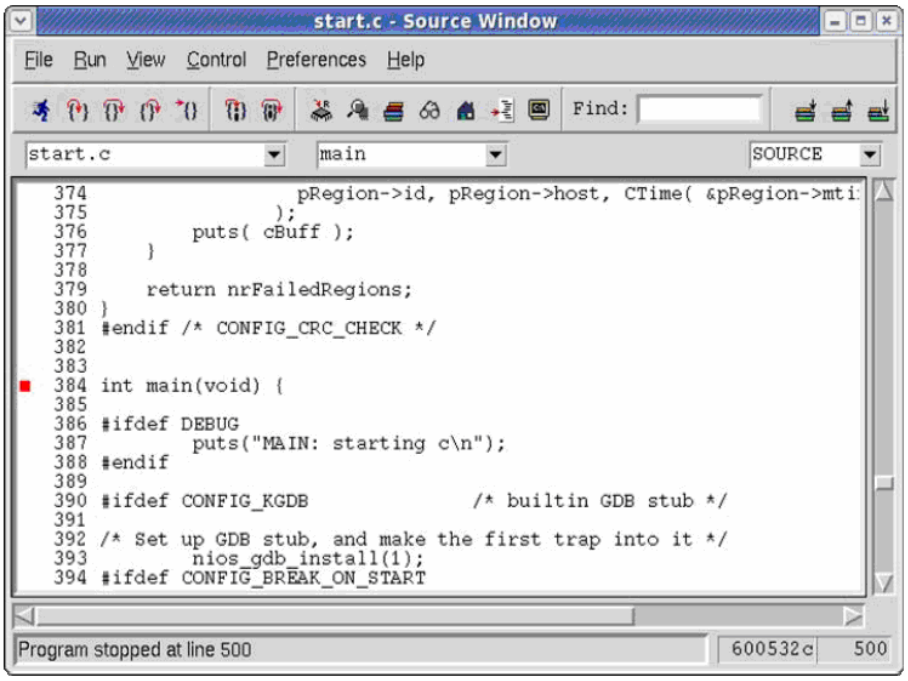
3. Go to **home/uClinux/uClinux-dist/linux 2.6.x** .You will find **vmlinux**. Copy it and paste it in same dir with name **vmlinux.elf**.

4. Issue the command:

```
#nios2-debug home/uClinux/uClinux-dist/linux
2.6.x/vmlinux.elf ↵
```

Wait for few seconds and following window will get opened.

Figure 19 : Start.C



Now you can debug easily with aid of GUI. You can set the break point, check the content of registers and see the assembly code also.

7.2 Debugging User Application using gdbserver over Ethernet

Insight is the GUI of gdb debugger. Often it's not easy to remember the debug Command. Therefore insight provides the graphical interface so user can debug easily. The aim of the document is to explain how to debug user space application. Steps are mentioned below:

For debugging user application over Ethernet you should have proper zImage .To build zImage, Follow **Driver for Ethernet in NEEK BSP DRIVERS.**

Here is the example of simple helloworld.c program debugging:

1. Select gdbserver (old) in menuconfig under user application → miscellaneous application.
2. Select the ifconfig utility in your busybox.
3. On your host set PATH environmental variable to toolchain with following command:

   ```
   #PATH=$PATH:/home/uClinux/Bintools/opt/nios2/bin ↵
   #export PATH ↵
   ```

4. Compile the application with debug symbols and no optimization, on your host, Here is helloworld.c example. Your current working dir should have this .c file.

   ```
   #nios2-linux-uclibc-gcc -g helloworld.c -o helloworld
   -elf2flt ↵
   ```

   This will generate **Helloworld** and **Helloworld.gdb** files in your current working dir. Copy generated Helloworld to **romfs/bin** in uClinux-dist dir.

5. Build the image, download it to target and configure the Ethernet IP, 192.168.0.14 through following command

   ```
   />ifconfig eth0 192.168.0.14 ↵
   ```

   Then start the gdbserver listening on an unused port eg. 9999,with command:

6. Apply the command given below:

   ```
   /> gdbserver localhost:9999 /bin/Helloworld ↵
   ```

7. It will display,

   ```
   Process /bin/ Helloworld created; pid = 20
   Listening on port 9999
   ```

8. Next, on your Linux PC, in the hello source dir, run insight gdb,

   ```
   #nios2-linux-uclibc-insight Helloworld.gdb ↵
   ```

9. A source window will open and display the source Helloworld.c.
10. The open a gdb console, with **View>Console**, enter gdb command in this window.

