

Reference Designs with Yocto - Intel SoC FPGAs

Some of the reference designs from Trenz Electronics include a preconfigured Yocto BSP layer. This is a short description of how to use the BSP layer to create a Linux image with the Yocto project for the Board.

Prepare Yocto Project

- 1. Prepare Yocto Project
- 2. Generate linux image
 - 2.1 Image with initial RAM filesystem

The Yocto BSP layer will be generated with the quartus project in the `<project name>/os/yocto/meta-<module>` folder. The generated layers depends on the meta-altera layer (for more information see: [Yocto KICKstart#BSP files](#)).

- 5. Table of contents
 1. Download a reference design that includes a Yocto BSP layer
 2. Generate the Quartus project as described in the wiki description of the downloaded reference design or in [Project Delivery - Intel devices#Quick Start](#)
 3. Copy the generated meta-<module> folder from `<project name>/os/yocto/meta-<module>` to the `path/to/yocto/poky/` directory
 4. Follow the steps from [Yocto KICKstart#Create a project for an Intel FPGA device](#) without running the 'bitbake' command
 5. Add the generated BSP layer meta-<machine> to `/yocto/poky/build/conf/bblayers.conf` with:

```
bitbake-layers add-layer ../meta-<module>
```

Generate linux image

There are two options to generate an image with the provided Yocto BSP layer:

1. Generate an image with a minimal RAM-based root filesystem, which is bundled inside the kernel image.
2. Generate an image with a root filesystem on sd card with its own partition.

For the reference design, the generation of an image with an init RAM filesystem is preferred.

Image with initial RAM filesystem

1. Redefine the variable MACHINE with '`<module>-<Board-Part-Short-Name>`' in `path/to/yocto/poky/build/conf/local.conf`
 - a. A list with the correct MACHINE names can be found in the wiki description of the reference design: [OverviewRequirementsHardware](#)
 - e.g. for the board TEI0022-03 see [TEI0022 Test Board#Hardware](#) here the MACHINE name is `tei0022-a5-c8-2gb`.
 - b. run following commands to redefine 'MACHINE':

```
sed -i '/^MACHINE/s/MACHINE/#MACHINE/g' conf/local.conf
echo -e '\nMACHINE = "<module>-<Board-Part-Short-Name>"' >>
conf/local.conf
```

2. Define the variables INITRAMFS_IMAGE_BUNDLE and INITRAMFS_IMAGE to create an image with initial RAM filesystem

```
echo -e '\nINITRAMFS_IMAGE_BUNDLE = "1"' >> conf/local.conf
echo -e 'INITRAMFS_IMAGE = "te-initramfs"' >> conf/local.conf
```

3. Build the image with following command (the image recipes are located in *meta-<module>/recipes-core/images/*):

```
bitbake te-image-minimal
```

Image with root filesystem on SD card

1. Redefine the variable MACHINE with '<module>-<Board-Part-Short-Name>' in *path/to/yocto/poky/build/conf/local.conf*
 - a. A list with the correct MACHINE names can be found in the wiki description of the reference design: [OverviewRequirementsHardware](#)
 - e.g. for the board TEI0022-03 see [TEI0022 Test Board#Hardware](#) here the MACHINE name is tei0022-a5-c8-2gb.
 - b. run following commands to redefine 'MACHINE':

```
sed -i '/^MACHINE/s/MACHINE/#MACHINE/g' conf/local.conf
echo -e '\nMACHINE = "<module>-<Board-Part-Short-Name>"' >>
conf/local.conf
```

2. Build the image with following command (the image recipes are located in *meta-<module>/recipes-core/images/*):

```
bitbake te-image-minimal
```

Copy .wic file to SD card

Yocto generates a .wic file which contains all needed files like u-boot, zImage and so on. This file is stored in *path/to/yocto/poky/build/tmp/deploy/images/<machine>/<image_name>.wic*. If you generate the linux yocto project yourself, using the .wic file is a very simple way to prepare the SD card for booting linux.

Do following steps to copy the .wic file to the SD card:

1. Insert the SD card into a SD card reader connected to the computer
2. Run following command to get the device name of the SD card (e.g. /dev/sdx):

```
lsblk
```

3. Copy the generated *.wic image to the SD card (replace 'sdx' in 'of=/dev/sdx' with the correct sd card device name:

```
sudo dd if=path/to/yocto/poky/build/tmp/deploy/images/<machine>
/<image_name>.wic of=/dev/sdx bs=1M seek=0
```

4. Insert the SD card into your board, set boot mode to sd card (if the setting is available) and boot it.

Serial Console

1. Open Serial Console (e.g. PuTTY)
 - a. select COM Port



Win OS: see device manager

Linux OS: see `dmesg | grep tty` (UART is *USB1)

- b. Speed: 115200
- 2. Press reset button on the board
- 3. Linux Console:
 - a. Login data:



Note: Wait until Linux boot finished

```
Username: root
Password: root
```

- b. You can use Linux shell now.

```
i2cdetect -y -r 1    (check I2C 1 Bus, if available)
dmesg | grep rtc     (RTC check, if available)
udhcpd               (ETH0 check, if available)
lsusb                 (USB check, if available)
```