06 project

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Content

1-u-boot tftp

2-rootfs ntfs

3-bringup driver

4-application with design

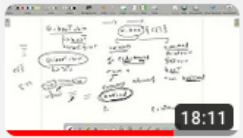
U-boot TFTP

Normal for u-boot

```
boot
U-Boot> printenv bootcmd
bootcmd=run distro_bootcmd
U-Boot> printenv distro_bootcmd
distro_bootcmd=for target in ${boot_targets}; do run bootcmd_${target}; done
U-Boot> printenv boot_targets
boot_targets=mmc0 mmc1 usb0 pxe dhcp
U-Boot>
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.8 | VT102 | Offline | ttyUSB0
```

Click to add speaker notes

U-boot loads kernel and dtb from tftp

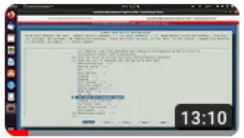


Embedded Linux U-boot Part1 #17 [عربى]

Moatasem Elsayed • 2.2K views • 1 year ago

Embedded Linux U-boot Part2 #18[عربى]

Moatasem Elsayed • 1.7K views • 1 year ago



Embedded Linux U-boot Build #19[عربى]

Moatasem Elsayed • 3.4K views • 1 year ago

How to start through yocto ?

- Who is responsible to start u-boot on my board

```
moatasem@DellLab:~/poky/build/out$ ^C
moatasem@DellLab:~/poky/build/out$ devtool find-recipe u-boot
NOTE: Starting bitbake server...
NOTE: Reconnecting to bitbake server...
NOTE: Retrying server connection (#1)...
WARNING: Host distribution "ubuntu-22.04" has not been validated with this ve
Loading cache: 100% |#################################################
Loaded 287 entries from dependency cache.
Parsing recipes: 100% |################################################
Parsing of 829 .bb files complete (183 cached, 646 parsed). 1383 targets, 65

Summary: There was 1 WARNING message shown.
/home/moatasem/poky/meta/recipes-bsp/u-boot/u-boot_2020.01.bb
moatasem@DellLab:~/poky/build/out$ bitbake-layers show-appends u-boot
NOTE: Starting bitbake server...
WARNING: Host distribution "ubuntu-22.04" has not been validated with this ve
Loading cache: 100% |#################################################
Loaded 1379 entries from dependency cache.
Parsing recipes: 100% |################################################
Parsing of 829 .bb files complete (825 cached, 4 parsed). 1383 targets, 65 sk

Summary: There was 1 WARNING message shown.
=== Matched appended recipes ===
u-boot_2020.01.bb:
  /home/moatasem/poky/meta-raspberrypi/recipes-bsp/u-boot/u-boot_%.bbappend
moatasem@DellLab:~/poky/build/out$
```

Understand how things are working

meta-raspberrypi > recipes-bsp > u-boot > u-boot_%.bbappend

```
Marek Belisko, 3 years ago | 2 authors (Fabio Berton and others)
1  FILESEXTRAPATHS_prepend := "${THISDIR}/files:"
2
3  SRC_URI_append_rpi = " \
4      file://fw_env.config \
5  "
6
7  # special fix for raspberrypi-cm3
8  SRC_URI_append_raspberrypi-cm3 = " file://0001-dm-core-Move-ofdata_to_platdata-call-earlier.patch"
9
10 DEPENDS_append_rpi = " u-boot-default-script"      Fabio Berton, 4 years ago • rpi-u-boot-scr: Set u-
11
12 do_install_append_rpi () {
13     install -d ${D}${sysconfdir}
14     install -m 0644 ${WORKDIR}/fw_env.config ${D}${sysconfdir}/fw_env.config
15 }
16
```

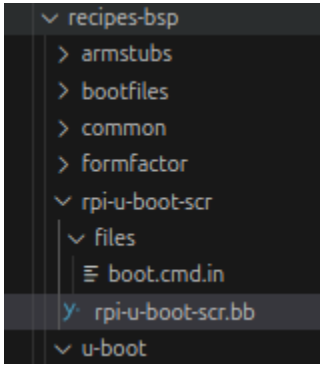
Search

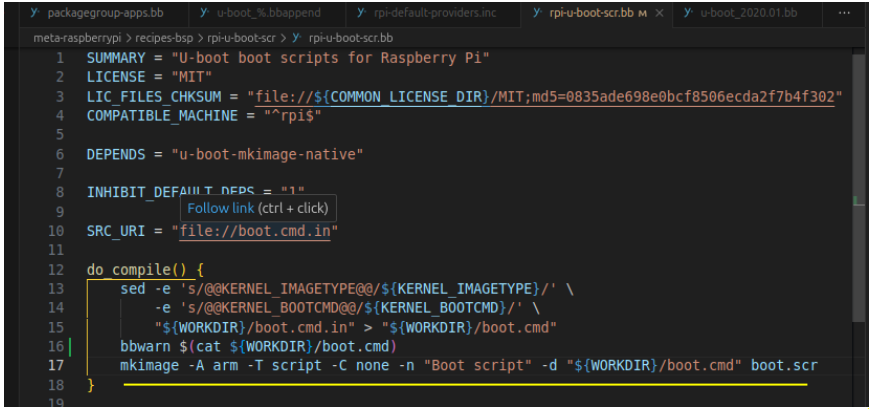
```
moatasem@DellLab:~/poky/meta-raspberrypi$ git grep u-bot^C
moatasem@DellLab:~/poky/meta-raspberrypi$ git grep u-boot-default-script
classes/sdcard_image-rpi.bbclass:    ${@bb.utils.contains('RPI_USE_U_BOOT', '1', 'u-boot-default-script:do_deploy', '',d)}
conf/machine/include/rpi-default-providers.inc:PREFERRED_PROVIDER_u-boot-default-script ??= "rpi-u-boot-scr"
recipes-bsp/rpi-u-boot-scr/rpi-u-boot-scr.bb:PROVIDES += "u-boot-default-script"
recipes-bsp/u-boot/u-boot_%.bbappend:DEPENDS_append_rpi = " u-boot-default-script"
moatasem@DellLab:~/poky/meta-raspberrypi$
```

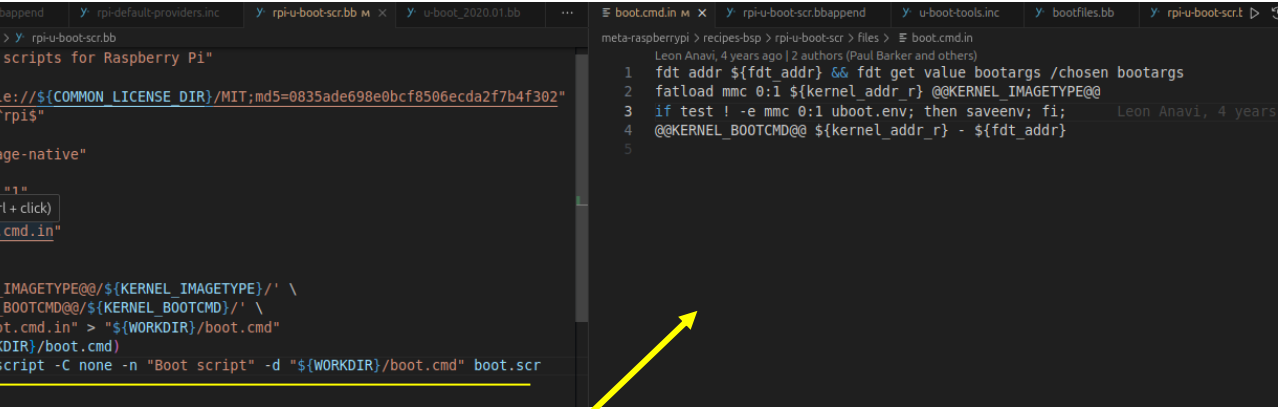
rpi-base.inc
rpi-default-providers.inc
rpi-default-settings.inc
rpi-default-versions.inc
tune-arm1176jzf-s.inc

```
11
12 PREFERRED_PROVIDER_virtual/libomxil ?= "userland"
13 VIRTUAL-RUNTIME_libomxil = "userland"
14
15 PREFERRED_PROVIDER_u-boot-default-script ??= "rpi-u-boot-scr"
16
```

Boot.scr Mechanism







We need to update this file

```
moatasem@DellLab:~/poky/meta-diploma$ mkdir -p recipes-bsp/rpi-u-boot-scr/files
moatasem@DellLab:~/poky/meta-diploma$ touch recipes-bsp/rpi-u-boot-scr/files/boot.cmd.in
moatasem@DellLab:~/poky/meta-diploma$ touch recipes-bsp/rpi-u-boot-scr/rpi-u-boot-scr.bbappend
```

```
moatasem@DellLab:~/poky/build/workspace/sources/rpi-u-boot-scr$ bitbake-layers show-appends rpi-u-boot-scr
NOTE: Starting bitbake server...
WARNING: Host distribution "ubuntu-22.04" has not been validated with this version of the build system; you
Loading cache: 100% |################################################################################################
Loaded 1379 entries from dependency cache.
Parsing recipes: 100% |##############################################################################################
Parsing of 829 .bb files complete (824 cached, 5 parsed). 1383 targets, 65 skipped, 0 masked, 0 errors.

Summary: There was 1 WARNING message shown.
=== Matched appended recipes ===
rpi-u-boot-scr.bb:
  /home/moatasem/poky/meta-diploma/recipes-bsp/rpi-u-boot-scr/rpi-u-boot-scr.bbappend
```

Make changes

```
eta-diploma > recipes-bsp > rpi-u-boot-scr > files > boot.cmd.in
1  fdt addr ${fdt_addr} && fdt get value bootargs /chosen bootargs
2  fatload mmc 0:1 ${kernel_addr_r} @@KERNEL_IMAGETYPE@@
3  setenv serverip 10.42.0.1;
4  setenv ipaddr2 10.42.0.3
5  if test ! -e mmc 0:1 uboot.env; then saveenv; fi;
6  @@KERNEL_BOOTCMD@@ ${kernel_addr_r} - ${fdt_addr}
7
```

```
ta-diploma > recipes-bsp > rpi-u-boot-scr > rpi-u-boot-scr.bbappend
1  FILESEXTRAPATHS_prepend := "${THISDIR}/files:"
2
3  SRC_URI = "file://boot.cmd.in"
4
```

