PetaLinux SDK User Guide

Getting Started Guide

UG977 (v2013.10) November 25, 2013

XILINX®

Notice of Disclaimer
The information disclosed to you hereunder (the "Materials") is provided solely for the selection and use of Xilinx products. To the maximum extent permitted by applicable law: (1) Materials are made available "AS IS" and with all faults, Xilinx hereby DISCLAIMS ALL WARRANTIES AND CONDITIONS, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING BUT NOT LIMITED TO ARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR ANY PARTICULAR PURPOSE; and (2) Xilinx shall not be liable (whether in contract or tort, including negligence, or under any other theory of liability) for any loss or damage of any kind or nature related to, arising under, or in connection with, the Materials (including your use of the Materials), including for any direct, indirect, special, incidental, or consequential loss or damage (including loss of data, profits, goodwill, or any type of loss or damage suffered as a result of any action brought by a third party) even if such damage or loss was reasonably foreseeable or Xilinx had been advised of the possibility of the same. Xilinx assumes no obligation to correct any errors contained in the Materials or to notify you of updates to the Materials or to product specifications. You may not reproduce, modify, distribute, or publicly display the Materials without prior written consent. Certain products are subject to the terms and conditions of the Limited Warranties which can be viewed at http://www.xilinx.com/warranty.htm; IP cores may be subject to warranty and support terms contained in a license issued to you by Xilinx. Xilinx products are not designed or intended to be fail-safe or for use in any application requiring fail-safe performance; you assume sole risk and liability for use of Xilinx products in Critical Applications: http://www.xilinx.com/warranty.htm#critapps.

Revision History

Date	Version	Notes
2009-11-19	1.1	Initial version for SDK 1.1 release
2011-11-26	1.3	Updated for PetaLinux SDK 1.3 release - PowerPC 440 support
2011-04-01	2.1	Updated for PetaLinux SDK 2.1 release - new procedure for rebuilding reference designs based on Xilinx 13.1
2012-08-03	3.1	Updated for PetaLinux SDK 3.1 release
2012-09-03	12.9	Updated for PetaLinux SDK 12.9 release
2012-12-17	2012.12	Updated for PetaLinux SDK 2012.12 release
2013-04-29	2013.04	Updated for PetaLinux SDK 2013.04 release
2013-11-25	2013.10	Updated for PetaLinux SDK 2013.10 release

Online Updates

Please refer to the PetaLinux v2013.10 Master Answer Record (Xilinx Answer Record #55776) for the latest updates on PetaLinux SDK usage and documentation.

Table of Contents

About this Guide

This document provides basic information on how to start working with the PetaLinux SDK. PetaLinux is an Embedded Linux System Development Kit specifically targeting FPGA-based System-on-Chip designs. With PetaLinux, you can:

- Synchronise your hardware platform and software platform in one step
- Easily propagate your user application to MicroBlaze or Zynq Embedded Linux systems
- Test your MicroBlaze or Zynq Linux system in a virtual machine environment using QEMU.

The following sections will get you started with building and booting linux using PetaLinux tools.

Prerequisites

This getting started document assumes that the following prerequisites have been satisfied:

- You have PetaLinux SDK installed on your Linux workstation. If you haven't installed PetaLinux SDK, please refer to *PetaLinux SDK Installation Guide (UG976)* to install it.
- You have created at least one PetaLinux project from a PetaLinux reference BSP. If you haven't, please refer to section BSP Installation Procedure of *PetaLinux SDK Installation Guide (UG976)* to create a project with a PetaLinux reference BSP.
- A serial communication program such as `minicom` or `kermit` has been installed; the baud rate of the serial communication program has been set to 115200bps.
- If you wish to work on hardware designs, Xilinx tools and JTAG cable drivers must be installed. Please refer to Xilinx installation documentation and procedures.
- The reader of this document is assumed to have basic Linux knowledge.
- Unless otherwise indicated the PetaLinux tool command must be run from within a project directory ("`<project-root>`").

  For some workflows you may need:

- A workstation with `tftpd` server running.
- A "`/tftpboot`" directory on your workstation and all users have read/write permissions to it.

Environment Setup

Setup the PetaLinux working environment by running the PetaLinux setup script as follows:

1. Source the set up script. For bash:

   ```
   $ source <path-to-installed-PetaLinux>/settings.sh
   ```

   or for C shell:

   ```
   $ source <path-to-installed-PetaLinux>/settings.csh
   ```

   WARNING:

   - *Only run one of these scripts - whichever is appropriate for your terminal shell*
   - *You must run the settings script each time you open a new terminal window or shell. The PetaLinux tools will fail otherwise.*

2. Verify that the PetaLinux working environment has been set:

   ```
   $ echo $PETALINUX
   /opt/petalinux-v2013.10-final
   ```

   Environment variable "`$PETALINUX`" should point to the path to the installed PetaLinux. Your echo output may be different from this example, it depends on where you installed PetaLinux.

Test a Pre-built PetaLinux Image

So far, you have successfully installed PetaLinux, one or more PetaLinux projects are created from PetaLinux reference BSP, and setup the PetaLinux working environment. Now, you can try one of the reference designs shipped with your BSP package. This is achieved with the `petalinux-boot` command, with the `--qemu` option to boot reference designs under software simulation (QEMU) and `--jtag` on a hardware board.

Test Pre-Built PetaLinux Image with QEMU

PetaLinux provides QEMU support such that the PetaLinux software image can be tested in a simulated environment, without any hardware.
To test the PetaLinux reference design with QEMU, follow these steps:

