QY-IMX6S Linux User Manual

Version No:V2.0

2014.11

QIYANG INTELLIGENT TECHNOLOGY CO., LTD

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Catalogue

Version Update

Version	Hardware	Description	date	Revisor
1.0	QY-IMX6S-V1.1	Launched	2014-02-21	wujj
2.0	QY-IMX6S-V1.2	Update hardware version	2014-11-11	wangwx

Preface

Welcome to use QY-IMX6S from Hangzhou Qiyang Intelligent Technology Co., Ltd.

Here are 4 Linux manual for reference:

QY-IMX6S User manual.pdf

QY-IMX6S Hardware Manual.pdf.

QY-IMX6 Functions and test manual.pdf

QY-IMX6 Image burning manual.pdf

• This manual mainly introduce cross-compilation environment construction, source code and compilation of application routine.

•Before using, please read ***QY-IMX6S Hardware Manual.pdf.***

•Please read this manual carefully before using.

Company Profile:

Zhejiang Qiyang Technology Co., Ltd. is located at the bank of the beautiful West Lake. It is a high and new technology enterprise which is specializing in R&D, manufacture and sell embedded computer main board with high performance, low power consumption, low cost, small volume, and provides embedded hardware solutions.

We Offer:

◆ Research & develop, manufacture and sell embedded module products which have independent intellectual property rights, and cooperate with TI, ATMEL, Cirrus Logic, Freescale, and other famous processor manufacturers. It has launched a series of hardware products, such as ARM development board, ARM core module, ARM industrial board, sound/video decoding transmission platform, supporting tools and software resources which support user for their next embedded design.

◆ We give full play to the technical accumulation in ARM platform and Windows CE, Linux, Android operating system for many users providing custom service (OEM/ODM), to realize embedded products into the market stably, reliably and quickly.

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Ⅰ .Illustration

◆ Build in Linux OS (ubuntu or other Linux release version). Operation Example: ubuntu 12.04. Installation steps, please refer to *Ubuntu Installation for Virtual Machine Manual.PDF*

◆ Copy file to virtual machine [ubuntu] while it is in compiling process, create a directory[mkdir~/work /*], [~]means user catalogue; Absolute Path is[/home/st*/].

All documentations are copied to this directory, users could create directory by themselves. Here just the Example:[~/work]

◆ Please refer to relevant materials about the common commands and vi operation in Linux.

◆ All of the copies of PC and virtual machine adopt samba shared access mode.

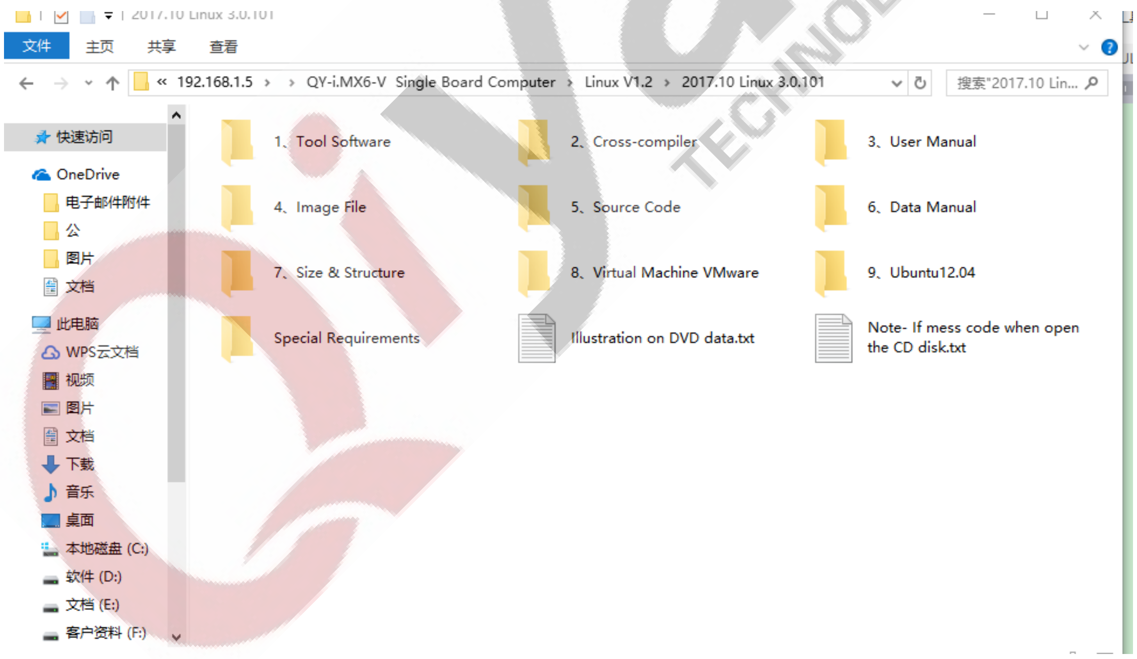
◆ Serial Connect: Use the provided 3 PIN debug port line to connect to PC mainframe's serial port, then the debug port line connect to mainboard's debug port (J6).

◆Network Connect: Connect Ethernet Interface (J13) to Network Interface on PC by network cable.

◆ USB Connect: Connect USB Device(J10) to USB on PC by USB cable

◆ Set Serial Port: Open terminal communication software(minicom or hyper terminal in Windows),select baud rate [115200],stop bit [1], data bit [8], parity bit [none] and data flow control[none]. Then test every serial ports.

◆ Mainboard has CD catalogue, the tools software and code file are in corresponding catalogue in CD. Please ensure that the materials are all in readiness.



Ⅱ .Program Linux System Image

IMX6 has its special programming tool [Mfgtools], please choose the most suitable boot method to burn.

Specific boot method, please refer to ***QY-IMX6S Linux System Image Burning Manual .pdf.***

Ⅲ .Function and Test

File system has integrated test program, after booting, you will find the corresponding test program under the [/user/test] directory.

Specific test method, please refer to ***QY-IMX6S Linux Function and Test Manual.pdf***.

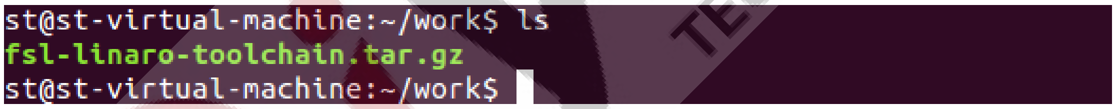
Ⅳ .Install Cross-Compiler Tool Chains

[Bootloader],[kernel] and [fs] need to use the cross-compiler.

All application programs and library files need cross-compiler to compile if running on the mainboard. So we will install the cross-compiler tool chain at first,there is a finished cross-compiler tool in CD. User could use it directly. The GCC version is 4.6.2.

Next, we will introduce "How to install Cross-Compiler Tool Chains?"

Copy [fsl-linaro-toolchain.tar.gz] cross-compiler tool chains to [~/work]directory.

