Practice Yocto

1. Exercise 1, 2

Build image:

Step 1: Create a folder (example: yocto) and git clone poky

$cd yocto

$git clone git://git.yoctoproject.org/poky -b dunfell

```
tutorialadda@linux:~/yocto$
tutorialadda@linux:~/yocto$ git clone git://git.yoctoproject.org/poky -b dunfell
Cloning into 'poky'...
remote: Enumerating objects: 523784, done.
remote: Counting objects: 100% (523784/523784), done.
remote: Compressing objects: 100% (123457/123457), done.
Receiving objects:   3% (16351/523784), 7.90 MiB | 766.00 KiB/s
```

Step 2: Download Raspberry pi meta layer

$cd poky

$git clone https://git.yoctoproject.org/meta-raspberrypi/ -b dunfell

```
tutorialadda@linux:~/yocto$
tutorialadda@linux:~/yocto$ cd poky/
tutorialadda@linux:~/yocto/poky$
tutorialadda@linux:~/yocto/poky$ git clone git://git.yoctoproject.org/meta-raspberrypi -b dunfell
Cloning into 'meta-raspberrypi'...
remote: Enumerating objects: 9169, done.
remote: Counting objects: 100% (9169/9169), done.
remote: Compressing objects: 100% (4502/4502), done.
remote: Total 9169 (delta 5299), reused 7484 (delta 4229)
Receiving objects: 100% (9169/9169), 1.82 MiB | 451.00 KiB/s, done.
Resolving deltas: 100% (5299/5299), done.
Checking connectivity... done.
```

Step 3: Set up an OpenEmbedded environment:

$source oe-init-build-env

```
tutorialadda@linux:~/yocto/poky$ source oe-init-build-env

### Shell environment set up for builds. ###

You can now run 'bitbake <target>'

Common targets are:
    core-image-minimal
    core-image-sato
    meta-toolchain
    meta-ide-support

You can also run generated qemu images with a command like 'runqemu qemux86'

Other commonly useful commands are:
 - 'devtool' and 'recipetool' handle common recipe tasks
 - 'bitbake-layers' handles common layer tasks
 - 'oe-pkgdata-util' handles common target package tasks
tutorialadda@linux:~/yocto/poky/build$
```

Step 4: Configure the project and choose a target:

Set machine name in local.conf and add the raspberry pi layer in bblayer.conf

In file local.conf add 2 line choose machine and generate an SD card image file

For raspberry pi 3 machine name

MACHINE ?= " raspberrypi3-64"

For SD card image

IMAGE_FSTYPES = "tar.xz ext3 rpi-sdimg"

In the build/conf/bblayers.conf add path to meta-raspberrypi folder

```
# POKY_BBLAYERS_CONF_VERSION is increased each time build/conf/bblayers.conf
# changes incompatibly
POKY_BBLAYERS_CONF_VERSION = "2"

BBPATH = "${TOPDIR}"
BBFILES ?= ""

BBLAYERS ?= " \
  /home/tutorialadda/yocto/poky/meta \
  /home/tutorialadda/yocto/poky/meta-poky \
  /home/tutorialadda/yocto/poky/meta-yocto-bsp \
  /home/tutorialadda/yocto/poky/meta-raspberrypi \
  "
```

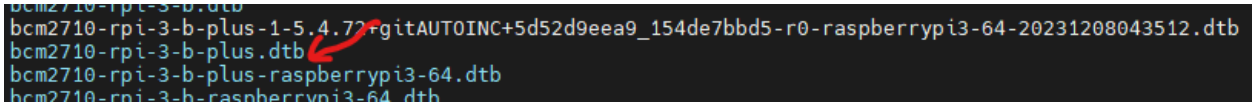
Step 5: Start bitbake to build the image

