

# PhyFLEX-i.MX6 RDK Linux Quickstart PD13.1.x

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## 1 About this Quickstart

This document describes how to install and work with the Linux Board Support Package (BSP) for the phyFLEX-i.MX6 platform. This BSP provides a fundamental software platform for development, deployment and execution on the phyFLEX-i.MX6.

The Quickstart contains instructions for:

- Getting Started
- Host Setup
- Building a BSP
- Booting Configurations
- Flashing images

## 2 System Requirements

### 2.1 Hardware

- phyFLEX-i.MX6 System on Module (PFL-A-02)
- phyFLEX-Mapper i.MX6 (FLM-A-XL1)
- phyFLEX Carrier Board (PBA-B-01)
- Serial cable (RS-232)
- Ethernet cross-over cable
- AC adapter supplying 12 VDC / min. 2 A

- 5", 7", 10.4" VGA LVDS (optional)

## 2.2 Software

To successfully build a customized Linux distribution using PTXdist, your host machine must be running a modern GNU/Linux Operating System either natively or via a virtual machine. This Quickstart was authored and tested with Ubuntu 12.04 LTS 32-bit Virtual Machine on a Windows 7 Host PC.

## 3 Getting Started

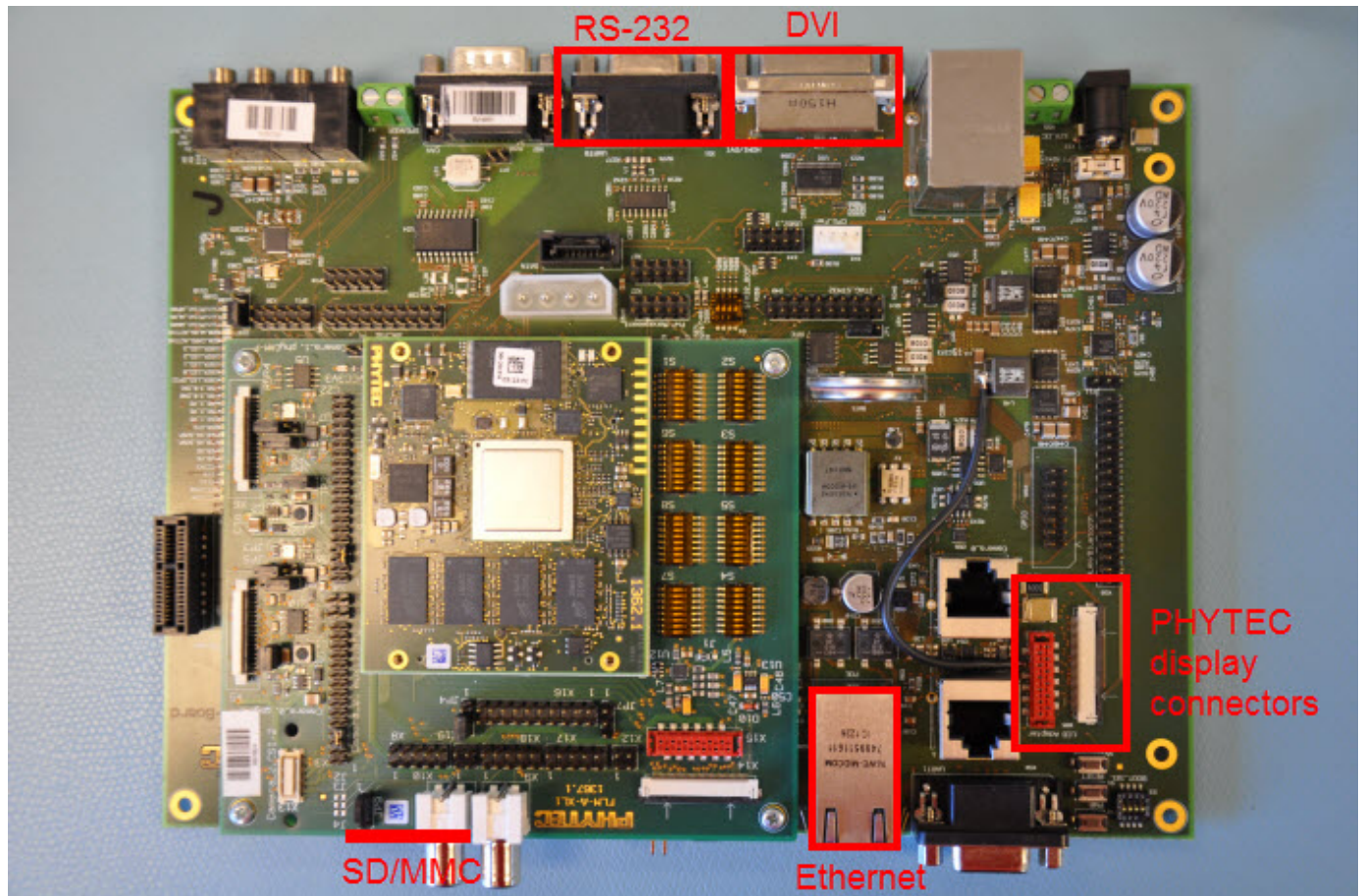
This section is designed to get the board up-and-running with the demo images included in the kit.

### 3.1 Making Connections

Make all required connections and then apply power to begin booting the device.

1. (optional) Connect the serial cable between UART\_0 DB9 (X51) and host - 115200 baud, 1 start bit, 8 data bits, 1 stop bit, no parity, no flow control
2. (optional) Connect the Ethernet cable to the RJ-45 connector (X28) and appropriate network card on the host
3. (optional) Connect the LCD power and data connectors at X65
4. (optional) Connect a USB keyboard or mouse to the USB Standard A port (X45)
5. Connect the 12 V supply to the 12V\_DC jack (X12)

Locations of the corresponding ports for Steps 1-5 are depicted in the following:



### 3.2 Kit Demos

After the target boots, Linux will be entered. A serial connection is recommended for all demos to interact with the kit and at least ensure proper shutdown. Additionally, connect a LCD to run fluid launcher, a Qt demo application launcher for embedded platforms.

#### Serial Communication

Requires a connected serial cable -- See [Step 1](#)



Interact with the fluid launcher on the display by touching the screen to browse through applications. When an application is highlighted, positioned in the center of the main screen and name displayed above the icon, simply clicking on it will open the application. Fluid launcher contains the following applications:

- **Calculator**

Use the calculator application to perform basic arithmetic. Enter operations by touching the screen or using a USB mouse or keyboard.

- **Calendar**

By month calendar display. Customize the view with formatting options.

- **Image Viewer**

View an image of choice and adjust the viewing perspective once it is loaded.

- **Scribble Paint**

The Scribble Paint application allows a user to draw an image in real time as well as to open and edit an existing image. Use the Options menu to select the pen width and color and begin drawing by touching the screen or clicking on the open area using a USB mouse. The following file types are supported: bmp, ico, jpeg, png, ppm, xbm, and xpm.

- **Spreadsheet Application**

Customized table that supports dynamic content in cells. Supports addition of two cells, subtraction of one cell from another, multiplication of two cells, dividing one cell from another, and summing contents from an arbitrary number of cells.

- **Game of Tetrix**

Qt version of the classic Tetrix game. The goal of the game is to fill every square in a row to clear a line. As blocks are dropped from the top of the playing area, move, rotate, and stack the blocks to fill entire rows at the bottom of the playing area. To control the blocks, connect a USB keyboard: Left cursor - move the piece one space to the left Right cursor - move the piece one space to the right Up cursor - rotates the piece 90 degrees counter-clockwise Down cursor - rotates the piece 90 degrees clockwise D - immediately move the piece down by one row Space - drop a piece as close to the bottom of the board as possible Use the buttons to control the game flow, press Start to begin; Quit to end; and Pause to freeze the game but retain its state.

- **Rich-Text Editor**

The Text Edit demonstration shows Qt's rich text editing facilities in action, providing an example document to experiment with. Connect a USB keyboard and mouse to insert and format text.

- **Wiggly Animated Text**

This example demonstrates how to animate text. Use a USB keyboard to dynamically modify the text displayed.

- **Exit Embedded Demo**

Exit fluid launcher. The demo can be relaunched by running the following from the Linux command line:

```
fluidlauncher &
```

*Note: Some applications display a Help menu in the toolbar, click on this to learn more about what Qt classes were used.*

If necessary, recalibrate the touchscreen from the Linux command line:

```
ts_calibrate
```

When finished with the kit demo, use the **reboot** command to restart, or the **poweroff** command to shutdown the system. Please note that failure to use these commands to end a session could result in a corrupted file system.

## 4 Host Setup

The phyFLEX-i.MX6 (PFL-A-02) has been developed and tested with Ubuntu 12.04 LTS Precise Pangolin [\[Installation Guide\]](#). Although it is possible to use a different OS, some setup information will contain OS-specific commands and paths for settings.

Update repositories and upgrade installed packages:

```
sudo apt-get update
sudo apt-get upgrade
```

### 4.1 Server Setup

Support for installing and setting up TFTP, NFS, and Samba server settings to enable communication between multiple systems and the target.

#### 4.1.1 TFTP

TFTP allows files to be downloaded from one machine to another. With most embedded Linux devices, TFTP is an efficient way to boot the kernel during development so that the user does not have to flash a new kernel every time it is modified. It is also helpful when updating images in flash from Barebox.

First, start by installing the TFTP server.

```
sudo apt-get install tftpd-hpa
```

Next, files can be accessed from another machine on the same network by simply using the IP address of the host. Specify a folder where the files will reside on the host by replacing the folder path for TFTP\_DIRECTORY with whatever folder you wish to use as your TFTP file storage location, or leave the folder as the default.

```
sudo gedit /etc/default/tftpd-hpa

# /etc/default/tftpd-hpa

TFTP_USERNAME="tftp"
TFTP_DIRECTORY="/var/lib/tftpboot"
TFTP_ADDRESS="0.0.0.0:69"
TFTP_OPTIONS="--secure"
```

If you made any changes to the settings of the TFTP server, you need to restart it for them to take effect.

```
sudo restart tftpd-hpa
```

Lastly, if you would like to grant every user on the system permission to place files in the TFTP directory, use the following command, replacing <TFTP\_DIRECTORY> with your chosen location.

```
sudo chmod ugo+rw <TFTP_DIRECTORY>
```

#### 4.1.2 NFS

A network file-system (NFS) server gives other systems the ability to mount a file-system stored on the host and exported over the network. In embedded development, this is essential for quickly testing applications and evaluating different file-system setups.