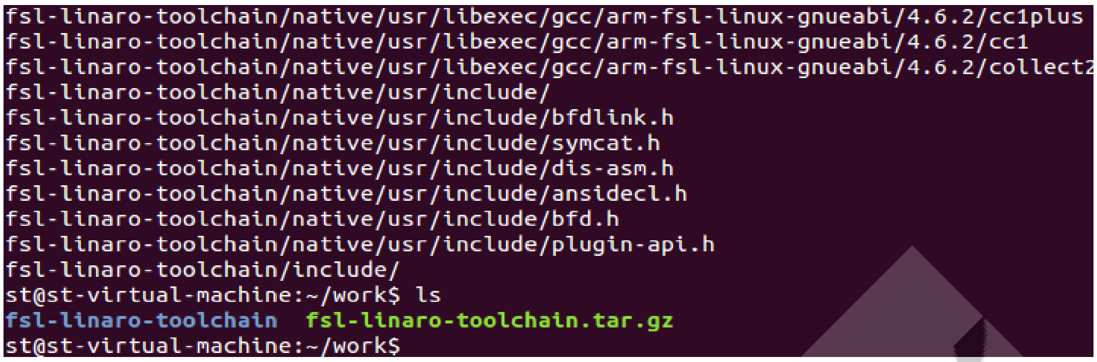


```
st@st-virtual-machine:~/work$ ls
fsl-linaro-toolchain.tar.gz
st@st-virtual-machine:~/work$
```

Use the following command to extract:

$ tar -xzvf fsl-linaro-toolchain.tar.gz

[fsl-linaro-toolchain] will be generated in current directory



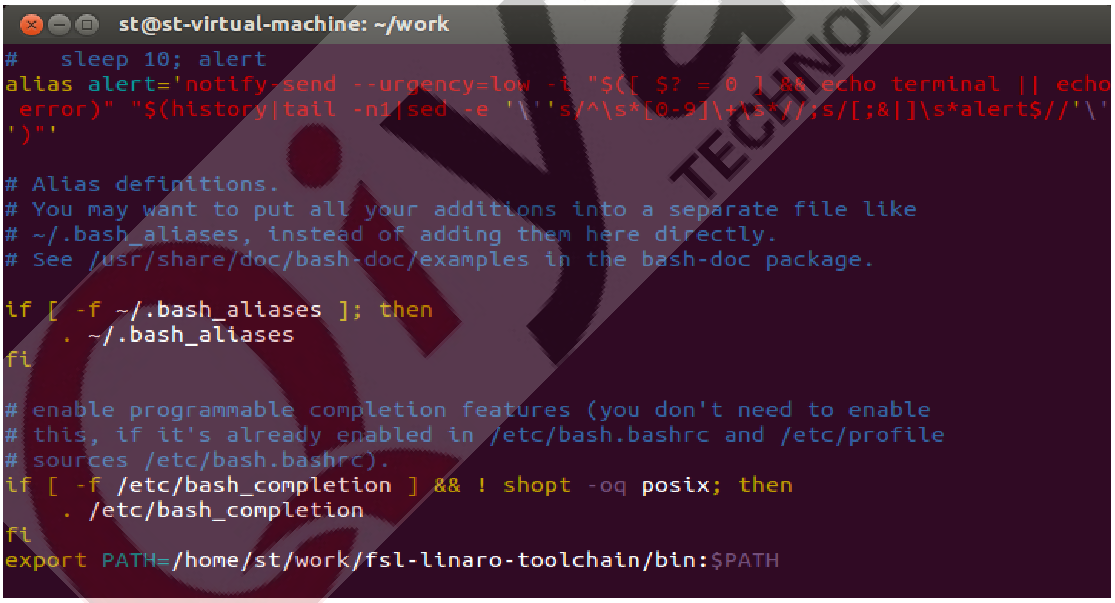
```
fsl-linaro-toolchain/native/usr/libexec/gcc/arm-fsl-linux-gnueabi/4.6.2/cc1plus
fsl-linaro-toolchain/native/usr/libexec/gcc/arm-fsl-linux-gnueabi/4.6.2/cc1
fsl-linaro-toolchain/native/usr/libexec/gcc/arm-fsl-linux-gnueabi/4.6.2/collect2
fsl-linaro-toolchain/native/usr/include/
fsl-linaro-toolchain/native/usr/include/bfdlink.h
fsl-linaro-toolchain/native/usr/include/symcat.h
fsl-linaro-toolchain/native/usr/include/dis-asm.h
fsl-linaro-toolchain/native/usr/include/ansidecl.h
fsl-linaro-toolchain/native/usr/include/bfd.h
fsl-linaro-toolchain/native/usr/include/plugin-api.h
fsl-linaro-toolchain/include/
st@st-virtual-machine:~/work$ ls
fsl-linaro-toolchain  fsl-linaro-toolchain.tar.gz
st@st-virtual-machine:~/work$
```

Add this cross-compilers’ path to system environment variable[PATH],and add to current user’s [bash.bashrc].

$ vi ~/.bashrc

Add the following path in file:

export PATH=/home/st/work/fsl-linaro-toolchain/bin:$PATH



st@st-virtual-machine: ~/work

```
#   sleep 10; alert
alias alert='notify-send --urgency=low -i "$([ $? = 0 ] && echo terminal || echo
 error)" "$(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/[;&|]\s*alert$//'\'
')"'

# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
    . ~/.bash_aliases
fi

# 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 [ -f /etc/bash_completion ] && ! shopt -oq posix; then
    . /etc/bash_completion
fi
export PATH=/home/st/work/fsl-linaro-toolchain/bin:$PATH
```

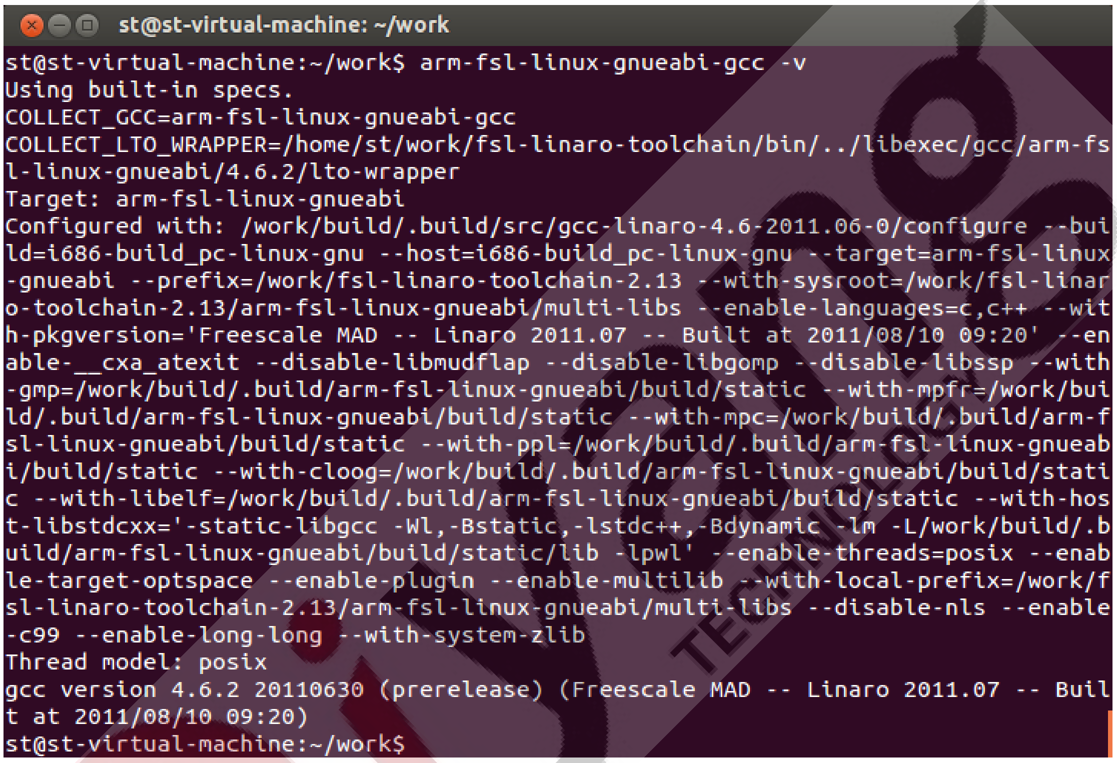
Save & Exit!