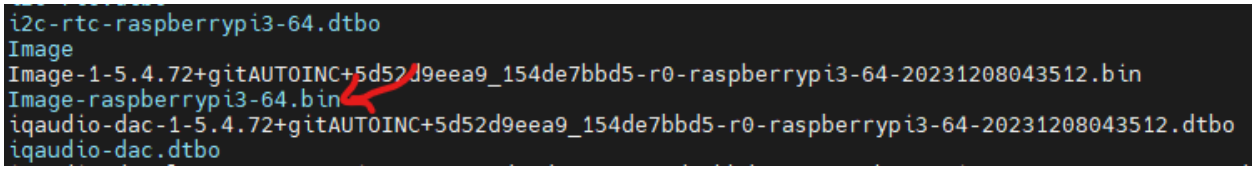
$bitbake core-image-minimal

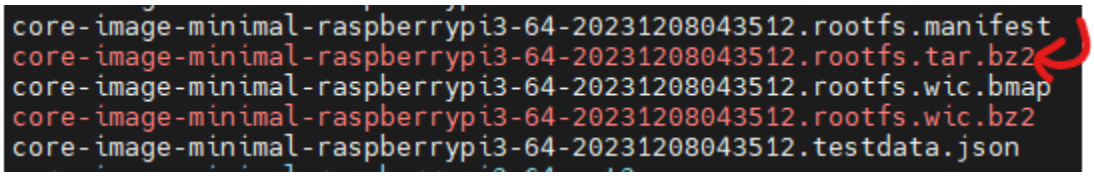
```
tutorialadda@linux:~/yocto/poky/build$
tutorialadda@linux:~/yocto/poky/build$ bitbake core-image-minimal
Parsing recipes: 100% |#########################################################################################################
Parsing of 805 .bb files complete (0 cached, 805 parsed). 1359 targets, 61 skipped, 0 masked, 0 errors.
NOTE: Resolving any missing task queue dependencies

Build Configuration:
BB_VERSION           = "1.46.0"
BUILD_SYS            = "x86_64-linux"
NATIVELSBSTRING      = "ubuntu-16.04"
TARGET_SYS           = "aarch64-poky-linux"
MACHINE              = "raspberrypi4-64"
DISTRO               = "poky"
DISTRO_VERSION       = "3.1.10"
TUNE_FEATURES        = "aarch64 cortexa72 crc crypto"
TARGET_FPU           = ""
meta
meta-poky
meta-yocto-bsp       = "dunfell:7d2f118cb6f5e140dbde794200b7c8cb07ae1b18"
meta-raspberrypi     = "dunfell:59c2d6f7a8b1239bd7b587b9180c2a55f9c695a2"

NOTE: Fetching uninative binary shim http://downloads.yoctoproject.org/releases/uninative/3.2/x86_64-nativesdk-libc.tar
2d4c7ae3887cddb97219f97b94efddfeee2e24923c0cb0e8ce84c6 (will check PREMIRRORS first)
Initialising tasks: 100% |#####################################################################################################
Sstate summary: Wanted 1158 Found 0 Missed 1158 Current 0 (0% match, 0% complete)
NOTE: Executing Tasks
Currently  2 running tasks (13 of 3150)   0% |
0: m4-native-1.4.18-r0 do_fetch (pid 20832)  66% |#################################################
1: gnu-config-native-20200117+gitAUTOINC+5256817ace-r0 do_fetch (pid 20830)  43% |####################
```

Boot to board with TFTP:

After build success, you need to 3 files: device tree, rootfs and Image***.bin in poky/build/tmp/deploy/images/raspberrypi4-64/







Step 1: Rename file *.bin to “Image”, move it and file device tree to:

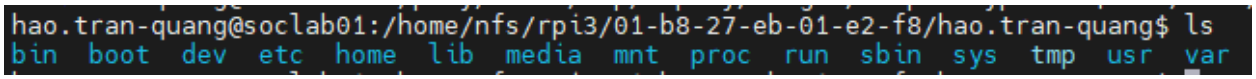
/home/tftpboot/rpi3/(board_target)/(your_folder)

Example: /home/tftpboot/rpi3/01-b8-27-eb-01-e2-f8/hao.tran-quang/

Step 2: Extract file rootfs to:

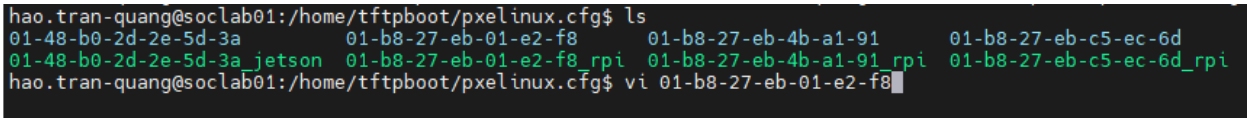
/home/nfs/rpi3/(board_target)/(your_folder)

Example: /home/nfs/rpi3/01-b8-27-eb-01-e2-f8/hao.tran-quang/



Step 3: Config file in /home/tftpboot/pxelinux.cfg/(MAC’s board)