To begin the installation process use the following command:

```
sudo apt-get install nfs-kernel-server
```

Exported filesystems are designated in the "/etc/exports" file and allow you to choose both the directory to be exported and many settings for accessing the exports. Below is an example for exporting a folder called "nfs\_export-ex" located in a user's home directory.

```
sudo gedit /etc/exports

# /etc/exports

/home/<user>/nfs_export-ex *(rw,sync,no_root_squash,no_subtree_check)
```

The options (rw, sync, no\_root\_squash, no\_subtree\_check) for this folder are essential in setting up the NFS export correctly. For more information on additional options, refer to the man page for 'exports'.

- rw enables

read and write access when the directory is mounted

- sync

tells the file-system to handle local access calls before remote access

- no\_root\_squash

allows root access when mounting the file-system

- no\_subtree\_check

reduces the number of checks the server must make to ensure that an exported sub-directory is within an exported tree and also enables access to root files in conjunction with no\_root\_squash

After modifying this file, in order to mount the directories as an NFS, you must force the NFS server to export all of the directories listed in "/etc/exports".

```
sudo /usr/sbin/exportfs -va
```

#### 4.1.3 Samba

Samba servers are an excellent way to access a Linux file-system on a Windows machine via a network connection. Using a Samba server, it is quick and easy to transfer files between systems. To install a Samba server, use the following command:

```
sudo apt-get install samba
```



Before the Samba share can be mounted on another machine it's necessary to modify the configuration file to allow write access and access to home directories. Start by editing the "/etc/samba/smb.conf" file.

```
sudo gedit /etc/samba/smb.conf
```

Inside this file there are four specific things that need to be uncommented (remove the ';' at the beginning of the line) to enable the sharing of home folders and write access. Below is the section that must be modified:

```
##### Share Definitions #####
# Un-comment the following (and tweak the other settings below to suit)
# to enable the default home directory shares. This will share each
# user's home directory as \\server\username
[homes]
; comment = Home Directories
; browseable = yes

# By default, the home directories are exported read-only. Change the
# next parameter to 'no' if you want to be able to write to them.
; read only = no
```

The outcomes after the changes are made follow:

```
##### Share Definitions #####
# Un-comment the following (and tweak the other settings below to suit)
# to enable the default home directory shares. This will share each
# user's home directory as \\server\username
[homes]
    comment = Home Directories
    browseable = yes

# By default, the home directories are exported read-only. Change the
# next parameter to 'no' if you want to be able to write to them.
    read only = no
```

*NOTE: It might also be necessary to change the "workgroup = " line to match the workgroup for your machine.*

To apply the changes, the next step is to restart all Samba-related processes.

```
sudo restart smbd
sudo restart nmbd
```

Lastly, each user needs to have a password enabled to be able to use the Samba server. There are no rules for this password. The simplest method for choosing this password is to make it the same as the UNIX user's password, but it is not a requirement. After typing in the command below, you will be prompted to enter the password for the specified user.

```
sudo smbpasswd -a <user>
```

As mentioned in the configuration file, the samba share can be connected by accessing "\\<host machine ip>\<user>" by either mounting a network share or using Windows explorer to navigate to it.

## 4.2 PTXdist

### 4.2.1 General Information

PTXdist is a set of tools created by Pengutronix to help manage all of the BSP sources, from x-loader to the filesystem and its applications. It makes it easier for a user to manage everything for specific platforms and toolchains without manually repeating relatively complex commands every time it is necessary to build a new image. It is important to note the PTXdist version because more than one may be necessary for building the toolchain and BSP.

### 4.2.2 Extracting Sources

Visit the phyFLEX-i.MX6's [BSP page](#) for information on the current versions of BSP tools.

Potentially, two versions of PTXdist will need to be downloaded:

1. ptxdist-2011.11.0 for installing/constructing the cross-compile toolchain (Optional if using a pre-existing environment)
2. ptxdist-2012.03.0 for building the BSP with the toolchain mentioned above.

The following instructions correspond to downloading PTXdist for building the BSP, *ptxdist-2012.03.0*. Therefore, to download the PTXdist software for building the toolchain, *ptxdist-2011.11.0*, repeat the instructions replacing *2012.03.0* with *2011.11.0*. In order to be built, extract the archive containing the PTXdist software:

```
tar -jxvf ptxdist-2012.03.0.tar.bz2
cd ptxdist-2012.03.0
```

Now that the source has been extracted, the next step is to configure it for building.

### 4.2.3 Pre-Requisites

PTXdist checks for specific packages that must be installed before it can be successfully built. From the PTXdist source directory, *ptxdist-2012.03.0*, execute the command to begin a script that uses GNU autotools to help set up the environment for building the distribution.

```
./configure
```

This command automatically stops if it is missing a package and states why and what package to install to continue with the initial setup. After successfully running the configure script, build and install PTXdist.

From the PTXdist source directory, *ptxdist-2012.03.0*:

```
make
sudo make install
```

The install location is "/usr/local" by default, which is why the **make install** command must be run with root privileges. If another directory is preferred for the install, use the --prefix option when installing, but be sure to add the "bin/" directory of the installed tools in this new folder to \$PATH by modifying and sourcing ~/.bashrc.

```
source ~/.bashrc
```

Now that the install is complete, the PTXdist folder can be removed, as well as the original archive.

**Optional:**

```
cd ..
rm -rf ptxdist-2012.03.0*
```

### 4.2.4 Using PTXdist

PTXdist is a console command tool and different functions are run by extending parameters to the **ptxdist** base command.

```
ptxdist <parameter>
```

To generate a full list of parameters and a description of the function, use the **help** command:

```
ptxdist help
```

Since PTXdist versions can be installed in parallel it may be useful to view the version number corresponding to the **ptxdist** command:

```
ptxdist --version
```

If the output of this command does not correlate to the desired version of PTXdist, affix the **ptxdist** command with the version number. For example, for the phyFLEX-i.MX6 BSP, affix all **ptxdist** commands with **2012.03.0** resulting in **ptxdist-2012.03.0**:

```
ptxdist-2012.03.0 <parameter>
```

Alternatively, to correlate the **ptxdist** command with a specific version create a symbolic link. For example, for **ptxdist** to correlate to **ptxdist-2012.03.0**:

```
sudo ln -fs /usr/local/lib/ptxdist-2012.03.0/bin/ptxdist /usr/local/bin/ptxdist
```

**Potential Issues:**

- Wrong PTXdist Version

It is important to use the correct version of PTXdist when building the Toolchain or BSP. If the incorrect version is used, the following will result:

```
error: The ptxconfig file version and ptxdist version do not match:configfile version: 2012.03.0ptxdist version: 2011.11.0
```

You can either migrate from an older ptxdist release with: 'ptxdist migrate'

or, to ignore this error, add '--force' to ptxdist's parameters, e.g.: 'ptxdist --force go'

The version of PTXdist used is noted as *ptxdist version* where the one required is specified as *configfile version*. Therefore, rerun the command with the correct version either appended to **ptxdist** or create a symbolic link. If the *merge* or *force* options were used on the Toolchain or BSP they will need to be removed and reinstalled to be built with the correct PTXdist version. Please note that the above is a generic example and may not apply directly to your BSP.

#### 4.2.4.1 Setup

The first time PTXdist is used, there are some setup properties that have to be configured. To run PTXdist's setup, use the following command:

```
ptxdist setup
```

Once in the ptxdist setup, the only settings that should be modified are the *User->Name* and *User->eMail*. This is mainly for general logging purposes. If you wish to modify any other settings, please refer to the [Getting Help](#) section for a link to PTXdist documentation.

Since PTXdist works with sources only, it needs to grab source archives from the web using wget as it advances through its setup if they do not exist already. Therefore, an internet connection is required.

## 4.3 Toolchains

In order to build images or applications for an embedded device, it is necessary to have a cross toolchain that will perform the necessary operations to compile code for a specified processor and system setup.

Each toolchain will have a modified GNU Compiler Collection (gcc) designed for the desired setup. The phyFLEX-i.MX6 PD13.1.1 uses the arm-cortexa9 toolchain which can be built from the OSELAS.Toolchain-2011.11.1 and ptxdist-2011.11.0 sources.

### 4.3.1 Existing Toolchains

If a working toolchain is already installed for a given architecture, it is possible to use this instead of building an OSELAS Toolchain. Do note that since external toolchains have not been tested it is possible that they may not work properly across all environments.

An extra step needs to be taken if the plan is to use an external toolchain. By default, the software package will be set to check for the vendor toolchain that it was compiled with. In order to change this, use the following command inside the root directory of the BSP:

```
ptxdist platformconfig
architecture --->
toolchain --->
() check for specific toolchain vendor
```

### 4.3.2 Building OSELAS Toolchains

An OSELAS toolchain, managed by PTXdist, can be easily built for a target architecture.

For the phyFLEX-i.MX6, the arm-cortexa9 architecture based toolchain is built from OSELAS.Toolchain-2011.11.1 [[Here](#)] and PTXdist 2011.11.0 [[Here](#)]. See [Section 2.2](#) for information regarding the installation of PTXdist sources.

```
tar -jxvf OSELAS.Toolchain-2011.11.1.tar.bz2
cd OSELAS.Toolchain-2011.11.1
```

Be sure to use the correct ptxdist version for the toolchain by affixing all **ptxdist** commands with **2011.11.0** resulting in **ptxdist-2011.11.0** or see [Section 2.2.4](#) for information on creating a symbolic link between **ptxdist** and **ptxdist-2011.11.0**.

```
ptxdist select ptxconfigs/arm-cortexa9-linux-gnueabi_gcc-4.6.2_glibc-2.14.1_binutils-2.21.1a_kernel-2.6.39-
sanitized.ptxconfig
ptxdist go
```

The toolchain is now built and installed in `/opt/OSELAS.Toolchain-2011.11.1/arm-cortexa9-linux-gnueabi` and ready to be used for building the BSP.

If you wish to build applications outside of the BSP directory, add the toolchain location to your PATH. Use the following from the command line or permanently add to your PATH by including it in `.bashrc`:

```
PATH=/opt/OSELAS.Toolchain-<toolchain version>/arm-<processor>-linux-gnueabi_gcc-linaro-<version>_glibc-
<version>_binutils-<version>_kernel-<version>-sanitized/bin/:$PATH
```

Following a successful build, the OSELAS.Toolchain-2011.11.1 folder can be removed, as well as the original archive.

#### Optional:

```
cd ..
rm -rf OSELAS.Toolchain-2011.11.1*
```

#### 4.3.2.1 Protecting Toolchains

It is recommended, although optional, to set the `/opt/OSELAS.Toolchain-2011.11.1/arm-cortexa9-linux-gnueabi` directory and its contents as read-only to prevent accidental modifications to the toolchain.