Test

```
U-Boot> printenv ipaddr2
ipaddr2=10.42.0.3
U-Boot> printenv ser
  serial# serverip
U-Boot> printenv serverip
serverip=10.42.0.1
U-Boot>
```

Check tftp commands

```
serverip=10.42.0.1
U-Boot> help tftp
tftpboot - boot image via network using TFTP protocol

Usage:
tftpboot [loadAddress] [[hostIPaddr:]bootfilename]
U-Boot>
```

Test commands before updating recipe

```
U-Boot> setenv ipaddr 10.42.0.2
U-Boot> ping 10.42.0.1
lan78xx_eth Waiting for PHY auto negotiation to complete.... done
Using lan78xx_eth device
host 10.42.0.1 is alive
U-Boot>tftpboot $kernel_addr_r zImage
lan78xx_eth Waiting for PHY auto negotiation to complete.... done
Using lan78xx_eth device
TFTP from server 10.42.0.1; our IP address is 10.42.0.2
Filename 'zImage'.
Load address: 0x80000
Loading: ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##  0 Bytes
         3.7 MiB/s
done
```

Update your cmd file
And build image

```
fdt addr ${fdt_addr} && fdt get value bootargs /chosen bootargs
# fatload mmc 0:1 ${kernel_addr_r} @@KERNEL_IMAGETYPE@@
setenv serverip 10.42.0.1;
setenv ipaddr 10.42.0.2
tftp $kernel_addr_r uImage
tftp $fdt_addr_r bcm2710-rpi-3-b-plus.dtb

if test ! -e mmc 0:1 uboot.env; then saveenv; fi;
@@KERNEL_BOOTCMD@@ ${kernel_addr_r} - ${fdt_addr_r}
```

Start Your Server

Setting up a TFTP server

Install the following packages on your host PC:

```
$ sudo apt-get update && sudo apt-get install xinetd tftpd tftp
```

Create file `/etc/xinetd.d/tftp' with the following contents:

```
service tftp
{
     protocol = udp
     port = 69
     socket_type = dgram
     wait = yes
     user = nobody
     server = /usr/sbin/in.tftpd
     server_args = /tftpboot
     disable = no
}
```

Create directory `/tftpboot/' (this matches the `server-args' above) and set its permissions:

```
$ sudo mkdir /tftpboot/
$ sudo chmod -R 777 /tftpboot/
$ sudo chown -R nobody /tftpboot/
```

Restart the `xinetd' service:

```
$ sudo service xinetd restart
```

TEST

Script to automate

```
#!/bin/bash
case $1 in

flash)
    echo " flash"
    set -ex
    DIR="/home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/"
    IMAGE=`readlink /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/diploma-minimal-diploma-machine.wic.bzz
    #update u-boot,zImage
    UIMAGE=$(readlink /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/uImage)
    sudo cp "$DIR$UIMAGE" /tftpboot/uImage
    #update dtb
    DTB=$(readlink /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/bcm2710-rpi-3-b-plus.dtb)
    sudo cp "$DIR$DTB" /tftpboot/bcm2710-rpi-3-b-plus.dtb
    FULLPATH="$DIR$IMAGE"

    cp "$FULLPATH" .
    bzip2 -d  $IMAGE
    IMAGE="${IMAGE%.bz2}"
    sudo dd if=$IMAGE of=/dev/mmcblk0 bs=100M
    rm $IMAGE
    set +ex
```

```
switch to partitions #0, OK
mmc0 is current device
Scanning mmc 0:1...
Found U-Boot script /boot.scr
388 bytes read in 1 ms (378.9 KiB/s)
## Executing script at 02400000
lan78xx_eth Waiting for PHY auto negotiation to complete.... done
Using lan78xx_eth device
TFTP from server 10.42.0.1; our IP address is 10.42.0.2
Filename 'uImage'.
Load address: 0x80000
Loading: ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
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         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################################################################
         ##################  0 Bytes
         3.8 MiB/s
done
Bytes transferred = 6094312 (5cfde8 hex)
lan78xx_eth Waiting for PHY auto negotiation to complete.... done
Using lan78xx_eth device
TFTP from server 10.42.0.1; our IP address is 10.42.0.2
Filename 'bcm2710-rpi-3-b-plus.dtb'.
Load address: 0x2600000
Loading: ######  0 Bytes
         3 MiB/s
done
Bytes transferred = 28599 (6fb7 hex)
Saving Environment to FAT... OK
## Booting kernel from Legacy Image at 00080000 ...
   Image Name:   Linux-5.4.72-v7
   Image Type:   ARM Linux Kernel Image (uncompressed)
   Data Size:    6094248 Bytes = 5.8 MiB
   Load Address: 00008000
   Entry Point:  00008000
   Verifying Checksum ... OK
## Flattened Device Tree blob at 02600000
```
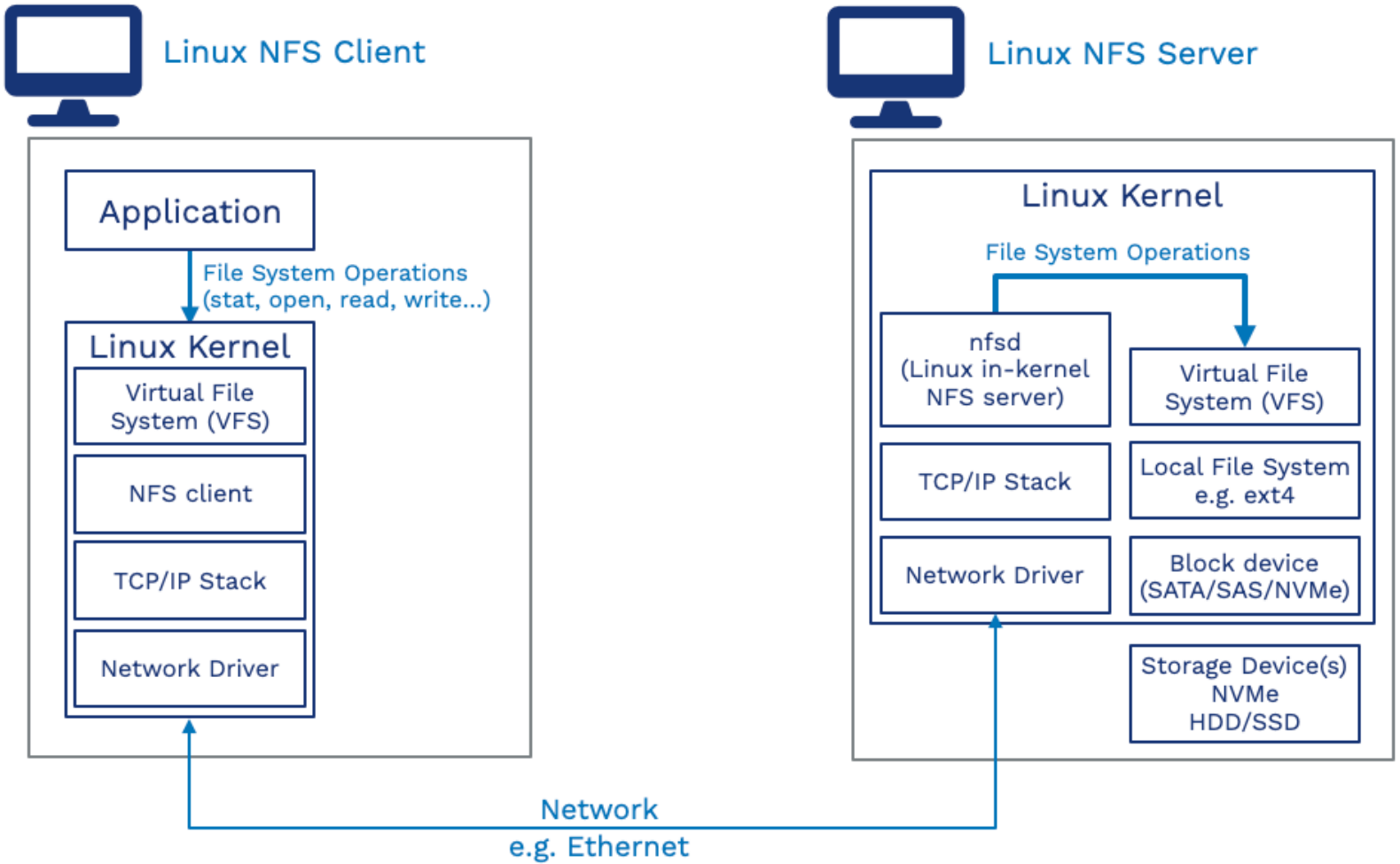

NTFS


Linux NFS Client
Application
File System Operations
(stat, open, read, write...)
Linux Kernel
Virtual File System (VFS)
NFS client
TCP/IP Stack
Network Driver
Linux NFS Server
Linux Kernel
File System Operations
nfsd
(Linux in-kernel NFS server)
Virtual File System (VFS)
TCP/IP Stack
Local File System
e.g. ext4
Network Driver
Block device
(SATA/SAS/NVMe)
Storage Device(s)
NVMe
HDD/SSD
Network
e.g. Ethernet

Install server

1- install nfs-kernel-server

```
moatasem@DellLab:~/board/raspberry/image_scratch/boot$ sudo apt-get install nfs-kernel-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nfs-kernel-server is already the newest version (1:2.6.1-1ubuntu1.2).
0 to upgrade, 0 to newly install, 0 to remove and 0 not to upgrade.
moatasem@DellLab:~/board/raspberry/image_scratch/boot$
```

2- prepare file system

```
moatasem@DellLab:~$ mkdir nfsroot
moatasem@DellLab:~$ cd nfsroot/
moatasem@DellLab:~/nfsroot$ pwd
/home/moatasem/nfsroot
moatasem@DellLab:~/nfsroot$
```