    ```
    gdb>target remote 192.168.0.14:9999 ↵ (board_ip:9999)
    ```

11. Then it will report the target address of the program. Now you can set break points and debug. On target you can see the message: Remote debugging from host IP, here you will see your IP (IP of host) address.

```
gdb> b main ↵ (insert break point at main)
gdb> c ↵       (continue)
```

12. Now you can debug via command or through GUI of insight. Insight GUI are quite easy to understand. If you want to use command then you can use:

```
gdb> s ↵      (for single stepping)
gdb> r ↵      (to run program )
```

7.3 Debugging User application using Eclipse IDE

To debug the user application, follow the steps below.

1. Follow all steps mentioned in Ethernet driver selection, from chapter Configuring Device Driver.
2. Build the uClinux kernel by selecting

```
User application ---->
   miscellaneous application ---->
      [*] gdbserver(old).
```

3. Open the terminal. Change directory to the Eclipse IDE folder
4. Write the command on the terminal to open the Eclipse IDE.

```
#./eclipse ↵
```

5. Type **workspace** to choose your workspace.
6. Select **File>New>C project** to Create a new project.
7. Enter **Helloworld** as your Project name.
8. Project types, executable, Hello world ANSI C Project, (or empty project and add your source).Finish.
9. Now, setup for nios2 tool chain in Eclipse IDE on the host by following the steps below:

   a) Select the project **Helloworld** under **Project Explorer**.
   b) Right click on **Helloworld** and select **Properties**. Project properties dialog box opens.
      - Select **Settings>GCC C Compiler** under **C/C++ build**. Make following settings:

- Command: **nios2-linux-uclibc-gcc**
- All options: **-O0 -g -Wall -c -fmessage-length=0**

- Click **Apply**.
- Select **Settings>GCC C Linker** under **C/C++ build** and make following settings
  - Command: **nios2-linux-uclibc-gcc**
  - All Options: **-elf2flt**
- Select **Miscellaneous** under **GCC C Linker**
  - Linker flags: **-elf2flt**
- Click **Apply**

c) Select **Run/Debug Settings** under Project properties. Run/Debug settings dialog box opens
   - Click on **New** button. Select Configuration Type dialog box opens
     - Select C/C++ Local application.
   - Click **OK**. Properties for new Configuration dialog box opens.
   - Under **Main** tab do the following settings:
     - Browse the **Helloworld** project under project.
     - Type **Debug/Helloworld.gdb**
   - Select Debugger tab. Make following settings
     - Debugger: **gdbserver Debugger**
   - Under **Main** tab of Debugger options make following settings
     - GDB Debugger: **nios2-linux-uclibc-gdb**
   - Under **Connection** tab
     - Type: **TCP**
     - Host name or IP address: **192.168.0.14** (**IP address of NEEK board)**
     - Port Number: **9999** (you can give any number)
   - Click **Apply** and click **OK**. You have finished setting of run/debug settings.
   - Click **Apply** and click **OK**. This finishes project properties settings.

d) Select **Project>Build Configuration>Build>All** to build your project.
   - Select workspace>Helloworld>Debug>Helloworld and copy the file into /uclinux-dist/romfs/bin.

e) Build the zImage as explained in early section.

f) Click **OK**.

10. Now, select **Project-->Build project** to compile your project.

11. Copy from your **workspace/Helloworld/Debug/Helloworld** to **romfs/bin** in uClinux-dist and build the zImage as explained earlier.

12. Configure the **SOF** on your board and download the **zImage**.

13. The kernel starts booting. After successful booting, configure the IP address of the board (same as entered in the Eclipse IDE). Here IP is: 192.168.0.14

    ```
    />ifconfig eth0 192.168.0.14 ↵
    ```

14. Now issue the command:

    ```
    />gdbserver localhost:9999 /bin/Helloworld ↵
    ```

15. It will display:

    ```
    Process /bin/Helloworld created; PID = 20
    Listening on port 9999
    ```

16. Now move to the IDE on host.

    a) Select **Run>Open Debug Dialog**
    - Select **Helloworld** as Debug application
        - C/C++ Application: **Debug/Helloworld.gdb**
    - Click **Apply.**
    - Click **Debug**.

    b) If there is no error then debug perspective opens and it will establish a connection with the board. You will see the following message on the target.

