

How to Install Petalinux

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<https://www.xilinx.com/support/download.html>

위의 링크로 이동한다.

아래 사진과 같이 Embedded Development 를 선택하고 Archive 를 누른다.

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Version

2017.4

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여기서 2015.4 를 누르고 Source Code 와 PetaLinux 2015.4 Installer 를 다운 받는다.

PetaLinux - 2015.4 Installation Files - 2015.4 Installation Files

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MD5 SUM Value: 7e9772ce396997d2898448ef52f25597

 [PetaLinux 2015.4 Source code](#) (TAR/GZIP - 778.1 MB)

MD5 SUM Value: a692ee5ce54ced935b25194edccc1036

 [PetaLinux 2015.4 Installer](#) (TAR/GZIP - 1.68GB)

MD5 SUM Value: 74e752d382aec28f464eb3ce0d9cbc15

 [Avnet-Digilent-ZedBoard BSP](#) (BSP - 23.41 MB)

MD5 SUM Value: 917db9d01437e2e69139216528c883fc

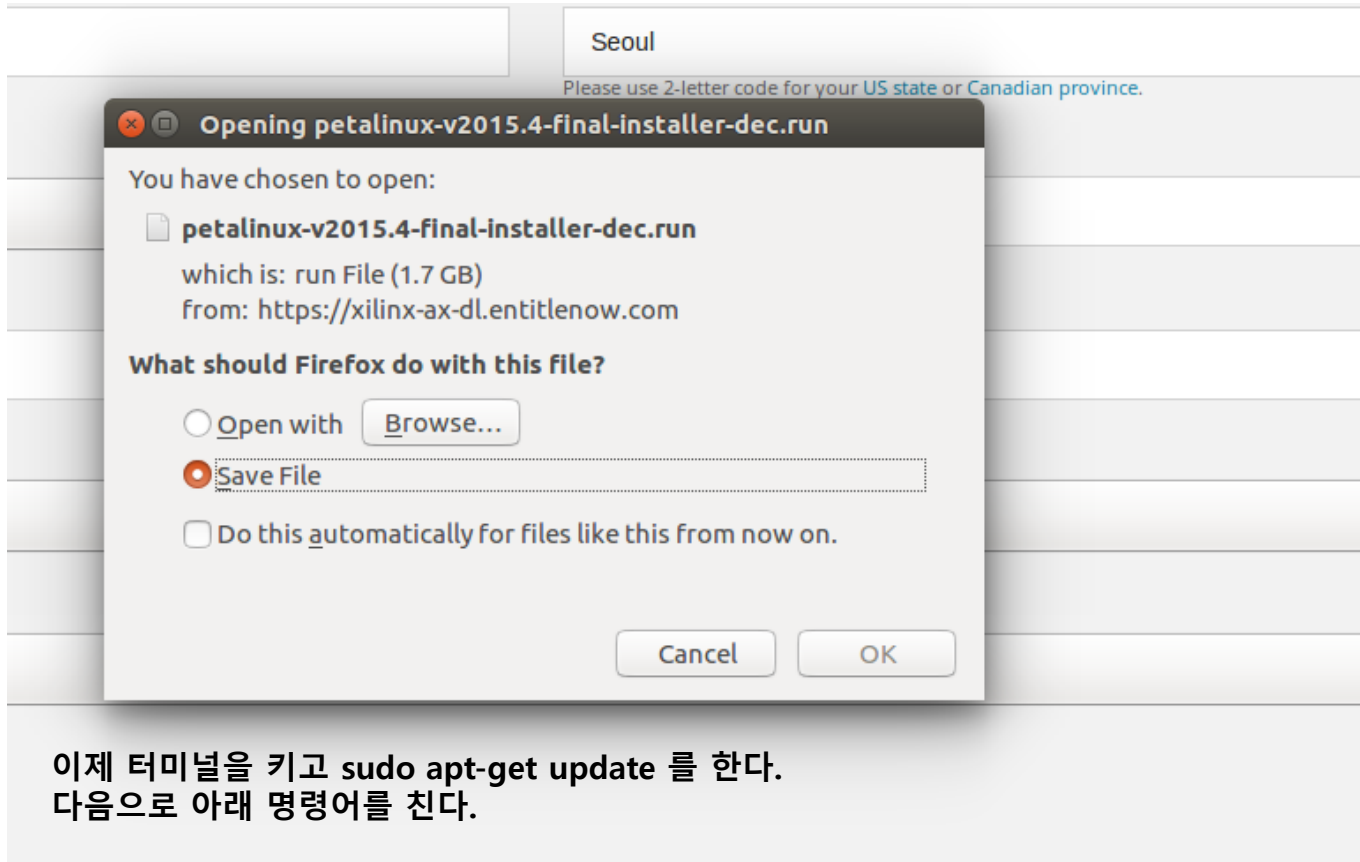
 [AC701 BSP](#) (BSP - 143.56 MB)

MD5 SUM Value: dba5e0c7f0532df8d99786d28778adef

 [KC705 BSP](#) (BSP - 118.39 MB)

MD5 SUM Value: 4924b72fd7107c3943f86dd278752cc0

필요하면 로그인하고 Next 눌러서 필요한 파일을 모두 받는다.



```
sudo apt-get install build-essential binutils ncurses-dev u-boot-tools file tofrodos iproute2 gawk net-tools  
libncurses5-dev tftp tftpd-hpa zlib1g-dev libssl-dev flex bison libselinux1 diffstat xfb chrpath xterm libtool  
socat autoconf unzip texinfo gcc-multilib libstdc++12-dev libglib2.0-dev zlib1g
```