3-Extract diploma-minimal-diploma-machine.tar.bz2 to your ntfs location

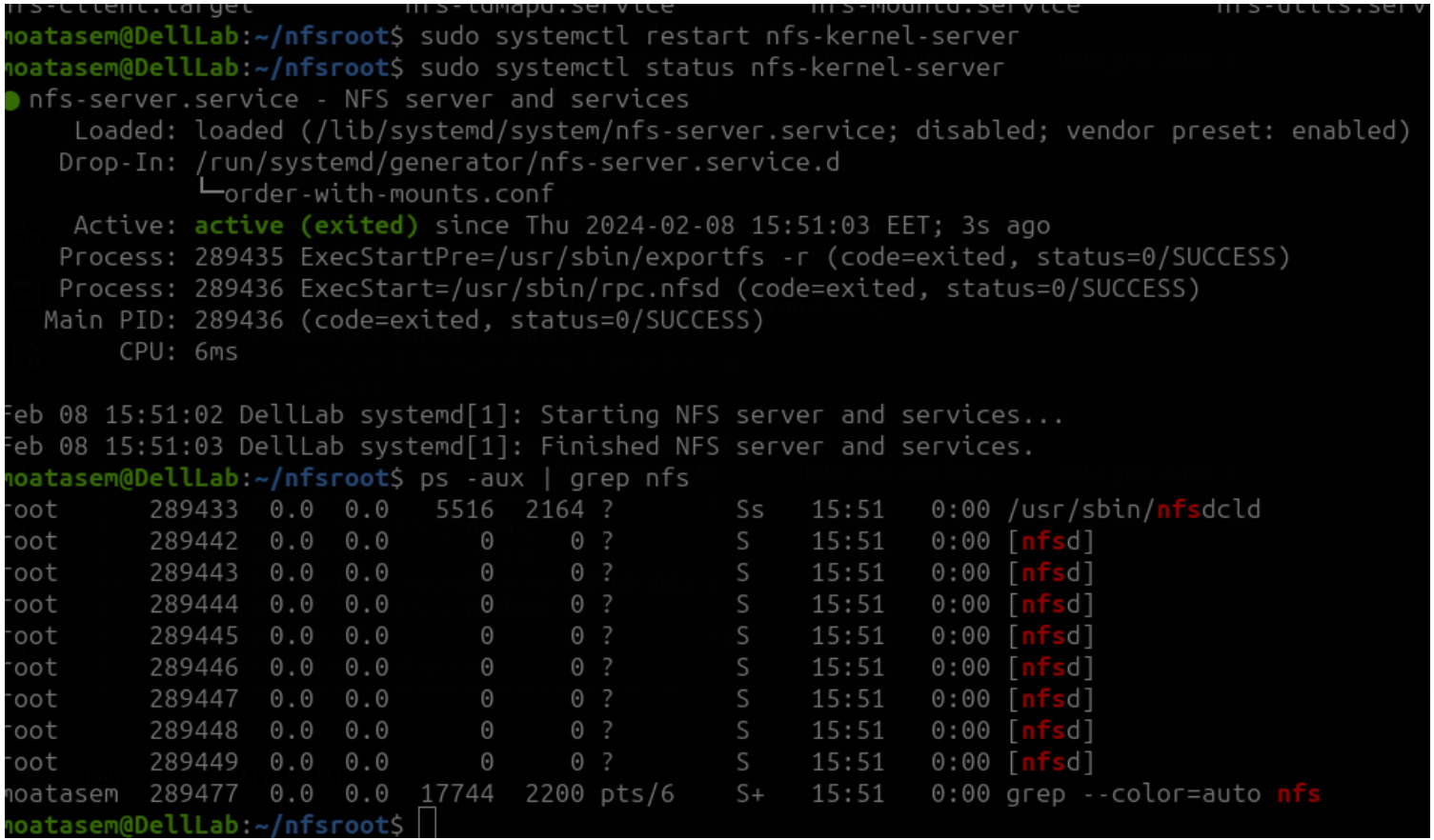
```
moatasem@DellLab:~/nfsroot$ sudo tar --same-owner -xvf /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine//diploma-minimal-diploma-machine.tar.bz2 -C .
moatasem@DellLab:~/nfsroot$ ^C
moatasem@DellLab:~/nfsroot$ ^C
moatasem@DellLab:~/nfsroot$
moatasem@DellLab:~/nfsroot$
moatasem@DellLab:~/nfsroot$ ls
bin  boot  dev  etc  home  lib  media  mnt  proc  run  sbin  sys  tmp  usr  var
moatasem@DellLab:~/nfsroot$ ls -l
total 60
drwxr-xr-x  2 root root 4096 Mar  9  2018 bin
drwxr-xr-x  2 root root 4096 Mar  9  2018 boot
drwxr-xr-x  2 root root 4096 Mar  9  2018 dev
drwxr-xr-x 19 root root 4096 Mar  9  2018 etc
drwxr-xr-x  3 root root 4096 Mar  9  2018 home
drwxr-xr-x  4 root root 4096 Mar  9  2018 lib
drwxr-xr-x  2 root root 4096 Mar  9  2018 media
drwxr-xr-x  2 root root 4096 Mar  9  2018 mnt
dr-xr-xr-x  2 root root 4096 Mar  9  2018 proc
drwxr-xr-x  2 root root 4096 Mar  9  2018 run
drwxr-xr-x  2 root root 4096 Mar  9  2018 sbin
dr-xr-xr-x  2 root root 4096 Mar  9  2018 sys
drwxrwxrwt  2 root root 4096 Mar  9  2018 tmp
drwxr-xr-x 10 root root 4096 Mar  9  2018 usr
drwxr-xr-x  8 root root 4096 Mar  9  2018 var
```

4- export your location

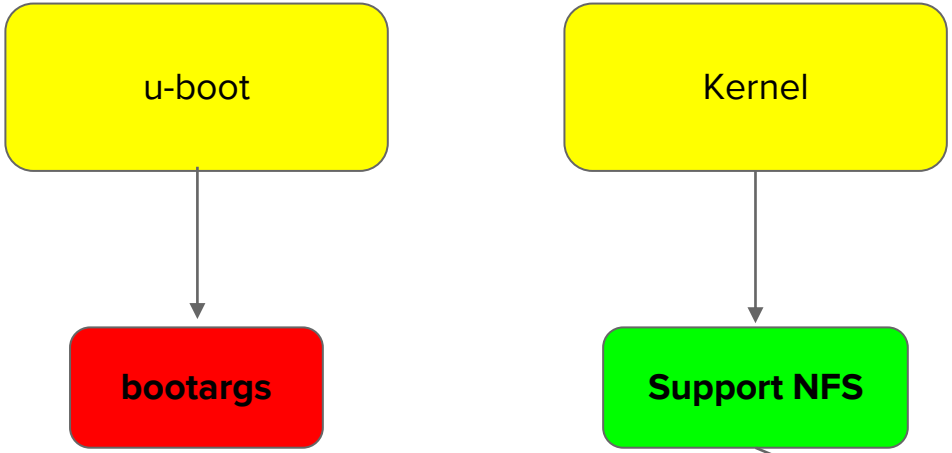
```
moatasem@DellLab:~/nfsroot$ sudo vim /etc/exports
```

```
# /srv/homes       hostname1(rw,sync,no_subtree_check) hostname2(ro,sync

/home/moatasem/nfsroot *(rw,sync,no_subtree_check,no_root_squash)
```

5- restart nfs daemon

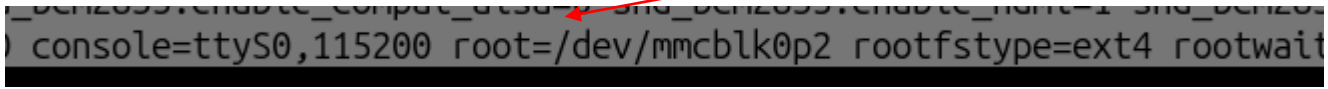


Raspberrypi

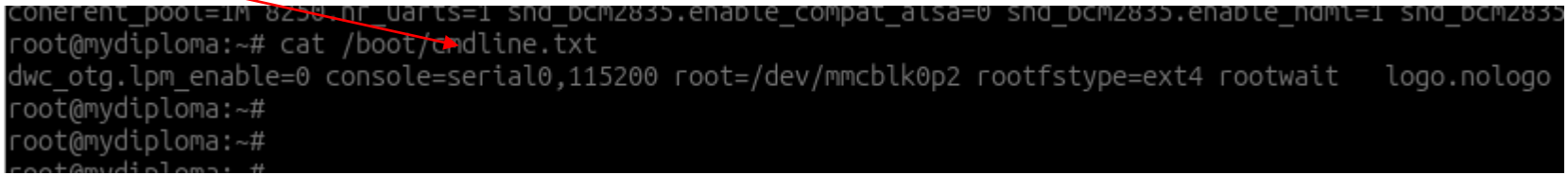



```
CONFIG_NFS_COMMON=y
moatasem@DellLab:~/poky/output/build_raspi/tmp/work-shared/diploma-machine/kernel-build-artifacts$ cat .config | grep -i NFS_FS
CONFIG_NFS_FS=y
CONFIG_NFS_FSCACHE=y
moatasem@DellLab:~/poky/output/build_raspi/tmp/work-shared/diploma-machine/kernel-build-artifacts$ cat .config | grep -i ROOT_NFS
CONFIG_ROOT_NFS=y
moatasem@DellLab:~/poky/output/build_raspi/tmp/work-shared/diploma-machine/kernel-build-artifacts$
```

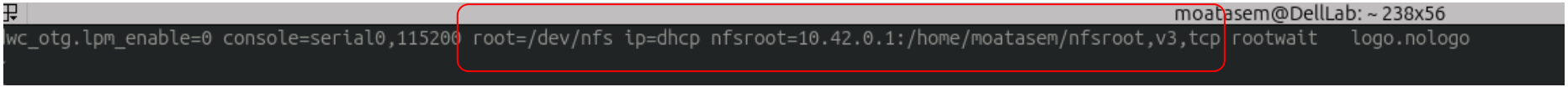
Test bootargs before updating recipe



Need to update file



update



reboot

```
root@mydiploma:~# mount
10.42.0.1:/home/moatasem/nfsroot on / type nfs (rw,relatime,vers=3,rsize=4096,wsize=4096,namlen=255,hard,nolock,proto=tcp,timeo=600,retrans=2,sec=sys,mountaddr=10.42.0.1,mountvers=3,mountproto=tcp,local
devtmpfs on /dev type devtmpfs (rw,relatime,size=440212k,nr_inodes=110053,mode=755)
proc on /proc type proc (rw,relatime)
sysfs on /sys type sysfs (rw,relatime)
debugfs on /sys/kernel/debug type debugfs (rw,relatime)
configfs on /sys/kernel/config type configfs (rw,relatime)
tmpfs on /run type tmpfs (rw,nosuid,nodev,mode=755)
tmpfs on /var/volatile type tmpfs (rw,relatime)
devpts on /dev/pts type devpts (rw,relatime,gid=5,mode=620,ptmxmode=000)
root@mydiploma:~#
```