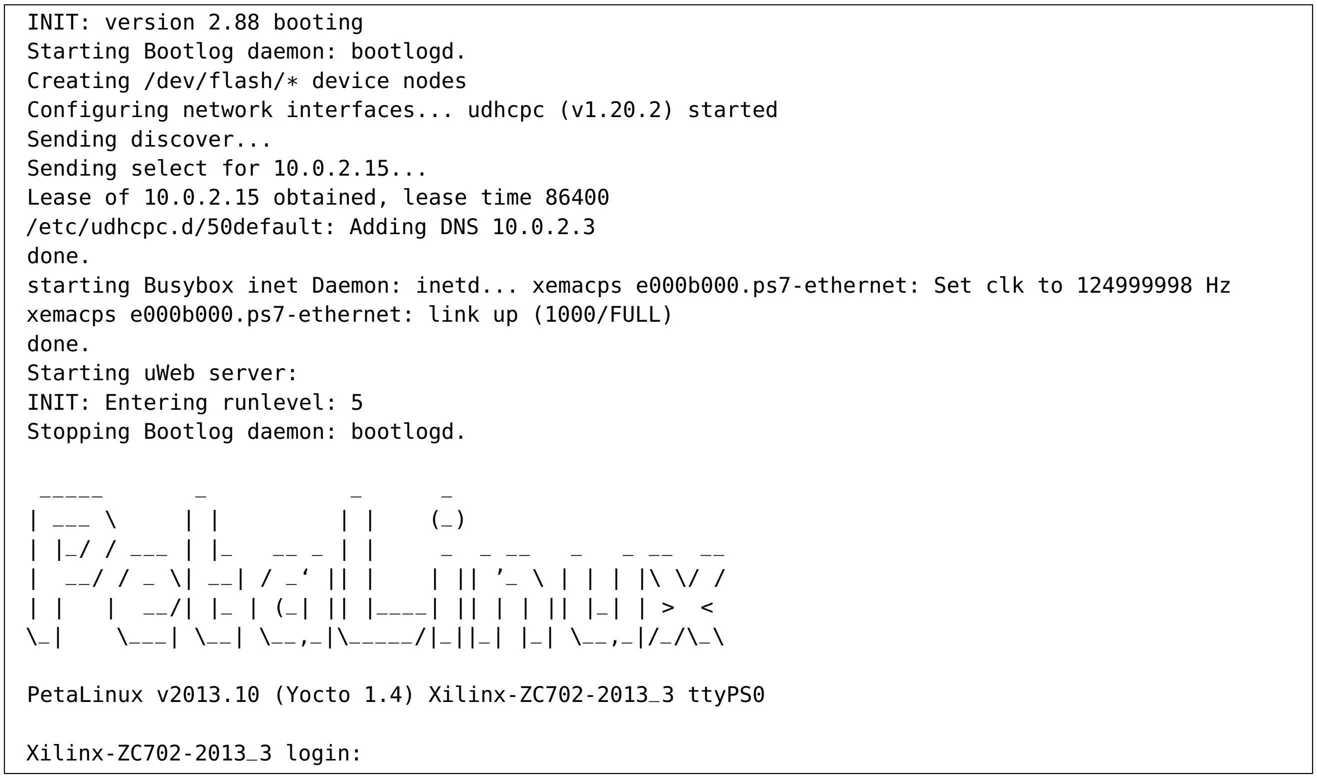
1. Change to your project directory and boot the prebuilt linux kernel image:

```
$ petalinux-boot --qemu --prebuilt 3
```

The `--qemu` option tells `petalinux-boot` to boot QEMU, instead of real hardware via JTAG, and the `--prebuilt 3` boots the linux kernel.

- The `--prebuilt 1` option performs a Level 1 boot, that is, only configure the FPGA.
- Level 2 is FPGA + u-boot.
- Level 3 is FPGA + pre-built Linux image.

You should see the following kernel boot log on the console:



```
INIT: version 2.88 booting
Starting Bootlog daemon: bootlogd.
Creating /dev/flash/* device nodes
Configuring network interfaces... udhcpc (v1.20.2) started
Sending discover...
Sending select for 10.0.2.15...
Lease of 10.0.2.15 obtained, lease time 86400
/etc/udhcpc.d/50default: Adding DNS 10.0.2.3
done.
starting Busybox inet Daemon: inetd... xemacps e000b000.ps7-ethernet: Set clk to 124999998 Hz
xemacps e000b000.ps7-ethernet: link up (1000/FULL)
done.
Starting uWeb server:
INIT: Entering runlevel: 5
Stopping Bootlog daemon: bootlogd.

 _____       _           _      _
| ___ \     | |         | |    (_)
| |_/ / ___ | |_   __ _ | |     _  _ __   _   _ __  __
|  __/ / _ \| __| / _‘ || |    | || ’_ \ | | | |\ \/ /
| |   |  __/| |_ | (_| || |____| || | | || |_| | >  <
\_|    \___| \__| \__,_|\_____/|_||_| |_| \__,_|/_/\_\

PetaLinux v2013.10 (Yocto 1.4) Xilinx-ZC702-2013_3 ttyPS0

Xilinx-ZC702-2013_3 login:
```

Figure 1: Serial console output of successful `petalinux-boot` prebuilt

2. Login to PetaLinux with the default user name `root` and password `root`.

TIP: *To exit QEMU, press Ctrl+A together, release and then press X*

Test Pre-Built PetaLinux Image on Hardware

PetaLinux BSPs include pre-built FPGA bitstreams for each reference design, allowing you to quickly boot linux on your hardware. Here are the steps to test a pre-built linux image with hardware:

1. Power off the board.
2. Connect the JTAG port on the board with the JTAG cable to your workstation.
3. Connect the serial port on the board to your workstation.
4. Connect the Ethernet port on the board to the local network via a network switch.
5. For Zynq boards, ensure the mode switches are set to JTAG mode. Refer to the board documentation for details.
6. Power on the board.

7. Open a console on your workstation and then start your preferred serial communication program (e.g. `kermit`, `minicom`) with the baud rate set to 115200 on that console.

8. Run the `petalinux-boot` command as follows on your workstation:

   ```
   $ petalinux-boot --jtag --prebuilt 3
   ```

   The `--jtag` option tells `petalinux-boot` to boot on hardware via JTAG, and the `--prebuilt 3` boots the linux kernel. This command will take some time to finish, please wait until you see the shell prompt again on the command console.

   The figures below are examples of the messages on the workstation command console and on the serial console:

```
$ petalinux-boot --jtag --prebuilt 3
INFO: The image provided is a zImage and no addition options were provided
INFO: Append dtb - /home/user/Xilinx-ZC702-2013.3/pre-built/linux/images/system.dtb
and other options to boot zImage
INFO: Configuring the FPGA...
INFO: FPGA configuration completed.
INFO: Downloading FSBL
INFO: FSBL download completed.
INFO: Launching XMD for file download and boot.
INFO: This may take a few minutes, depending on the size of your image.
```

Figure 2: Workstation console output for successful `petalinux-boot`

```
INIT: version 2.88 booting
Starting Bootlog daemon: bootlogd.
Creating /dev/flash/* device nodes
Configuring network interfaces... udhcpc (v1.20.2) started
Sending discover...
Sending select for 10.0.2.15...
Lease of 10.0.2.15 obtained, lease time 86400
/etc/udhcpc.d/50default: Adding DNS 10.0.2.3
done.
starting Busybox inet Daemon: inetd... xemacps e000b000.ps7-ethernet: Set clk to 124999998 Hz
xemacps e000b000.ps7-ethernet: link up (1000/FULL)
done.
Starting uWeb server:
INIT: Entering runlevel: 5
Stopping Bootlog daemon: bootlogd.

 _____       _           _      _
| ___ \     | |         | |    (_)
| |_/ / ___ | |_   __ _ | |     _  _ __   _   _ __  __
|  __/ / _ \| __| / _‘ || |    | || ’_ \ | | | |\ \/ /
| |   |  __/| |_ | (_| || |____| || | | || |_| | >  <
\_|    \___| \__| \__,_|\_____/|_||_| |_| \__,_|/_/\_\

PetaLinux v2013.10 (Yocto 1.4) Xilinx-ZC702-2013_3 ttyPS0

Xilinx-ZC702-2013_3 login:
```

Figure 3: Serial console output of `petalinux-boot`

By default, network settings for PetaLinux reference designs are configured using DHCP. The output you see may be slightly different from the above example, depending upon which PetaLinux reference design you test.