아래와 같이 fpga 디렉토리를 만들고 다운 받은 파일을 옮긴 이후에 unzip 하고 zip 파일명을 입력해서 압축을 해제한다.
tar.gz 로 되어 있는것은 이전에 tar zxvf 로 풀었듯이 풀면 된다.
일단 현재 필요한건 LiveUSB_2015.4.zip 만 있으면 된다.

```
sdr@sdr-Samsung-DeskTop-System: ~/fpga
sdr@sdr-Samsung-DeskTop-System:~$ ls
Desktop Documents Downloads examples.desktop Music Pictures Public Templates
sdr@sdr-Samsung-DeskTop-System:~$ mkdir fpga
sdr@sdr-Samsung-DeskTop-System:~$ cd fpga/
sdr@sdr-Samsung-DeskTop-System:~/fpga$ ls
sdr@sdr-Samsung-DeskTop-System:~/fpga$ cp ~/Downloads/* ./
sdr@sdr-Samsung-DeskTop-System:~/fpga$ ls
2015_4_zynq_zybo_sources      petalinux_installation_log
2015_4_zynq_zybo_sources.zip  petalinux-v2015.4-final-installer-dec.run
LiveUSB_2015.4                plnx_2015.4_src.tar.gz
LiveUSB_2015.4.zip            Xilinx_Vivado_SDK_2015.4_1118_2.tar.gz
sdr@sdr-Samsung-DeskTop-System:~/fpga$ ls ~/petalinux_zynq/petalinux-v2015.4-final/
components/  etc/          settings.csh  settings.sh  .sourcelog   tools/
sdr@sdr-Samsung-DeskTop-System:~/fpga$ ls ~/petalinux_zynq/petalinux-v2015.4-final/
components  etc  settings.csh  settings.sh  tools
sdr@sdr-Samsung-DeskTop-System:~/fpga$ ls
2015_4_zynq_zybo_sources      petalinux_installation_log
2015_4_zynq_zybo_sources.zip  petalinux-v2015.4-final-installer-dec.run
LiveUSB_2015.4                plnx_2015.4_src.tar.gz
LiveUSB_2015.4.zip            Xilinx_Vivado_SDK_2015.4_1118_2.tar.gz
sdr@sdr-Samsung-DeskTop-System:~/fpga$
```

아래 명령어를 입력하여 petalinux 툴들을 만들도록 한다.

첫 번째 명령어는 실행하고 두 번째 명령어는 실수가 있었으니 아래와 같이 수정하여 실행한다.

`./petalinux-v2015.4-final-installer-dec.run ~/petalinux_zynq/`

중간에 라이선스 동의는 아래 페이지를 보고 한다.

```
chmod 755 petalinux-v2015.4-final-installer-dec.run  
./petalinux-v2015.4-final-installer-dec.run /opt/pkg
```

설치가 잘 완료된다면 아래와 같이 홈 디렉토리 밑에 petalinux_zynq 에 petalinux-v2015.4-final 디렉토리가 만들어진 것을 볼 수 있을 것이다.

```
sdr@sdr-Samsung-DeskTop-System: ~/petalinux_zynq/petalinux-v2015.4-final  
apps          device-tree    libs          packages-repo u-boot  
arm-trusted-firmware edk_user_repository linux-kernel rootfs  
bootloader     generic        modules       subsystem  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components$ cd linux-kernel/xlnx-4.0/drivers/uiso/  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components/linux-kernel/xlnx-4.0/drivers/uiso$ vi uio_pdrv_genirq.c  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components/linux-kernel/xlnx-4.0/drivers/uiso$ cd ../../..  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components/linux-kernel$ ls  
attributes  defconfig.yaml  get_initramfs_file  Makefile  xlnx-4.0  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components/linux-kernel$ cd ..  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components$ ls  
apps          device-tree    libs          packages-repo u-boot  
arm-trusted-firmware edk_user_repository linux-kernel rootfs  
bootloader     generic        modules       subsystem  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final/components$ cd ..  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final$ ls  
components  etc  settings.csh  settings.sh  tools  
sdr@sdr-Samsung-DeskTop-System:~/petalinux_zynq/petalinux-v2015.4-final$
```

실행하면 라이선스 동의하라고 나오는데 뭔가 글이 잔뜩 써있는 페이지가 나오면 q 누르고 창 밖으로 나와서 아래와 같이 y 눌러주고 엔터를 반복하면 된다.

```
INFO: Checking installer checksum...
INFO: Extracting PetaLinux installer...
INFO: Installing PetaLinux...
INFO: Checking PetaLinux installer integrity...
INFO: Extracting Installation files...
```

LICENSE AGREEMENTS

PetaLinux SDK contains software from a number of sources. Please review the following licenses and indicate your acceptance of each to continue.

You do not have to accept the licenses, however if you do not then you may not use PetaLinux SDK.

Use PgUp/PgDn to navigate the license viewer, and press 'q' to close

```
Press Enter to display the license agreements
Do you accept Xilinx End User License Agreement? [y/N] > y
Do you accept Webtalk Terms and Conditions? [y/N] > y
Do you accept Third Party End User License Agreement? [y/N] > y
INFO: Checking installation environment requirements...
INFO: Checking free disk space
INFO: Checking installed tools
INFO: Checking installed development libraries
INFO: Checking network and other services
```

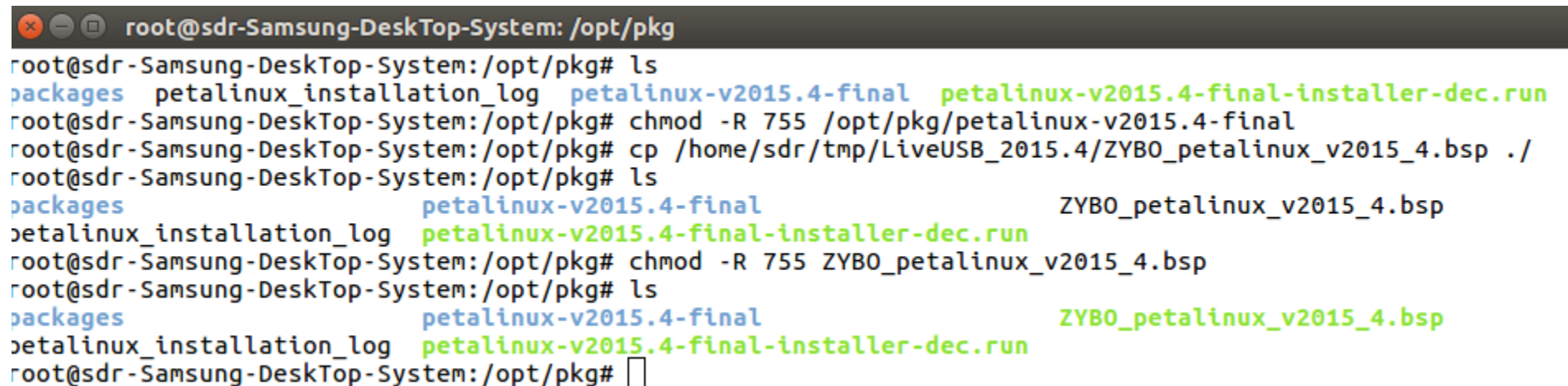
다음으로 아래와 같은 절차를 가지도록 한다.