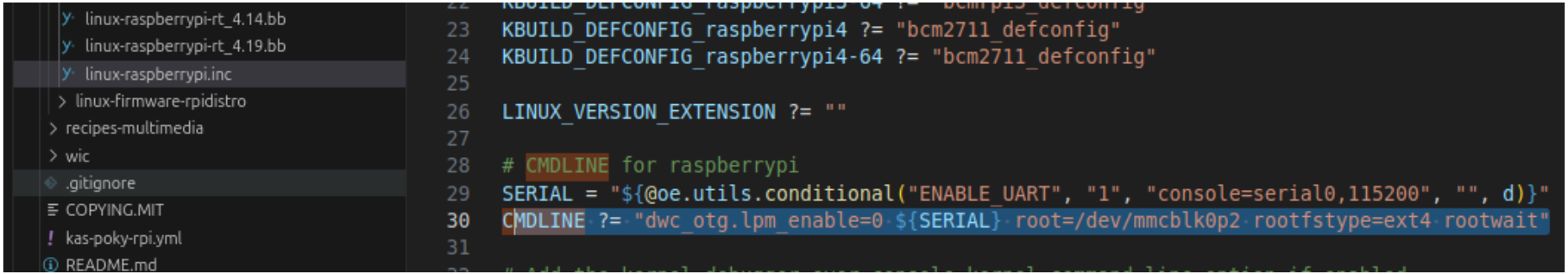
TEST

```
root@mydiploma:~# ifconfig
eth0      Link encap:Ethernet  HWaddr B8:27:EB:04:A4:B5
          inet addr:10.42.0.55  Bcast:10.42.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4858 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4302 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4083675 (3.8 MiB)  TX bytes:682088 (666.1 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@mydiploma:~# ls
root@mydiploma:~# ls /
bin   boot  dev   etc   home  lib   media  mnt   proc  run   sbin  sys   tmp   usr   var
root@mydiploma:~#
```

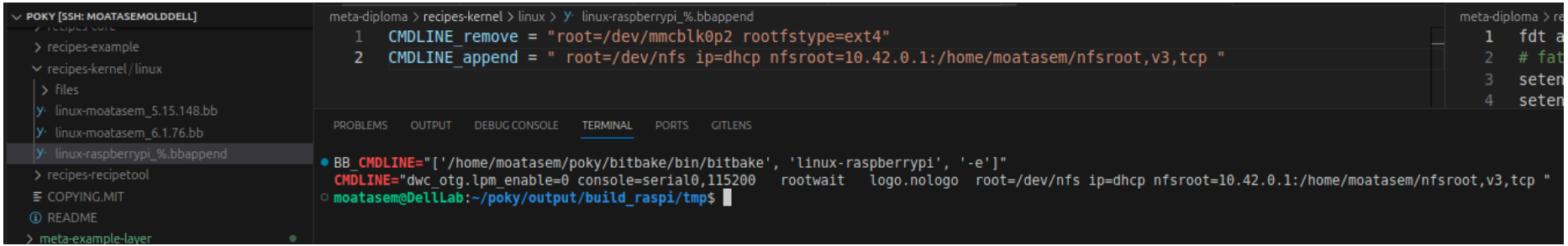
```
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.8 | VT102 | Offline | ttyUSB0
16:30:15.641063 IP 10.42.0.55.953 > DellLab.nfs: Flags [P.], seq 1524:1644, ack 1417
getattr fh Unknown/010007018F483A0000000000AC9D3D1D89124915B8C082D2986C8661709C4200
16:30:15.641145 IP DellLab.nfs > 10.42.0.55.953: Flags [P.], seq 1417:1533, ack 1644
 112 getattr DIR 755 ids 0/0 sz 4096
16:30:15.641448 IP 10.42.0.55.953 > DellLab.nfs: Flags [.], ack 1533, win 11294, opt
16:30:15.641608 IP 10.42.0.55.953 > DellLab.nfs: Flags [P.], seq 1644:1764, ack 1533
getattr fh Unknown/010007018F483A0000000000AC9D3D1D89124915B8C082D2986C8661A99C4200
16:30:15.641696 IP DellLab.nfs > 10.42.0.55.953: Flags [P.], seq 1533:1649, ack 1764
 112 getattr DIR 755 ids 0/0 sz 4096
16:30:15.642017 IP 10.42.0.55.953 > DellLab.nfs: Flags [.], ack 1649, win 11294, opt
16:30:15.642191 IP 10.42.0.55.953 > DellLab.nfs: Flags [P.], seq 1764:1900, ack 1649
readdirplus fh Unknown/010007008F483A0000000000AC9D3D1D89124915B8C082D2986C8661 512
16:30:15.642321 IP DellLab.nfs > 10.42.0.55.953: Flags [.], seq 1649:3097, ack 1900,
 1444 readdirplus
16:30:15.642329 IP DellLab.nfs > 10.42.0.55.953: Flags [P.], seq 3097:4377, ack 1900
16:30:15.642870 IP 10.42.0.55.953 > DellLab.nfs: Flags [.], ack 4377, win 11289, opt
16:30:15.644297 IP 10.42.0.55.953 > DellLab.nfs: Flags [P.], seq 1900:2020, ack 4377
getattr fh Unknown/010007018F483A0000000000AC9D3D1D89124915B8C082D2986C8661BE9B4200
16:30:15.644337 IP DellLab.nfs > 10.42.0.55.953: Flags [P.], seq 4377:4493, ack 2020
```

Which recipe is responsible on cmdline.txt ?

```
moatasem@DellLab:~/poky/build$ cd ../meta-raspberrypi/
moatasem@DellLab:~/poky/meta-raspberrypi$ git grep cmdline.txt
recipes-kernel/linux/linux-raspberrypi.inc:    # Deploy cmdline.txt only for the main kernel package
recipes-kernel/linux/linux-raspberrypi.inc:        echo "${CMDLINE}${PITFT_PARAMS}" > ${DEPLOYDIR}/${BOOTFILES_DIR_NAME}/cmdline.txt
moatasem@DellLab:~/poky/meta-raspberrypi$ code recipes-kernel/linux/linux-raspberrypi.inc
moatasem@DellLab:~/poky/meta-raspberrypi$
0  BitBake: 0 recipes scanned
```



bbappend to overwrite this one



TEST

```
flash)
    echo " flash"
    set -ex
    DIR="/home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/"
    IMAGE=`readlink /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/diploma-minimal-diploma-machine.wic.bz2`
    #update u-boot,zImage
    UIMAGE=$(readlink /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/uImage)
    sudo cp "$DIR$UIMAGE" /tftpboot/uImage
    #update dtb
    DTB=$(readlink /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/bcm2710-rpi-3-b-plus.dtb)
    sudo cp "$DIR$DTB" /tftpboot/bcm2710-rpi-3-b-plus.dtb
    #update rootfs
    sudo rm -rf  /home/moatasem/nfsroot/*
    sudo tar --same-owner -pxvf /home/moatasem/poky/output/build_raspi/tmp/deploy/images/diploma-machine/diploma-minimal-diploma-machine.tar.bz2 -C /home/moatasem/nfsro
    #flash image
    FULLPATH="$DIR$IMAGE"
    # cp "$FULLPATH" .
    # bzip2 -d  $IMAGE
    # IMAGE="${IMAGE%.bz2}"
    # sudo dd if=$IMAGE of=/dev/mmcblk0 bs=100M
    # rm $IMAGE
    set +ex
    ;;
```

```
moatasem@DellLab:~/nfsroot$ sudo touch test_exist
[sudo] password for moatasem:
```

```
devpts on /dev/pts type devpts (rw,relatime,gid=5,mode=620,ptmxmode=000)
root@mydiploma:~# ls /
bin         boot        dev         etc         home        lib         media       mnt         proc        run         sbin        sys         test_exist  tmp         usr         var
root@mydiploma:~#
```

```
Starting udev
[    10.962916] random: crng init done
[    11.066911] udevd[121]: starting version 3.2.9
[    11.155194] udevd[122]: starting eudev-3.2.9
[    11.579657] i2c /dev entries driver
Fri Mar  9 12:34:56 UTC 2018
Configuring packages on first boot....
 (This may take several minutes. Please do not power off the machine.)
Running postinst /etc/ipk-postinsts/000-sysvinit-inittab...
update-rc.d: /etc/init.d/run-postinsts exists during rc.d purge (continuing)
                  system startup links for run-postinsts ...
                  99run-postinsts
                  runlevel: 5
                  twork interfaces... ip: RTNETLINK answers: File exists
                  or nfsroot interface eth0
run-parts: /etc/network/if-pre-up.d/nfsroot: exit status 1
Starting Dropbear SSH server: Generating 2048 bit rsa key, this may take a while...
Public key portion is:
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDFSMNOq4CSQyj3eBwGXroQlR2m4hajYTUXOFTD/+u7fLgEX
Fingerprint: sha1!! 17:89:9c:e0:c3:ad:73:55:52:82:26:7f:8f:a2:04:0c:e6:0b:10:48
dropbear.
Starting syslogd/klogd: done

my diploma distro 1.0 mydiploma /dev/ttyS0

mydiploma login: root
root@mydiploma:~# mount
10.42.0.1:/home/moatasem/nfsroot on / type nfs (rw,relatime,vers=3,rsize=4096,wsize=4
devtmpfs on /dev type devtmpfs (rw,relatime,size=440212k,nr_inodes=110053,mode=755)
proc on /proc type proc (rw,relatime)
sysfs on /sys type sysfs (rw,relatime)
debugfs on /sys/kernel/debug type debugfs (rw,relatime)
configfs on /sys/kernel/config type configfs (rw,relatime)
tmpfs on /run type tmpfs (rw,nosuid,nodev,mode=755)
tmpfs on /var/volatile type tmpfs (rw,relatime)
devpts on /dev/pts type devpts (rw,relatime,gid=5,mode=620,ptmxmode=000)
root@mydiploma:~#
```

