

# Reference Designs with Yocto - Intel SoC FPGAs

Some of the reference designs from Trenez 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#Use Console 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)
```