9. Type user name `root` and password `root` on the serial console to log into the PetaLinux system.
10. Determine the IP address of the PetaLinux by running `ifconfig` on the system console.

Troubleshooting

If your local network does not have a DHCP server, the system will fail to acquire an IP address. If so, refer to Apendix A which describes how to manually specify the address.

If the `petalinux-boot` for jtag command fails, it is typically from a JTAG connectivity failure. Please ensure the board is powered on and your JTAG cable is properly connected. Please refer to the Xilinx JTAG cable and tools documentation for more detailed troubleshooting.

Rebuilding the Reference Design Software Image

So far, you have tested the PetaLinux reference design pre-built software image both with QEMU and on hardware. You can also rebuild the reference design. The following subsections describe how to do it and how to test the resulting image.

Compile PetaLinux Reference Design Software

First of all, let's look at how to rebuild the PetaLinux reference design.

1. Run `petalinux-build` to compile the software images:

```
$ petalinux-build
```

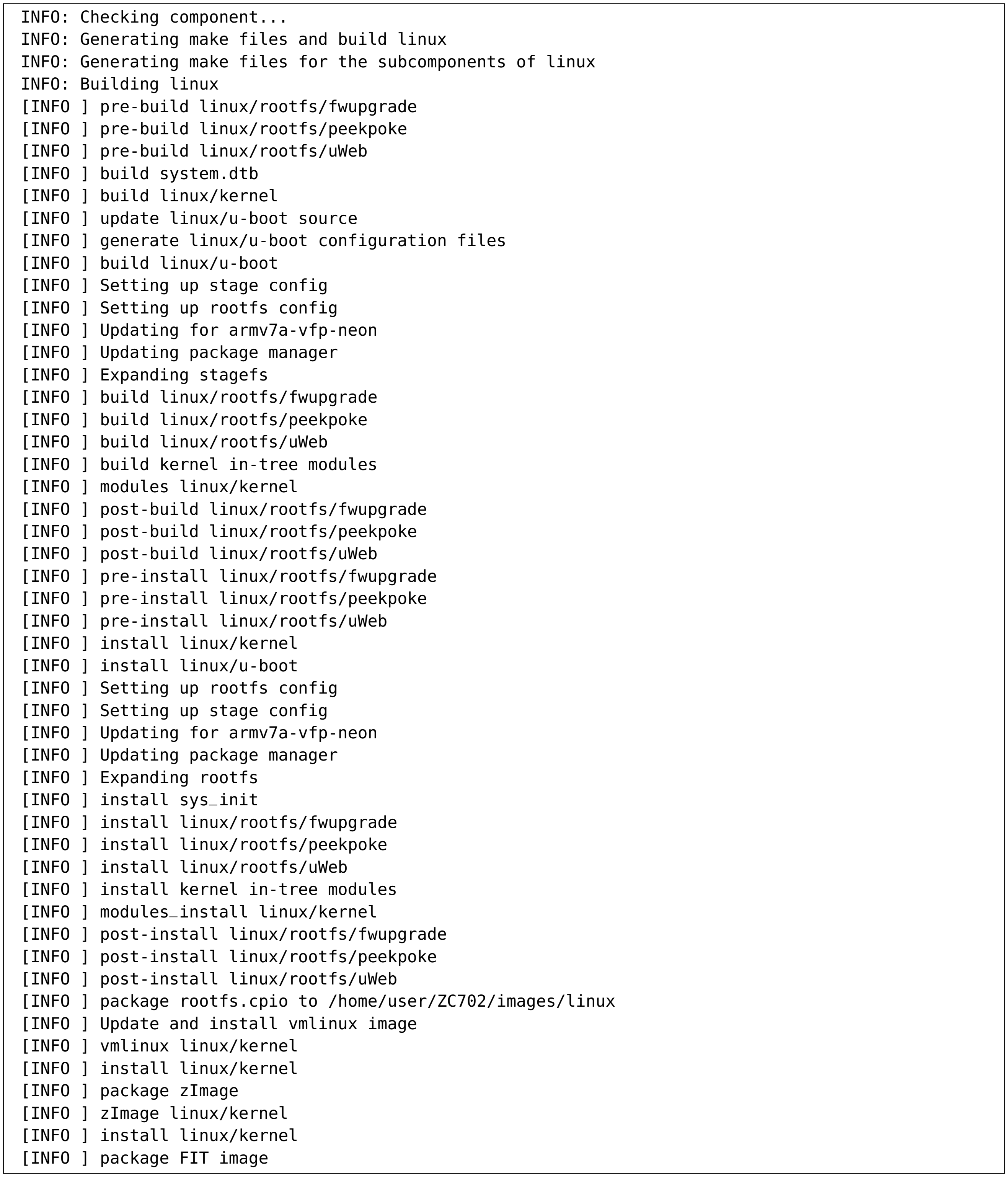
2. The compilation progress will show on the console. Wait until the compilation finishes.

TIP:

- *A detailed compilation log will be in "`<project-root>/build/build.log`" file.*

When the build finishes, the generated images will be within the "`<project-root>/images`" and "`/tftpboot`" directories.

Here is an example of the compilation progress output:



```
INFO: Checking component...
INFO: Generating make files and build linux
INFO: Generating make files for the subcomponents of linux
INFO: Building linux
[INFO ] pre-build linux/rootfs/fwupgrade
[INFO ] pre-build linux/rootfs/peekpoke
[INFO ] pre-build linux/rootfs/uWeb
[INFO ] build system.dtb
[INFO ] build linux/kernel
[INFO ] update linux/u-boot source
[INFO ] generate linux/u-boot configuration files
[INFO ] build linux/u-boot
[INFO ] Setting up stage config
[INFO ] Setting up rootfs config
[INFO ] Updating for armv7a-vfp-neon
[INFO ] Updating package manager
[INFO ] Expanding stagefs
[INFO ] build linux/rootfs/fwupgrade
[INFO ] build linux/rootfs/peekpoke
[INFO ] build linux/rootfs/uWeb
[INFO ] build kernel in-tree modules
[INFO ] modules linux/kernel
[INFO ] post-build linux/rootfs/fwupgrade
[INFO ] post-build linux/rootfs/peekpoke
[INFO ] post-build linux/rootfs/uWeb
[INFO ] pre-install linux/rootfs/fwupgrade
[INFO ] pre-install linux/rootfs/peekpoke
[INFO ] pre-install linux/rootfs/uWeb
[INFO ] install linux/kernel
[INFO ] install linux/u-boot
[INFO ] Setting up rootfs config
[INFO ] Setting up stage config
[INFO ] Updating for armv7a-vfp-neon
[INFO ] Updating package manager
[INFO ] Expanding rootfs
[INFO ] install sys_init
[INFO ] install linux/rootfs/fwupgrade
[INFO ] install linux/rootfs/peekpoke
[INFO ] install linux/rootfs/uWeb
[INFO ] install kernel in-tree modules
[INFO ] modules_install linux/kernel
[INFO ] post-install linux/rootfs/fwupgrade
[INFO ] post-install linux/rootfs/peekpoke
[INFO ] post-install linux/rootfs/uWeb
[INFO ] package rootfs.cpio to /home/user/ZC702/images/linux
[INFO ] Update and install vmlinux image
[INFO ] vmlinux linux/kernel
[INFO ] install linux/kernel
[INFO ] package zImage
[INFO ] zImage linux/kernel
[INFO ] install linux/kernel
[INFO ] package FIT image
```

Figure 4: Compilation progress output

The final kernel image is the "`zImage`" for Zynq or "`image.elf`" for MicroBlaze, living in the "`<project-root>/images/linux`" folder. A copy is also placed in the "`/tftpboot`" directory or your development workstation, to support network-based kernel boot.

