

# PetaLinux SDK User Guide

## *Firmware Upgrade Guide*

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## Revision History

| Date       | Version | Notes                                     |
|------------|---------|---|
| 2010-11-24 | 1.3     | Initial version for SDK 1.3 release       |
| 2011-04-04 | 2.1     | Updated for PetaLinux SDK 2.1 release     |
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## About this Guide

This document provides an example of how to do production configuration and firmware upgrades with PetaLinux.

This document assumes that you know how to manage your hardware project with Xilinx EDK, you are familiar with Linux and you have experience with PetaLinux.



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**WARNING:** *The methods described in this document are intended as examples only. PetaLinux SDK users are recommended to have their production configuration and firmware upgrade methods based on their requirements.*

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## Production

During production boards may require individual configuration, with hardware parameters such as the Ethernet MAC address. In this section, examples are provide which detail how to make the same PetaLinux firmware images work with hardware which have different configuration on a per board basis.

### Background Knowledge

Zynq and MicroBlaze Linux systems use Device Tree (DTS/DTB) files to configure board specific information of the hardware system. Using the the Device Tree configuration different hardware parameters can be set which will configure the Linux Kernel and its respective drivers during boot.

By default, when PetaLinux boots, it uses the DTB within the PetaLinux Kernel image. The DTB (Device Tree Blob) is generated from a DTS file. PetaLinux can also boot with a DTB which is not located inside the PetaLinux Kernel image, this allows for easy modification of the DTB which can be stored in a separate Flash partition.

Besides the Linux kernel, the U-Boot bootloader may also be configured with board specific parameters such as Ethernet MAC address. However U-boot does not use a DTB for the hardware configuration, some parameters are available for configuration through the U-Boot environment variables.

The following sections are going to detail how to create a Flash partition for the DTB, how to change the Ethernet MAC address in U-Boot and how to edit the DTB from U-Boot.

### Create a DTB Flash Partition

Firmware images are generally stored in Flash, it is possible to store and boot with a DTB located in a Flash partition.

1. Run `petalinux-config-apps` inside the PetaLinux tree:

```
$ petalinux-config-apps
```

2. Go to **System Settings**
3. Enable the option **Boot image with the DTB partition** to allow U-Boot to load the DTB from a separate Flash partition.

```
System Settings
--- Bootloader settings
[*] Boot image with the DTB partition
```

4. Go to **Flash Partition Table**
5. Add a **dtb** partition. It is recommended to use a size of 16 KByte and must aligned to flash sector size:

```
--- Partition X
(dtb) name
(0x4000) size
```

6. Save and exit menuconfig.
7. Rebuild PetaLinux inside the "petalinux-dist/" directory to update both the firmware images with the new Flash partition settings. If you have already built PetaLinux, run `make clean` first to ensure all changes are propagated to all components.

```
$ cd $PETALINUX/software/petalinux-dist
$ make clean
$ make
```

If you boot your board with the newly built U-Boot or the kernel image, the additional dtb partition should be available.

### Update Flash Partition from U-boot

The following steps use the Flash memory to store the U-Boot and kernel images as well as the DTB.

1. Boot the board into U-Boot
2. Setup the TFTP server location to load the firmware images from.

```
U-Boot-PetaLinux> set serverip <HOST IP>
```

3. Make sure the U-Boot image ("u-boot-s.bin"), kernel image ("image.ub") and DTB ("system.dtb") are in the TFTP directory on the TFTP server.
4. Make sure U-Boot IP has been set:

```
U-Boot-PetaLinux> print ipaddr
```

5. Update the U-Boot bootloader with the `update_uboot` command:

```
U-Boot-PetaLinux> run update_uboot
```

The `update_uboot` command will use TFTP to load the U-Boot image ("u-boot-s.bin") from the TFTP server and then save the image into the boot Flash partition.

6. Update the kernel image with the `update_kernel` command:

```
U-Boot-PetaLinux> run update_kernel
```

The `update_kernel` command will use TFTP to load the kernel image ("image.ub") from the TFTP server and then save the image into the image Flash partition.

7. Update the DTB with the `update_dtb` command:

```
U-Boot-PetaLinux> run update_dtb
```

The `update_dtb` command will use TFTP to load the DTB ("system.dtb") from the TFTP server and then save the DTB into the dtb Flash partition.

Next time the board is booted, it will boot into the kernel with the DTB located in the dtb Flash partition.

### Update U-boot Environment Variables from U-boot

In U-Boot the Ethernet MAC address is configured as an environment variable. The MAC address environment variable can be changed from the U-Boot console and then saved into the bootenv Flash partition using the saveenv command.