단 작업을 하는 디렉토리 위치가 /opt/pkg 가 아니라 petalinux_zynq 디렉토리에서 해야 한다.
그곳에 petalinux-v2015.4-final 이 만들어졌기 때문이다.

그리고 cp 명령어는 아래와 같이 입력한다.
먼저 cd 로 디렉토리를 이동한다.

```
cd ~/petalinux_zynq/petalinux-v2015.4-final
cp ~/tmp/LiveUSB_2015.4/ZYBO_petalinux_v2015_4.bsp ./
chmod 755 ZYBO_petalinux_v2015_4.bsp
```

디렉토리 위치만 조심하고 아래와 같은 느낌으로 하면 된다.



```
root@sdr-Samsung-DeskTop-System: /opt/pkg
root@sdr-Samsung-DeskTop-System:/opt/pkg# ls
packages  petalinux_installation_log  petalinux-v2015.4-final  petalinux-v2015.4-final-installer-dec.run
root@sdr-Samsung-DeskTop-System:/opt/pkg# chmod -R 755 /opt/pkg/petalinux-v2015.4-final
root@sdr-Samsung-DeskTop-System:/opt/pkg# cp /home/sdr/tmp/LiveUSB_2015.4/ZYBO_petalinux_v2015_4.bsp ./
root@sdr-Samsung-DeskTop-System:/opt/pkg# ls
packages  petalinux-v2015.4-final  ZYBO_petalinux_v2015_4.bsp
petalinux_installation_log  petalinux-v2015.4-final-installer-dec.run
root@sdr-Samsung-DeskTop-System:/opt/pkg# chmod -R 755 ZYBO_petalinux_v2015_4.bsp
root@sdr-Samsung-DeskTop-System:/opt/pkg# ls
packages  petalinux-v2015.4-final  ZYBO_petalinux_v2015_4.bsp
petalinux_installation_log  petalinux-v2015.4-final-installer-dec.run
root@sdr-Samsung-DeskTop-System:/opt/pkg#
```


어쨌든 이제 petalinux-v2015.4-final 위치에서 아래와 같이 uio 로 이동한다.

```
cd components/linux-kernel/xlnx-4.0/drivers/uio/  
vi uio_pdrv_genirq.c
```

```
/opt/pkg# cd petalinux-v2015.4-final/components/linux-kernel/xlnx-4.0/drivers/uio/  
/opt/pkg/petalinux-v2015.4-final/components/linux-kernel/xlnx-4.0/drivers/uio# vi uio_pdrv_genirq.c
```

#ifdef CONFIG_OF 쪽 부분에 구조체에 내용을 추가해야 한다.

```
root@sdr-Samsung-DeskTop-System: /opt/pkg/petalinux-v2015.4-final/components/linux  
    */  
    return 0;  
}  
  
static const struct dev_pm_ops uio_pdrv_genirq_dev_pm_ops = {  
    .runtime_suspend = uio_pdrv_genirq_runtime_nop,  
    .runtime_resume = uio_pdrv_genirq_runtime_nop,  
};  
  
#ifdef CONFIG_OF  
static struct of_device_id uio_of_genirq_match[] = {  
    { /* This is filled with module_parm */ },  
    { /* Sentinel */ },  
};  
MODULE_DEVICE_TABLE(of, uio_of_genirq_match);  
module_param_string(of_id, uio_of_genirq_match[0].compatible, 128, 0);  
MODULE_PARM_DESC(of_id, "Openfirmware id of the device to be handled by uio");  
#endif  
  
static struct platform_driver uio_pdrv_genirq = {  
    .probe = uio_pdrv_genirq_probe,  
    .remove = uio_pdrv_genirq_remove,  
    .driver = {
```

뭐 아무튼 아래와 같이 구조체에 내용을 추가하도록 한다.

```
root@sdr-Samsung-DeskTop-System: /opt/pkg/petalinux-v2015.4-final/components/linux
    */
    return 0;
}

static const struct dev_pm_ops uio_pdrv_genirq_dev_pm_ops = {
    .runtime_suspend = uio_pdrv_genirq_runtime_nop,
    .runtime_resume = uio_pdrv_genirq_runtime_nop,
};

#ifdef CONFIG_OF
static struct of_device_id uio_of_genirq_match[] = {
    { .compatible = "generic-uio", },
    { /* This is filled with module_parm */ },
    { /* Sentinel */ },
};
MODULE_DEVICE_TABLE(of, uio_of_genirq_match);
module_param_string(of_id, uio_of_genirq_match[0].compatible, 128, 0);
MODULE_PARM_DESC(of_id, "Openfirmware id of the device to be handled by uio");
#endif

static struct platform_driver uio_pdrv_genirq = {
    .probe = uio_pdrv_genirq_probe,
    .remove = uio_pdrv_genirq_remove,
-- INSERT --
```

이제 home 디렉토리의 .bashrc 를 아래와 같이 수정하도록 하자!
아래와 같은 명령어를 입력한다.

```
vi ~/.bashrc
```

그리고 맨 아래쪽으로 이동해서 맨 아래 source /home/sdr 부분을 입력해주면 된다.

```
# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi
source /home/sdr/petalinux_zynq/petalinux-v2015.4-final/settings.sh
```

119,1

Bot

그리고 source ~/.bashrc 를 한 번 입력해준다.
추가적으로 뒤쪽에서 sudo su - 를 하는 부분이 있다.
해당 내용을 해준 이후에도 pwd 로 이 경로를 파악해 두었다가

source 파악한경로/.bashrc 를 해서 petalinux 작업을 수행하도록 한다.