Test New Software Image with QEMU

Now you have successfully rebuilt the software system image, it is time to test it out.

1. Use `petalinux-boot --qemu` command to test the newly built software image:

   ```
   $ petalinux-boot --qemu --image --kernel
   ```

   The system boot messages will be shown on the console where QEMU is running.

2. When you see the login prompt on the QEMU console, login as `root` with password `root`.

TIP:

- *To exit QEMU, press Ctrl+A together, release and then press X*

Test New Software Image on Hardware

Next, let's test the rebuilt software image on the real hardware. Follow the instructions from the previous Test Pre-built PetaLinux Image on Hardware section, to connect the board, serial and JTAG correctly.

1. Use `petalinux-boot` to program the FPGA with the reference design pre-built bitstream:

   ```
   $ petalinux-boot --jtag --prebuilt 1
   ```

   This command will take a few moments, please wait until you see the shell prompt shows again on the command console.

2. Use `petalinux-boot` to download the built Linux image to the board and boot it:

   ```
   $ petalinux-boot --jtag --kernel
   ```

   This command will take a few minutes, downloading the entire kernel image over the JTAG link. Please wait until the shell prompt displays again on the serial console.

3. Watch the serial console, you should see the Linux booting messages shown on the serial console.

You can now repeat the previous steps for connecting to the board via the serial console and the network demo.

Appendix A: IP Address Configuration

IP Address Configuration with ifconfig

After the PetaLinux system boots, you can set or change its IP address manually.

1. First determine which network the PetaLinux system is connected to.
   - If you are booting on real hardware, and the board is connected to a local network, the IP address of the system should be in the subnet of the local network.
   - If you are booting in QEMU, the IP address of the system should be in the QEMU subnet. Refer to the *PetaLinux SDK QEMU System Simulation Guide (UG982)* for more details.
2. Use ifconfig command to set the systems IP address on the login console:

   ```
   # ifconfig eth0 <IP>
   ```

   e.g:

   ```
   # ifconfig eth0 192.168.10.10
   ```

3. Use `ifconfig` on the system login console again to confirm whether the IP address has been successfully set:

   ```
   # ifconfig
   ```

   You should be able to see the IP has been set to the interface eth0.

Appendix B: PetaLinux Project Structure

This section provides a brief introduction on a PetaLinux project:
Here is an example of a PetaLinux project:

```
<project-root>
    |-.petalinux/
    |-hw-description/
    |-config.project
    |-subsystems/
    |    |-linux/
    |    |    |-config
    |    |    |-hw-description/
    |    |    |    |-system.dts
    |    |    |    |-xparameters.h
    |    |    |    |-config.mk
    |    |    |-configs/
    |    |    |    |-kernel/
    |    |    |    |    |-config
    |    |    |    |-u-boot/
    |    |    |    |    |-petalinux-user-config.h.template
    |    |    |    |-rootfs/
    |    |    |        |-config
    |-components/
    |    |-apps/
    |    |    |-myapp/
```

File/Directory in a PetaLinux Project	Description
`"<project-root>/.petalinux/"`	directory to hold tools usage and webtalk data
`"<project-root>/hw-description/"`	project level hardware description, NOT USED for this released
`"<project-root>/config.project"`	project configuration file it defines the external components search path and the subsystem in the project
`"<project-root>/subsystems/"`	subsystems of the project
`"<project-root>/subsystems/linux/"`	Linux subsystem. This is the only subsystem supported in this release
`"<project-root>/subsystems/linux/config"`	Linux subsystem configuration file used when building the subsystem
`"<project-root>/subsystems/linux/hw-description/"`	subsystem hardware description
`"<project-root>/subsystems/linux/hw-description/system.dts"`	DTS file used when building the subsystem

"<project-root>/subsystems/linux/hw-description/xparameters.h"	U-Boot "xparameter.h" file
"<project-root>/subsystems/linux/hw-description/config.mk"	U-Boot "config.mk" file
"<project-root>/subsystems/linux/configs/"	configuration files of the components of the subsystem
"<project-root>/subsystems/linux/configs/kernel/config"	configuration file used to build the Linux kernel
"<project-root>/subsystems/linux/configs/u-boot/petalinux-user-config.h.template"	file for users to define or undefine U-Boot configuration macros
"<project-root>/subsystems/linux/configs/rootfs/config"	configuration file used to build the rootfs
"<project-root>/components/"	directory for local components. If you don't have local components, this directory is not required. Components created by petalinux-create will be placed into this directory. You can also manually copy components into this directory. Here is the rule to place a local component: "<project-root>/components/<COMPONENT_TYPE>/<COMPONENT>"

When the project is built, two directories will be auto generated:

- "<project-root>/build" for the files generated for build
- "<project-root>/images" for the bootable images

Here is an example:

```
<project-root>
    |-.petalinux/
    |-hw-description/
    |-config.project
    |-subsystems/
    |    |-linux/
    |    |    |-config
    |    |    |-hw-description/
    |    |    |    |-system.dts
    |    |    |    |-xparameters.h
    |    |    |    |-config.mk
    |    |    |-configs/
    |    |    |    |-kernel/
    |    |    |    |    |-config
    |    |    |    |-u-boot/
    |    |    |    |    |-petalinux-user-config.h.template
    |    |    |    |-rootfs/
    |    |    |        |-config
    |-components/
    |    |-apps/
    |    |    |-myapp/
    |-build/
    |    |-build.log
    |    |-linux/
    |    |    |-rootfs/
    |    |    |    |-targetroot/
    |    |    |    |-stage/
    |    |    |    |-apps/
    |    |    |    |    |-myapp/
    |    |    |-kernel/
    |    |    |-u-boot/
    |-images/
    |    |-linux/
```

WARNING: *"`<project-root>/build/`" is automatically generated. Don't manually edit. Contents in this directory will get upated when you run `petalinux-config` or `petalinux-build`.*

"`<project-root>/images/`" is automatically generated. Files in this directory will get updated when you run `petalinux-build`.