No Flashing anymore

```
bin    boot   dev    etc    hom
root@mydiploma:~# hello_
hello_c          hello_makefile
root@mydiploma:~# hello_
```

before

```
FULLPATH="$DIR$IMAGE"
#cp "$FULLPATH" .
#bzip2 -d $IMAGE
#IMAGE="${IMAGE%.bz2}"
#sudo dd if=$IMAGE of=/dev/mmcblk0 bs=100M
#rm $IMAGE
```

```
es-application > packagegroups > pac
SUMMARY = "groups for ap
inherit packagegroup
RDEPENDS_${PN} = "\
hello-makefile \
hello-cmake \
"
```

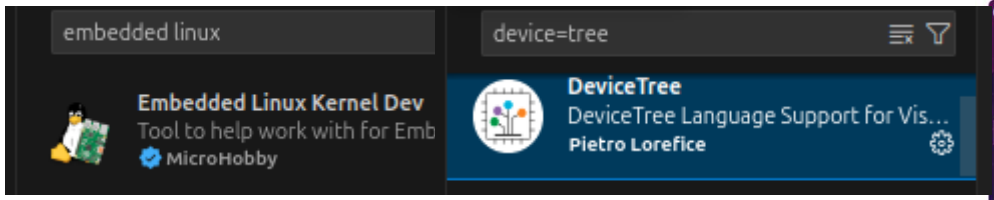
```
moatasem@DellLab:~/poky/build/out$ sync
moatasem@DellLab:~/poky/build/out$ bitbake diploma-minimal
WARNING: Host distribution "ubuntu-22.04" has not been valid
```

Now

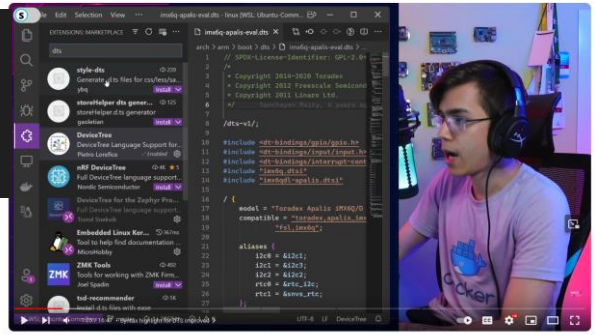
```
in    boot   dev    etc    home   lib    media  mn
oot@mydiploma:~# hello_
ello_c          hello_makefile
oot@mydiploma:~# hello_
ello_c          hello_cmake     hello_makefile
oot@mydiploma:~# hello_cmake
ello cmake
oot@mydiploma:~#
```

bringup

1

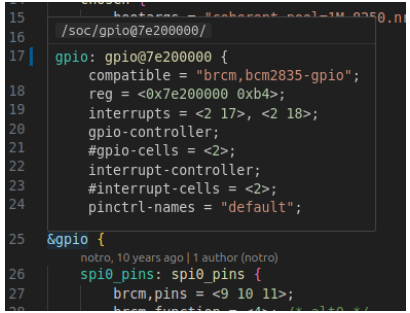


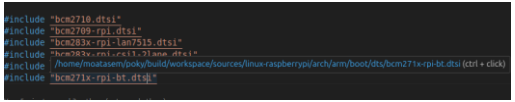
2 sudo apt-get install universal-ctags

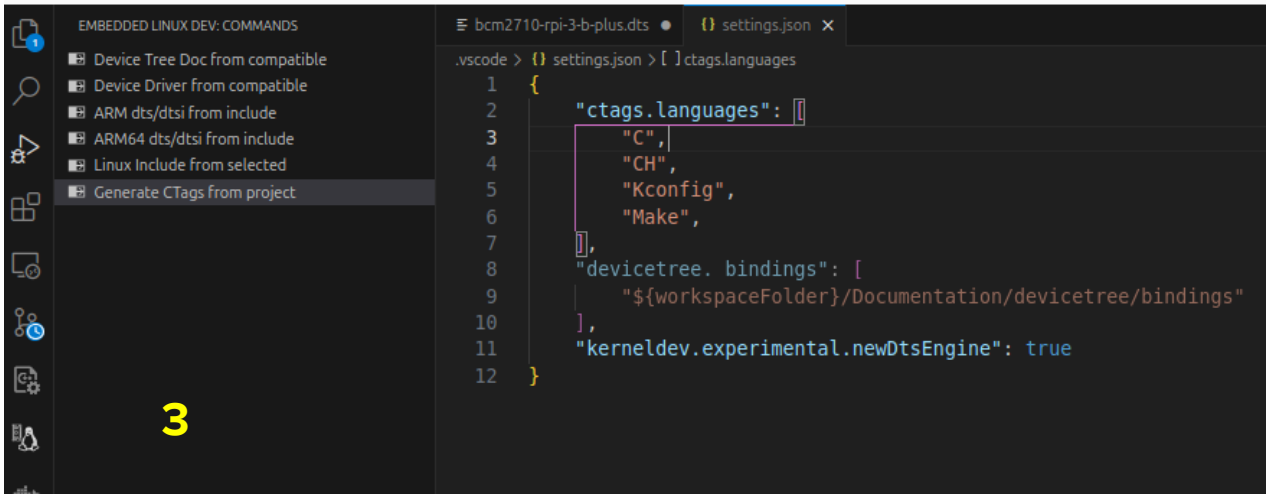


VS Code Extension for Embedded Linux Kernel Dev - New Version v0.4.9

5

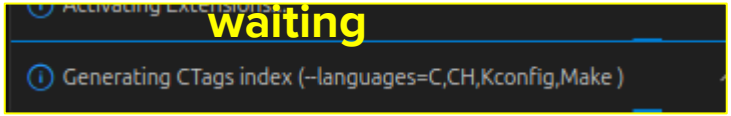






3

4



Lets add i2c-tools

```
moatasem@DellLab:~/poky$ find meta* -iname i2c*.bb
meta/recipes-devtools/i2c-tools/i2c-tools_4.1.bb
moatasem@DellLab:~/poky$
```

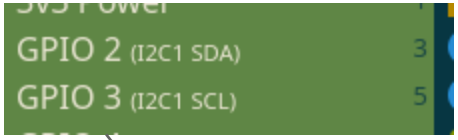
meta-diploma > recipes-core > images > diploma-minimal.bb

```
1  include recipes-core/images/core-image-minimal.bb
2  IMAGE_FEATURES += " ssh-server-dropbear"
3  IMAGE_INSTALL  += " strace"
4  IMAGE_INSTALL  += " packagegroup-apps"
5  IMAGE_INSTALL  += " i2c-tools"
6
```

```
root@mydiploma:~#
root@mydiploma:~# i2cdetect -y 1
Error: Could not open file `/dev/i2c-1' or `/dev/i2c/1': No such file or directory
root@mydiploma:~#
```

Lets enable i2c

```
moatasem@DellLab:/tftpboot$ dtc -I dtb -O dts -o file.dts bcm2710-rpi-3-b-plus.dtb
file.dts: Warning (dma_ranges_format): /soc/firmware:dma-ranges: empty "dma-ranges" property but its #address-cells (2) diff
file.dts: Warning (unit_address_vs_reg): /soc: node has a reg or ranges property, but no unit name
file.dts: Warning (unit_address_vs_reg): /soc/axiperf: node has a reg or ranges property, but no unit name
file.dts: Warning (unit_address_vs_reg): /soc/gpiomem: node has a reg or ranges property, but no unit name
file.dts: Warning (simple_bus_reg): /soc/i2c0mux: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/gpu: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/axiperf: simple-bus unit address format error, expected "7e009800"
file.dts: Warning (simple_bus_reg): /soc/firmware/clocks: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/firmware/expgpio: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/power: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/gpiomem: simple-bus unit address format error, expected "7e200000"
file.dts: Warning (simple_bus_reg): /soc/fb: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/vcsm: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/sound: missing or empty reg/ranges property
file.dts: Warning (unique_unit_address): /soc/mmc@7e300000: duplicate unit-address (also used in node /soc/mmcnr@7e300000)
file.dts: Warning (unique_unit_address): /soc/firmwarekms@7e600000: duplicate unit-address (also used in node /soc/smi@7e600
file.dts: Warning (clocks_property): /__symbols__:clocks: property size (21) is invalid, expected multiple of 4
file.dts: Warning (gpios_property): /aliases:gpio: property size (19) is invalid, expected multiple of 4
file.dts: Warning (gpios_property): /__symbols__:gpio: property size (19) is invalid, expected multiple of 4
file.dts: Warning (interrupt_provider): /soc/gpio@7e200000: Missing #address-cells in interrupt provider
file.dts: Warning (interrupt_provider): /soc/interrupt-controller@7e00b200: Missing #address-cells in interrupt provider
file.dts: Warning (interrupt_provider): /soc/local_intc@40000000: Missing #address-cells in interrupt provider
```




```
i2c0 = "/soc/i2c0mux/i2c@0";
i2c1 = "/soc/i2c@7e804000";
```

```
i2c@7e804000 {
        compatible = "brcm,bcm2835-i2c";
        reg = <0x7e804000 0x1000>;
        interrupts = <0x02 0x15>;
        clocks = <0x07 0x14>;
        #address-cells = <0x01>;
        #size-cells = <0x00>;
        status = "disabled";
        pinctrl-names = "default";
        pinctrl-0 = <0x17>;
```