## 4.4 Eclipse

Eclipse is a software development environment that offers extended functionality by plug-in integration. Install Eclipse and the C/C++ Development Toolkit (CDT) plug-in to write, build, and debug C/C++ code.

```
sudo apt-get install eclipse
```

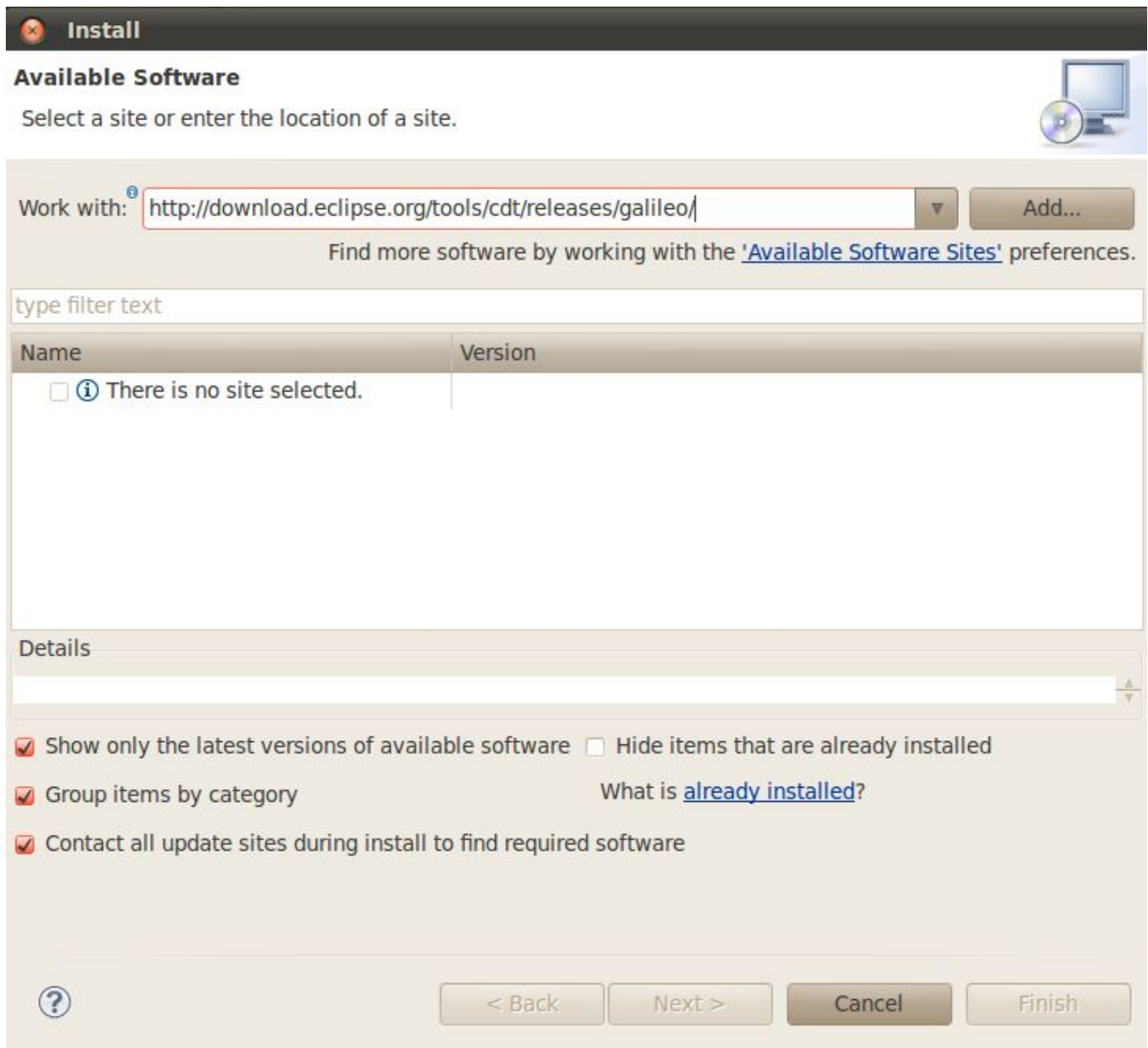
Open Eclipse from the command line and specify a workspace for storing Eclipse settings and projects, ex. `/home/<user>/workspace`.

```
eclipse &
```

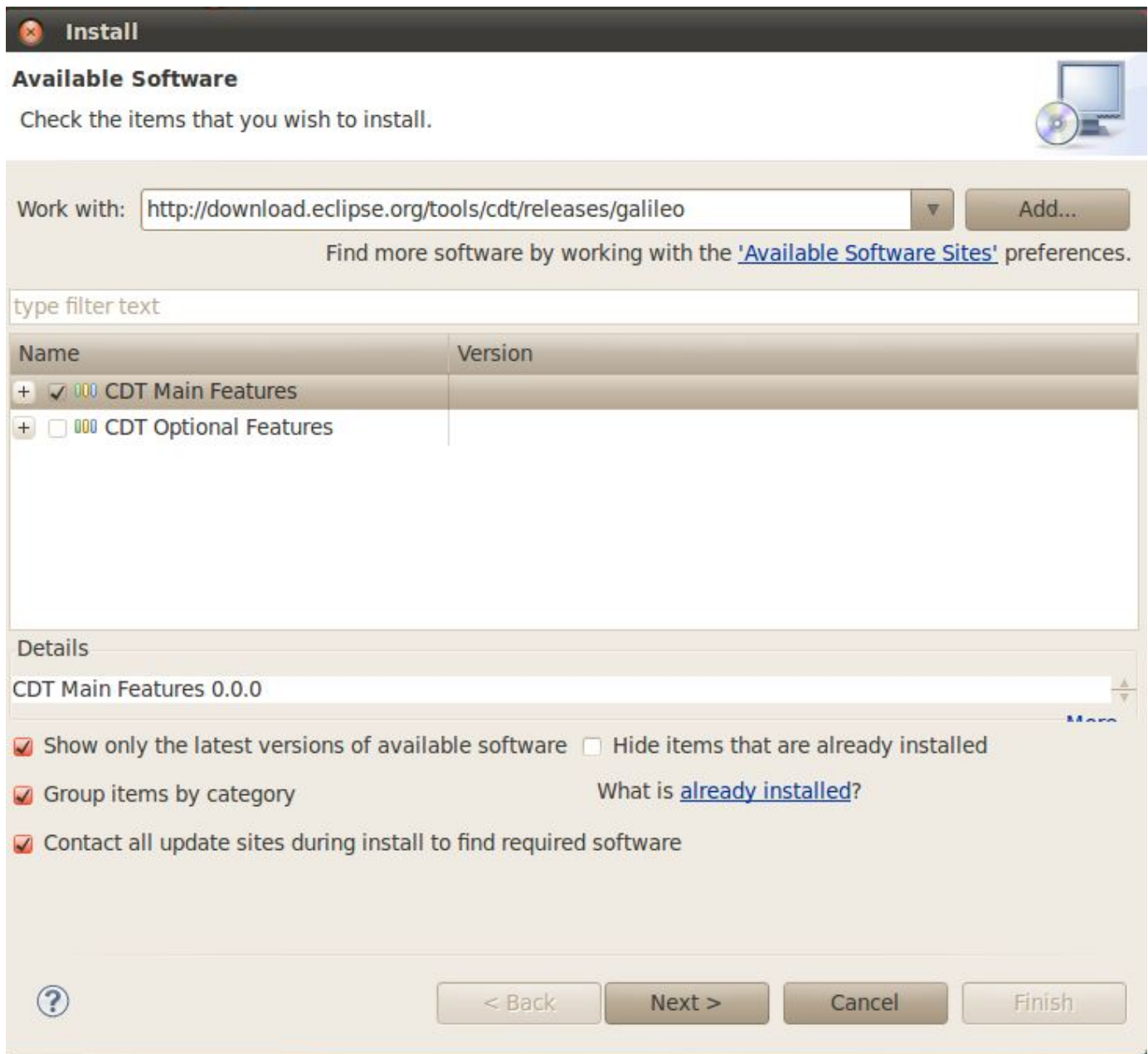
Eclipse is now started and the CDT plug-in can be integrated.

- From the Eclipse menu bar, select **Help -> Install New Software...**
- In the *Work with:* text bar, enter <http://download.eclipse.org/tools/cdt/releases/galileo/>
- Click **Add**





- Check *CDT Main Features* from the list of available software
- Click **Next**



- Review the install details
- Click **Next**
- Review and accept the terms of the license agreements
- Click **Finish**
- Restart Eclipse to apply changes

The CDT plug-in is now installed and programming in C/C++ is supported in the Eclipse environment.

#### 4.4.1 Additional Plug-ins

##### Qt Integration

##### Note:

Setup of the Qt plug-in in Eclipse requires files located in `<bsp_install_dir>/platform-phyFLEX-i.MX6/`. These files are not generated until after a successful build of the BSP -- see [Section 6](#) for additional information.

Download and extract the Qt Eclipse plug-in [Here](#) to `/usr/lib`.

```
tar -xvzf qt-eclipse-integration-linux.x86-1.6.1.tar.gz -C /usr/lib
```

Install the Qt plug-in in Eclipse:

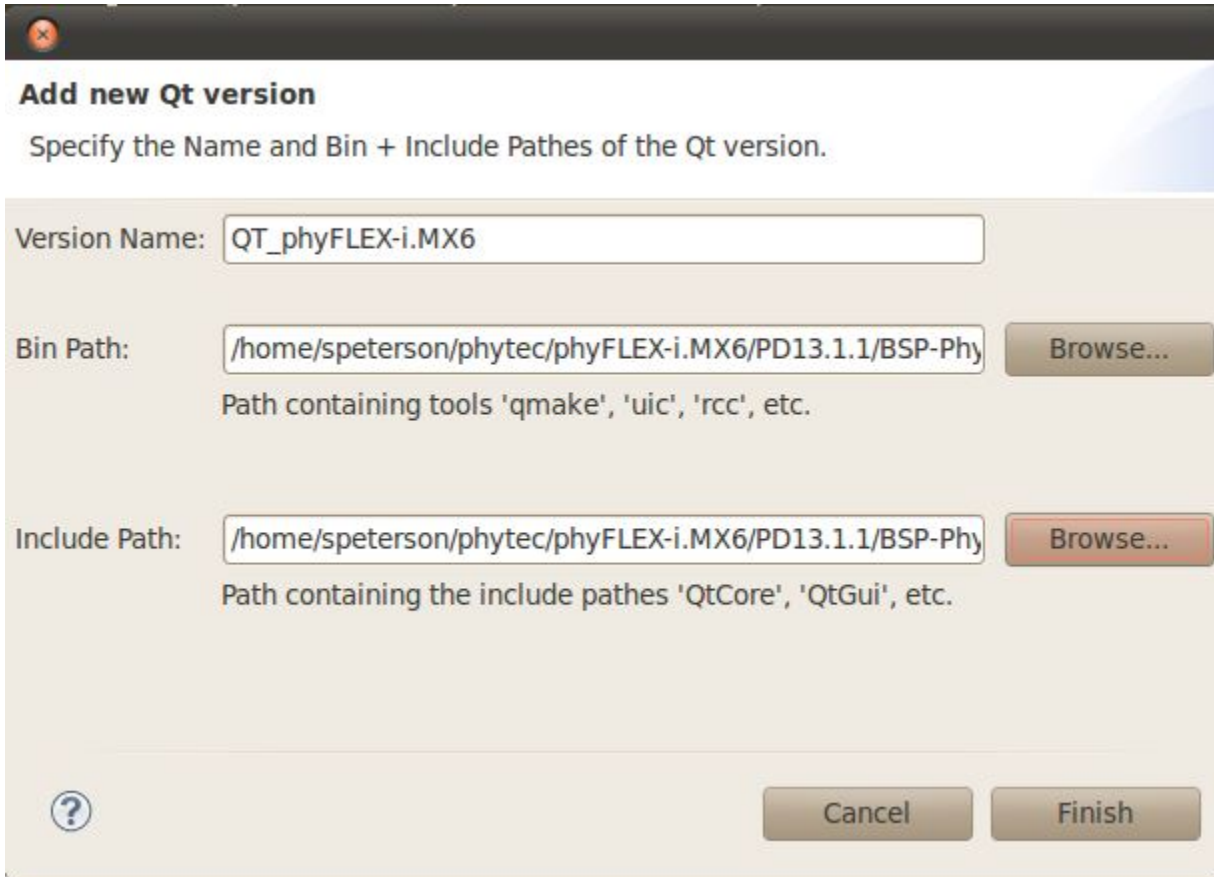
- Open Eclipse with the *clean* option, which cleans any cached data

```
eclipse --clean &
```

- From the Eclipse menu bar, select **Window -> Preferences**
- From the navigation menu on the left, click **Qt**
- Click **Add**
- Enter the following:

Version Name: QT\_phyFLEX-i.MX6 Bin Path: /platform-phyFLEX-i.MX6/sysroot-cross/bin Include Path: /platform-phyFLEX-i.MX6/sysroot-host/include

- Click **Finish**



## 5 Debugging

This section provides an example of using Eclipse to debug a *HelloWorld* Linux application, downloadable from the [PHYTEC FTP](#), using aGNU debugger GDB via a TCP/IP network connection.

**From the Linux command line on the target:** Setup the remote settings

- Open a terminal on the host, such as TeraTerm (Windows) or Minicom (Linux), and setup a serial port connection -- see [Serial Communication](#)
- Connect a serial cable -- see [Step 1](#)
- Connect a Ethernet cable -- see [Step 2](#)
- Power the device -- see [Step 5](#)
- Login as *root*
- View current network settings. The IP address will be used to communicate with the target in Eclipse:

```
ifconfig eth0
```

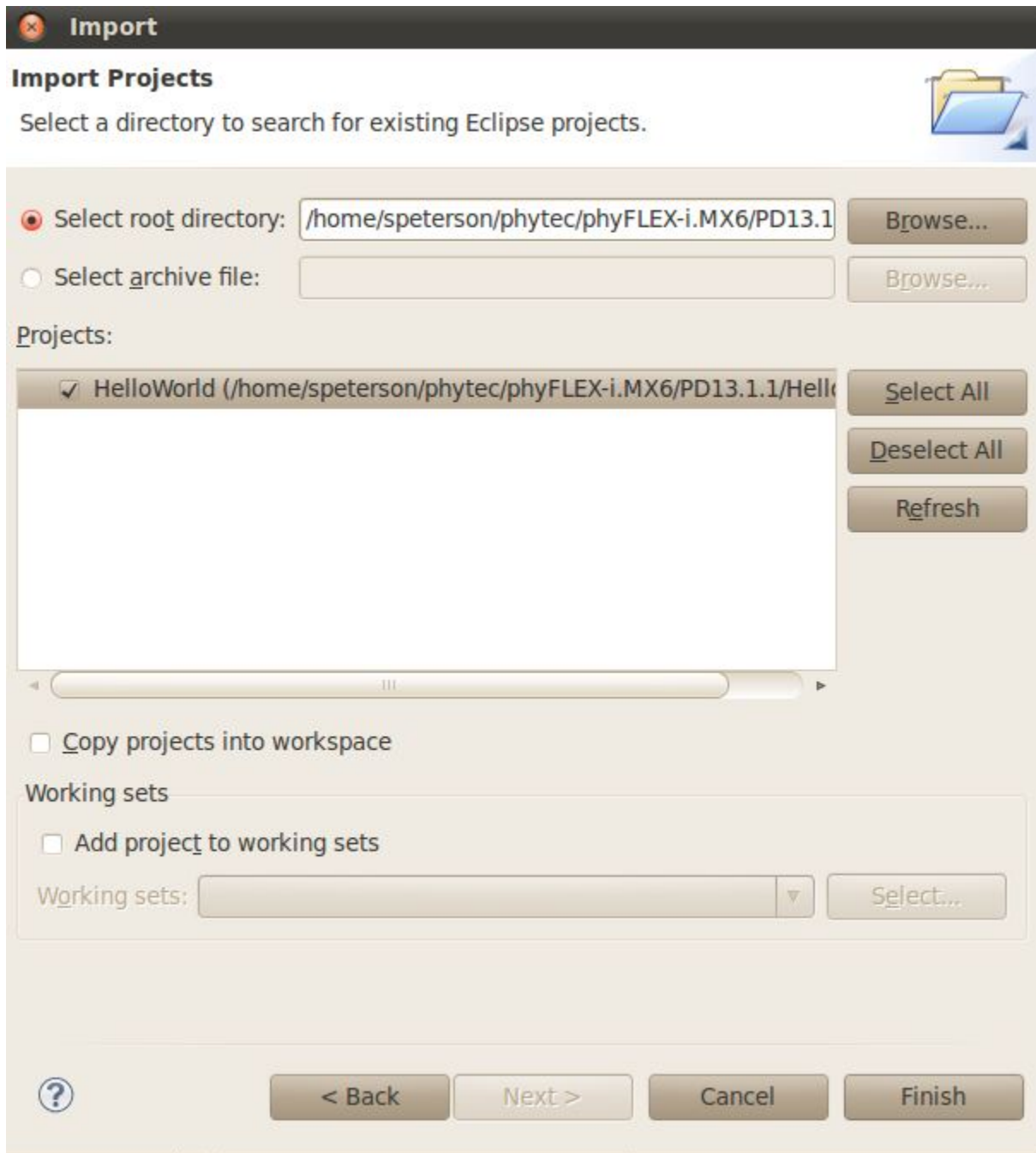
The network settings can be modified. Set the IP address and, if the device is outside the network, the gateway IP address.

```
ifconfig eth0 ###.###.###.###
route add default gw ###.###.###.###
```

**From Eclipse on the host:** Open the HelloWorld demo

- From the menu bar, click **File -> Import**
- Select **General -> Existing Projects into Workspace**
- Click **Next**

- With the **Select root directory:** option selected, browse to the **HelloWorld** directory
- Click **OK**
- Select *HelloWorld* from the **Projects:** menu
- Click **Finish**



**From Eclipse on the host:** Build the application

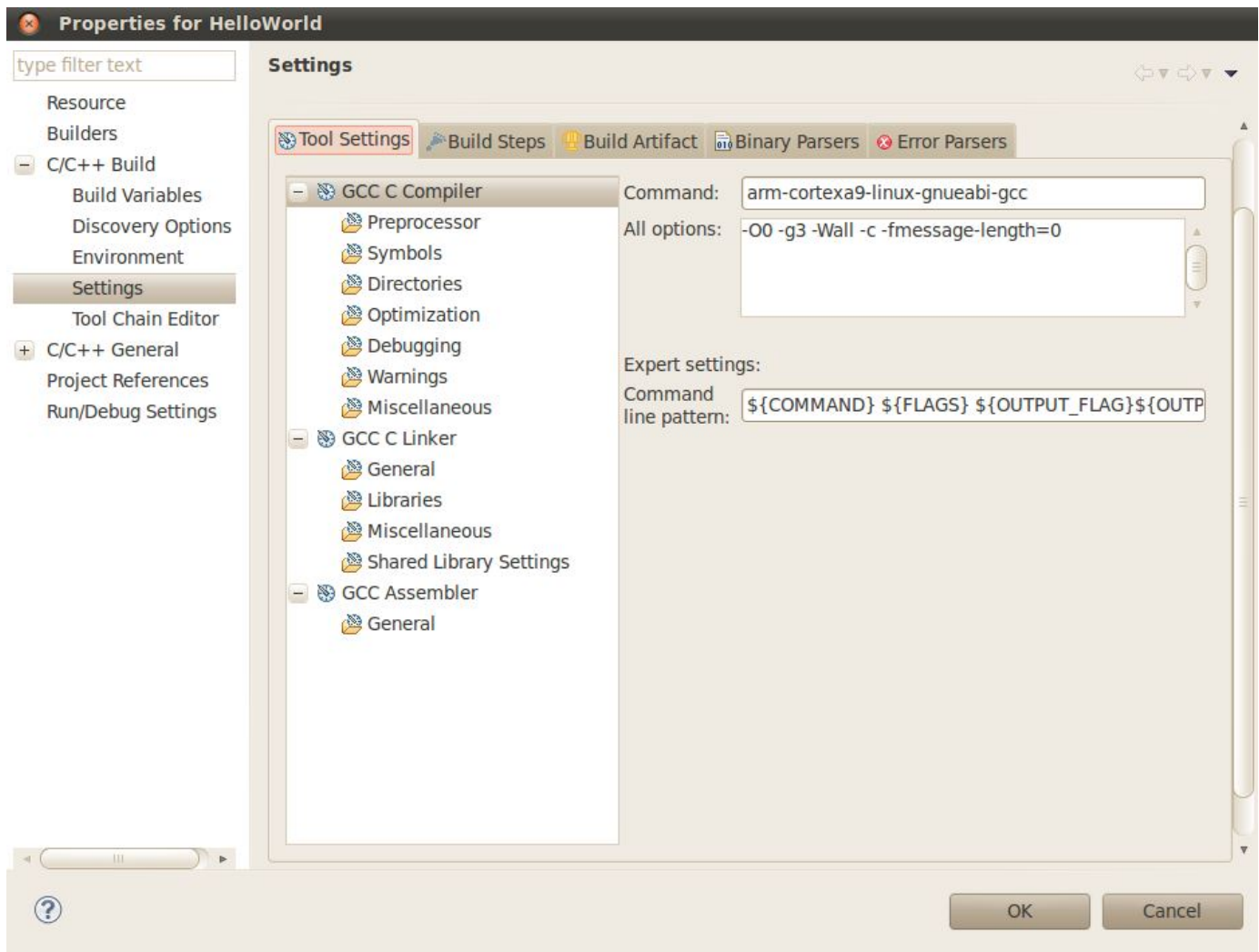
- In the Project View Window, right click on the *HelloWorld* project
- Select **Properties**
- From the navigation menu on the left, click **C/C++ Build -> Settings**
- On the Tool Settings tab, enter the following:

GCC C Compiler -> Command: arm-cortexa9-linux-gnueabi-gcc  
GCC C Linker -> Command: arm-cortexa9-linux-gnueabi-gcc  
GCC Assembler -> Command: arm-cortexa9-linux-gnueabi-as

- On the **Build Steps** tab, in the Post-build steps modify the **Command** field to reflect the target IP Address (###.###.###.###)

scp ./HelloWorld root@###.###.###.###:/home/. ;ssh root@###.###.###.### ./HelloWorld

- Click **OK**



- In the Project View Window, right click on the *HelloWorld* project
- Select **Build Configurations** -> **Set Active** -> **Debug**
- In the Project View Window, select the *HelloWorld* project
- From the menu bar, click **Project** -> **Build Project**

The Linux application, *HelloWorld*, will be copied to the `/home/` directory of the root filesystem on the target.

**From the Linux command line on the target:** Start the GDB server

- From the Linux command line enter the following, where `###.###.###.###` is the IP address of the target:

```
gdbserver ###.###.###.###:10000 HelloWorld
```

COM1:115200baud - Tera Term VT

File Edit Setup Control Window Help

Kernel Log Buffer Bridge.

Started System Logging Service.

systemd[1]: Startup finished in 13s 799ms 130us (kernel) + 6s 641ms 221us (userspace) = 20s 440ms 351us.

BE

phyFLEX-i.MX6

OSELAS(R)-phyFLEX-i.MX6PD13.1.1 / phyFLEX-i.MX6-master  
ptxdist-2012.03.0/2013-34-23T16:34:09+0200

phyFLEX-i login: root

root@phyFLEX-i:~ gdbserver 192.168.3.66:10000 HelloWorld

Process HelloWorld created; pid = 2702

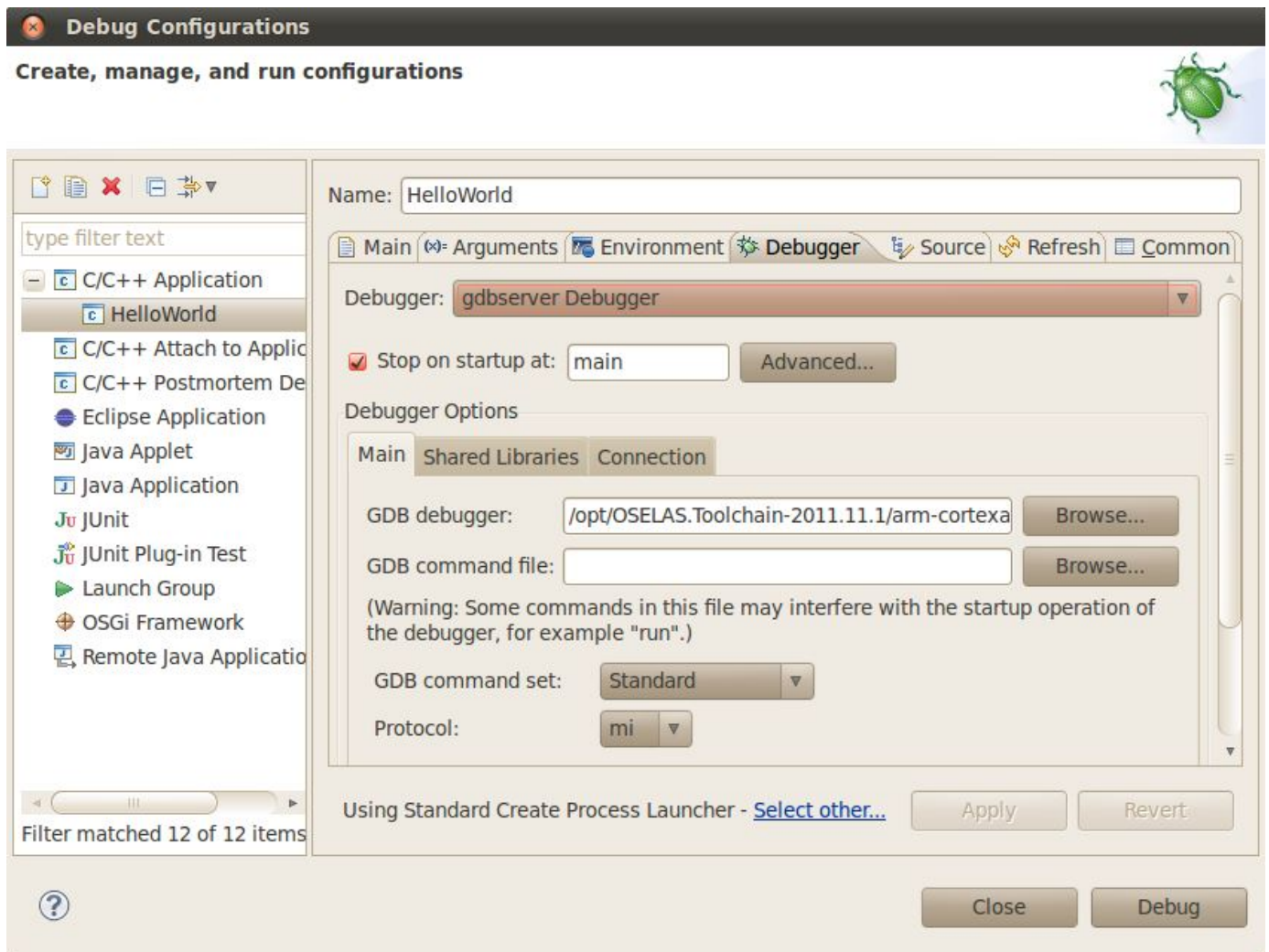
Listening on port 10000

The GDB server has been started on the target, it is now waiting for connections on the TCP port 10000.

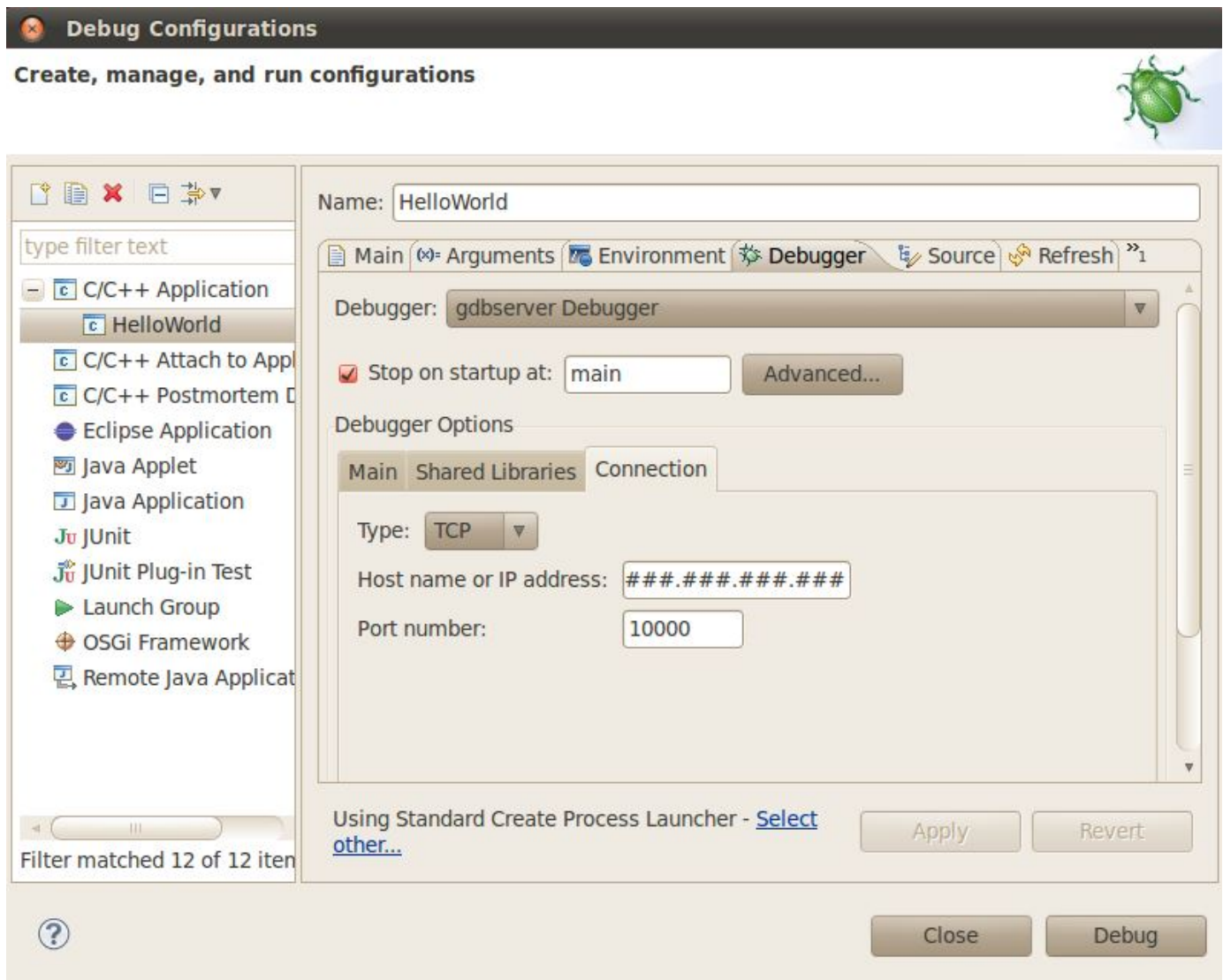
### From Eclipse on the host: Setup the debug configuration