Build Directory in a PetaLinux Project	Description
`"<project-root>/build/build.log"`	logfile of the build
`"<project-root>/build/linux/"`	directory to hold files related to the linux subsystem build
`"<project-root>/build/linux/rootfs/"`	directory to hold files related to the rootfs build
`"<project-root>/build/linux/rootfs/targetroot/"`	target rootfs host copy

`"<project-root>/build/linux/rootfs/stage/"`	stage directory to hold the libs and header files required to build user apps/libs
`"<project-root>/build/linux/kernel/"`	directory to hold files related to the kernel build
`"<project-root>/build/linux/u-boot/"`	directory to hold files related to the u-boot build

Image Directory in a PetaLinux Project	Description
`"<project-root>/images/linux/"`	directory to hold the bootable images for Linux subsystem

Appendix C: PetaLinux SDK tools usage

This section provides usage information on PetaLinux SDK tools.

petalinux-create

```
petalinux-create             (c) 2005-2013 Xilinx, Inc.

This command creates a new PetaLinux Project or component

Usage:
  petalinux-create [options] -t|--type <TYPE> -n|--name <COMPONENT_NAME>

Required:
  -t, --type <TYPE>                      Available type:
                                           * project
                                           * apps
                                           * libs
                                           * modules
                                           * generic
  -n, --name <COMPONENT_NAME>            specify a name for the component or
                                         project. It is OPTIONAL to create a
                                         PROJECT. If you specify source BSP when
                                         you create a project, you are not
                                         required to specify the name.

Options:
  -p, --project <PROJECT>                specify full path to a PetaLinux project
                                         this option is NOT USED for PROJECT CREATION.
                                         default is the working project.
  --force                                force overwriting an existing component
                                         directory.
  -h, --help                             show function usage
  --enable                               this option applies to all types except
                                         project.
                                         enable the created component

Options for project:
  --template <TEMPLATE>                  zynq|microblaze
                                         default is zynq.
  -s|--source <SOURCE>                   specify a PetaLinux BSP as a project
                                         source.
  --out <OUTPUT_DIR>                     diretory to place your project default
                                         is your working directory

Options for apps:
  --template <TEMPLATE>                  <c|c++|autoconf|install>
                                         c   : c user application(default)
                                         c++ : c++ user application
                                         autoconf: autoconf user application
                                         install: install data only
  -s, --source <SOURCE>                  valid source name format:
                                           XXX.tar.gz, XXX.tar.bz2, XXX.tar,
                                           XXX.zip, app source directory
```

```
Options for libs:
  --template <TEMPLATE>                 <c|c++|autoconf|install-only>
                                        c   : c user library(default)
                                        c++ : c++ user library
                                        autoconf: autoconf user library
  --priority                            Library priority (1 to 11, Default is 7)
  -s, --source <SOURCE>                 valid source name format:
                                          XXX.tar.gz, XXX.tar.bz2, XXX.tar,
                                          XXX.zip,lib source directory

Options for modules: (No specific options for modules)

Options for generic: (No specific options for generic)

Example to create projects:
From PetaLinux Project BSP:
  $ petalinux-create -t project -s <PATH_TO_PETALINUX_PROJECT_BSP>
From template:
  $ petalinux-create -t project -n <PROJECT> --template zynq

Example to create apps:
Create an app and enable it:
  $ petalinux-create -t apps -n myapp --enable
The application "myapp" will be created with c template in:
  <PROJECT>/components/apps/myapp/

Example to create libs:
Create an lib and enable it:
  $ petalinux-create -t libs -n mylib --enable
The library "mylib" will be created with c template in:
  <PROJECT>/components/libs/mylib/

Example to create moduless:
Create an lib and enable it:
  $ petalinux-create -t modules -n mymodule --enable
The library "mymodule" will be created with template in:
  <PROJECT>/components/modules/mymodule/
```

petalinux-config

```
petalinux-config             (c) 2005-2013 Xilinx, Inc.

INFO: Checking component...
Configures the project or the specified component with menuconfig.

Usage:
  petalinux-config [options] {--component <COMPONENT> |\
  --get-hw-description[=SRC] |--searchpath <--ACTION> [VALUE]}

Options:
  -h, --help                      show function usage
  -p, --project <PROJECT>         path to PetaLinux SDK project.
                                  default is the working project
  --oldconfig                     takes the working configuration
  -c, --component <COMPONENT>     Specify the component
                                  If no component is specified, it will do
                                  top level subsystem configuration only
                                  all: to configure the whole project
                                  If you specify other component,it will
                                  configure that component
                                  E.g. -c rootfs
                                  If you use ?, it will show you subcomponents
                                  E.g. -c ? shows subcomponents of the subsystem
  --get-hw-description[=SRC]      get hardware description.
                                  if [SRC] is specified, look in that
                                  location for an XSDK BSP project.
                                  Otherwise, this MUST be run from
                                  WITHIN an XSDK PetaLinux BSP project.
  --searchpath                    edit project search path

Available project user searchpath actions:
  --prepend <SEARCHPATH>          prepend <SEARCHPATH> to project external searchpath
  --append <SEARCHPATH>           append <SEARCHPATH> to project external searchpath
  --replace <SEARCHPATH>          replace project user searchpath with <SEARCHPATH>
  --print                         print full project searchpath
  --delete                        delete project external searchpath

Available Components of linux for this command:
        * kernel        # is of linux-kernel type
        * rootfs        # is of rootfs type

Examples to edit searchpath:
  Default PetaLinux tools will look into <PROJECT>/components/ first and then
  ${PETALINUX}/components/ for components
Prepend external searchpath:
  $ petalinux-config --searchpath --prepend <EXTERN_SEARCHPATH0>
  the components searchpath will become:
  <PROJECT>/components:<EXTERN_SEARCHPATH0>:${PETALINUX}/components/
Append external searchpath:
  $ petalinux-config --searchpath --append <EXTERN_SEARCHPATH1>
  the components searchpath will become:
  <PROJECT>/components:<EXTERN_SEARCHPATH0>:<EXTERN_SEARCHPATH1>:${PETALINUX}/components/
Delete external searchpath:
  $ petalinux-config --searchpath --delete
  the components searchpath will become:
  <PROJECT>/components:${PETALINUX}/components/
```

```
Examples to sync hardware description:
Sync hardware description from XSDK PetaLinux BSP project:
  $ cd <XSDK_PLNX_BSP>
  $ petalinux-config --get-hw-description
  It will sync up the DTS, the xparameters.h and the config.mk from
  <XSDK_PLNX_BSP> to subsystems/linux/hw-description/ directory.
Sync hardware description inside PetaLinux project but outside XSDK PetaLinux BSP project:
  $ petalinux-config --get-hw-description=<XSDK_PLNX_BSP>

Examples to configure PetaLinux project:
Configure subsystem level configuration:
  $ petalinux-config
Configure kernel:
  $ petalinux-config -c kernel
Configure rootfs:
  $ petalinux-config -c rootfs
```