Change to okay
Then compile
Then reboot

```
moatasem@DellLab:/tftpboot$ sudo dtc -I dts -O dtb  -o bcm2710-rpi-3-b-plus.dtb  file.dts
file.dts:997.4-15: Warning (dma_ranges_format): /soc/firmware:dma-ranges: empty "dma-ranges"
file.dts:79.6-1061.4: Warning (unit_address_vs_reg): /soc: node has a reg or ranges property
file.dts:986.11-992.5: Warning (unit_address_vs_reg): /soc/axiperf: node has a reg or ranges
file.dts:1038.11-1041.5: Warning (unit_address_vs_reg): /soc/gpiomem: node has a reg or rang
file.dts:579.11-603.5: Warning (simple_bus_reg): /soc/i2c0mux: missing or empty reg/ranges p
file.dts:889.7-893.5: Warning (simple_bus_reg): /soc/gpu: missing or empty reg/ranges proper
```

```
root@mydiploma:~# reboot

Broadcast message from root@mydiploma (ttyS0

INIT: Sending processes configured via /etc/
root@mydiploma:~# Stopping Dropbear SSH serv
dropbear.
Stopping syslogd/klogd: stopped syslogd (pid
stopped klogd (pid 320)
done
not deconfiguring network interfaces: networ
Sending all processes the TERM signal...
```

Configure kernel

```
moatasem@DellLab:~/poky/build$ bitbake -c menuconfig virtual/kernel
WARNING: Host distribution "ubuntu-22.04" has not been validated with this version
Loading cache: 100% |#########################################################
Loaded 1377 entries from dependency cache.
Parsing recipes: 100% |#######################################################
Parsing of 826 .bb files complete (823 cached, 3 parsed). 1380 targets, 65 skipped,
NOTE: Resolving any missing task queue dependencies

Build Configuration:
BB_VERSION           = "1.46.0"
BUILD_SYS            = "x86_64-linux"
NATIVELSBSTRING      = "universal"
TARGET_SYS           = "arm-poky-linux-gnueabi"
MACHINE              = "diploma-machine"
DISTRO               = "diploma"
DISTRO_VERSION       = "1.0"
TUNE_FEATURES        = "arm vfp cortexa7 neon vfpv4 thumb callconvention-hard"
TARGET_FPU           = "hard"
meta
```

```
<M> MLX90614 contact-less infrared sensor
< > MLX90632 contact-less infrared sensor with medic
```

```
moatasem@DellLab:~/poky/build$ bitbake -c savedefconfig virtual/kernel
WARNING: Host distribution "ubuntu-22.04" has not been validated with this vers
Loading cache: 100% |#########################################################
Loaded 1377 entries from dependency cache.
Parsing recipes: 100% |#######################################################
Parsing of 826 .bb files complete (823 cached, 3 parsed). 1380 targets, 65 skip
```

Change dts manually

```
i2c@7e804000 {
    compatible = "brcm,bcm2835-i2c";
    reg = <0x7e804000 0x1000>;
    interrupts = <0x02 0x15>;
    clocks = <0x07 0x14>;
    #address-cells = <0x01>;
    #size-cells = <0x00>;
    status = "okay";
    pinctrl-names = "default";
    pinctrl-0 = <0x17>;
    clock-frequency = <0x186a0>;
    phandle = <0x2a>;
    temp-sensor@5a {
    compatible = "melexis,mlx90614";
    reg = <0x5a>;
};
};
```

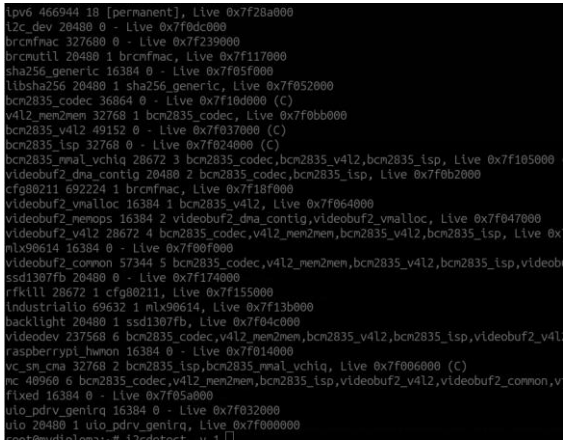
```
iploma > recipes-kernel > linux > linux-raspberrypi_%.bbappend
You, 1 second ago | 1 author (You)
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"
SRC_URI = "file://defconfig"      You, 1 second ago • Uncommitted changes
CMDLINE_remove = "root=/dev/mmcblk0p2 rootfstype=ext4"
CMDLINE_append = " root=/dev/nfs ip=dhcp nfsroot=10.42.0.1:/home/moatasem/nfsroot,v3,tcp "
```

kernel-modules is just a package, so you can include it in IMAGE_INSTALL just like any other package name (although this may not be the most appropriate solution), alternatively, add them to MACHINE_ESSENTIAL_EXTRA_RRECOMMENDS.

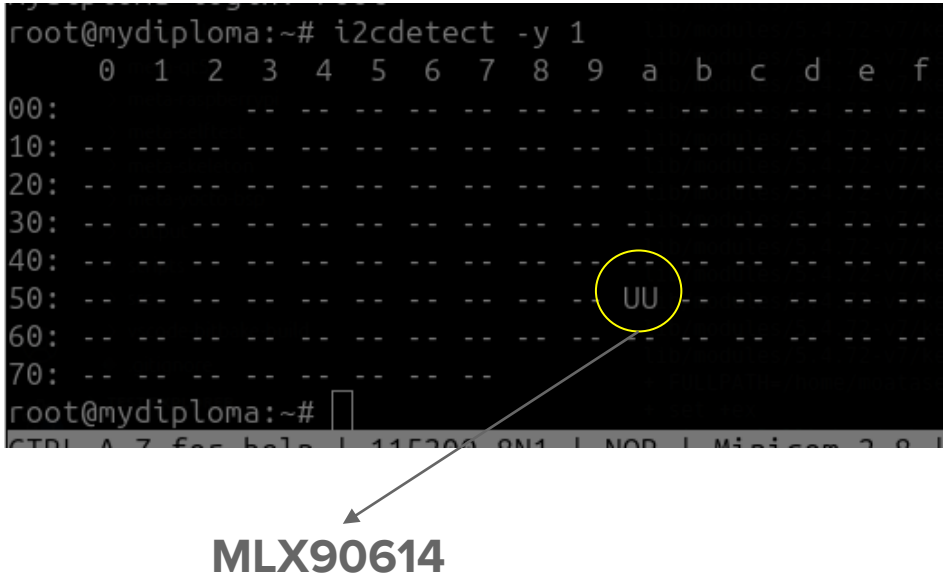
IMAGE_INSTALL_append = " kernel-modules"

or

MACHINE_ESSENTIAL_EXTRA_RRECOMMENDS_append = " kernel-modules"



I2c and mlx are working fine now



MLX90614

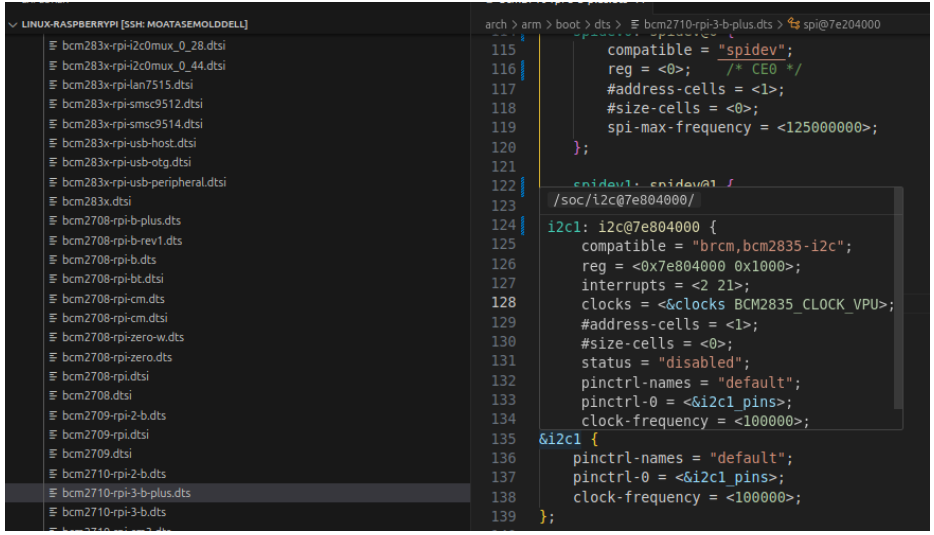
Test MLX90614

```
IMAGE_INSTALL  += "bc"
```

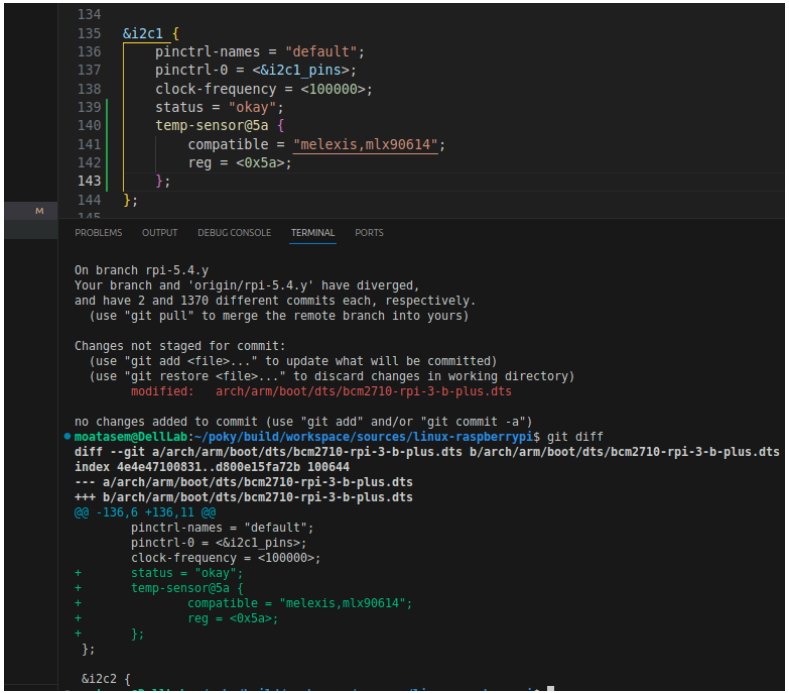
```
14687 *0.02 - 273
root@mydiploma:/sys/devices/platform/soc/3f804000.i2c/i2c-1/1-005a/iio:device0# echo "$(cat in_temp_object_raw) *0.02 - 273" | bc
20.76
root@mydiploma:/sys/devices/platform/soc/3f804000.i2c/i2c-1/1-005a/iio:device0#
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.8 | VT102 | Offline | ttyUSB0
```