Make the new environment variable effective.

$ source ~/.bashrc

After the environment variables taking effect, we confirm whether the cross-compiler is installed successfully：

$ arm-fsl-linux-gnueabi-gcc -v



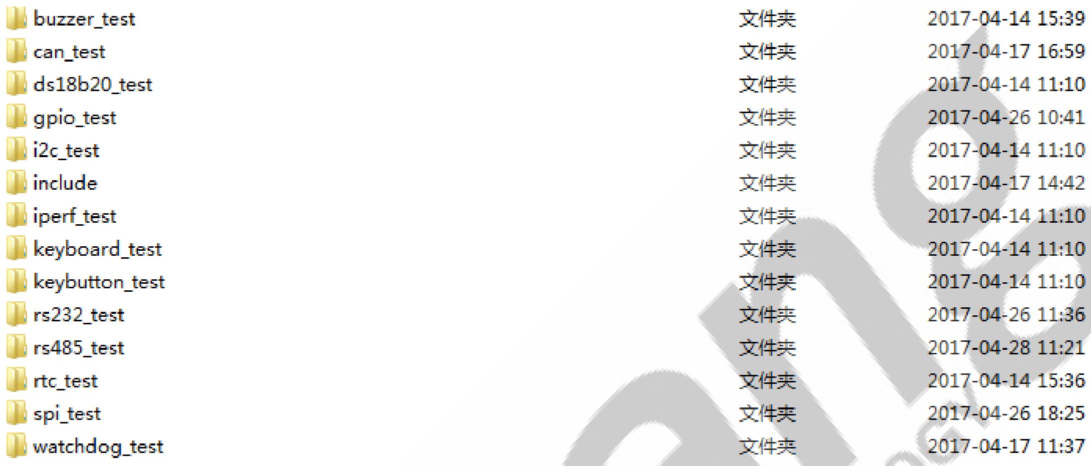
```
st@st-virtual-machine:~/work$ arm-fsl-linux-gnueabi-gcc -v
Using built-in specs.
COLLECT_GCC=arm-fsl-linux-gnueabi-gcc
COLLECT_LTO_WRAPPER=/home/st/work/fsl-linaro-toolchain/bin/../libexec/gcc/arm-fs
l-linux-gnueabi/4.6.2/lto-wrapper
Target: arm-fsl-linux-gnueabi
Configured with: /work/build/.build/src/gcc-linaro-4.6-2011.06-0/configure --bui
ld=i686-build_pc-linux-gnu --host=i686-build_pc-linux-gnu --target=arm-fsl-linux
-gnueabi --prefix=/work/fsl-linaro-toolchain-2.13 --with-sysroot=/work/fsl-linar
o-toolchain-2.13/arm-fsl-linux-gnueabi/multi-libs --enable-languages=c,c++ --wit
h-pkgversion='Freescale MAD -- Linaro 2011.07 -- Built at 2011/08/10 09:20' --en
able-__cxa_atexit --disable-libmudflap --disable-libgomp --disable-libssp --with
-gmp=/work/build/.build/arm-fsl-linux-gnueabi/build/static --with-mpfr=/work/bui
ld/.build/arm-fsl-linux-gnueabi/build/static --with-mpc=/work/build/.build/arm-f
sl-linux-gnueabi/build/static --with-ppl=/work/build/.build/arm-fsl-linux-gnueab
i/build/static --with-cloog=/work/build/.build/arm-fsl-linux-gnueabi/build/stati
c --with-libelf=/work/build/.build/arm-fsl-linux-gnueabi/build/static --with-hos
t-libstdcxx='-static-libgcc -Wl,-Bstatic,-lstdc++,-Bdynamic -lm -L/work/build/.b
uild/arm-fsl-linux-gnueabi/build/static/lib -lpwl' --enable-threads=posix --enab
le-target-optspace --enable-plugin --enable-multilib --with-local-prefix=/work/f
sl-linaro-toolchain-2.13/arm-fsl-linux-gnueabi/multi-libs --disable-nls --enable
-c99 --enable-long-long --with-system-zlib
Thread model: posix
gcc version 4.6.2 20110630 (prerelease) (Freescale MAD -- Linaro 2011.07 -- Buil
t at 2011/08/10 09:20)
st@st-virtual-machine:~/work$
```

As shown, GCC version is 4.6.2.

So far, our cross-compiler are totally installed, then we could use it to compile our source code and application program.

Ⅴ .Compile Test Code

Provide all test codes in [CD/]test code. You can modify and compile according to your own need.



```
buzzer_test        文件夹    2017-04-14 15:39
can_test           文件夹    2017-04-17 16:59
ds18b20_test       文件夹    2017-04-14 11:10
gpio_test          文件夹    2017-04-26 10:41
i2c_test           文件夹    2017-04-14 11:10
include            文件夹    2017-04-17 14:42
iperf_test         文件夹    2017-04-14 11:10
keyboard_test      文件夹    2017-04-14 11:10
keybutton_test     文件夹    2017-04-14 11:10
rs232_test         文件夹    2017-04-26 11:36
rs485_test         文件夹    2017-04-28 11:21
rtc_test           文件夹    2017-04-14 15:36
spi_test           文件夹    2017-04-26 18:25
watchdog_test      文件夹    2017-04-17 11:37
```

Here we take an example of Buzzer test program [buzzer_test] to introduce.

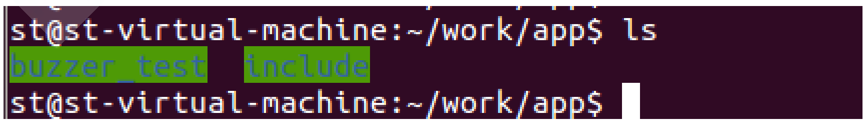
Create [app] file in [~/work], then enter into [app] file.

$ mkdir app

$ cd app

Copy CD/Test code [/buzzer_test] file and [include]file to [app] directory, then enter into [app] directory.