petalinux-build

```
petalinux-build             (c) 2005-2013 Xilinx, Inc.

INFO: Checking component...
Builds the project or the specified components.

Usage:
  petalinux-build [options]

Required:

Options:
  -h, --help                          show function usage
  -p, --project <PROJECT>             path to PetaLinux SDK project.
                                      Default is working project.
  -c, --component <COMPONENT>         Specify the component
                                      all: to build the whole project
                                      If you specify other component,it will
                                      build that component
                                      E.g. -c rootfs
                                      E.g. -c rootfs/myapp
                                      If you use ?, it will show you subcomponents
                                      E.g. -c rootfs/? shows subcomponents of rootfs
  -x, --execute <GNU_MAKE_TARGET>     Specify a GNU make command of the component
  --makeenv <MAKE ENV>                Pass GNU make environment variables
  -v, --verbose                       Show compile messages verbose mode

Available Components for linux:
        * kernel        # is of linux-kernel type
        * u-boot        # is of u-boot type
        * rootfs        # is of rootfs type

Available make target for linux:

Quick reference for various supported build targets for linux.
----------------------------------------------------
  clean                   clean out build objects
  distclean               clean out build
  all                     build subsystem and generate final image
  build                   build subsystem
  build_hw-description    build hw-description
  install_hw-description install dtb to subsystem images directory
  install                 install built objects to target subsystem host copy
  package                 combine target file system and kernel into final image

Examples:
Build the project:
  $ petalinux-build
  It is the same as "petalinux-build -c all"
  the bootable images are in <PRJOECT>/images/linux/.
Build kernel only:
  $ petalinux-build -c kernel
Build kernel and update the bootable images:
  $ petalinux-build -c kernel
  $ petalinux-build -x package
```

```
Build rootfs only:
  $ petalinux-build -c rootfs
Build myapp of rootfs only:
  $ petalinux-build -c rootfs/myapp
Clean up u-boot and build again:
  $ petalinux-build -c u-boot -x distclean
  ## above command will remove the <PROJECT>/build/linux/u-boot/ directory.
  $ petalinux-build -c u-boot
Clean up the project build and build again:
  $ petalinux-build -x distclean
  ## above command will remove the <PROJECT>/build/ directory.
  $ petalinux-build
Clean up the project build and the generated bootable images:
  $ petalinux-build -x mrproper
  ## above command will remove <PROJECT>/images/ and <PROJECT>/build/ directories
```

petalinux-boot

petalinux-boot with –jtag Option

```
petalinux-boot             (c) 2005-2013 Xilinx, Inc.

This command boots the MicroBlaze/Zynq systems with Petalinux images
through JTAG/QEMU.
Usage:
  petalinux-boot --qemu|--jtag -c|--component <COMPONENT> [options]
Required:
  --jtag|--qemu                JTAG/QEMU boot mode

Options:
  --prebuilt <BOOT_LEVEL>      Boot prebuilt images (override all settings).
                               supported boot level 1 to 3
                                 1 - download FPGA bitstream (and FSBL for Zynq)
                                 2 - Boot U-Boot only
                                 3 - Boot Linux Kernel only
  --boot-addr <BOOT_ADDR>      boot address
  -i, --image <IMAGE>          image to boot
  --uboot                      boot images/linux/u-boot.elf image
                               if --kernel is specified, --uboot will not take
                               effect.
  --kernel                     boot images/linux/zImage for Zynq
                               boot images/linux/image.elf for MicroBlaze
                               if --kernel is specified, --uboot will not take
                               effect.
  -v, --verbose                output debug messages
  -h|--help                    Display help messages

JTAG available options:
  --load-addr <LOADADDR>       address to load the image
  --regdata <REGDATA>          register data
  --extra-xmd "EXTRA_CMD"    extra XMD command to run before loading the
                               image, can be repeated
                               E.g. -x "debugconfig -reset_on_run disable"
  --xmd-conn "CONNECT_CMD"     customised XMD connect command, can be repeated
                               E.g. --xmd-connect "connect mb mdm"
  --tcl TCL_OUTPUT             dump XMD commands to the specified file
  --targetcpu <TARGET_CPU>     specify target CPUID (0 to N-1)
  --fpga                       Programs the hardware with the specified
                               bitstream, If not specified, it will use
                               the pre-built bitstream.
  --bitstream [BITSTREAM]      Programs the hardware with the specified
                               bitstream.

Example to download prebuilt bitstream (and FSBL for zynq) to target board:
  $ petalinux-boot --jtag --prebuilt 1
Example to boot prebuilt u-boot on target board:
  $ petalinux-boot --jtag --prebuilt 2
  It will download the prebuilt bitstream (and FSBL for zynq) to target board,
  and then boot prebuilt u-boot on target board.
```

```
Example to boot prebuilt kernel on target board:
  $ petalinux-boot --jtag --prebuilt 3
  For microblaze, it will download the prebuilt bitstream to target board, and
  then boot the prebuilt kernel image on target board.
  For Zynq, it will download the prebuilt bitstream and FSBL to target board,
  and then boot the prebuilt u-boot and then the prebuilt kernel on target
  board.
Example to download a bitstream to target board:
  $ petalinux-boot --jtag --fpga --bitstream <BITSTREAM>
Example to download newly built u-boot to target board:
  $ petalinux-boot --jtag --uboot
  It will download <PROJECT>/images/linux/u-boot.elf on target board.
Example to download newly built kernel to target board:
  $ petalinux-boot --jtag --kernel
  For MicroBlaze, it will download <PROJECT>/images/linux/image.elf on target
  board.
  For Zynq, it will download <PROJECT>/images/linux/system.dtb and
  <PROJECT>/images/linux/zImage on target board.
```