이제 아래와 같은 명령어를 입력해서 test 프로젝트를 만들어보도록 한다.
아래와 같이 ls 를 했을때 test 디렉토리가 보이면 된다.

```
sdr@sdr-Samsung-DeskTop-System: ~/fpga_test
sdr@sdr-Samsung-DeskTop-System:~$ mkdir fpga_test
sdr@sdr-Samsung-DeskTop-System:~$ cd fpga_test/
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ petalinux-create -t project -n test --template zynq
INFO: Create project: test
INFO: New project successfully created in /home/sdr/fpga_test/test
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ ls
test
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$
```

이제 BSP(Board Support Package)를 기반으로 프로젝트를 만들어보자.
추가적으로 앞서 만든 test 디렉토리를 rm 명령어를 활용하여 지워준다.

```
sdr@sdr-Samsung-DeskTop-System: ~/fpga_test
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ ls
test
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ ls
test
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ cp ~/tmp/LiveUSB_2015.4/ZYBO_petalinux_v2015_4.bsp .
/
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ ls
test ZYBO_petalinux_v2015_4.bsp
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ petalinux-create -t project -s ZYBO_petalinux_v2015_4.bsp
INFO: Create project:
INFO: Projects:
INFO: * ZYBO_petalinux_v2015_4
INFO: has been successfully installed to /home/sdr/fpga_test/
INFO: New project successfully created in /home/sdr/fpga_test/
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ ls
test ZYBO_petalinux_v2015_4 ZYBO_petalinux_v2015_4.bsp
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ rm -rf test
sdr@sdr-Samsung-DeskTop-System:~/fpga_test$ petalinux-build
```

아래와 같이 petalinux-build 를 입력하면 파일을 찾을 수 없다며 에러가 나는데 아래와 같이 sudo dpkg-reconfigure dash 를 입력한다.

```
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYBO_petalinux_v2015_4
sdr@sdr-Samsung-DeskTop-System:~/zynq_test$ ls
ZYBO_petalinux_v2015_4  ZYBO_petalinux_v2015_4.bsp
sdr@sdr-Samsung-DeskTop-System:~/zynq_test$ cd ZYBO_petalinux_v2015_4/
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ petalinux-build
INFO: Checking component...
INFO: Generating make files and build linux
INFO: Generating make files for the subcomponents of linux
INFO: Building linux
[ERROR] make[1]: *** linux-kernel: No such file or directory.  Stop.
ERROR: Failed to build linux
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ ls
build  components  config.project  hardware  hw-description  pre-built  subsystems
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ petalinux-build
INFO: Checking component...
INFO: Generating make files and build linux
INFO: Generating make files for the subcomponents of linux
INFO: Building linux
[ERROR] make[1]: *** linux-kernel: No such file or directory.  Stop.
ERROR: Failed to build linux
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ sudo dpkg-reconfigure dash
```

화면이 나오면 No 를 선택한다.

이제 다시 petalinux-build 를 해보자!

```
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYBO_petalinux_v2015_4
ERROR: Failed to build linux
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ ls
build components config.project hardware hw-description pre-built subsystems
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ petalinux-build
INFO: Checking component...
INFO: Generating make files and build linux
INFO: Generating make files for the subcomponents of linux
INFO: Building linux
[ERROR] make[1]: *** linux-kernel: No such file or directory. Stop.
ERROR: Failed to build linux
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ sudo dpkg-reconfigure dash
[sudo] password for sdr:
Removing 'diversion of /bin/sh to /bin/sh.distrib by dash'
Adding 'diversion of /bin/sh to /bin/sh.distrib by bash'
Removing 'diversion of /usr/share/man/man1/sh.1.gz to /usr/share/man/man1/sh.distrib.1.gz by dash'
Adding 'diversion of /usr/share/man/man1/sh.1.gz to /usr/share/man/man1/sh.distrib.1.gz by bash'
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ petalinux-build
INFO: Checking component...
INFO: Generating make files and build linux
INFO: Generating make files for the subcomponents of linux
INFO: Building linux
[INFO ] pre-build linux/rootfs/fwupgrade
[INFO ] pre-build linux/rootfs/gpio-demo
[INFO ] pre-build linux/rootfs/peekpoke
[INFO ] build system.dtb
[INFO ] build linux/kernel
```

package-subsystem-FIT 에러가 나는데 패키지를 설치해야 함을 의미한다.
아래쪽에 `sudo apt-get` 부분은 무시하고 다음 페이지를 보도록 한다.

```
[INFO ] install sys_init
[INFO ] install linux/rootfs/fwupgrade
[INFO ] install linux/rootfs/gpio-demo
[INFO ] install linux/rootfs/peekpoke
[INFO ] install kernel in-tree modules
[INFO ] modules_install linux/kernel
[INFO ] post-install linux/rootfs/fwupgrade
[INFO ] post-install linux/rootfs/gpio-demo
[INFO ] post-install linux/rootfs/peekpoke
[INFO ] package rootfs.cpio to /home/sdr/zynq_test/ZYB0_petalinux_v2015_4/images/linux
[INFO ] Update and install vmlinux image
[INFO ] vmlinux linux/kernel
[INFO ] install linux/kernel
[INFO ] package zImage
[INFO ] zImage linux/kernel
[INFO ] install linux/kernel
[ERROR] ERROR: Invalid ELF file '/home/sdr/zynq_test/ZYB0_petalinux_v2015_4/images/linux/vmlinux'
[ERROR] make[1]: *** [package-subsystem-FIT] Error 255
ERROR: Failed to build linux
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYB0_petalinux_v2015_4$ sudo apt-get install tofrodos ip
route tftpd-hpa gawk gcc git-core make net-tools libncurses5-dev zlib1g-dev libssl-dev flex bison l
ib32z1 lib32ncurses5 lib32bz2-1.0 lib32stdc++6 libselinux1
Reading package lists... Done
Building dependency tree
Reading state information... Done
E: Unable to locate package lib32bz2-1.0
E: Couldn't find any package by glob 'lib32bz2-1.0'
E: Couldn't find any package by regex 'lib32bz2-1.0'
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYB0_petalinux_v2015_4$ █
```