    ```
    remote debugging from: 192.168.0.26 (your host ip)
    ```

17. Now you can debug easily with the help of step into/step over feature of IDE.

8. Demonstrations & Quick Reference

Download **Demonstrations and Quick Reference** from http://slscorp.com/pages/bspdownload.php. This demo package contains two types of applications:

- Applications supported to NEEK Application Selector
    - SLS uClinux demo
    - SLS_Player

These demonstrations are not the final product but are for demo purpose only It demonstrates how to develop real time application using the uClinux and nios2.

8.1 Demonstrations

8.1.1 NEEK Application Selector Demos

NEEK Application Selector demos are developed using NEEK BSP. The demos are located at */Demos/NEEK_Application_Selector_Demos* directory. To run the demos, the board should be preconfigured with Altera application selector utility.

SLS_Player

It is a media player application designed by SLS to play the MP3 files and MPEG 1/2 files without audio information.

To know how to run this demo, refer **HowToRun.txt** located at *Demo/ NEEK_Application_Selector_Demos/Media_Player*.

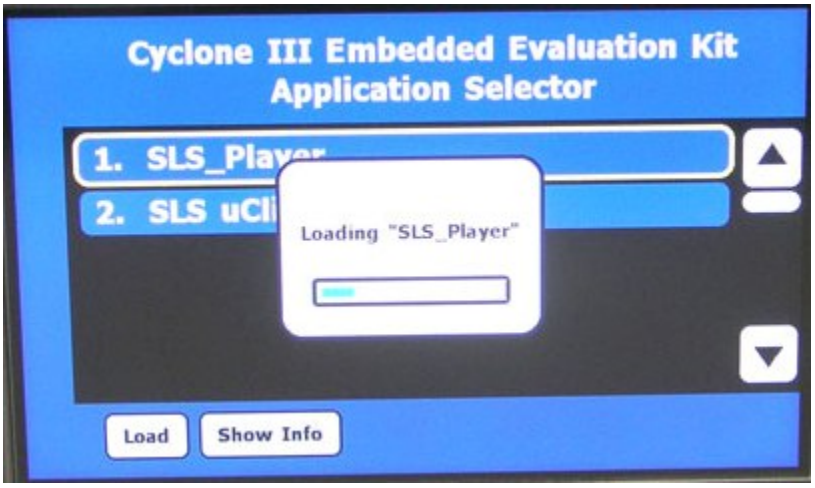
Follow the steps mentioned below to run the SLS uClinux demo.

6. Power on the board by pressing the switch SW1. You will see the Application Selector menu on the LCD Touch Screen Display. See Figure 20

Figure 20 : Application Selector

7. In the application selector main menu, touch the SLS_Player to select it.
8. Touch the Load button located on the bottom left corner of the Touch Screen to load the SLS Player application. You will see Figure 21