1. Boot the board into U-Boot and stop at the console (cancel auto boot if enabled)
2. Change the U-Boot MAC address environment variable:

```
U-Boot-PetaLinux> set ethaddr AA:BB:CC:DD:EE:FF
```

Where AA:BB:CC:DD:EE:FF is the MAC address you want to configure.

3. Save the u-boot environment variables into the flash:

```
U-Boot-PetaLinux> saveenv
```

### Update DTB in U-boot

This section details how to modify the DTB from within the U-Boot console.

1. Load the DTB from the dtb Flash partition into the memory:

```
U-Boot-PetaLinux> run get_dtb
```

2. Make any required changes using fat fdt set command.
3. Save the changed DTB back to Flash:

```
U-Boot-PetaLinux> run install_dtb
```

---

## Firmware Upgrade

PetaLinux has an easy process for firmware upgrades. With the PetaLinux firmware upgrade tools upgrading firmware is a two-step process, packaging the firmware images and FPGA bitstream and installing the images into the destination Flash memory.

---

### IMPORTANT:



- That PetaLinux assumes all the images and or the bitstream are saved in the Flash and that each image/bitstream corresponds to a flash partition.
  - *petalinux-package-firmware* and the *firmware-upgrade* tools do not support Zynq SD Card boot configurations.
- 

### Step 1: Package the Files Need to Upgrade

The PetaLinux tool `petalinux-package-firmware` is used to package the images and bitstream required for the upgrade. e.g. to create a firmware upgrade package containing the FPGA bitstream, kernel image and a u-boot image, you can use the package firmware upgrade command as follows:

```
$ petalinux-package-firmware --image <Path-to-image.ub>
  --uboot <Path-to-u-boot-s.bin>
  --fpga <Path-to-the-FPGA bitstream>
```

Please note that the above command must be executed as **a single line** only.

- `--image` - the image file specified with this argument is by default stored in the `image` flash partition.
- `--boot` (*Zynq Only*) - the `BOOT.BIN` file specified with this argument is by default stored in the `boot` flash partition.
- `--uboot` (*MicroBlaze only*) - the u-boot file specified with this argument is by default stored in the `boot` flash partition.
- `--fpga` (*MicroBlaze only*) - the bitstream file specified with this argument is by default stored in the `fpga` flash partition.
- By default, the package firmware tool automatically detects the configured Flash setup for the selected platform.

You can also generate a firmware upgrade package with `jffs2` and other Flash partitions using `petalinux-package-firmware` command. For more details of the `petalinux-package-firmware` command, please use `-h` option, which will show the usage of the command.



## Step 2: Firmware Upgrade

After you have created the firmware upgrade package, you can upgrade the firmware on the target with PetaLinux firmware upgrade command `upgrade-firmware` on a running PetaLinux system.

By default, the Firmware Upgrade Tools are enabled and built into the image. You can configure this via the `petalinux-config-apps` command and the associated `menuconfig`:

```
PetaLinux Configuration --->
  PetaLinux Demo Applications --->
    [*] fwupgrade
```



---

**WARNING:** Please note that the `PetaLinux upgrade-firmware` command can only be used to upgrade with the package generated by the `petalinux-package-firmware` tool.

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There are two different ways to upgrade the firmware with the `upgrade-firmware` command, the first is by using the command on the console and the second is via the demo web server (if configured).

Please note:

- All the below methods of firmware upgrade will upgrade the images which are saved in the Flash partitions and will then do a soft restart automatically to load the system with the new software images.
- To make the soft restart successfully in a MicroBlaze Linux system, you need to have a soft reset GPIO in your system. Please refer to the PetaLinux Documentation for the details on configuration and setup of a Reset GPIO.
- The firmware upgrade method introduced in this section is a demonstration of how to do firmware upgrade with PetaLinux. It is recommended to design your own firmware upgrade procedure.

### Upgrading via the command line

- If your upgrade package is on the Internet, you can use the `upgrade-firmware` which uses `wget` to download it from the remote source and then upgrade the system with it:

```
# upgrade-firmware <URL to your upgrade package tar ball>
```

e.g.:

```
# upgrade-firmware http://192.168.0.1/firmware.tar.gz
```

- If your upgrade package is on your host, you can ftp your firmware upgrade package to the running PetaLinux system and then use the `upgrade-firmware` command to upgrade the firmware. e.g.:

```
# upgrade-firmware /var/ftp/firmware.tar.gz
```



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**WARNING:** Please do not interrupt (powercycle) the board while it is upgrading the firmware.