Patch devicetree → Devtool modify

before



After



Update-recipe Test

ta-diploma > recipes-kernel > linux > linux-raspberrypi_%.bbappend

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"
SRC_URI = "file://defconfig \
file://0001-add-temp-sensor.patch \
"
CMDLINE_remove = "root=/dev/mmcblk0p2 rootfstype=ext4"
CMDLINE_append = " root=/dev/nfs ip=dhcp nfsroot=10.42.0.1:/home/moatasem/nfsroot,v3,tcp "
```

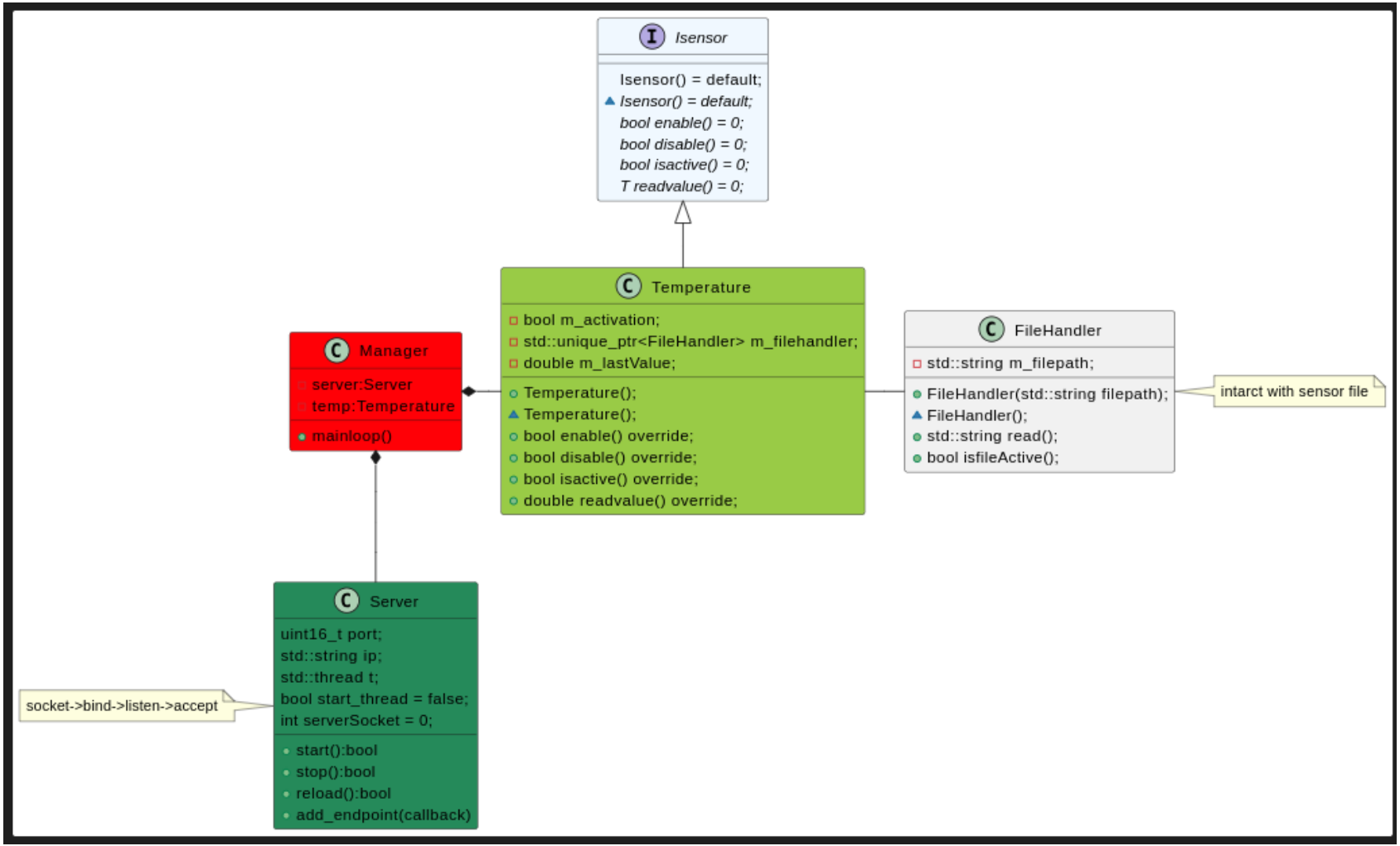
```
root@mydiploma:~# i2cdetect -y 1
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:                         -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- UU -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
root@mydiploma:~# lsmod
Module                  Size  Used by
ipv6                  466944  18
i2c_dev                20480  0
brcmfmac               327680  0
brcmutil               20480  1 brcmfmac
sha256_generic         16384  0
libsha256              20480  1 sha256_generic
bcm2835_codec          36864  0
bcm2835_v4l2           49152  0
bcm2835_isp            32768  0
v4l2_mem2mem           32768  1 bcm2835_codec
bcm2835_mmal_vchiq     28672  3 bcm2835_isp,bcm2835_codec,bcm2835_v4l2
videobuf2_vmalloc      16384  1 bcm2835_v4l2
videobuf2_dma_contig   20480  2 bcm2835_isp,bcm2835_codec
cfg80211              692224  1 brcmfmac
videobuf2_memops       16384  2 videobuf2_dma_contig,videobuf2_vmalloc
videobuf2_v4l2         28672  4 bcm2835_isp,bcm2835_codec,bcm2835_v4l2,v4l2_mem2mem
mlx90614               16384  0
videobuf2_common       57344  5 bcm2835_isp,bcm2835_codec,bcm2835_v4l2,v4l2_mem2mem,videobuf2_v4l2
vc_sm_cma              32768  2 bcm2835_isp,bcm2835_mmal_vchiq
industrialio           69632  1 mlx90614
videodev              237568  6 bcm2835_isp,bcm2835_codec,videobuf2_common,bcm2835_v4l2,v4l2_mem2mem
rfkill                 28672  1 cfg80211
mc                     40960  6 bcm2835_isp,bcm2835_codec,videobuf2_common,videodev,v4l2_mem2mem,vid
raspberrypi_hwmon      16384  0
uio_pdrv_genirq        16384  0
uio                    20480  1 uio_pdrv_genirq
fixed                  16384  0
root@mydiploma:~#
```

local.conf | buildme.sh | generate-class_git.bbappend | linux-raspberrypi_%.bbappend M | 0001-add-temp-sensor.patch

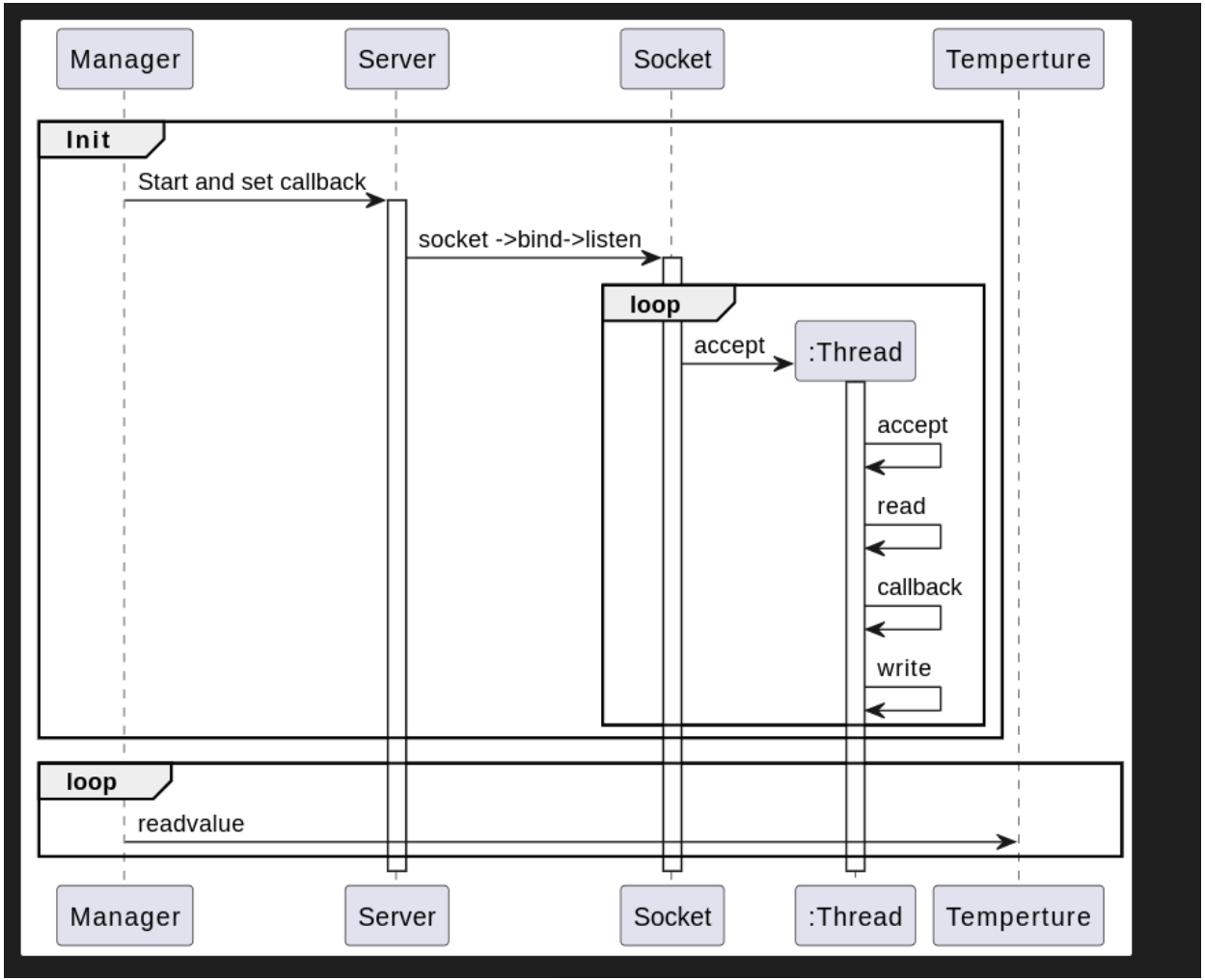
meta-diploma > recipes-kernel > linux > linux-raspberrypi > 0001-add-temp-sensor.patch