Figure 21 : Loading SLS Player

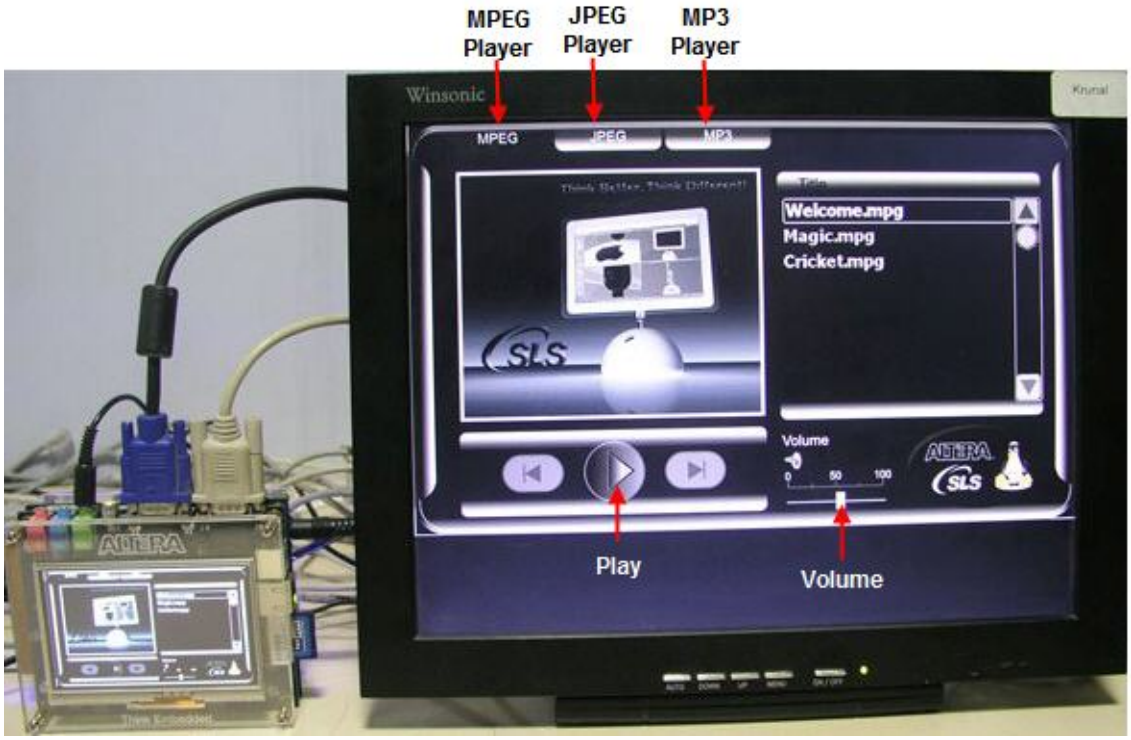


9. The SLS Player information dialog box displays as shown in Figure 22 below.

Figure 22 : Running the SLS Player - Main Menu

10. Change the SD Card mode as mentioned in dialog box and click **OK**. The SLS Player main menu displays.
11. Select MPEG to play MPEG clips. See Figure 23 below.

Figure 23 : SLS Player Main Menu



12. Select **Welcome.mpg** and click **Play**. The MPEG clip will get played on the screen.
13. Repeat steps 6 to 7 to play JPEG and MP3 files

SLS uClinux Demo

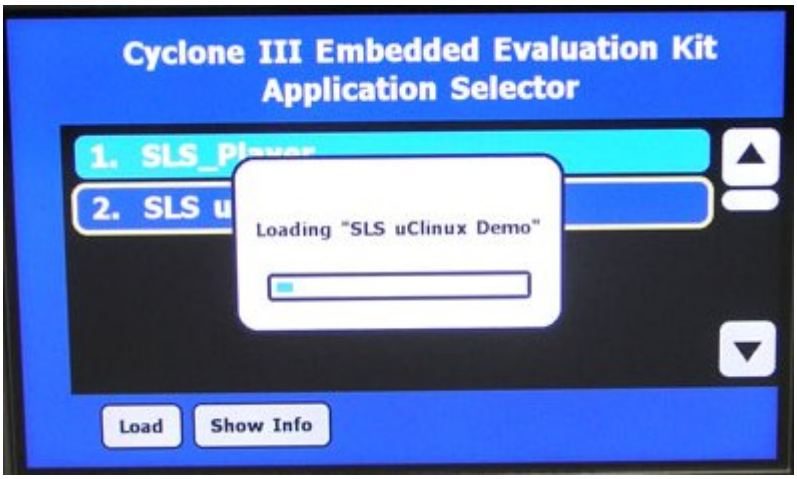
The SLS uClinux demo is designed to run multiple applications on uClinux platform. The application uses SLS GUI library and various SLS IP cores including Ethernet Mac 10/100, TPC and VGA /LCD Controller.

To know how to run this demo, refer **HowToRun.txt** located at *Demo/ NEEK_Application_Selector_Demos/Multiple_Processing*.

Follow the steps mentioned below to run the SLS uClinux demo.