Example: 01-b8-27-eb-01-e2-f8



Add your label:

LABEL your_label

MENU your_menu

LINUX rpi3/(board_target) /(your_folder)/Image

FDT rpi3/(board_target) /(your_folder)/bcm2710-rpi-3-b-plus.dtb

APPEND ${cbootargs} ${bootargs} 8250.nr_uarts=1 console=ttyS0,115200 rw ip=dhcp root=/dev/nfs
nfsroot=192.168.200.100:/home/nfs/rpi3/(board_target)/(your_folder)/,nfsvers=3,tcp

Example:

LABEL quanghao

MENU quanghao

LINUX rpi3/01-b8-27-eb-01-e2-f8/hao.tran-quang/Image

FDT rpi3/01-b8-27-eb-01-e2-f8/hao.tran-quang/bcm2710-rpi-3-b-plus.dtb

APPEND ${cbootargs} ${bootargs} 8250.nr_uarts=1 console=ttyS0,115200 rw ip=dhcp root=/dev/nfs nfsroot=192.168.200.100:/home/nfs/rpi3/01-b8-27-eb-01-e2-f8/hao.tran-quang,nfsvers=3,tcp

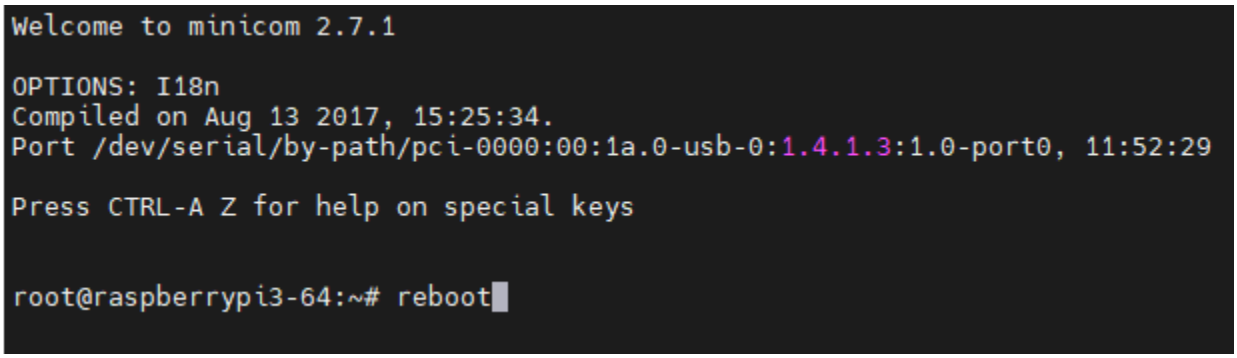
Step 4: Access to board you want to boot by minicon command:

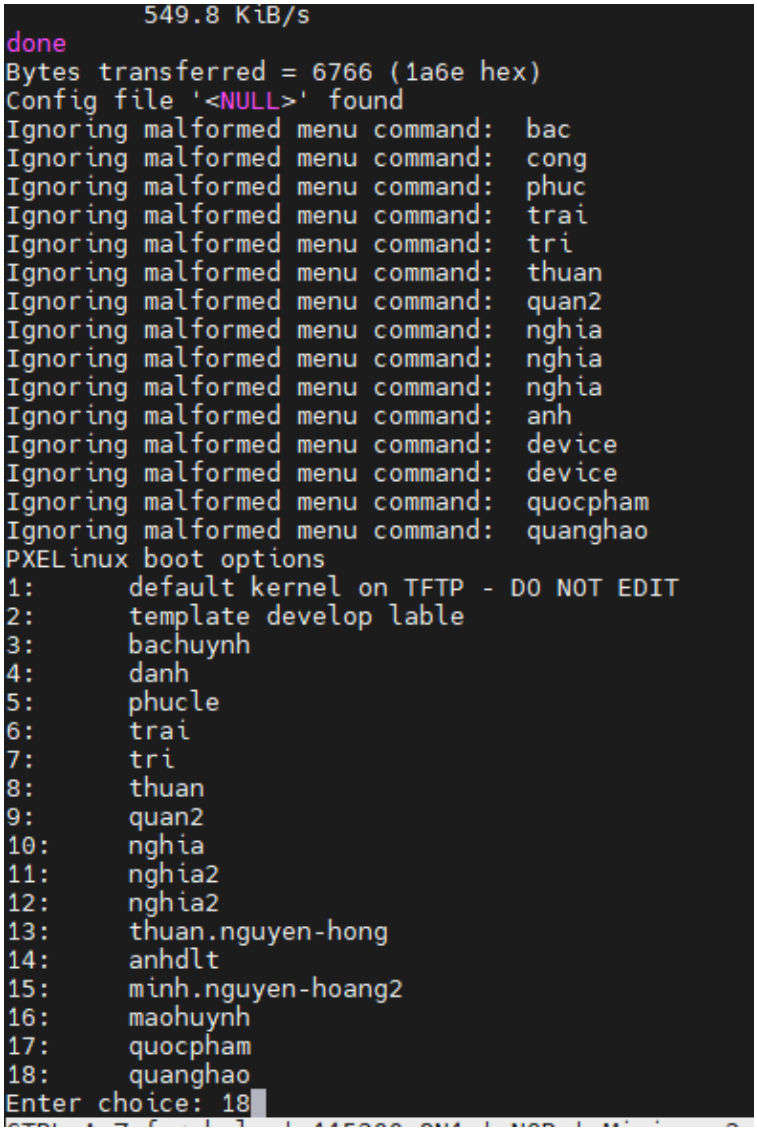
Raspberry Pi (MAC: B8:27:EB:4B:A1:91)