```
From aa03181c9737c71592b90a242dcfa4626b3e3875 Mon Sep 17 00:00:00 2001
From: Moatasem-Elsayed <eng.moatasem.8@gmail.com>
Date: Sat, 10 Feb 2024 21:58:26 +0200
Subject: [PATCH] add temp sensor

---
 arch/arm/boot/dts/bcm2710-rpi-3-b-plus.dts | 5 +++++
 1 file changed, 5 insertions(+)

diff --git a/arch/arm/boot/dts/bcm2710-rpi-3-b-plus.dts b/arch/arm/boot/dts/bcm2710-rpi-3-b-plus.
index 4e4e47100831..d800e15fa72b 100644
--- a/arch/arm/boot/dts/bcm2710-rpi-3-b-plus.dts
+++ b/arch/arm/boot/dts/bcm2710-rpi-3-b-plus.dts
@@ -136,6 +136,11 @@
     pinctrl-names = "default";
     pinctrl-0 = <&i2c1_pins>;
     clock-frequency = <100000>;
+    status = "okay";
+    temp-sensor@5a {
+        compatible = "melexis,mlx90614";
+        reg = <0x5a>;
+    };
 };

 &i2c2 {
```

Application


Isensor
Isensor() = default;
Isensor() = default;
bool enable() = 0;
bool disable() = 0;
bool isactive() = 0;
T readvalue() = 0;
Temperature
bool m_activation;
std::unique_ptr<FileHandler> m_filehandler;
double m_lastValue;
Temperature();
Temperature();
bool enable() override;
bool disable() override;
bool isactive() override;
double readvalue() override;
FileHandler
std::string m_filepath;
FileHandler(std::string filepath);
FileHandler();
std::string read();
bool isfileActive();
intarct with sensor file
Manager
server:Server
temp:Temperature
mainloop()
Server
uint16_t port;
std::string ip;
std::thread t;
bool start_thread = false;
int serverSocket = 0;
start():bool
stop():bool
reload():bool
add_endpoint(callback)
socket->bind->listen->accept

Sequence Diagram



FileHandler

```hpp
namespace live_monitor {

class FileHandler {

public:
  FileHandler(std::string filepath);
  ~FileHandler();
  std::string read();
  bool isfileActive();

private:
  std::string m_filepath;
};
} // namespace live_monitor
```

```cpp
//
//              CopyRight Moatasem Elsayed
//
/****************************************/
/*
author : Moatasem Elsayed
date :Sat Feb 10 10:58:06 PM EET 2024
brief:
*/
#include "FileHandler.hpp"
#include <filesystem>
#include <fstream>
#include <iostream>
#include <unistd.h>

namespace live_monitor {
FileHandler::FileHandler(std::string filepath) : m_filepath(filepath) {
  if (!std::filesystem::exists(p: m_filepath)) {
    exit(status: EXIT_FAILURE);
  } else {
  }
}

FileHandler::~FileHandler() {}

bool FileHandler::isfileActive() {
  if (!std::filesystem::exists(p: m_filepath)) {
    return false;
  } else {
    return true;
  }
}
std::string FileHandler::read() {
  std::string result;
  std::ifstream file;
  file.open(s: m_filepath);
  file >> result;
  std::cout << "Value:" << result << std::endl;
  file.close();

  return result;
}
} // namespace live_monitor

```

Temperature

```
*/
namespace live_monitor {
template <typename T> class Isensor {

public:
  Isensor() = default;
  virtual ~Isensor() = default;
  virtual bool enable() = 0;
  virtual bool disable() = 0;
  virtual bool isactive() = 0;
  virtual T readvalue() = 0;
};
} // namespace live_monitor
```

```
#pragma once
/*****************************************/
//
//              CopyRight Moatasem Elsayed
//
/*****************************************/
/*
author : Moatasem Elsayed
date :Sun Feb 11 12:35:40 AM EET 2024
brief:
*/
#include "FileHandler.hpp"
#include "Isensor.hpp"
#include <memory>
namespace live_monitor {
constexpr const char *PATH =
  "/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device
class Temperature : public Isensor<double> {

public:
  Temperature();
  ~Temperature();
  bool enable() override;
  bool disable() override;
  bool isactive() override;
  double readvalue() override;

private:
  bool m_activation;
  std::unique_ptr<FileHandler> m_filehandler;
  double m_lastValue;
};
} // namespace live_monitor
```

```
//
//              CopyRight Moatasem Elsayed
//
/*****************************************/
/*
author : Moatasem Elsayed
date :Sun Feb 11 12:35:41 AM EET 2024
brief:
*/
#include "Temperature.hpp"
#include "FileHandler.hpp"
#include <iostream>
#include <memory>
#include <string>

namespace live_monitor {
Temperature::Temperature()
    : m_filehandler(std::make_unique<FileHandler>(filepath: PATH)) {}
Temperature::~Temperature() {}
bool Temperature::enable() {
  if (m_filehandler->isfileActive()) {
    m_activation = true;
  } else {
    m_activation = false;
  }
  return m_activation;
}

bool Temperature::isactive() { return m_activation; }

double Temperature::readvalue() {

  if (m_activation) {
    std::string result = m_filehandler->read();
    // std::stringstream result;
    m_lastValue = std::stod(str: result);
  } else {
    std::cout << "[warning] the sensor is not enabled " << std::endl;
  }
  return (m_lastValue * 0.02 - 273);
}

bool Temperature::disable() {
  m_activation = false;
  return true;
```

Server

Server > ServerHandler.hpp > {} live_monitor > ServerHandler > Start

```hpp
#include <cstdint>
#include <functional>
#include <string>
#include <thread>
namespace live_monitor {

class ServerHandler {

public:
  ServerHandler(std::string ip, uint16_t port);
  ~ServerHandler();
  bool Start(std::function<std::string()> callback);
  bool Stop();
  bool Reload();

private:
  uint16_t port;
  std::string ip;
  std::thread t;
  bool start_thread = false;
  int serverSocket = 0;
};
} // namespace live_monitor
```

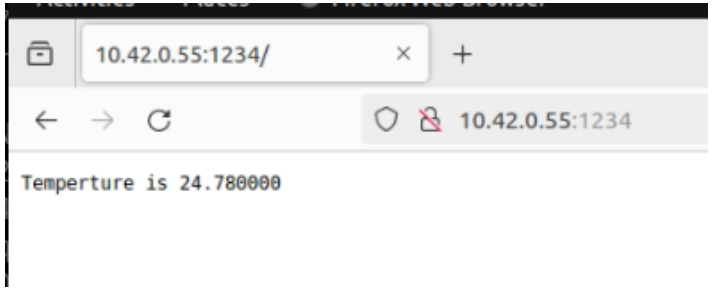
src > Server > ServerHandler.cpp > {} live_monitor > ServerHandler::Start

```cpp
namespace live_monitor {
ServerHandler::ServerHandler(std::string ip, uint16_t port)
    : ip(ip), port(port) {}
ServerHandler::~ServerHandler() {
  start_thread = false;
  if (t.joinable()) {
    t.join();
  }
  close(fd: serverSocket);
}
bool ServerHandler::Start(std::function<std::string()> callback) {

  bool status = false;
  signal(sig: SIGINT, handler: [](int signal) -> void { exit(status: 0); });
  serverSocket = socket(domain: AF_INET, type: SOCK_STREAM, protocol: 0);
  if (serverSocket == -1) {
    perror(s: "SOCKET failed to create");
    exit(status: EXIT_FAILURE);
  }
  sockaddr_in address{
      .sin_family = AF_INET,
      .sin_port = htons(hostshort: port),
      .sin_addr{.s_addr = INADDR_ANY},
  };
  if (bind(fd: serverSocket, addr: reinterpret_cast<sockaddr *>(&address),
           len: sizeof(address)) == -1) {
    perror(s: "bind failed");
    exit(status: EXIT_FAILURE);
  }
  if (listen(fd: serverSocket, n: 10) == -1) {
    perror(s: "listen failed");
    exit(status: EXIT_FAILURE);
  }
  std::cout << "Server listening on Ip:Port " << ip << port << std::endl;
  t = std::thread(f: [&]() -> void {
    std::cout << "Thread for server will launch now " << std::endl;
    start_thread = true;
    while (start_thread) {
      // Accept a connection
      sockaddr_in clientAddr;
      socklen_t clientAddrLen = sizeof(clientAddr);
      int clientSocket =
          accept(fd: serverSocket, addr: (struct sockaddr *)&clientAddr, addr_len: &clientAddrLe
      if (clientSocket == -1) {
        std::cerr << "Error accepting connection" << std::endl;
        continue;
      }

      // Read data from the client
      char httprequest[1024];
      ssize_t bytesRead = read(fd: clientSocket, buf: httprequest, nbytes: sizeof(httprequest));
      std::cout << "Request from address:" << inet_ntoa(in: clientAddr.sin_addr)
                << httprequest << std::endl;
      // Send a response back to the client
      std::string body = callback();
      // Send a response back to the client
      std::string body = callback();
      write(fd: clientSocket, buf: body.c_str(), n: body.length());
      std::this_thread::sleep_for(rtime: std::chrono::seconds(rep: 1));
      close(fd: clientSocket);
    }
    // Close the client socket
  });
  return status;
}
} // namespace live_monitor
```

main

Please implement
Manager
and startup recipe

```cpp
#include <thread>
int main() {
  live_monitor::Temperature test;
  live_monitor::ServerHandler server(ip: std::string(s: "10.42.0.55"), port: 1234);
  test.enable();
  double temp = test.readvalue();
  server.Start(callback: [&temp]() -> std::string {
    std::string result =
        "Temperture is " + std::to_string(val: temp) + std::string(s: " ");

    return result;
  });
  while (1) {
    temp = test.readvalue();
    std::this_thread::sleep_for(rtime: std::chrono::seconds(rep: 1));
  }

  return 0;
}
```



End