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### Upgrading via the uWeb Demo Web Server

You can also use PetaLinux uWeb demo web server to do the firmware upgrade:



**IMPORTANT:** *This can only be completed if the uWeb demo webserver is installed on the target system (it is enabled by default).*

1. Using a Web Browser, navigate to the target system by IP or hostname.
2. Select the Admin link from the **NAVIGATION** menu at the left of the web page, and then select the Firmware Upgrade tab:

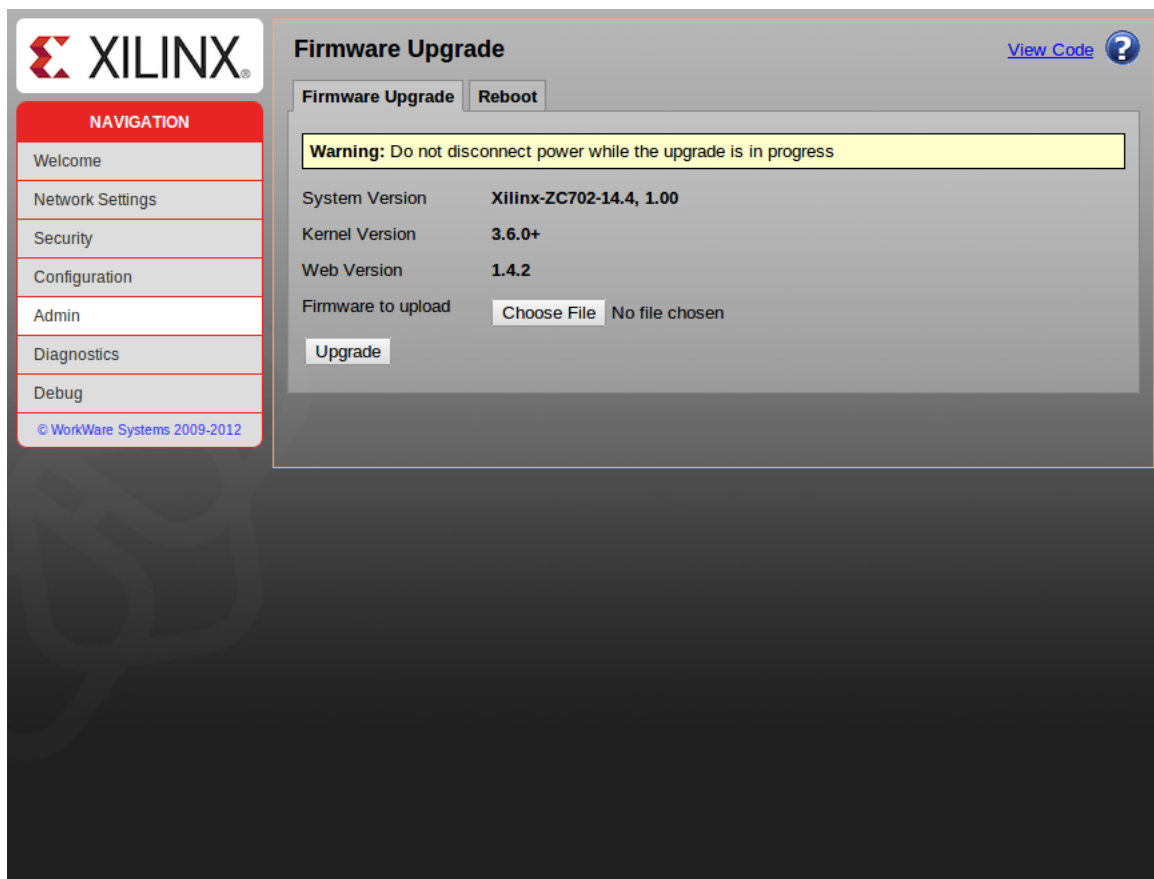


Figure 1: uWeb Firmware Upgrade Page

3. Select the firmware upgrade package from your host by clicking the **Browse...** button.
4. Click **Upgrade** to do the firmware upgrade. Please note that the firmware can take a while, please be patient and wait until it finishes.



**WARNING:** *Please do not interrupt (powercycle) the board while it is upgrading the firmware.*

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## Additional Resources

### References

- PetaLinux SDK Application Development Guide (UG981)
- PetaLinux SDK Board Bringup Guide (UG980)
- PetaLinux SDK Eclipse Plugin Guide (UG979)
- PetaLinux SDK Firmware Upgrade Guide (UG983)
- PetaLinux SDK Getting Started Guide (UG977)
- PetaLinux SDK Installation Guide (UG976)
- PetaLinux SDK QEMU System Simulation Guide (UG982)