UART debug(../../ttyUSB0): minicom -D /dev/serial/by-path/pci-0000\:00\:1a.0-usb-0\:1.4.1.4\:1.0-port0

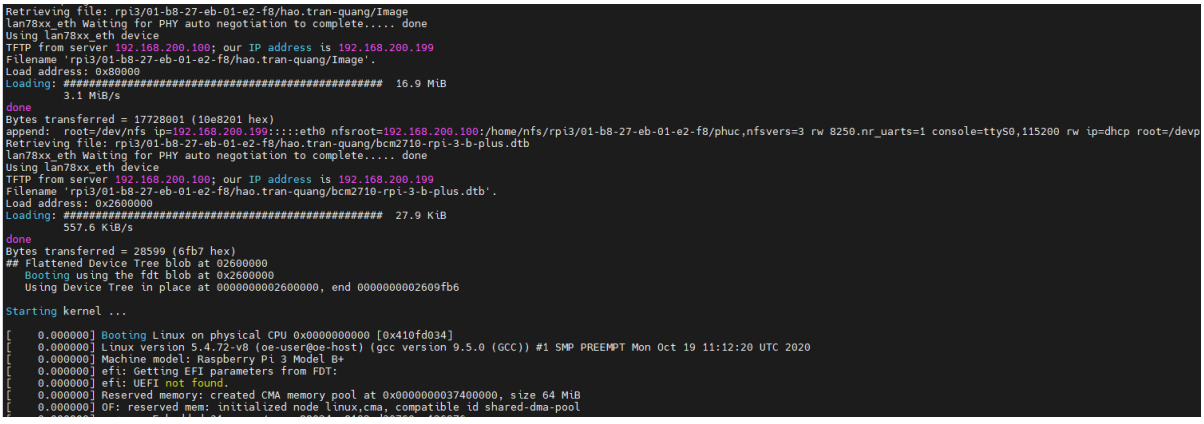
UART debug (ttyUSB1): minicom -D /dev/serial/by-path/pci-0000\:00\:1a.0-usb-0\:1.4.1.3\:1.0-port0

Step 5: Boot OS:





Choose your label



Device Tree and Image loaded

```
INIT: version 2.99 booting
Starting udev
[    11.007430] udevd[122]: starting version 3.2.10
[    11.267738] udevd[123]: starting eudev-3.2.10
Sun Mar 25 23:41:51 UTC 2018
INIT: Entering runlevel: 5
Configuring network interfaces... ip: RTNETLINK answers: File exists
ifup skipped for nfsroot interface eth0
run-parts: /etc/network/if-pre-up.d/nfsroot: exit status 1
Starting syslogd/klogd: done

Poky (Yocto Project Reference Distro) 3.4.1 raspberrypi3-64 /dev/ttyS0

raspberrypi3-64 login: root
```

```
root@raspberrypi3-64:~# uname -r
5.4.72-v8
```