$ ls

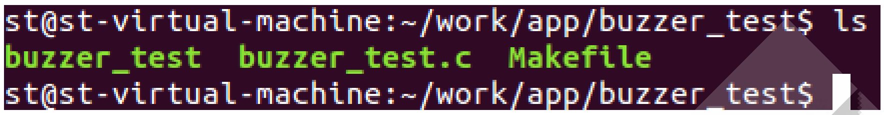


```
st@st-virtual-machine:~/work/app$ ls
buzzer_test  include
st@st-virtual-machine:~/work/app$
```

Enter into [buzzer_test] file.

$ cd buzzer_test

$ ls



```
st@st-virtual-machine:~/work/app/buzzer_test$ ls
buzzer_test  buzzer_test.c  Makefile
st@st-virtual-machine:~/work/app/buzzer_test$ 
```

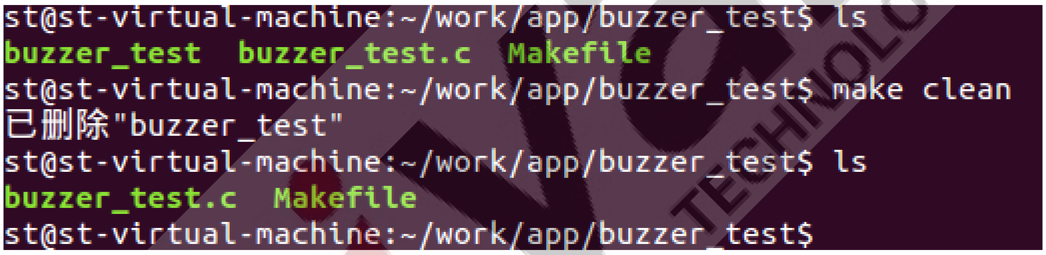
Note: [buzzer_test] is compiled executable application

[Buzzer_test.c] is test code

Including our [Makefile].

Please clear previous compiled content before starting compiling.

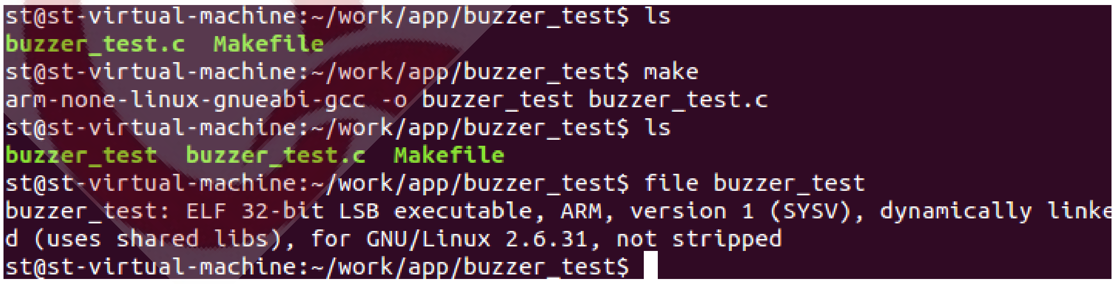
$ make clean



```
st@st-virtual-machine:~/work/app/buzzer_test$ ls
buzzer_test  buzzer_test.c  Makefile
st@st-virtual-machine:~/work/app/buzzer_test$ make clean
已删除"buzzer_test"
st@st-virtual-machine:~/work/app/buzzer_test$ ls
buzzer_test.c  Makefile
st@st-virtual-machine:~/work/app/buzzer_test$
```

Compile test program

$ make



```
st@st-virtual-machine:~/work/app/buzzer_test$ ls
buzzer_test.c  Makefile
st@st-virtual-machine:~/work/app/buzzer_test$ make
arm-none-linux-gnueabi-gcc -o buzzer_test buzzer_test.c
st@st-virtual-machine:~/work/app/buzzer_test$ ls
buzzer_test  buzzer_test.c  Makefile
st@st-virtual-machine:~/work/app/buzzer_test$ file buzzer_test
buzzer_test: ELF 32-bit LSB executable, ARM, version 1 (SYSV), dynamically linke
d (uses shared libs), for GNU/Linux 2.6.31, not stripped
st@st-virtual-machine:~/work/app/buzzer_test$ 
```

The [buzzer_test] is the executable test application program in mainboard.

Ⅵ .Compile u-boot

The migrated [uboot] source code is in CD, users can compile it directly.

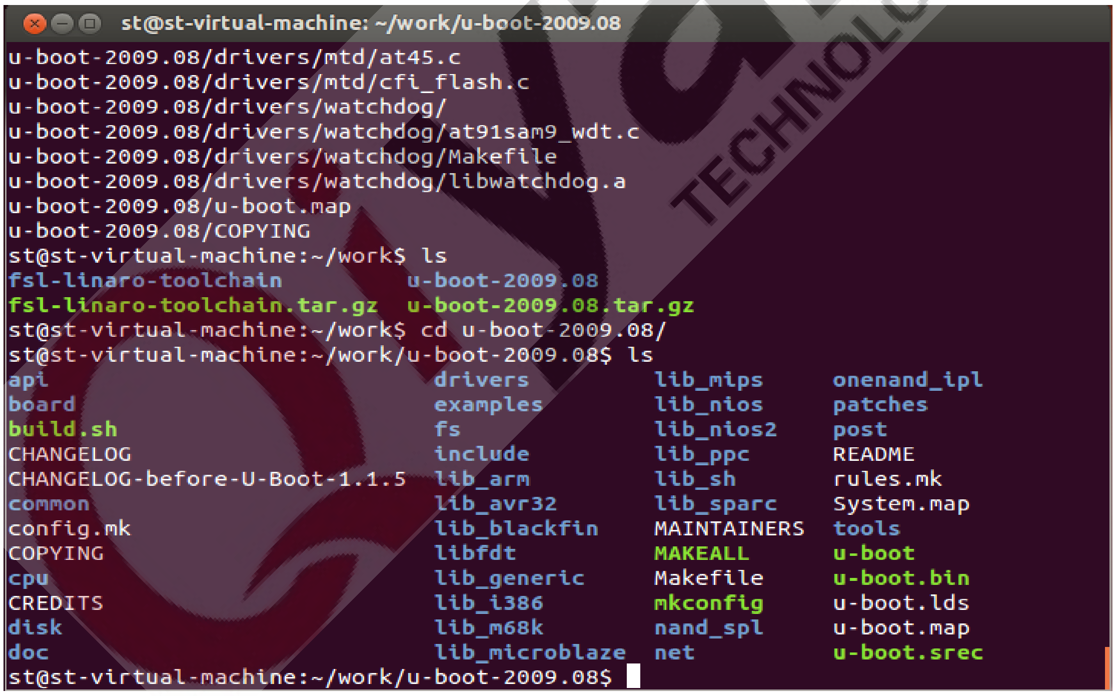
Copy source code of [u-boot] in CD to [~/work]directory, then extract by the following command:

$ tar -xjvf qiyang_uboot_QY_IMX6S_V1.2_XXXX.tar.bz2

After Unzip, get the uboot source folder, Enter this folder.