아래와 같은 명령어를 입력하고 패키지 리스트를 업데이트 하도록 한다.

```
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYBO_petalinux_v2015_4
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ sudo dpkg --add-architecture i386
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ sudo apt-get update
Hit:1 http://kr.archive.ubuntu.com/ubuntu xenial InRelease
Get:2 http://kr.archive.ubuntu.com/ubuntu xenial-updates InRelease [102 kB]
Get:3 http://kr.archive.ubuntu.com/ubuntu xenial-backports InRelease [102 kB]
Get:4 http://kr.archive.ubuntu.com/ubuntu xenial-updates/main amd64 Packages [715 kB]
Get:5 http://kr.archive.ubuntu.com/ubuntu xenial-updates/main i386 Packages [665 kB]
Get:6 http://kr.archive.ubuntu.com/ubuntu xenial-updates/main amd64 DEP-11 Metadata [307 kB]
Get:7 http://kr.archive.ubuntu.com/ubuntu xenial-updates/main DEP-11 64x64 Icons [219 kB]
Get:8 http://kr.archive.ubuntu.com/ubuntu xenial-updates/universe amd64 Packages [582 kB]
Get:9 http://security.ubuntu.com/ubuntu xenial-security InRelease [102 kB]
Get:10 http://kr.archive.ubuntu.com/ubuntu xenial-updates/universe i386 Packages [540 kB]
Get:11 http://kr.archive.ubuntu.com/ubuntu xenial-updates/universe amd64 DEP-11 Metadata [190 kB]
Get:12 http://kr.archive.ubuntu.com/ubuntu xenial-updates/universe DEP-11 64x64 Icons [272 kB]
Get:13 http://kr.archive.ubuntu.com/ubuntu xenial-updates/multiverse amd64 DEP-11 Metadata [5,888 B]
Get:14 http://security.ubuntu.com/ubuntu xenial-security/main amd64 DEP-11 Metadata [67.5 kB]
Get:15 http://kr.archive.ubuntu.com/ubuntu xenial-backports/main amd64 DEP-11 Metadata [3,328 B]
Get:16 http://kr.archive.ubuntu.com/ubuntu xenial-backports/universe amd64 DEP-11 Metadata [4,696 B]
Get:17 http://security.ubuntu.com/ubuntu xenial-security/main DEP-11 64x64 Icons [72.2 kB]
Get:18 http://security.ubuntu.com/ubuntu xenial-security/universe amd64 DEP-11 Metadata [51.3 kB]
Get:19 http://security.ubuntu.com/ubuntu xenial-security/universe DEP-11 64x64 Icons [85.1 kB]
Fetched 4,086 kB in 4s (855 kB/s)
Reading package lists... Done
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$
```



```
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYB0_petalinux_v2015_4$ sudo apt-get install libbz2-1.0:i386
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  gcc-6-base:i386 libc6:i386 libgcc1:i386
Suggested packages:
  glibc-doc:i386 locales:i386
The following NEW packages will be installed:
  gcc-6-base:i386 libbz2-1.0:i386 libc6:i386 libgcc1:i386
0 upgraded, 4 newly installed, 0 to remove and 252 not upgraded.
Need to get 2,358 kB of archives.
After this operation, 10.1 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://kr.archive.ubuntu.com/ubuntu xenial/main i386 gcc-6-base i386 6.0.1-0ubuntu1 [14.3 kB]
Get:2 http://kr.archive.ubuntu.com/ubuntu xenial/main i386 libgcc1 i386 1:6.0.1-0ubuntu1 [46.8 kB]
Get:3 http://kr.archive.ubuntu.com/ubuntu xenial-updates/main i386 libc6 i386 2.23-0ubuntu10 [2,266 kB]
Get:4 http://kr.archive.ubuntu.com/ubuntu xenial/main i386 libbz2-1.0 i386 1.0.6-8 [30.9 kB]
Fetched 2,358 kB in 2s (816 kB/s)
Preconfiguring packages ...
Selecting previously unselected package gcc-6-base:i386.
(Reading database ... 223401 files and directories currently installed.)
Preparing to unpack .../gcc-6-base_6.0.1-0ubuntu1_i386.deb ...
Unpacking gcc-6-base:i386 (6.0.1-0ubuntu1) ...
Selecting previously unselected package libgcc1:i386.
Preparing to unpack .../libgcc1_1%3a6.0.1-0ubuntu1_i386.deb ...
Unpacking libgcc1:i386 (1:6.0.1-0ubuntu1) ...
Selecting previously unselected package libc6:i386.
Preparing to unpack .../libc6_2.23-0ubuntu10_i386.deb ...
Unpacking libc6:i386 (2.23-0ubuntu10) ...
Replacing files in old package libc6-i386 (2.23-0ubuntu10) ...
Selecting previously unselected package libbz2-1.0:i386.
Preparing to unpack .../libbz2-1.0_1.0.6-8_i386.deb ...
Unpacking libbz2-1.0:i386 (1.0.6-8) ...
Processing triggers for libc-bin (2.23-0ubuntu9) ...
Setting up gcc-6-base:i386 (6.0.1-0ubuntu1) ...
Setting up libgcc1:i386 (1:6.0.1-0ubuntu1) ...
Setting up libc6:i386 (2.23-0ubuntu10) ...
Setting up libbz2-1.0:i386 (1.0.6-8) ...
Processing triggers for libc-bin (2.23-0ubuntu9) ...
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYB0_petalinux_v2015_4$
```

위 명령어를 입력하고 y 를 눌러서 설치한다.