- In the Project View Window, right click on the *HelloWorld* project
- Click **Debug As -> Debug Configurations...**
- From the navigation menu on the left, expand **C/C++ Application**
- Select *HelloWorld*
- On the Debugger tab, select from the **Debugger** drop-down menu *gdbserver Debugger*
- From the Main tab under Debugger Options, under **GDB debugger:** select **Browse...**
- Browse to the location of the cross toolchain, if built in [Section 4.3](#) */opt/OSELAS.Toolchain-2011.11.1/arm-cortexa9-linux-gnueabi/gcc-4.6.2-glibc-2.14.1-binutils-2.21.1a-kernel-2.6.39-sanitized/bin/arm-cortexa9-linux-gnueabi-gdb*
- Clear the text under **GDB command file:**

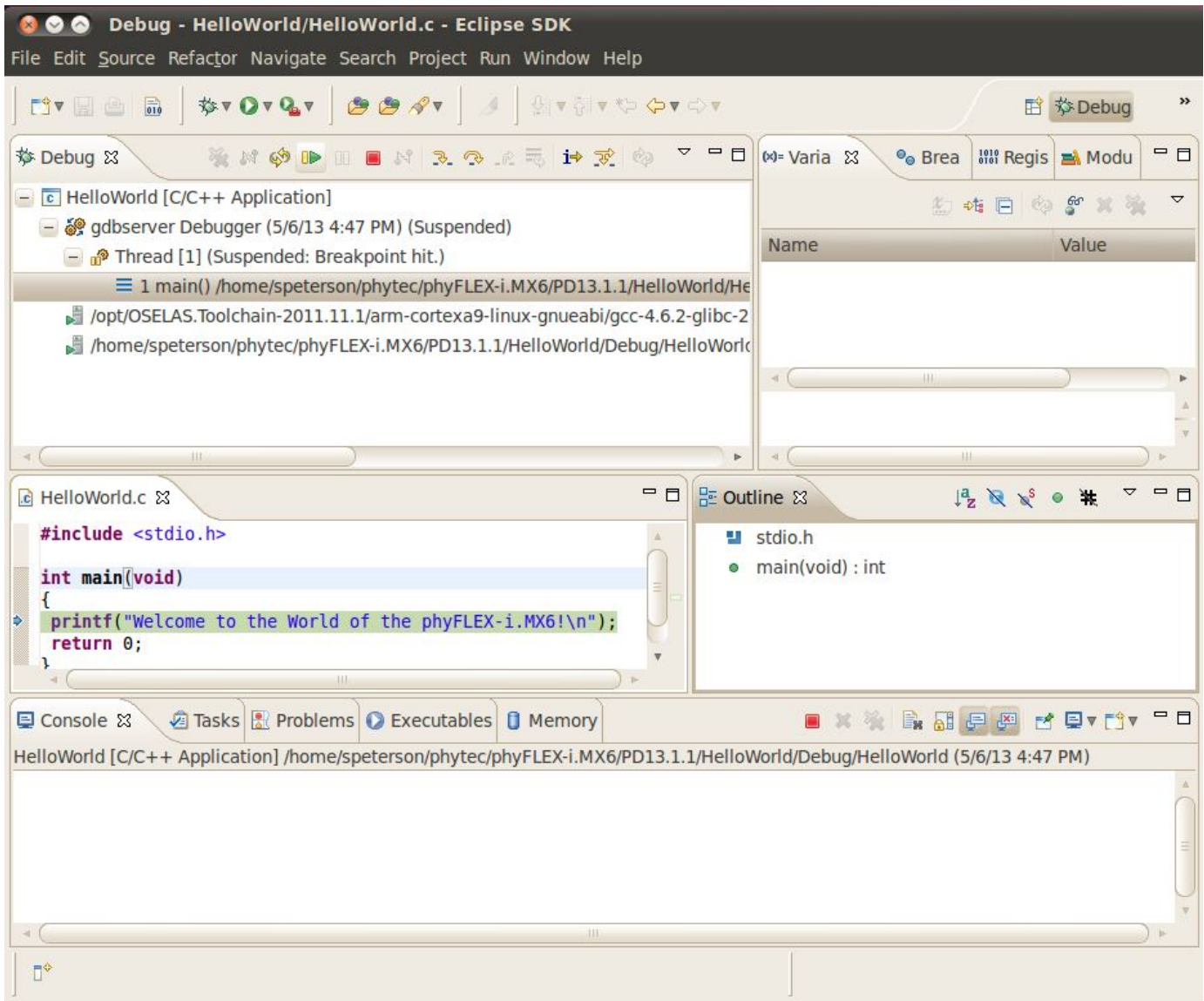




- From the Connection tab under Debugger Options, select from the **Type**: drop-down menu *TCP* and enter the IP address of the target
- Click **Apply**



- Launch and debug the demo application from the Debug Configurations menu by clicking **Debug**.



Automatically, Eclipse is switched into the debug perspective and the debugger stops automatically at the first line and the host's GDB is now connected to the GDB server on the target. The debug configuration, *HelloWorld [C/C++ Application]*, in the Debug control window displays the current state of the application. Continue using the Eclipse debugger to set breakpoints, step through a project, watch and change content of variables, and use the memory monitor to view the content at a memory address.

## 6 Building the BSP

Management of the phyFLEX-i.MX6 BSPs is provided by PTXdist version 2012.03.0. If a symbolic link was not created between **ptxdist** and **ptxdist-2012.03.0** affix all **ptxdist** commands with *2012.03.0* resulting in **ptxdist-2012.03.0**, see [Section 2.2](#) for additional information on using PTXdist.

### 6.1 PTXdist Project Setup

Download and extract the BSP, *BSP-Phytec-phyFLEX-i.MX6-<release-version>.tar.gz*, available on the [PHYTEC FTP](#).

*Note: Replace <release-version> with the BSP release version downloaded, ex. for phyFLEX-PD13.1.1 BSP release, replace BSP-Phytec-phyFLEX-i.MX6-<release-version> with BSP-Phytec-phyFLEX-i.MX6-PD13.1.1.*

```
tar -xvzf BSP-Phytec-phyFLEX-i.MX6-<release-version>.tar.gz
cd BSP-Phytec-phyFLEX-i.MX6-<release-version>
```

Use the pre-defined ptxconfig to select a software platform and select *phyCORE-i.MX6* for the hardware platform.

```
ptxdist-2012.03.0 select configs/ptxconfig
ptxdist-2012.03.0 platform configs/phyFLEX-i.MX6/platformconfig
```

PTXdist should automatically detect the toolchain:

```
found and using toolchain:
'/opt/OSELAS.Toolchain-2011.11.1/arm-cortexa9-linux-gnueabi/gcc-4.6.2-glibc-2.14.1-binutils-2.21.1a-kernel-2.6.39-
sanitized/bin'
```

*Note: If the toolchain was not installed in the OSELAS.Toolchain() default location, PTXdist will not automatically detect it. The toolchain will need to be selected manually, see [PTXdist User Manual](#) Section 3.2.4 for additional information.*

## 6.2 Managing Configurations

All source code is located in the `BSP-Phytec-phyFLEX-i.MX6-<release-version>/platform-phyFLEX-i.MX6/build-target` directory. To help integrate and modify features on the system for both driver development and general settings or carrier board design, it is necessary to know about the files summarized by the following:

- **Linux Kernel Source** (`linux-3.0.35`)

Board File: `linux-3.0.35/arch/arm/mach-mx6/board-mx6q-phyflex.c`

- **Barebox Source** (`barebox-2012.02.0`)

Board File: `barebox-2012.02.0/arch/arm/boards/phyflex-imx6/board.c` Default Configuration File: `barebox-2012.02.0/arch/arm/boards/phyflex-imx6/env/config`

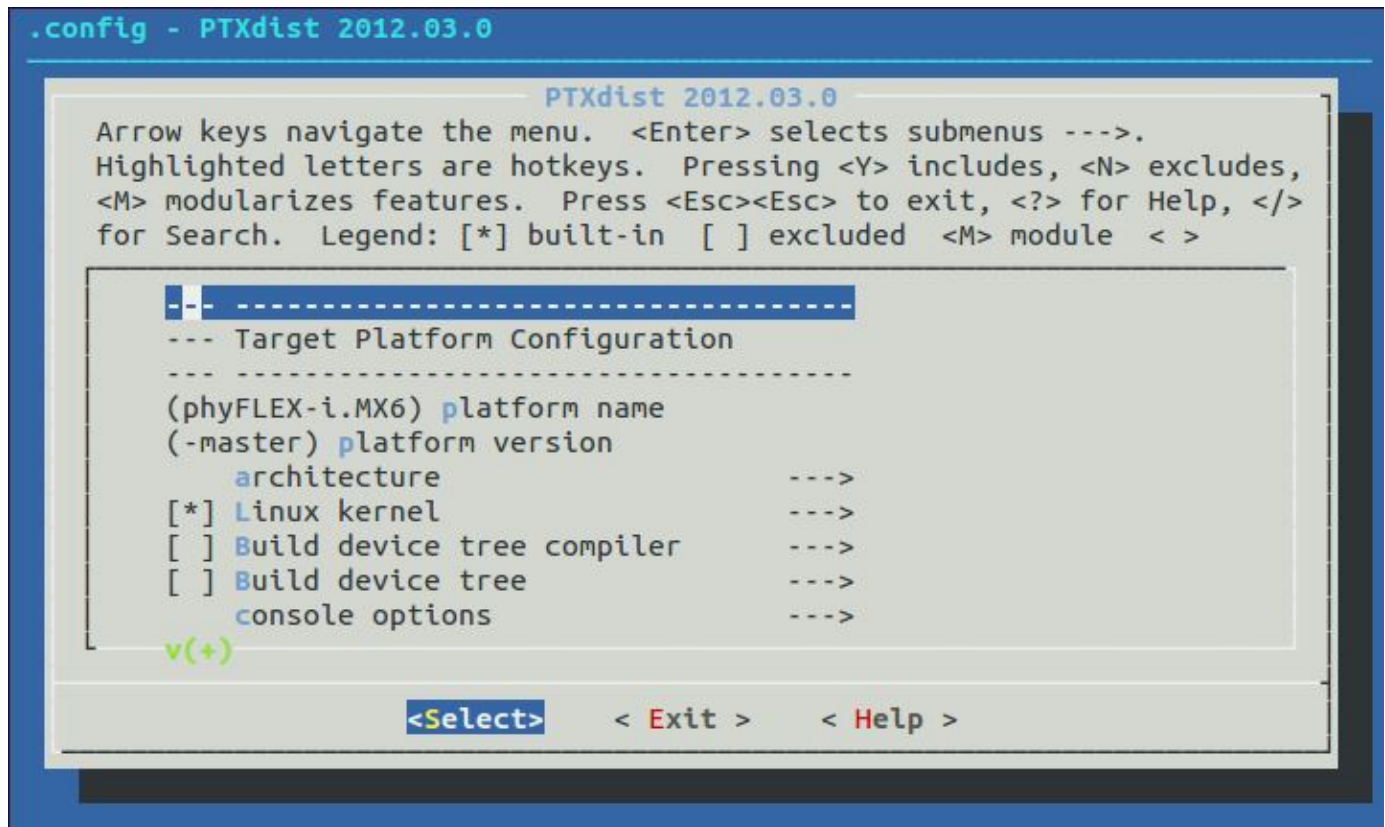
*Note: The files located in `<bsp_install_dir>/platform-phyFLEX-i.MX6/` are not generated until after the first successful build of the BSP.*

PTXdist uses the kernel configuration, KConfig, files present throughout the BSP for straightforward user configuration of individual settings and drivers. The platform, kernel, and project's root filesystem configuration menus will be the most beneficial.