$ cd qiyang_uboot

$ ls



```
u-boot-2009.08/drivers/mtd/at45.c
u-boot-2009.08/drivers/mtd/cfi_flash.c
u-boot-2009.08/drivers/watchdog/
u-boot-2009.08/drivers/watchdog/at91sam9_wdt.c
u-boot-2009.08/drivers/watchdog/Makefile
u-boot-2009.08/drivers/watchdog/libwatchdog.a
u-boot-2009.08/u-boot.map
u-boot-2009.08/COPYING
st@st-virtual-machine:~/work$ ls
fsl-linaro-toolchain         u-boot-2009.08
fsl-linaro-toolchain.tar.gz  u-boot-2009.08.tar.gz
st@st-virtual-machine:~/work$ cd u-boot-2009.08/
st@st-virtual-machine:~/work/u-boot-2009.08$ ls
api                            drivers        lib_mips     onenand_ipl
board                          examples       lib_nios     patches
build.sh                       fs             lib_nios2    post
CHANGELOG                      include        lib_ppc      README
CHANGELOG-before-U-Boot-1.1.5  lib_arm        lib_sh       rules.mk
common                         lib_avr32      lib_sparc    System.map
config.mk                      lib_blackfin   MAINTAINERS  tools
COPYING                        libfdt         MAKEALL      u-boot
cpu                            lib_generic    Makefile     u-boot.bin
CREDITS                        lib_i386       mkconfig     u-boot.lds
disk                           lib_m68k       nand_spl     u-boot.map
doc                            lib_microblaze net          u-boot.srec
st@st-virtual-machine:~/work/u-boot-2009.08$
```

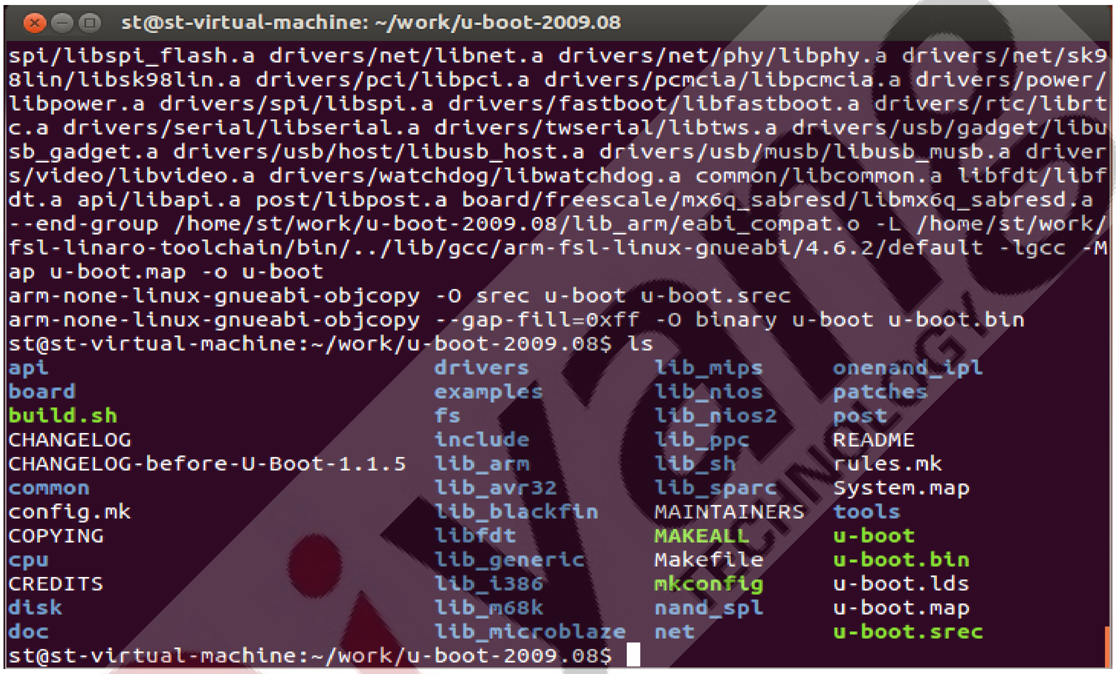
Perform compilation command:

$ make distclean

$make mx6q_qiyang_config

$make

After executing, then compile ,the compiling process will keep about 1-3 minutes. After compiling, the directory will generate image file[u-boot.bin] that can be burnt into mainboard.



```
st@st-virtual-machine: ~/work/u-boot-2009.08
spi/libspi_flash.a drivers/net/libnet.a drivers/net/phy/libphy.a drivers/net/sk9
8lin/libsk98lin.a drivers/pci/libpci.a drivers/pcmcia/libpcmcia.a drivers/power/
libpower.a drivers/spi/libspi.a drivers/fastboot/libfastboot.a drivers/rtc/librt
c.a drivers/serial/libserial.a drivers/twserial/libtws.a drivers/usb/gadget/libu
sb_gadget.a drivers/usb/host/libusb_host.a drivers/usb/musb/libusb_musb.a driver
s/video/libvideo.a drivers/watchdog/libwatchdog.a common/libcommon.a libfdt/libf
dt.a api/libapi.a post/libpost.a board/freescale/mx6q_sabresd/libmx6q_sabresd.a
--end-group /home/st/work/u-boot-2009.08/lib_arm/eabi_compat.o -L /home/st/work/
fsl-linaro-toolchain/bin/../lib/gcc/arm-fsl-linux-gnueabi/4.6.2/default -lgcc -M
ap u-boot.map -o u-boot
arm-none-linux-gnueabi-objcopy -O srec u-boot u-boot.srec
arm-none-linux-gnueabi-objcopy --gap-fill=0xff -O binary u-boot u-boot.bin
st@st-virtual-machine:~/work/u-boot-2009.08$ ls
api                            drivers         lib_mips     onenand_ipl
board                          examples        lib_nios     patches
build.sh                       fs              lib_nios2    post
CHANGELOG                      include         lib_ppc      README
CHANGELOG-before-U-Boot-1.1.5  lib_arm         lib_sh       rules.mk
common                         lib_avr32       lib_sparc    System.map
config.mk                      lib_blackfin    MAINTAINERS  tools
COPYING                        libfdt          MAKEALL      u-boot
cpu                            lib_generic     Makefile     u-boot.bin
CREDITS                        lib_i386        mkconfig     u-boot.lds
disk                           lib_m68k        nand_spl     u-boot.map
doc                            lib_microblaze  net          u-boot.srec
st@st-virtual-machine:~/work/u-boot-2009.08$
```