2. Exercise 3, 4, 5

Step 1: Create a new meta layer and add it to bblayer.conf file

$source oe-init-build-env

```
hao.tran-quang@soclab01:~/poky$ source oe-init-build-env

### Shell environment set up for builds. ###

You can now run 'bitbake <target>'

Common targets are:
    core-image-minimal
    core-image-sato
    meta-toolchain
    meta-ide-support

You can also run generated qemu images with a command like 'runqemu qemux86'

Other commonly useful commands are:
 - 'devtool' and 'recipetool' handle common recipe tasks
 - 'bitbake-layers' handles common layer tasks
 - 'oe-pkgdata-util' handles common target package tasks
```

$bitbake-layers create-layer ../meta-custom

```
hao.tran-quang@soclab01:~/poky/build$ bitbake-layers create-layer ../meta-custom
NOTE: Starting bitbake server...
NOTE: Bitbake server didn't start within 5 seconds, waiting for 90
Add your new layer with 'bitbake-layers add-layer ../meta-custom'
hao.tran-quang@soclab01:~/poky/build$
```

$bitbake-layers add-layer ../meta-custom

```
hao.tran-quang@soclab01:~/poky/build$ bitbake-layers add-layer ../meta-custom
NOTE: Starting bitbake server...
hao.tran-quang@soclab01:~/poky/build$
```

bitbake-layers show-layers

```
hao.tran-quang@soclab01:~/poky$ bitbake-layers show-layers
NOTE: Starting bitbake server...
layer                 path                                      priority
==========================================================================
meta                  /home/hao.tran-quang/poky/meta            5
meta-poky             /home/hao.tran-quang/poky/meta-poky       5
meta-yocto-bsp        /home/hao.tran-quang/poky/meta-yocto-bsp  5
meta-raspberrypi      /home/hao.tran-quang/poky/meta-raspberrypi  9
meta-custom           /home/hao.tran-quang/poky/meta-custom     6
```

```
hao.tran-quang@soclab01:~/poky/meta-custom$ tree
.
├── conf
│   └── layer.conf
├── COPYING.MIT
├── README
└── recipes-example
    └── example
        └── example_0.1.bb
```

Step 2: Create Directory For Recipe and Source Files

Our meta custom layer directory structure looks like this.

```
hao.tran-quang@soclab01:~/poky/meta-custom$ tree
.
├── conf
│   └── layer.conf
├── COPYING.MIT
├── README
└── recipes-example
    ├── example
    │   └── example_0.1.bb
    └── hello
        ├── files
        │   └── hello.c
        └── hello_1.0.bb
```

We need to create a hello and files directory at the below location.

poky/meta-tutorial/recipe-example/hello

poky/meta-tutorial/recipe-example/hello/files/

Step 3: Write the simple hello world C program

Create the hello.c file at the poky/meta-tutorial/recipe-example/hello/files/hello.c

//Simple Hello World Program

#include<stdio.h>

int main() {

printf("Hello World , Created Bitbake recipe successfully\n");

return 0;

}

Step 4: Write the simple hello recipe file

Create hello_1.0.bb recipe file at the **poky/meta-tutorial/recipe-example/hello/hello_1.0.bb**

DESCRIPTION = "Simple helloworld application"

LICENSE = "MIT"

LIC_FILES_CHKSUM = "file://${COMMON_LICENSE_DIR}/MIT;md5=0835ade698e0bcf8506ecda2f7b4f302"

SRC_URI = "file://hello.c"

S = "${WORKDIR}"

do_compile() {

    ${CC} hello.c ${LDFLAGS} -o hello

}

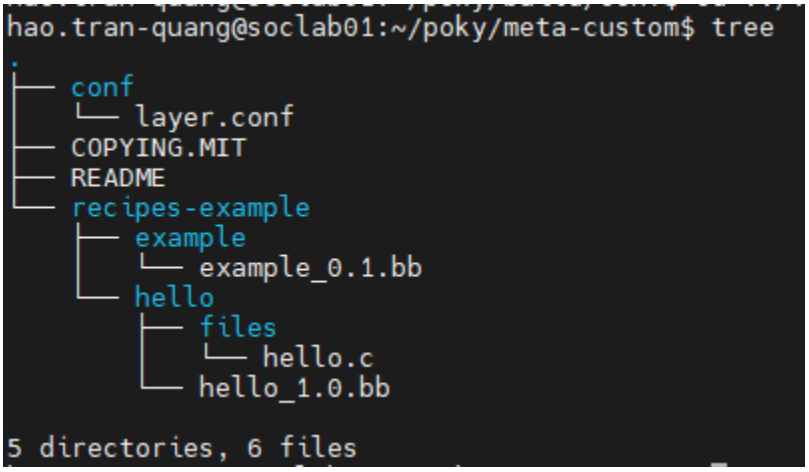
do_install() {

    install -d ${D}${bindir}

    install -m 0755 hello ${D}${bindir}

}

- This hello recipe fetch the source file(hello.c) using the SRC_URI variable and do_compile used to compile the hello.c source file and generated the hello binary.
- do_install function install hello binary at the /usr/bin of the target rootfs.
- Now, the latest directory looks like this.