1. Power on the board by pressing the switch SW1. You will see the Application selector menu on the LCD Touch Screen Display.
2. In the application selector main menu, touch the SLS uClinux Demo to select it.
3. Touch the Load button located on the bottom left corner of the Touch Screen to load the SLS uClinux demo application. You will see the Figure 24

Figure 24 : Loading SLS uClinux Demo

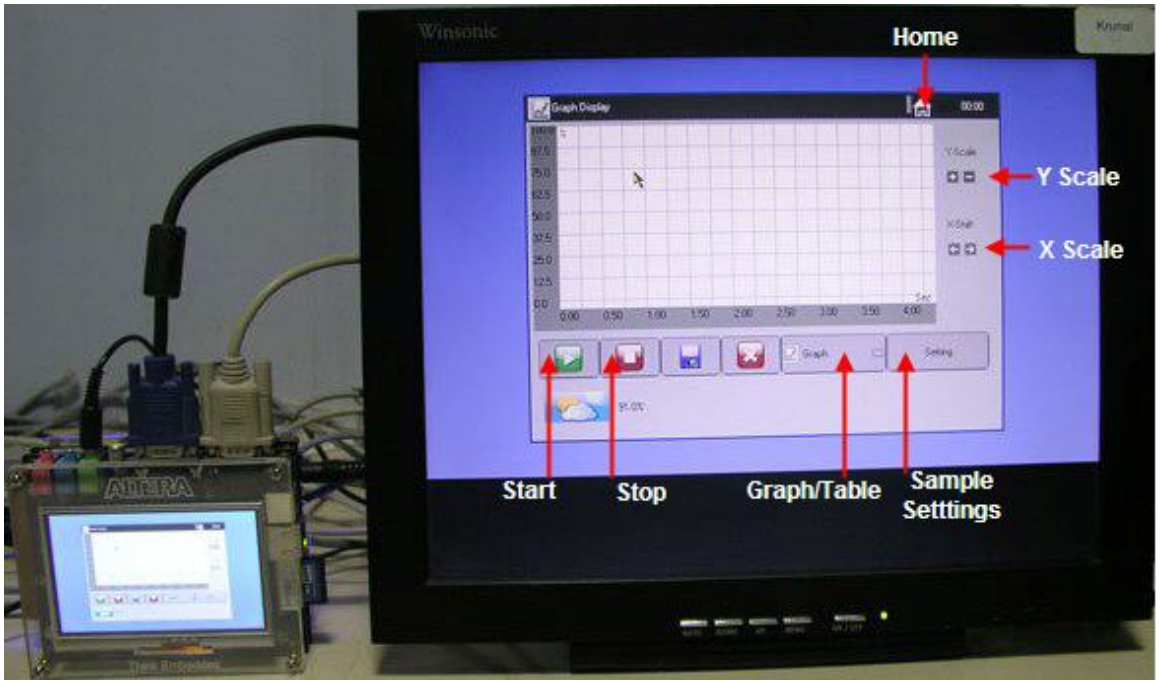


4. The SLS uClinux Main menu displays as shown in Figure 25 below.

Figure 25 : Running the SLS uClinux Demo - Main Menu

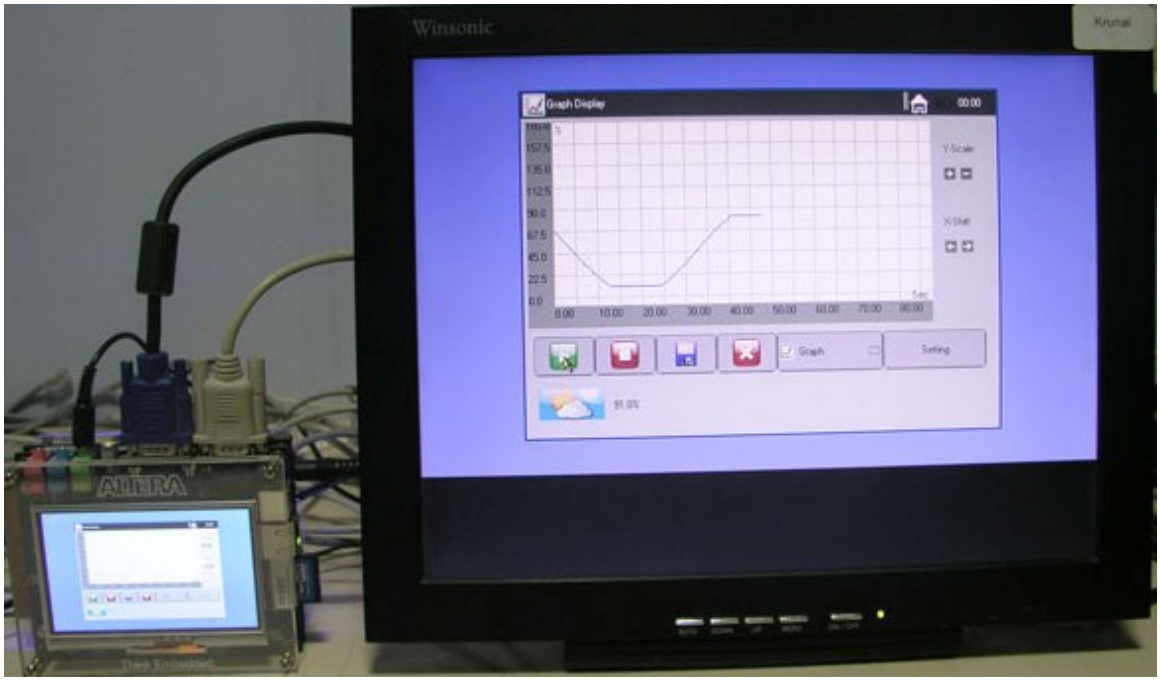
5. Select **Start Experiment** option. You will see a blank graph window as shown in Figure 26.