petalinux-boot with –qemu Option

```
petalinux-boot             (c) 2005-2013 Xilinx, Inc.

This command boots the MicroBlaze/Zynq systems with Petalinux images
through JTAG/QEMU.
Usage:
  petalinux-boot --qemu|--jtag -c|--component <COMPONENT> [options]
Required:
  --jtag|--qemu                JTAG/QEMU boot mode

Options:
  --prebuilt <BOOT_LEVEL>      Boot prebuilt images (override all settings).
                               supported boot level 1 to 3
                                 1 - download FPGA bitstream (and FSBL for Zynq)
                                 2 - Boot U-Boot only
                                 3 - Boot Linux Kernel only
  --boot-addr <BOOT_ADDR>      boot address
  -i, --image <IMAGE>          image to boot
  --uboot                      boot images/linux/u-boot.elf image
                               if --kernel is specified, --uboot will not take
                               effect.
  --kernel                     boot images/linux/zImage for Zynq
                               boot images/linux/image.elf for MicroBlaze
                               if --kernel is specified, --uboot will not take
                               effect.
  -v, --verbose                output debug messages
  -h|--help                    Display help messages

QEMU available options:
  --dtb DTB                    force use of a particular device tree file.
                               if not specified, QEMU uses
                               <PROJECT>/images/linux/system.dtb
  --dhcpd enable|disable       enable or disable dhcpd. This option applies
                               for ROOT MODE ONLY.
                               default is to enable dhcpd.
  --iptables-allowed           whether to allow to implement iptables commands.
                               This option applies for ROOT MODE ONLY
                               Default is not allowed.
  --net-intf NET_INTERFACE     network interface on the host to bridge with
                               the QEMU subnet. This option applies for ROOT
                               MODE ONLY. Default is eth0.
  --subnet SUBNET              subnet_gateway_ip/num_bits_of_subnet_mask
                               subnet gateway IP and the number of valid bits
                               of network mask. This option applies for ROOT
                               MODE ONLY. Default is 192.168.10.1/24
  --root                       QEMU as root (ROOT MODE).
  --qemu-args "QEMU_ARGUMENTS" extra arguments to QEMU command

Example to boot prebuilt u-boot with QEMU:
  $ petalinux-boot --jtag --prebuilt 2
Example to boot prebuilt kernel with QEMU:
  $ petalinux-boot --jtag --prebuilt 3
Example to download newly built u-boot with QEMU:
  $ petalinux-boot --jtag --uboot
  It will boot <PROJECT>/images/linux/u-boot.elf with QEMU.
```

```
Example to download newly built kernel to target board:
  $ petalinux-boot --jtag --kernel
  For MicroBlaze, it will boot <PROJECT>/images/linux/image.elf with QEMU.
  For Zynq, it will boot <PROJECT>/images/linux/zImage with QEMU.
```

petalinux-package

```
petalinux-package              (c) 2005-2013 Xilinx, Inc.

This command packages various image format, firmware, prebuilt
and bsps
Usage:
  petalinux-package --boot|--bsp|--firmware|--image|--prebuilt [options]

Required:
  --boot|--bsp|--firmware|--image|--prebuilt
                               Various package mode.
                                 boot: packages a boot.bin for Zynq
                                 bsp: packages a bsp
                                 firmware: creates a firmware package used
                                   by PetaLinux firmware upgrade demo app to
                                   upgrade firmwares.
                                 image: package various image type
                                 prebuilt: package images to prebuilt
Options:
  -h|--help                    Display help messages
Please specify a package mode option for the detailed options
Show package boot options:
  $ petalinux-package --boot --help
Show package bsp options:
  $ petalinux-package --bsp --help
Show package firmware options:
  $ petalinux-package --firmware --help
Show package image options:
  $ petalinux-package --image --help
Show package prebuilt options:
  $ petalinux-package --prebuilt --help
```

```
Required option for boot image package:
  --fsbl <FSBL_ELF>           Path to FSBL ELF image location
Options for boot image package:
  --force                     Force overwrite the boot binary image
  --fpga <BITSTREAM>          Path to FPGA bitstream image location
  --uboot[=<UBOOT_IMG>]       Path to the u-boot elf image location
                              (default <PROJECT>/images/linux/u-boot.elf)
  -o, --output <PKGNAME>      Generated boot image name
  -p, --project <PROJECT>     PetaLinux SDK project location.
                              Default is the working project.

Example to package BOOT.BIN for Zynq:
  $ petalinux-package --boot --fsbl <FSBL_ELF> --fpga <BITSTREAM> --uboot
  It will generate a BOOT.BIN in your working directory with:
    * specified <BITSTREAM>
    * specified <FSBL_ELF>
    * newly built u-boot image which is <PROJECT>/images/linux/u-boot.elf

Required options for BSP packaging:
  -o, --output <BSP_NAME>      BSP package name - <BSP_NAME>.bsp
  -p, --project <PROJECT>      PetaLinux projects path to be included in
                               BSP (allow multiple).
Options for BSP packaging:
  --force                      Force overwrite the BSP
  --clean                      Force clean hardware project
  --hwsource <PATH_TO_HW>      Include a hardware source
  --no-extern                  Exclude external components
                               If this option is enabled, you can only
                               rebuild the BSP if the BSP is installed
                               in machine which can see the external
                               component search path.
  --no-local                   Exclude local components
                               If the option is enabled, you may not be
                               able to build the BSP since the components
                               placed in your project will notbe included
                               in the BSP. You may want this option if
                               you don’t want to expose your local
                               components.
```

```
Example to package BSP with a PetaLinux project:
  $ petalinux-package --bsp -p <PATH_TO_PROJECT> --output MY.BSP
  It will generate MY.BSP including:
    * <PROJECT>/hw-description/
    * <PROJECT>/config.project
    * <PROJECT>/.petalinux/
    * <PROJECT>/subsystems/
    * <PROJECT>/pre-built/
    * all selected components
  from the specified project.
Example to package BSP with hardware source:
  $ petalinux-package --bsp -p <PATH_TO_PROJECT> \
  --hwsource <PATH_TO_HARDWARE_PROJECT> --output MY.BSP
  It will not modify the specified PetaLinux project <PATH_TO_PROJECT>. It will
  put the specified hardware project source to <PROJECT>/hardware/ inside MY.BSP
  archive.
Example to package BSP excluding local components:
  $ petalinux-package --bsp -p <PATH_TO_PROJECT> --output MY.BSP --no-local
  It will not include any local component in <PROJECT>/components directory,
  however, it will not change the configuration file, that is, it is possible
  that you may fail to rebuild the project from MY.BSP.
Example to package BSP excluding extern components:
  $ petalinux-package --bsp -p <PATH_TO_PROJECT> --output MY.BSP --no-extern
  It will not include any extern component in user specified components
  searchpaths. However, it will not change the configuration file, that is,
  it is possible that you may fail to rebuild the project from MY.BSP.
```

```
Required options for firmware packaging:

Options for firmware packaging:
  -o, --output <PKGNAME>       Output firmware package name
                               (default firmware.tar.gz)
  -p, --project <PROJECT>      Path to PetaLinux project.
                               (default current project)
  --linux[=<UBIMAGE>]
                               Update linux kernel image partition with
                               UBIMAGE. (default images/image.ub)
  --dtb[=<DTBFILE>]
                               Update DTB partition with specified DTBFILE
                               (default system.dtb)
  --fpga <BITSTREAM>           Update FPGA image partition with bitstream
  --uboot[=<UBOOT_S>]          Update u-boot partition with UBOOT_S
                               (default images/u-boot-s.bin)
  --bootbin[=<BOOT.BIN>]       Update boot partition with BOOT.BIN
                               (default images/BOOT.BIN) (Arm only)
  --jffs2[=<JFFS2IMG>]         Update JFFS2 partition with JFFS2IMG
                               (default images/jffs2.img)
  -a, --add  dev:file          Update flash partition "dev" with "file", can be repeated.
                               e.g. -a /dev/flash/fpga:<path-to-fpga-bin>
  --flash FLASH_TYPE           Flash type(spi, parallel. default is "parallel")
  --little-endian              Specify the system is a little endian system.
                               E.g. AXI system is little endian.
                               It can be 8 bits, 16 bits or 32 bits.
  --big-endian                 Specify the system is a big endian system.
                               E.g. PLB system is big endian.
  --data-width <8|16|32>       Specify the data width of the Parallel Flash.
                               Only valid if the target system is little endian.
  --product <PRODUCT_STRING>   Specify additional compatible product strings
  --pre  SCRIPT                Run SCRIPT on target prior to firmware upgrade
  -v, --verbose                Verbose mode

The --image, --dtb, --uboot and --jffs2 options allow to override the default
filenames and partitions using the partition:file syntax of the --add option.
For example:

    Install the image.ub file into the flash partition safe-image:
       $ petalinux-package --firmware -a /dev/flash/safe-image:/path/to/image.ub

    Install the uboot-s.bin file into the flash partition safe-boot:
       $ petalinux-package --firmware -a /dev/flash/safe-boot:/path/to/u-boot-s.bin

Example to package firmware with BOOT.BIN and kernel image for Zynq:
  $ petalinux-package --firmware --bootbin=<BOOT_BIN> --linux
  It will create firmware.tar.gz archive in your working directory
  including the specified <BOOT_BIN> and <PROJECT>/images/linux/image.ub.
Example to package firmware with bistream, u-boot and  kernel image for
microBlaze:
  $ petalinux-package --firmware --fpga <BITSTREAM> --uboot --linux
  It will create firmware.tar.gz archive in your working directory
  including:
    * specified <BITSTREAM>
    * <PROJECT>/images/linux/u-boot-s.bin
    * <PROJECT>/images/linux/iamge.ub
```

```
Options for prebuilt:
  -p, --project <PROJECT>      PetaLinux SDK project.
                               Default is the working project.
  --force                      Force update the pre-built folder
  --clean                      Clean pre-built directory (remove any files).
  --fpga <BITSTREAM>           FPGA bitstream
  -a, --add  src:dest          Add file/folder to prebuilt directory
                               "src" with "dest"

Example to package prebuilt images:
  $ petalinux-package --prebuilt
  It will create a pre-built/ directory in <PROJECT>/, and copy the following
  files from <PROJECT>/images to <PROJECT>/pre-built/linux/images/ directory:
    * images.ub
    * system.dtb
    * u-boot.elf
    * image.elf
    * System.map.linux
    * u-boot-s.bin
    * zImage (For zynq only)
    * zynq_fsbl.elf (If it is there for zynq only)
    * BOOT.BIN (If it is there for zynq only)
Example to package prebuilt images and specified bitstream:
  $ petalinux-package --prebuilt --prebuilt --fpga <BITSTREAM>
  Besides copying the images, it will copy the bitstream to
  <PROJECT>/pre-built/linux/implentation/
Example to package prebuilt images and add myfile to prebuilt:
  $ petalinux-package --prebuilt --prebuilt -a myfile:images/myfile
  Besides copying the images, it will copy myfile to
  <PROJECT>/pre-built/linux/images/myfile
```