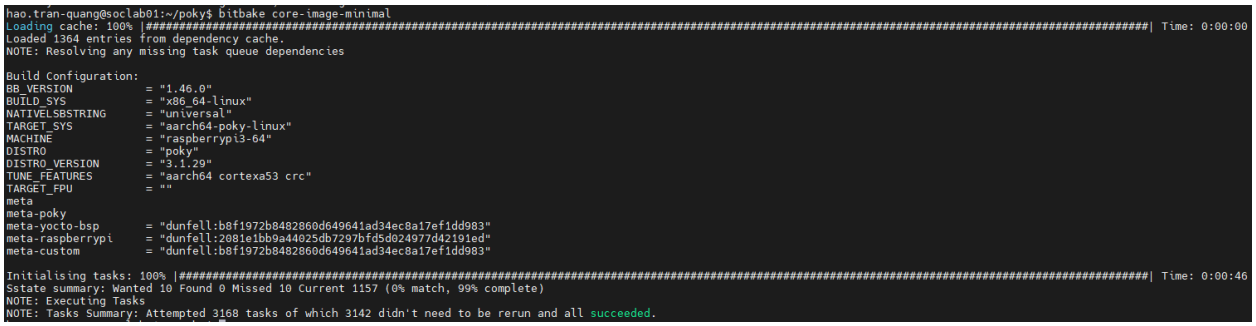
Step 5: Add hello package to rootfs

Add in conf/local.conf file:

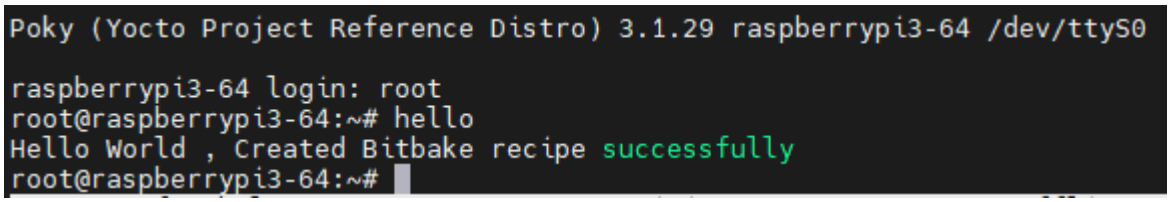
IMAGE_INSTALL_append = "hello"

Step 6: Build Image

$bitbake core-image-minimal



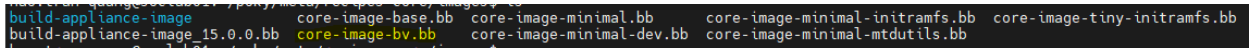
Step 7: Boot Image (Same in Exercise 1)



3. Exercise 6:

Step 1: Create file "your_machine.bb" in /poky/meta/recipes-core/images

Example: core_image_bv.bb



Step 2: Open file and add line "require recipes-core/images/core-image-minimal.bb" to have a machine with name is "your_machine" and it inherit core-image-minmal, you can add some package or more install something.

Step 3: Build image:

$bitbake core_image_bv.bb

```
core-image-bv-raspberrypi3-64-20231214074157.rootfs.ext3
core-image-bv-raspberrypi3-64-20231214074157.rootfs.manifest
core-image-bv-raspberrypi3-64-20231214074157.rootfs.rpi-sdimg
core-image-bv-raspberrypi3-64-20231214074157.rootfs.tar.xz
core-image-bv-raspberrypi3-64-20231214074157.testdata.json
core-image-bv-raspberrypi3-64.ext3
core-image-bv-raspberrypi3-64.manifest
core-image-bv-raspberrypi3-64.rpi-sdimg
core-image-bv-raspberrypi3-64.tar.xz
core-image-bv-raspberrypi3-64.testdata.json
```

Exercise 7:

```
root@raspberrypi3-64:~# vim test.txt
```


```
root@raspberrypi3-64:~# ls
test.txt
root@raspberrypi3-64:~#
```