Figure 26 : SLS Player Main Menu



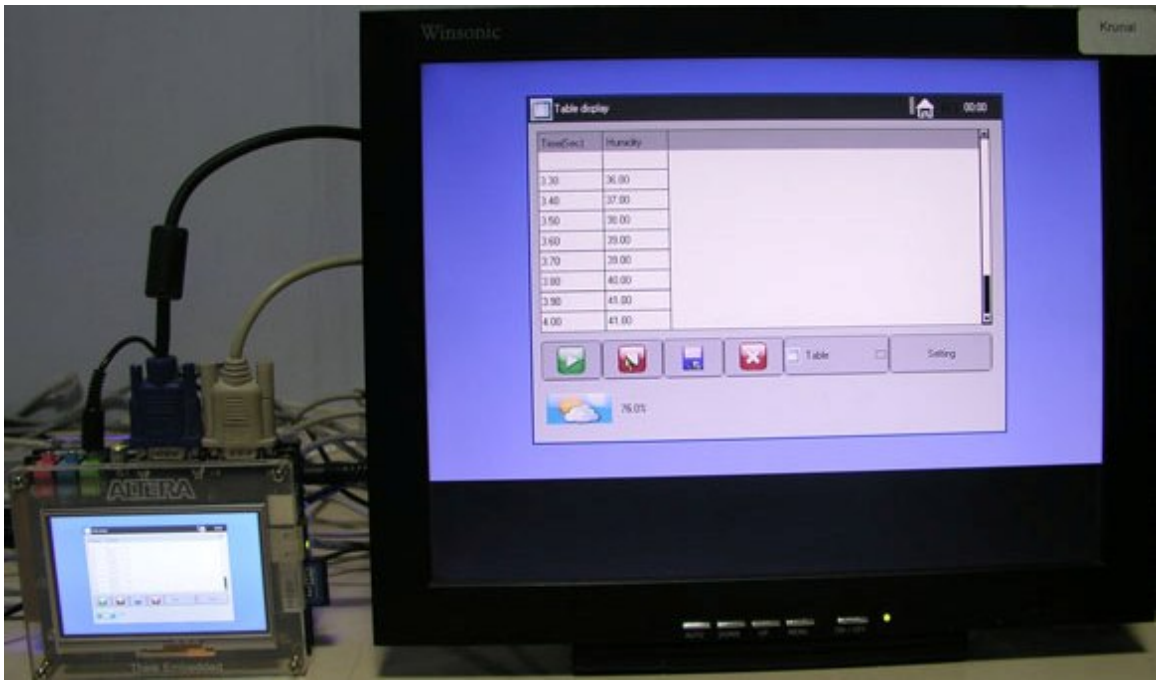
6. Select **Start** button to start logging the dummy data. The graph will be drawn as shown in Figure 27 below.