petalinux-util

```
petalinux-util             (c) 2005-2013 Xilinx, Inc.

This command provides the misc utilities.
Usage:
  petalinux-util --gdb | --jtag-logbuf | --update-sdcard |--webtalk <on|off> [options]

Required:
  --gdb | --jtag-logbuf | --update-sdcard |--webtalk
                               Various utilities.
                                 gdb: petalinux gdb debug wrapper
                                 jtag-logbuf: prints kernel early printk
                                 with JTAG.
                                 update-sdcard: updates the contents of
                                 SD card.
                                 webtalk: Enable or disable webtalk
Options:
  -h|--help                    Display help messages
Please specify a package mode option for the detailed options
Show gdb util options:
  $ petalinux-util --gdb --help
Show jtag-logbuf util options:
  $ petalinux-util --jtag-logbuf --help
Show update-sdcard util options:
  $ petalinux-util --update-sdcard --help
Show webtalk util options:
  $ petalinux-util --webtalk --help

Required options for JTAG logbuf:
  -i, --image <IMAGE>          kernel ELF image
                               For MicroBlaze/ARM - PetaLinux image
                               (vmlinux or image.elf).
Available options for JTAG logbuf:
  -p, --project                specify a PetaLinux project (ARM only)
  -v, --verbose                show all the outputs
  --noless                     do not pipe the output to less when in a terminal

Required options for update-sdcard :
  -d , --dir <boot:rootfs>     SD device mount point. First argument is
                               the boot partition mount point and the
                               rootfs partition mount point for rootfs
                               at least one mount point must be provided
                               Note: ROOT mode is required for rootfs setup
Available option for update-sdcard:
  -p, --project PROJECT        specify a PetaLinux reference project
```

```
Example to update SD card:
  $ petalinux-util --update-sdcard --dir /mnt/vfat
  It will copy BOOT.BIN and image.ub from <PROJECT>/images/linux/ to
  /mnt/vfat. The /mnt/vfat is the SD device mount point.

Example to update boot parition and rootfs parition in SD card:
  $ petalinux-util --update-sdcard --dir /mnt/vfat:/mnt/rootfs
  It will require sudo permission.
  It will copy BOOT.BIN and image.ub from <PROJECT>/images/linux/ to
  /mnt/vfat and <PROJECT>/build/linux/rootfs/targetroot/ to /mnt/rootfs.
  /mnt/rootfs is the SD device mount point. It needs to be ext2 and
  above for rootfs.

Required options for update-sdcard :
  -d , --dir <boot:rootfs>     SD device mount point. First argument is
                               the boot partition mount point and the
                               rootfs partition mount point for rootfs
                               at least one mount point must be provided
                               Note: ROOT mode is required for rootfs setup
Available option for update-sdcard:
  -p, --project PROJECT        specify a PetaLinux reference project

Example to update SD card:
  $ petalinux-util --update-sdcard --dir /mnt/vfat
  It will copy BOOT.BIN and image.ub from <PROJECT>/images/linux/ to
  /mnt/vfat. The /mnt/vfat is the SD device mount point.

Example to update boot parition and rootfs parition in SD card:
  $ petalinux-util --update-sdcard --dir /mnt/vfat:/mnt/rootfs
  It will require sudo permission.
  It will copy BOOT.BIN and image.ub from <PROJECT>/images/linux/ to
  /mnt/vfat and <PROJECT>/build/linux/rootfs/targetroot/ to /mnt/rootfs.
  /mnt/rootfs is the SD device mount point. It needs to be ext2 and
  above for rootfs.

Available options for Webalk:
  petalinux-util --webtalk on
                               enable webtalk feature
  petalinux-util --webtalk off
                               disable webtalk feature
```

Additional Resources

References

- PetaLinux SDK Application Development Guide (UG981)
- PetaLinux SDK Board Bringup Guide (UG980)
- PetaLinux SDK Firmware Upgrade Guide (UG983)
- PetaLinux SDK Getting Started Guide (UG977)
- PetaLinux SDK Installation Guide (UG976)
- PetaLinux SDK QEMU System Simulation Guide (UG982)

PetaLinux SDK Documentation is available at http://www.xilinx.com/petalinux.