아래 명령어도 입력하고 y 를 눌러 설치한다.

```
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYB0_petalinux_v2015_4$ sudo apt-get install tofrodos iproute t
ftpd-hpa gawk gcc git-core make net-tools libncurses5-dev zlib1g-dev libssl-dev flex bison lib32z1 lib32nc
urses5 lib32stdc++6 libselinux1
Reading package lists... Done
Building dependency tree
Reading state information... Done
bison is already the newest version (2:3.0.4.dfsg-1).
flex is already the newest version (2.6.0-11).
gawk is already the newest version (1:4.1.3+dfsg-0.1).
gcc is already the newest version (4:5.3.1-1ubuntu1).
libncurses5-dev is already the newest version (6.0+20160213-1ubuntu1).
libselinux1 is already the newest version (2.4-3build2).
make is already the newest version (4.1-6).
net-tools is already the newest version (1.60-26ubuntu1).
tofrodos is already the newest version (1.7.13+ds-2ubuntu1).
lib32stdc++6 is already the newest version (5.4.0-6ubuntu1~16.04.6).
lib32stdc++6 set to manually installed.
libssl-dev is already the newest version (1.0.2g-1ubuntu4.10).
tftpd-hpa is already the newest version (5.2+20150808-1ubuntu1.16.04.1).
zlib1g-dev is already the newest version (1:1.2.8.dfsg-2ubuntu4.1).
The following additional packages will be installed:
  lib32tinfo5
The following NEW packages will be installed:
  git-core iproute lib32ncurses5 lib32tinfo5 lib32z1
0 upgraded, 5 newly installed, 0 to remove and 252 not upgraded.
Need to get 232 kB of archives.
After this operation, 936 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

이제 다시 petalinux-build 를 해보면 이번엔 아래와 같이 tftpboot 부분에서 문제가 발생하는 것을 볼 수 있다.
루트 파일 시스템에 권한 없이 접근하는 것이 문제가 된 것이다.

```
[INFO ] install system.dtb
[INFO ] install linux/kernel
[INFO ] generate linux/u-boot configuration files
[INFO ] update linux/u-boot source
[INFO ] build linux/u-boot
[INFO ] install linux/u-boot
[INFO ] install sys_init
[INFO ] install linux/rootfs/fwupgrade
[INFO ] install linux/rootfs/gpio-demo
[INFO ] install linux/rootfs/peekpoke
[INFO ] install kernel in-tree modules
[INFO ] modules_install linux/kernel
[INFO ] post-install linux/rootfs/fwupgrade
[INFO ] post-install linux/rootfs/gpio-demo
[INFO ] post-install linux/rootfs/peekpoke
[INFO ] package rootfs.cpio to /home/sdr/zynq_test/ZYBO_petalinux_v2015_4/images/linux
[INFO ] Update and install vmlinux image
[INFO ] vmlinux linux/kernel
[INFO ] install linux/kernel
[INFO ] package zImage
[INFO ] zImage linux/kernel
[INFO ] install linux/kernel
[INFO ] Package HDF bitstream
[INFO ] Failed to copy images to TFTPBOOT /tftpboot
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ sudo apt-get install xinetd tftpd-hpa
```

```
[INFO ] pre-build linux/rootfs/fwupgrade
[INFO ] pre-build linux/rootfs/gpio-demo
[INFO ] pre-build linux/rootfs/peekpoke
[INFO ] build linux/kernel
[INFO ] generate linux/u-boot configuration files
[INFO ] update linux/u-boot source
[INFO ] build linux/u-boot
[INFO ] build zynq_fsbl
[INFO ] build linux/rootfs/fwupgrade
[INFO ] build linux/rootfs/gpio-demo
[INFO ] build linux/rootfs/peekpoke
[INFO ] build kernel in-tree modules
[INFO ] modules linux/kernel
[INFO ] post-build linux/rootfs/fwupgrade
[INFO ] post-build linux/rootfs/gpio-demo
[INFO ] post-build linux/rootfs/peekpoke
[INFO ] pre-install linux/rootfs/fwupgrade
[INFO ] pre-install linux/rootfs/gpio-demo
[INFO ] pre-install linux/rootfs/peekpoke
[INFO ] install system.dtb
[INFO ] install linux/kernel
[INFO ] generate linux/u-boot configuration files
[INFO ] update linux/u-boot source
[INFO ] build linux/u-boot
[INFO ] install linux/u-boot
[INFO ] install sys_init
[INFO ] install linux/rootfs/fwupgrade
[INFO ] install linux/rootfs/gpio-demo
[INFO ] install linux/rootfs/peekpoke
[INFO ] install kernel in-tree modules
[INFO ] modules_install linux/kernel
[INFO ] post-install linux/rootfs/fwupgrade
[INFO ] post-install linux/rootfs/gpio-demo
[INFO ] post-install linux/rootfs/peekpoke
[INFO ] package rootfs.cpio to /home/sdr/zynq_test/ZYBO_petalinux_v2015_4/images/linux
[INFO ] Update and install vmlinux image
[INFO ] vmlinux linux/kernel
[INFO ] install linux/kernel
[INFO ] package zImage
[INFO ] zImage linux/kernel
[INFO ] install linux/kernel
[INFO ] Package HDF bitstream
```

아래와 같이 강제 루트 권한을 활성화 하고 petalinux-build 를 하면 정상적으로 모든 작업이 완료되는 것을 볼 수 있다.

`sudo su -`

위 명령어를 입력하면 강제적으로 root 의 권한을 가진다.
(정확하게는 빌린다는 표현이 맞긴 하다)

아무튼 위 명령어를 입력하면 루트 디렉토리로 이동하므로 현재 위치를 `pwd` 로 확인하고 위 명령어를 입력하고 `cd` 명령어를 입력하여 위치를 확인하도록 한다.

또는 다른 방법으로 아예 bin 위치를 등록해버리면 `sudo` 를 사용해서 호출할 수도 있다.

```
root@sdr-Samsung-DeskTop-System:/home/sdr/zynq_test/ZYBO_petalinux_v2015_4#
```


컴파일한 정보들은 images/linux 에 있음을 아래와 같이 볼 수 있다.