Ⅶ .Compile Kernel

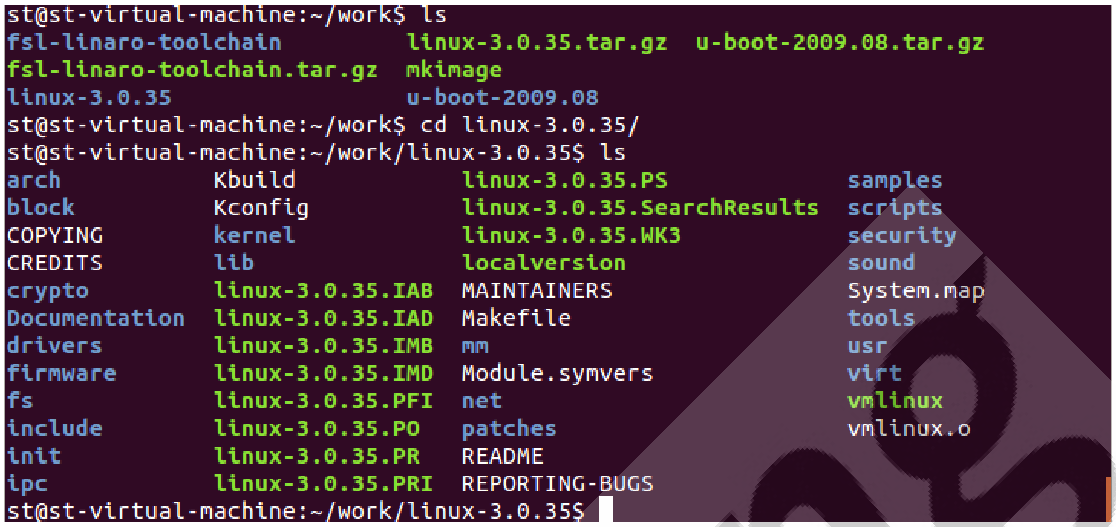
There are configured kernel source files in CD.

Copy kernel source code under \Linux\5, source code \kernel directory to ~/work directory, unzip the kernel source code:

$ tar -xjvf qiyang_kernel_IMX6S_V1.2_XXXX.tar.bz2

After unzip, generated the folder, enter this folder

$ cd qying_kernel

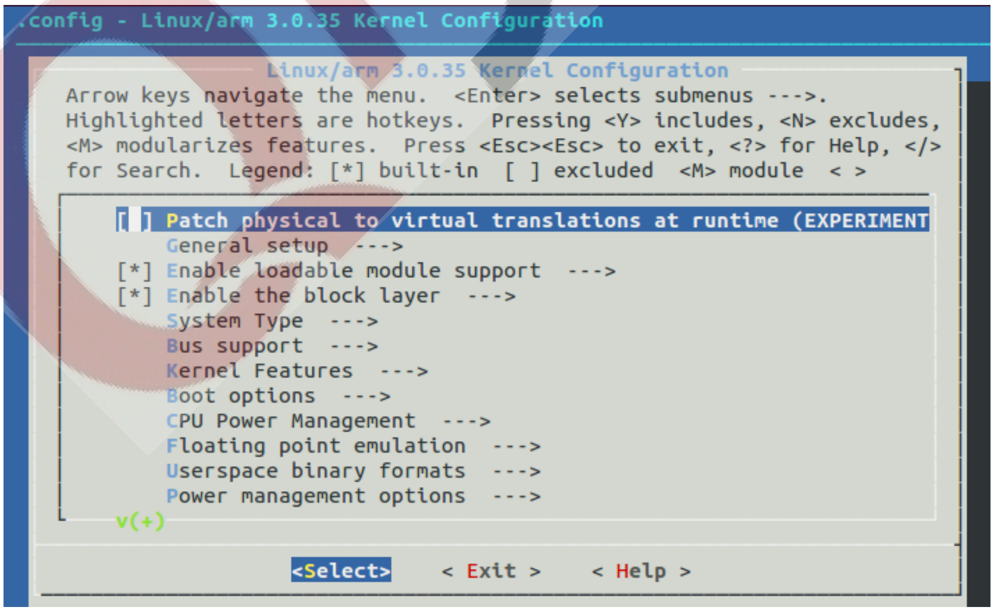


```
st@st-virtual-machine:~/work$ ls
fsl-linaro-toolchain         linux-3.0.35.tar.gz  u-boot-2009.08.tar.gz
fsl-linaro-toolchain.tar.gz  mkimage
linux-3.0.35                 u-boot-2009.08
st@st-virtual-machine:~/work$ cd linux-3.0.35/
st@st-virtual-machine:~/work/linux-3.0.35$ ls
arch           Kbuild             linux-3.0.35.PS             samples
block          Kconfig            linux-3.0.35.SearchResults  scripts
COPYING        kernel             linux-3.0.35.WK3            security
CREDITS        lib                localversion                sound
crypto         linux-3.0.35.IAB   MAINTAINERS                 System.map
Documentation  linux-3.0.35.IAD   Makefile                    tools
drivers        linux-3.0.35.IMB   mm                          usr
firmware       linux-3.0.35.IMD   Module.symvers              virt
fs             linux-3.0.35.PFI   net                         vmlinux
include        linux-3.0.35.PO    patches                     vmlinux.o
init           linux-3.0.35.PR    README
ipc            linux-3.0.35.PRI   REPORTING-BUGS
st@st-virtual-machine:~/work/linux-3.0.35$
```

Before compiling, you need to configure kernel with the following command.

$ make menuconfig

After executing, it will popup the following kernel option configuration interface.

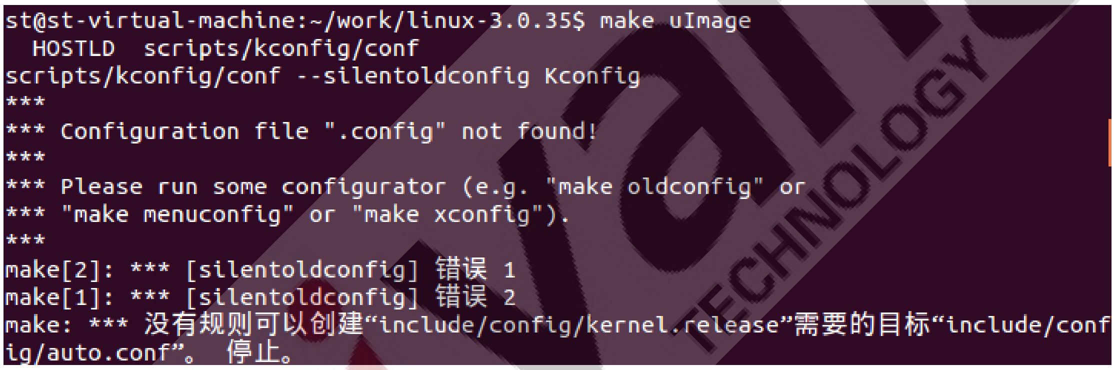


```
.config - Linux/arm 3.0.35 Kernel Configuration
                Linux/arm 3.0.35 Kernel Configuration
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >

      [ ] Patch physical to virtual translations at runtime (EXPERIMENT
          General setup  --->
      [*] Enable loadable module support  --->
      [*] Enable the block layer  --->
          System Type  --->
          Bus support  --->
          Kernel Features  --->
          Boot options  --->
          CPU Power Management  --->
          Floating point emulation  --->
          Userspace binary formats  --->
          Power management options  --->
      v(+)

              <Select>    < Exit >    < Help >
```

Users can make adjustment in kernel function option, about the other configuration and cutting, users can configure them according to your own needs. If you do not have any other special needs, you can use the defaulted kernel option configuration to compile kernel.