### 6.2.1 Platform

The platform configuration menu contains the default settings for each platform including what bootloaders, kernel, and filesystem images are to be built and located.

```
ptxdist-2012.03.0 platformconfig
```



### 6.2.2 Kernel

The kernel configuration menu allows the user to adjust the drivers and support included in a Linux kernel build.

```
ptxdist-2012.03.0 kernelconfig
```



**.config - Linux/arm 3.0.35 Kernel Configuration****Linux/arm 3.0.35 Kernel Configuration**

Arrow keys navigate the menu. <Enter> selects submenus --->. Highlighted letters are hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [\*] built-in [ ] excluded <M> module < >

**[ ] Patch physical to virtual translations at runtime (EXPERIMENT**

General setup --->

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

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

System Type --->

Bus support --->

Kernel Features --->

Boot options --->

CPU Power Management --->

Floating point emulation --->

v(+)

<Select>

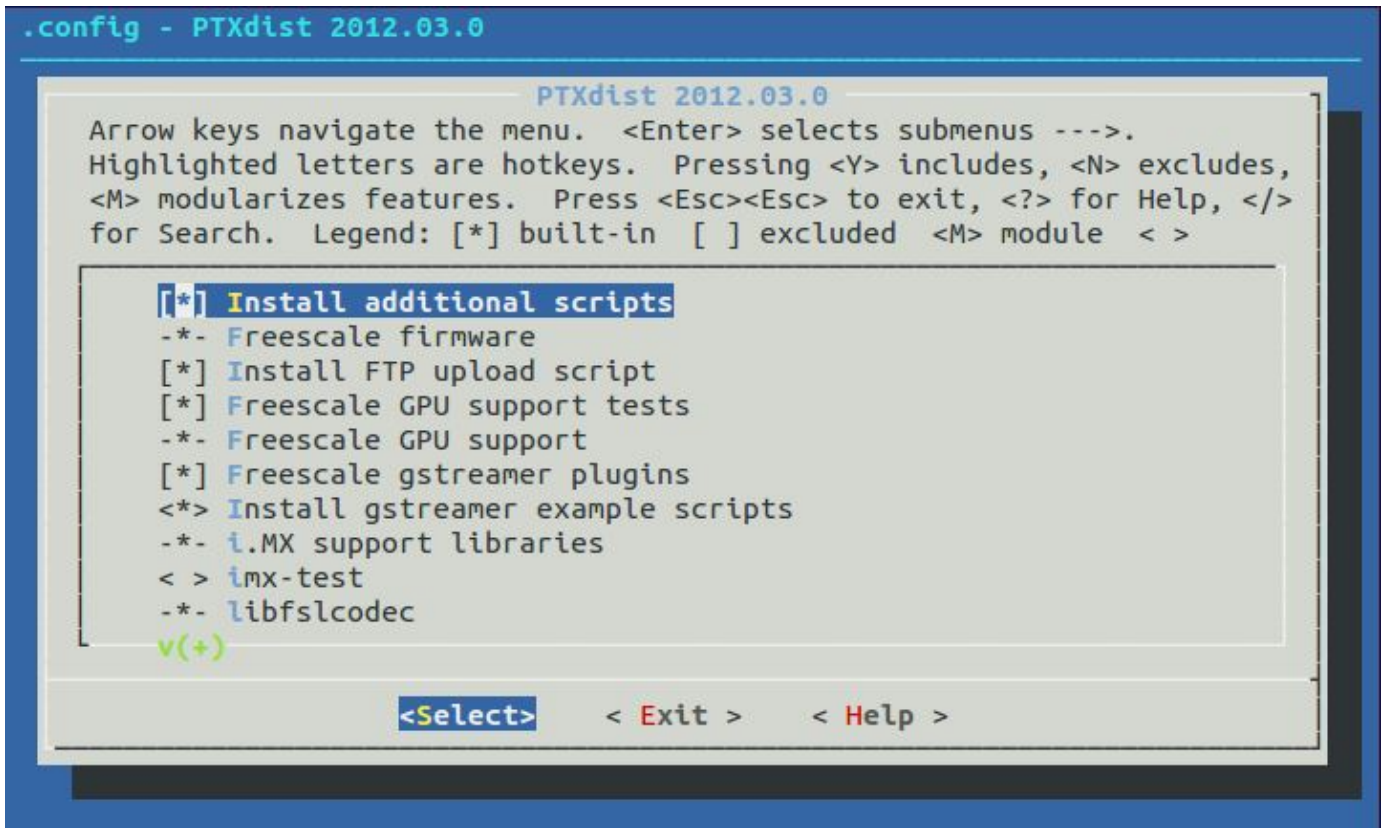
< Exit >

< Help >

### 6.2.3 Root Filesystem

Configuration of the project's filesystem can be done in the overall menuconfig. By toggling the options in the base configuration, the applications and content built into the filesystem can be modified directly. This allows both minimal and more complete filesystem builds to be created easily.

ptxdist-2012.03.0 menuconfig



### 6.3 Building Images

Building and creating images with PTXdist is very simple. All the required steps to download sources and build packages in the correct order are done using the **ptxdist go** command. Following a successful build, the **ptxdist images** command will create images to deploy on the target.

```
ptxdist-2012.03.0 go
ptxdist-2012.03.0 images
```

#### Note:

The build process relies on obtaining source information from the web, therefore in some cases the content to be downloaded may no longer exist and **ptxdist go** will fail. If this occurs, check the PHYTEC ftp-server via [ftp://ftp.phytec.de/pub/BSP\\_PACKAGES/EXTERNALS](ftp://ftp.phytec.de/pub/BSP_PACKAGES/EXTERNALS) for an alternative download link for the file as it appears in the build output. Download the file and place it in *BSP-Phytec-phyFLEX-i.MX6-<release-version>/src* directory in its compressed form. After that, restart the build process by calling **ptxdist go** again. If the package is not available on the FTP, please contact [support@phytec.de](mailto:support@phytec.de). We will then take it from our buildserver and upload it onto our ftp-server for you.

It is also possible that ptxdist will download a file that is claimed to be an archive but then is unable to decompress it. This is because the link didn't deliver the requested archive, but rather HTML containing a message like: "Error - This file has been moved to ...". Please treat this case in the same way as stated above.

All images are stored in *BSP-Phytec-phyFLEX-i.MX6-<release-version>/platform-mx6/images*.

### 7 Managing Images

The phyFLEX-i.MX6 is pre-loaded with kit demo images in Flash. Images located on the [PHYTEC FTP](#) or built images can be run on the target.

To boot the board, the following images will be required:

File	Name
Bootloader	barebox-image
Default environment	barebox_default_env
Linux kernel	ulImage-pfla02
Root Filesystem	root.ubi (NAND or NOR Flash) root-pfla02.tgz (SD Card)



If using a SD card that has already been formatted skip to the appropriate steps below -- Step 5 if the Linux kernel is changing or Step 7 if the root filesystem is the only change and continue the steps from there.

#### 1. Determine the SD card device name

- The SD card device name is of the form /dev/sd[b|c|d|e]. Run the following without and with the SD card connected:

```
ls /dev/sd*
```

- The device that appeared on the call to ls with the SD card but not the call without is the SD card device.

#### 2. Unmount all partitions of the SD card, using the SD card device name from Step 1:

```
umount /dev/sd[b|c|d|e]*
```

#### 3. Make two partitions on the SD card using *fdisk* from the Linux kernel, specifying the SD card device name from Step 1:

```
sudo fdisk -ls
```

```
Command (m for help): o
Building a new DOS disklabel with disk identifier 0x2fe3ef94.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.
```

- Create a new primary partition (**n** command) with partition id C, leaving 8 MB of free space at the beginning of the card:

```
Command (m for help): n
Partition type:
  p   primary (0 primary, 0 extended, 4 free)
  e   extended
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-7626751, default 2048): 17432
Last sector, +sectors or +size{K,M,G} (17432-7626751, default 7626751): 1267432

Command (m for help): t
Partition number (1-4): 1
Hex code (type L to list codes): C
Changed system type of partition 1 to c (W95 FAT32 (LBA))
```

- Create a new Linux partition (**n** command) with partition id 83

```
Command (m for help): n
Partition type:
  p   primary (1 primary, 0 extended, 3 free)
  e   extended
Select (default p): p
Partition number (1-4, default 2): 2
First sector (2048-7626751, default 2048): 1267433
Last sector, +sectors or +size{K,M,G} (1267433-7626751, default 7626751):
Using default value 7626751

Command (m for help): t
Partition number (1-4): 2
Hex code (type L to list codes): 83
```

- Write the partition table to the card (**w** command) which will destroy all data on the SD card

```
Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

WARNING: If you have created or modified any DOS 6.x
partitions, please see the fdisk manual page for additional
information.
Syncing disks.
```

- Create a filesystem on the partitions from the Linux command line:

```
sudo mkfs.vfat /dev/sd[b|c|d|e]1 -F 32 -n boot
sudo mkfs.ext3 /dev/sd[b|c|d|e]2 -L rootfs
```

#### 4. Mount all partitions

Remove and reinsert the SD card, automount will mount /media/kernel and /media/rootfs

#### Kernel

5. If modifying the Linux kernel, remove the existing ulmage-3.0-ts-armv7l file:

```
rm -rf /media/boot/*
```

6. Load the new Linux kernel to the SD Card:

```
cp <path to uImage-pfla02>/uImage-pfla02 /media/boot; sync
```

### Root Filesystem

7. If modifying the root filesystem, remove the existing:

```
sudo rm -rf /media/rootfs/*
```

8. Load the new filesystem to the SD Card:

```
sudo tar -zxvf <path to rootfs.tgz> -C /media/rootfs/; sync
```

9. Unmount each partition before copying the bootloader or removing the SD Card:

```
umount /media/boot /media/rootfs
```