```
[INFO ] Unpack kernel
[INFO ] Package HDF bitstream
root@sdr-Samsung-DeskTop-System: /home/sdr/zynq_test/ZYB0_petalinux_v2015_4# exit
logout
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYB0_petalinux_v2015_4$ ls
build components config.project hardware hw-description images pre-built subsystems
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYB0_petalinux_v2015_4$ ls images/linux/
image.elf      rootfs.cpio.gz  u-boot.bin      u-boot-s.elf    urootfs.cpio.gz  zybo_wrapper.bit
image.ub       system.dtb      u-boot.elf      u-boot.srec     vmlinux           zynq_fsbl.elf
rootfs.cpio    System.map.linux u-boot-s.bin    u-boot-s.srec   zImage
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYB0_petalinux_v2015_4$ █
```

다음으로 qemu 를 설치해보도록 하자(실제 ARM 어셈블리 교육할때도 qemu 를 사용한다)

```
sdr@sdr-Samsung-DeskTop-System: ~
sdr@sdr-Samsung-DeskTop-System: ~$ sudo apt-get install qemu-user-static qemu-system
[sudo] password for sdr:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  binfmt-support cpu-checker ipxe-qemu libaio1 libboost-random1.58.0 libboost-thread1.58.0
  libcacard0 libfdt1 libiscsi2 librados2 librbd1 libspice-server1 libusbredirparser1
  libxen-4.6 libxenstore3.0 msr-tools qemu-block-extra qemu-slof qemu-system-arm
  qemu-system-common qemu-system-mips qemu-system-misc qemu-system-ppc qemu-system-sparc
  qemu-system-x86 qemu-utils seabios sharutils
Suggested packages:
  qemu samba vde2 openbios-ppc openhackware sgabios ovmf debootstrap bsd-mailx | mailx
The following NEW packages will be installed:
  binfmt-support cpu-checker ipxe-qemu libaio1 libboost-random1.58.0 libboost-thread1.58.0
  libcacard0 libfdt1 libiscsi2 librados2 librbd1 libspice-server1 libusbredirparser1
  libxen-4.6 libxenstore3.0 msr-tools qemu-block-extra qemu-slof qemu-system
  qemu-system-arm qemu-system-common qemu-system-mips qemu-system-misc qemu-system-ppc
  qemu-system-sparc qemu-system-x86 qemu-user-static qemu-utils seabios sharutils
0 upgraded, 30 newly installed, 0 to remove and 252 not upgraded.
Need to get 41.1 MB of archives.
After this operation, 281 MB of additional disk space will be used.
Do you want to continue? [Y/n] y█
```

아래 명령어를 입력하여 cross tool 의 일부를 설치한다.

```
sdr@sdr-Samsung-DeskTop-System: ~  
sdr@sdr-Samsung-DeskTop-System:~$ sudo apt-get install linaro-image-tools  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:  
  btrfs-tools python-apt python-chardet python-dbus python-debian python-gi  
  python-linaro-image-tools python-parted python-pkg-resources python-six python-yaml  
Suggested packages:  
  python-apt-dbg python-apt-doc python-dbus-doc python-dbus-dbg python-gi-cairo  
  python-setuptools  
Recommended packages:  
  udisks  
The following NEW packages will be installed:  
  btrfs-tools linaro-image-tools python-apt python-chardet python-dbus python-debian  
  python-gi python-linaro-image-tools python-parted python-pkg-resources python-six  
  python-yaml  
0 upgraded, 12 newly installed, 0 to remove and 252 not upgraded.  
Need to get 1,522 kB of archives.  
After this operation, 8,472 kB of additional disk space will be used.  
Do you want to continue? [Y/n] y
```

아래 명령어를 입력하여 cross tool 의 일부를 설치한다.

```
sdr@sdr-Samsung-DeskTop-System: ~  
sdr@sdr-Samsung-DeskTop-System:~$ sudo apt-get install linaro-image-tools  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:  
  btrfs-tools python-apt python-chardet python-dbus python-debian python-gi  
  python-linaro-image-tools python-parted python-pkg-resources python-six python-yaml  
Suggested packages:  
  python-apt-dbg python-apt-doc python-dbus-doc python-dbus-dbg python-gi-cairo  
  python-setuptools  
Recommended packages:  
  udisks  
The following NEW packages will be installed:  
  btrfs-tools linaro-image-tools python-apt python-chardet python-dbus python-debian  
  python-gi python-linaro-image-tools python-parted python-pkg-resources python-six  
  python-yaml  
0 upgraded, 12 newly installed, 0 to remove and 252 not upgraded.  
Need to get 1,522 kB of archives.  
After this operation, 8,472 kB of additional disk space will be used.  
Do you want to continue? [Y/n] y
```

아래 명령어를 입력하여 Cross Compiler 를 설치한다.