Save and exit

Before exiting, please choose "YES" to save configuration. If not, it will hints error as shown:



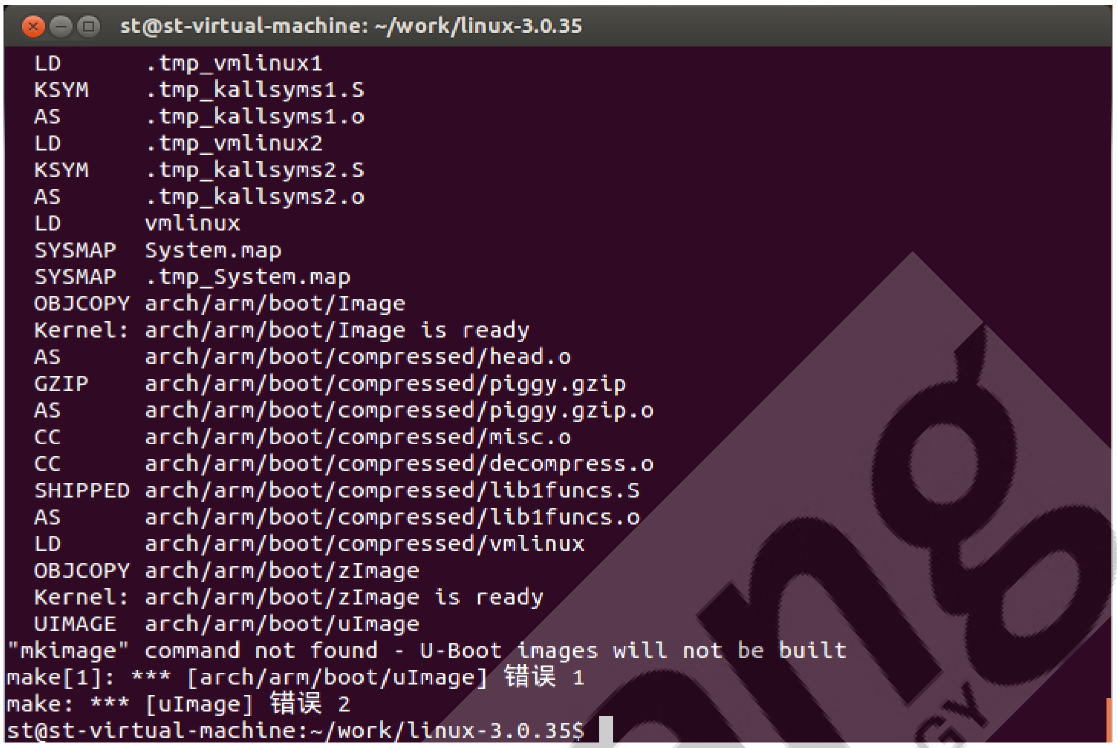
```
st@st-virtual-machine:~/work/linux-3.0.35$ make uImage
  HOSTLD  scripts/kconfig/conf
scripts/kconfig/conf --silentoldconfig Kconfig
***
*** Configuration file ".config" not found!
***
*** Please run some configurator (e.g. "make oldconfig" or
*** "make menuconfig" or "make xconfig").
***
make[2]: *** [silentoldconfig] 错误 1
make[1]: *** [silentoldconfig] 错误 2
make: *** 没有规则可以创建“include/config/kernel.release”需要的目标“include/config/auto.conf”。 停止。
```

Start to compile kernel image

$ make uImage

Start to compile after executing. The initial compiling may need a certain time, Please be patient!

After finishing compiling, generate [uImage], it will hints the following errors:


st@st-virtual-machine: ~/work/linux-3.0.35

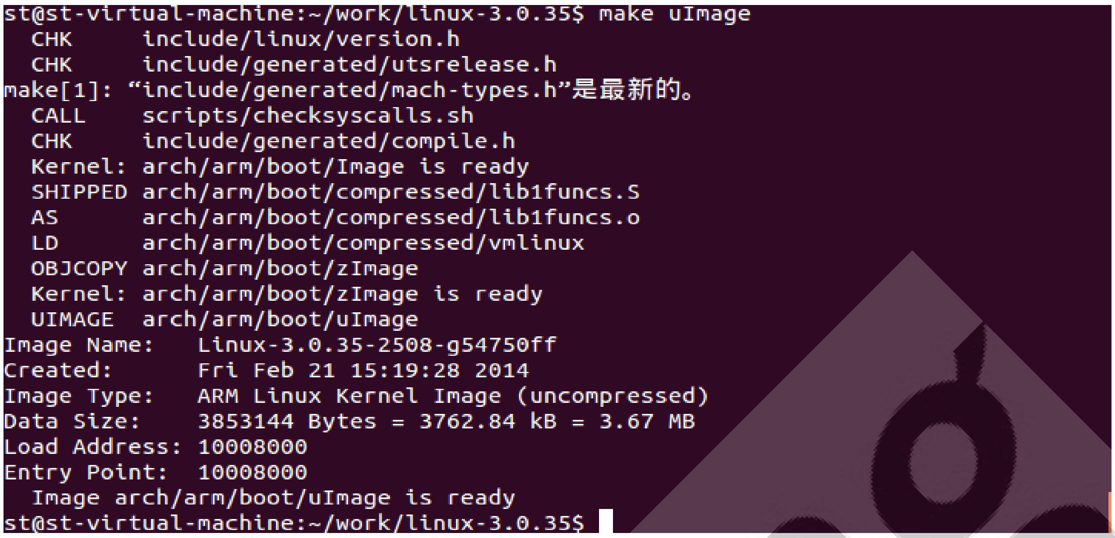
```
  LD      .tmp_vmlinux1
  KSYM    .tmp_kallsyms1.S
  AS      .tmp_kallsyms1.o
  LD      .tmp_vmlinux2
  KSYM    .tmp_kallsyms2.S
  AS      .tmp_kallsyms2.o
  LD      vmlinux
  SYSMAP  System.map
  SYSMAP  .tmp_System.map
  OBJCOPY arch/arm/boot/Image
  Kernel: arch/arm/boot/Image is ready
  AS      arch/arm/boot/compressed/head.o
  GZIP    arch/arm/boot/compressed/piggy.gzip
  AS      arch/arm/boot/compressed/piggy.gzip.o
  CC      arch/arm/boot/compressed/misc.o
  CC      arch/arm/boot/compressed/decompress.o
  SHIPPED arch/arm/boot/compressed/lib1funcs.S
  AS      arch/arm/boot/compressed/lib1funcs.o
  LD      arch/arm/boot/compressed/vmlinux
  OBJCOPY arch/arm/boot/zImage
  Kernel: arch/arm/boot/zImage is ready
  UIMAGE  arch/arm/boot/uImage
"mkimage" command not found - U-Boot images will not be built
make[1]: *** [arch/arm/boot/uImage] 错误 1
make: *** [uImage] 错误 2
st@st-virtual-machine:~/work/linux-3.0.35$
```

Above picture shows lacking [mkimage] command, it needs [mkimage]tool to generate kernel image. Just now we have copied [mkimage]tool to work directory, we should add it to system environment variables, so that the system can use automatically. To be brief, copy [mkimage] to [bin] directory of cross compiler.