### Bootloader

10. Use the dd command to copy barebox-image to the SD Card:

```
dd if=barebox-image of=/dev/sd[b|c|d|e] bs=512 skip=2 seek=2
```

11. Use the dd command to copy the barebox default environment to the SD Card:

```
dd if=barebox_default_env of=/dev/sd[b|c|d|e] bs=512 seek=4096
```

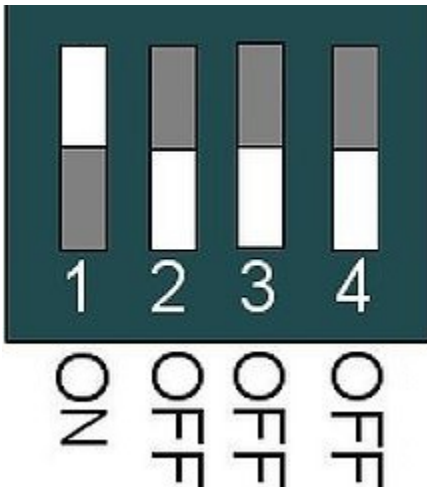
## 8 Booting Configurations

### 8.1 Selecting Boot Modes

The bootloader, one of the key software components included in the BSP, completes the required hardware initializations to download and run operating system images. The boot mode, selected from the S3 dipswitch on the Carrier Board, determines the location of the primary bootloader. Set the S3 switches correspondingly:

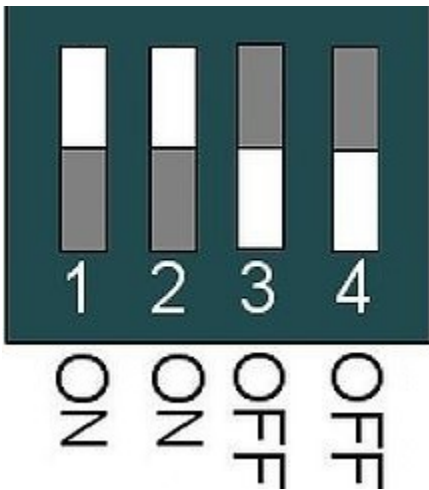
#### SPI NOR

S3-1 ONS3-2, S3-3, S3-4 OFF



#### SD Card

S3-1, S3-2 ONS3-3, S3-4 OFF



## 8.2 Basic Settings

After application of power, approximately three seconds are allotted for the user to hit any key which will halt autoboot and enter Barebox.

```
COM1:115200baud - Tera Term VT
File Edit Setup Control Window Help

Board: phyFLEX i.MX6
registered netconsole as cs1
imx-esdhc@mci0: registered as mci0
Cannot reset the SD/MMC interface
ehci@ehci1: USB EHCI 1.00
Got valid MAC from hardware device
eth@eth0: MAC address: 50:2D:F4:05:23:FC
phyflex_init_ethernet() mii_open() ok, mdev->address = 0x3
m25p@m25p0: n25q128 (16384 Kbytes)
NAND device: Manufacturer ID: 0xec, Chip ID: 0xd3 (Samsung NAND 1GiB 3,3V 8-bit)
Scanning device for bad blocks
Bad eraseblock 817 at 0x06620000
Bad eraseblock 1216 at 0x09800000
Bad eraseblock 1239 at 0x09ae0000
Bad eraseblock 1671 at 0x0d0e0000
Bad eraseblock 2637 at 0x149a0000
Bad eraseblock 3623 at 0x1c4e0000
Bad eraseblock 6710 at 0x346c0000
Set nor0.barebox as self0 device
Use nor0.bareboxenv for default barebox environment
Malloc space: 0x47c00000 -> 0x4fbfffff (size 128 MB)
Stack space : 0x47bf8000 -> 0x47c00000 (size 32 kB)
running /env/bin/init...

Hit any key to stop autoboot:  3
barebox:/
```

Note: **help** is a useful tool in Barebox to show available commands and usage.

Use the Barebox configuration file to modify environment variables, select boot settings, and setup networking parameters.

```
edit /env/config
```

### 8.2.1 Network Settings

```
serverip=###.###.###.###

eth0.ipaddr=###.###.###.###
eth0.netmask=###.###.###.###
eth0.gateway=###.###.###.###
eth0.serverip=###.###.###.###
eth0.ethaddr=##:##:##:##:##:##

kernel_loc=<tftp|disk|nor|nand>
rootfs_loc=<net|disk|nor|nand>
rootfs_type=<ext3|jffs2|ubifs>

nfsroot=$serverip:<NFS mount location>
```

- **ipaddr**

A dedicated IP address for the SOM. This is crucial if TFTP will be used for updating the device's images at any point.

- **netmask**

Netmask for the network: typically 255.255.255.0. This is only necessary if the TFTP directory is located on another network.

- **gateway**

Gateway IP for the network. This is only necessary if the TFTP directory is located on another network.

- **serverip**

IP address of the host or another machine. serverip corresponds to where the NFS directory, if it exists is located; eth0.serverip corresponds to where the TFTP directory, if it exists, is located.

- **ethaddr**

MAC address for the device. Set this to the MAC ID, which is printed on the sticker on the SOM.

- **nfsroot**

Location of the path to the NFS directory of the host or another machine, setup in [Section 4.1.2](#). For example: /home//phyCORE-NFS

### 8.2.2 Boot Settings

By default, the phyFLEX-i.MX6 kit is setup to boot the Linux kernel and root filesystem from NAND. Boot settings are determined by the following environment variables:

```
kernel_loc=nand
rootfs_loc=nand
rootfs_type=ubifs
```

- **kernel\_loc**

Specifies the location of the Linux kernel. Set this to be:tftp - To boot the Linux kernel via TFTPnor - To boot the Linux kernel from NORnand - To boot the Linux kernel from NAND (default)

- **rootfs\_loc**

Specifies the location of the root filesystem. Set this to be:net - To mount the root filesystem via NFSnor - To mount the root filesystem from NORFlashnand - To mount the root filesystem from NAND Flash (default)

- **rootfs\_type**

Specifies the root filesystem type. Set this depending on the location of the root filesystem:ext3 - If rootfs\_loc=diskubifs - If rootfs\_loc=nand or rootfs\_loc=nor (default)

### 8.2.3 Display Settings

By default the system is set to support the 7" EDT display with capacitive touch and adapter board, *ETM0700G0DH6* (LCD-018-070KAP). To select a different display, in the *Displays* section uncomment the LCD selected and comment out the remaining by placing a '#' at the beginning of the line.

```
# Displays
#display=Primeview-PD050VL1
#display=Primeview-PD035VL1
#display=Primeview-PD104SLF
#display=Primeview-PM070WL4
display=ETM0700G0DH6
```

### 8.2.4 Saving Configurations

From the configuration file, return to the Barebox prompt by pressing **CTL+D** to apply changes or **CTL+C** to cancel. To retain changes, at the Barebox prompt save the environment.

```
saveenv
```

## 8.3 Booting Options

From the Barebox prompt, continue the boot process using the locations for the Linux kernel and root filesystem defined in the configuration file.

```
boot
```

This command also allows the user specify the location of the kernel and root filesystem without modifying the configuration file.

```
boot [-m <mode>] [-k <kernel_option>] [-r <rootfs_option>] [-i <ip_mode>] [-o <oftree_option>]
```

*Note: By typing **\_boot\_help** in the barebox prompt, a summary of the syntax, options, and parameters are provided.*

The following provides examples to show the different uses of the *boot* command.

Description	Kernel	Root Filesystem	Command
Fixed kernel and root filesystem, same location	TFTP	NFS	<i>boot -m net</i>
Fixed kernel, default root filesystem	NAND	default	<i>boot -k nand</i>
Default kernel and fixed root filesystem	default	NFS	<i>boot -r net</i>
Fixed kernel and root filesystem, different location	TFTP	NOR	<i>boot -k net -r nor</i>

*Note: The **rootfs\_type** parameter will need to be modified prior to running the boot command.*

## 9 Flashing Images

Images that were built or the example images located on the PHYTEC America FTP [[Here](#)] can be flashed to the NAND or NOR Flash on the target from a TFTP server using the Barebox command line.

- Make a serial connection, see [Step 2](#) and [Serial Communication](#)
- Connect an Ethernet cable, see [Step 3](#)
- Power the target, see [Step 5](#)
- Halt autoboot and enter Barebox
- Verify the network settings in the environment configuration file

eth0.ipaddr, eth0.serverip, eth0.netmask, and eth0.gateway should match that of the TFTP server

- Use the Barebox update command to download an image from the TFTP server, erase the required amount of flash, and then write the image from RAM into the flash.

```
update -t <kernel>|<rootfs>|barebox|bareboxenv|xload|oftree> -d <nor>|<nand> [-m tftp|xmodem] [-f imagename] -c
```

*Note: Enter **\_update\_help** or **update** in the Barebox prompt to generate a summary of the syntax, options, and parameters.*

- If the bootloader, Barebox or the Barebox default environment, was updated reboot the target for the changes to take effect.

```
reset
```

### 9.1 Barebox

A valid *barebox-image* must be available on the TFTP server, <TFTP\_DIRECTORY>/phyFLEX-iMX6/images.

*Note: Use caution when updating Barebox. If it is not updated with a valid image, the target will not boot and since SD Card boot is not supported it will be difficult to rectify.*

#### NOR Flash

```
update -t barebox -d nor -m tftp -f phyFLEX-iMX6/images/barebox-image
```

### 9.2 Barebox Default Environment

To restore the default Barebox environment, simply delete the Barebox environment partition.

#### NOR Flash

```
erase /dev/env0
```

## 9.3 Kernel

A valid *ulmage-pfla02* must be available on the TFTP server, <TFTP\_DIRECTORY>/phyFLEX-iMX6/images.

### NAND Flash

```
update -t kernel -d nand -m tftp -f phyFLEX-iMX6/images/uImage-pfla02
```

### NOR Flash

```
update -t kernel -d nor -m tftp -f phyFLEX-iMX6/images/uImage-pfla02
```

## 9.4 Root Filesystem

A valid *root-pfla02.ubi* must be available on the TFTP server, <TFTP\_DIRECTORY>/phyFLEX-iMX6/images.

### NAND Flash

```
update -t rootfs -d nand -m tftp -f phyFLEX-iMX6/images/root-pfla02.ubi
```

### NOR Flash

```
update -t rootfs -d nor -m tftp -f phyFLEX-iMX6/images/root-pfla02.ubi
```

*Note: The root filesystem available on the FTP will be too large to flash to NOR. However, if a more minimal filesystem was built, it can be flashed.*