```
sdr@sdr-Samsung-DeskTop-System: ~  
sdr@sdr-Samsung-DeskTop-System:~$ ls  
Desktop      Downloads      fpga    my_proj      Pictures  Templates  zynq_test  
Documents    examples.desktop Music    petalinux_zynq Public      Videos  
sdr@sdr-Samsung-DeskTop-System:~$ sudo apt-get install gcc-arm-linux-gnueabi  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:  
  binutils-arm-linux-gnueabi cpp-5-arm-linux-gnueabi cpp-arm-linux-gnueabi gcc-5-arm-linux-gnueabi  
  gcc-5-arm-linux-gnueabi-base gcc-5-cross-base libasan2-armel-cross libatomic1-armel-cross  
  libc6-armel-cross libc6-dev-armel-cross libgcc-5-dev-armel-cross libgcc1-armel-cross  
  libgomp1-armel-cross libstdc++6-armel-cross libubsan0-armel-cross linux-libc-dev-armel-cross  
Suggested packages:  
  binutils-doc gcc-5-locales cpp-doc gcc-5-multilib-arm-linux-gnueabi gcc-5-doc  
  libgcc1-dbg-armel-cross libgomp1-dbg-armel-cross libitm1-dbg-armel-cross  
  libatomic1-dbg-armel-cross libasan2-dbg-armel-cross liblsan0-dbg-armel-cross  
  libtsan0-dbg-armel-cross libubsan0-dbg-armel-cross libcilkrts5-dbg-armel-cross  
  libmpx0-dbg-armel-cross libquadmath0-dbg-armel-cross gdb-arm-linux-gnueabi gcc-doc  
The following packages will be REMOVED:  
  gcc-multilib  
The following NEW packages will be installed:  
  binutils-arm-linux-gnueabi cpp-5-arm-linux-gnueabi cpp-arm-linux-gnueabi gcc-5-arm-linux-gnueabi  
  gcc-5-arm-linux-gnueabi-base gcc-5-cross-base gcc-arm-linux-gnueabi libasan2-armel-cross  
  libatomic1-armel-cross libc6-armel-cross libc6-dev-armel-cross libgcc-5-dev-armel-cross  
  libgcc1-armel-cross libgomp1-armel-cross libstdc++6-armel-cross libubsan0-armel-cross  
  linux-libc-dev-armel-cross  
0 upgraded, 17 newly installed, 1 to remove and 252 not upgraded.  
Need to get 19.3 MB of archives.  
After this operation, 62.0 MB of additional disk space will be used.  
Do you want to continue? [Y/n] y
```


아무런 간단한 프로그램을 하나 만들고 Cross Compiler 로 컴파일 한다.
이 파일을 `readelf -h a.out` 으로 보면 ARM 머신용인것도 확인할 수 있는데 타이핑하진 않았다.
아무튼 아래와 같이 명령을 입력하면 만든 프로그램이 실행되는 것을 볼 수 있을 것이다.
즉 `qemu` 가 잘 깔려서 ARM 환경을 구동할 수 있게 되었음을 의미한다.

```
Setting up libasan2-armel-cross (5.4.0-6ubuntu1~16.04.4cross1) ...
Setting up libstdc++6-armel-cross (5.4.0-6ubuntu1~16.04.4cross1) ...
Setting up libubsan0-armel-cross (5.4.0-6ubuntu1~16.04.4cross1) ...
Setting up libgcc-5-dev-armel-cross (5.4.0-6ubuntu1~16.04.4cross1) ...
Setting up gcc-5-arm-linux-gnueabi (5.4.0-6ubuntu1~16.04.4cross1) ...
Setting up gcc-arm-linux-gnueabi (4:5.3.1-1ubuntu1) ...
Setting up linux-libc-dev-armel-cross (4.4.0-18.34cross1) ...
Setting up libc6-dev-armel-cross (2.23-0ubuntu3cross1) ...
Processing triggers for libc-bin (2.23-0ubuntu9) ...
sdr@sdr-Samsung-DeskTop-System:~$ ls
Desktop    Downloads      fpga    my_proj    Pictures    Templates    zynq_test
Documents  examples.desktop Music    petalinux_zynq Public      Videos
sdr@sdr-Samsung-DeskTop-System:~$ mkdir test
sdr@sdr-Samsung-DeskTop-System:~$ ls
Desktop    Downloads      fpga    my_proj    Pictures    Templates    Videos
Documents  examples.desktop Music    petalinux_zynq Public      test        zynq_test
sdr@sdr-Samsung-DeskTop-System:~$ cd test
sdr@sdr-Samsung-DeskTop-System:~/test$ mkdir c
sdr@sdr-Samsung-DeskTop-System:~/test$ cd c
sdr@sdr-Samsung-DeskTop-System:~/test/c$ ls
sdr@sdr-Samsung-DeskTop-System:~/test/c$ vi hello.c
sdr@sdr-Samsung-DeskTop-System:~/test/c$ gcc hello.c
sdr@sdr-Samsung-DeskTop-System:~/test/c$ arm-linux-gnueabi-gcc hello.c
sdr@sdr-Samsung-DeskTop-System:~/test/c$ qemu-arm-static -L /usr/arm-linux-gnueabi ./a.out
Hello
sdr@sdr-Samsung-DeskTop-System:~/test/c$ █
```

이제 petalinux-boot --qemu --kernel 을 입력하여 커널을 부팅시켜보자!

```
sdr@sdr-Samsung-DeskTop-System: ~/zynq_test/ZYBO_petalinux_v2015_4
sdr@sdr-Samsung-DeskTop-System:~/zynq_test/ZYBO_petalinux_v2015_4$ petalinux-boot --qemu --kernel
```

부팅후 창이 하나 나오면서 id 랑 pw 를 묻는데 둘 다 root 를 입력하면 된다.

```
can: netlink gateway (rev 20130117) max_hops=1
zynq_pm_ioremap: no compatible node found for 'xlnx,zynq-ddrc-a05'
zynq_pm_late_init: Unable to map DDRC IO memory.
zynq_pm_remap_ocm: no compatible node found for 'xlnx,zynq-ocmc-1.0'
zynq_pm_suspend_init: Unable to map OCM.
Registering SWP/SWPB emulation handler
/home/sdr/petalinux_zynq/petalinux-v2015.4-final/components/linux-kernel/xlnx-
nable to open rtc device (rtc0)
ALSA device list:
  No soundcards found.
Freeing unused kernel memory: 3956K (c0659000 - c0a36000)
INIT: version 2.88 booting
Creating /dev/flash/* device nodes
random: dd urandom read with 0 bits of entropy available
Starting internet superserver: inetd.
update-rc.d: /etc/init.d/run-postinsts exists during rc.d purge (continuing)
  Removing any system startup links for run-postinsts ...
    /etc/rcS.d/S99run-postinsts
INIT: Entering runlevel: 5
Configuring network interfaces... done.
starting Busybox HTTP Daemon: httpd... done.
NET: Registered protocol family 10
IPv6: ADDRCONF(NETDEV_UP): eth0: link is not ready

Built with PetaLinux v2015.4 (Yocto 1.8) ZYBO_petalinux_v2015_4 /dev/ttyPS0
ZYBO_petalinux_v2015_4 login: macb e000b000.ethernet eth0: link up (1000/Full)
IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
root
Password:
login[827]: root login on 'ttyPS0'
root@ZYBO petalinux v2015 4:~#
```

Ctrl + A 누른 이후에 X 를 누르면 종료된다.
이로써 환경 구성은 완벽하다.