Figure 27 : Data Logger - Graph Display



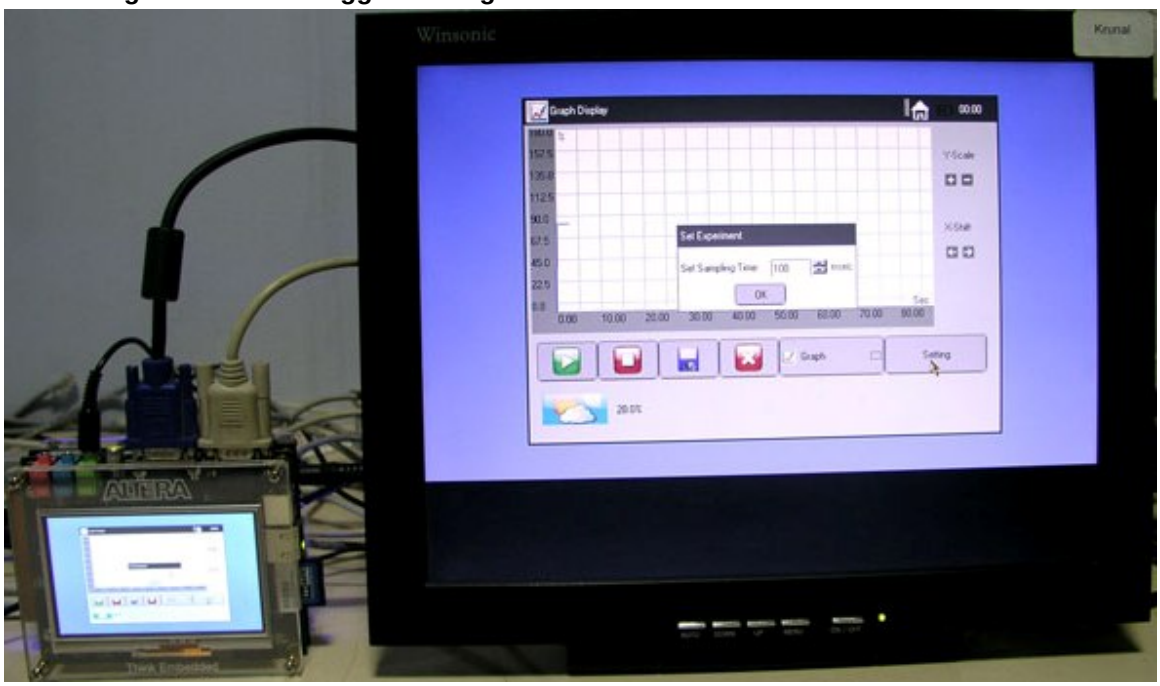
7. To view the logged data in table view, select **Table** option. See Figure 28 below.

Figure 28 : Logged Data in Table View



8. To change sampling frequency click on Settings button. Enter the desired frequency. See Figure 29 below.

Figure 29 : Data Logger Settings



8.2 Quick Reference

Quick Reference gives you quick overview of the applications explained in chapter 5 and 6. When you extract Quick Reference, you will find following directories:

- Prebuilt_zImage
- Framebuffer_console

8.2.1 Prebuilt_zImage

Prebuilt_zImage directory contains files to format the SD Card and other ready to use applications:

- zImage
- sls_neek_bsp_hw.sof
- readme.txt

Before going further, please refer the readme.txt.

SD Card formatting for Application Selector

Download .sof and zImgae. You will get console on serial UART. When the zImage is up and running, plug the SD card into the socket (NEEK board). Issue the following command to format the SD card.

/>mkdosfs –I –F 16 /dev/hda

Other Applications

zImage given here is a ready reference to test all applications explained in chapter 5 and 6. See User Applications and Configuring Network utilities and NFS (Client) for more details. Using this zImage you can only explore some of the capabilities of BSP.

8.2.2 Framebuffer_console

Framebuffer_console directory contains files to boot the uClinux to get the console on frame buffer (NEEK LCD).

- zImage
- sls_neek_bsp_hw.sof
- readme.txt

Before going further, please refer the readme.txt.

Booting uClinux on NEEK LCD

Download .sof and zImgae, you will see booting uClinux on NEEK LCD. When the zImage is already up and running, plug PS/2 keyboard in PS/2 port. Now execute the shell command as usual. You can execute all shell commands offered by shell and can run various programs and utilities available in the zImage.

After successfully running the zImage, you will see the booting of uClinux on the NEEK LCD. See Figure 30 and Figure 31.

Figure 30 : Framebuffer Console View 1

Figure 31 : Framebuffer Console View 2