$ cp ../mkimage ~/work/fsl-linaro-toolchain/bin/

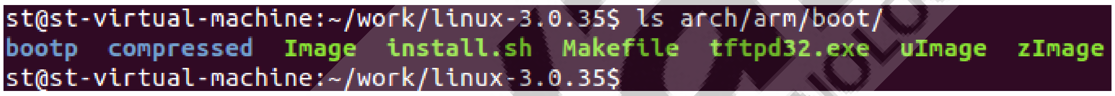
Now we can execute compile command to compile kernel image smoothly.

$ make uImage



```
st@st-virtual-machine:~/work/linux-3.0.35$ make uImage
  CHK     include/linux/version.h
  CHK     include/generated/utsrelease.h
make[1]: “include/generated/mach-types.h”是最新的。
  CALL    scripts/checksyscalls.sh
  CHK     include/generated/compile.h
  Kernel: arch/arm/boot/Image is ready
  SHIPPED arch/arm/boot/compressed/lib1funcs.S
  AS      arch/arm/boot/compressed/lib1funcs.o
  LD      arch/arm/boot/compressed/vmlinux
  OBJCOPY arch/arm/boot/zImage
  Kernel: arch/arm/boot/zImage is ready
  UIMAGE  arch/arm/boot/uImage
Image Name:   Linux-3.0.35-2508-g54750ff
Created:      Fri Feb 21 15:19:28 2014
Image Type:   ARM Linux Kernel Image (uncompressed)
Data Size:    3853144 Bytes = 3762.84 kB = 3.67 MB
Load Address: 10008000
Entry Point:  10008000
  Image arch/arm/boot/uImage is ready
st@st-virtual-machine:~/work/linux-3.0.35$ 
```

After finishing compiling, generate kernel image file[uImage] in [arch/arm/boot/] directory which could be burnt into mainboard.



```
st@st-virtual-machine:~/work/linux-3.0.35$ ls arch/arm/boot/
bootp  compressed  Image  install.sh  Makefile  tftpd32.exe  uImage  zImage
st@st-virtual-machine:~/work/linux-3.0.35$
```

Ⅷ .Develop Application Program

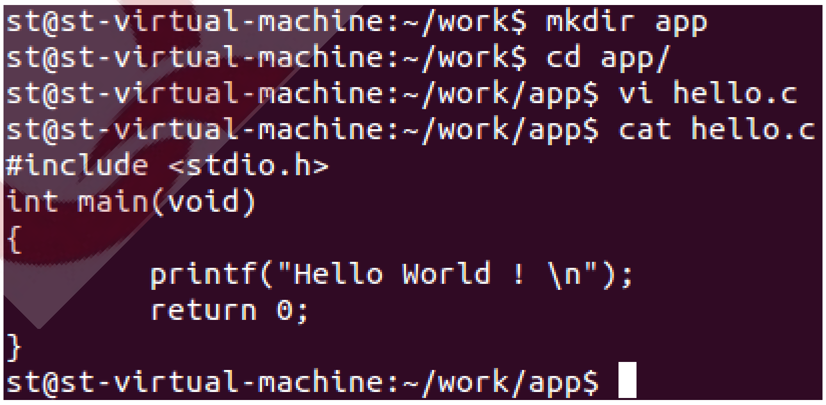
You can develop application program in PC. Here is the sample [Hello World].At first, create [app] folder in [~/work] directory, then enter into the [app]folder:

```
$ mkdir app
$ cd app
```

```
#include <stdio.h>
int main(void)
{
        printf("Hello World ! \n");
        return 0;
}
```

At first, compile [Hello World] program code as follows

Save to [hello.c] file.

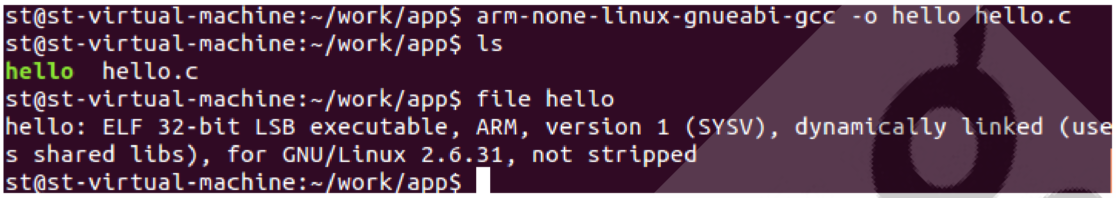


```
st@st-virtual-machine:~/work$ mkdir app
st@st-virtual-machine:~/work$ cd app/
st@st-virtual-machine:~/work/app$ vi hello.c
st@st-virtual-machine:~/work/app$ cat hello.c
#include <stdio.h>
int main(void)
{
        printf("Hello World ! \n");
        return 0;
}
st@st-virtual-machine:~/work/app$
```

Use the installed cross-compiler to compile the application program. Use the following command to compile:

$ arm-fsl-linux-gnueabi-gcc -o hello hello.c

$ file hello



```
st@st-virtual-machine:~/work/app$ arm-none-linux-gnueabi-gcc -o hello hello.c
st@st-virtual-machine:~/work/app$ ls
hello  hello.c
st@st-virtual-machine:~/work/app$ file hello
hello: ELF 32-bit LSB executable, ARM, version 1 (SYSV), dynamically linked (use
s shared libs), for GNU/Linux 2.6.31, not stripped
st@st-virtual-machine:~/work/app$
```

It will generate executable binary file in current directory.

Next, copy the executable program[hello] to mainboard through SD,USB Hardware Disk, tftp, or nfs. Then we could execute the [hello]program in mainboard.

Ⅸ .Add Application Program to File System

As usual, the application programs, libraries and configuration files are placed in file system. Then we just need to burn the file system, do not need to add the application programs, libraries and configuration files manually.

Then we will introduce” How to add the application program to file system?”

The finished file system source code and authoring tool are in CD disk.

Copy file system source code and authoring tool to [~/work] directory.

Create [fs] folder in [~/work] directory.

$ mkdir fs

Move file system source code[rootfs.tar.bz2] to [fs]folder.

$ mv qiyang_filesystem_QY_IMX6S_V1.2_XXXX.tar.bz2 fs/

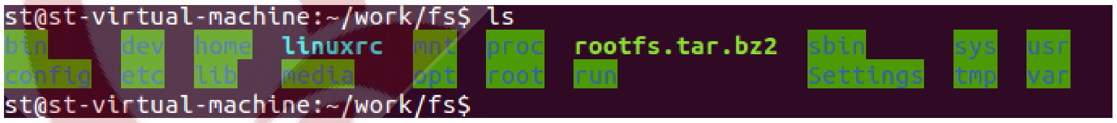
Enter into [fs]folder ,and extract [rootfs.tar.bz2]

The file system needs [root] limitation, then it could do the complete extraction , add [sudo] before the extracting command.

$ cd fs

$ sudo tar -xjvf qiyang_filesystem_QY_IMX6S_V1.2_XXXX.tar.bz2

After extracting, it appears as follows:



```
st@st-virtual-machine:~/work/fs$ ls
bin     dev  home  linuxrc  mnt  proc  rootfs.tar.bz2  sbin      sys  usr
config  etc  lib   media    opt  root  run             Settings  tmp  var
st@st-virtual-machine:~/work/fs$
```

picture 1

Add application programs, libraries, and configuration files to directory respectively in [fs]directory.

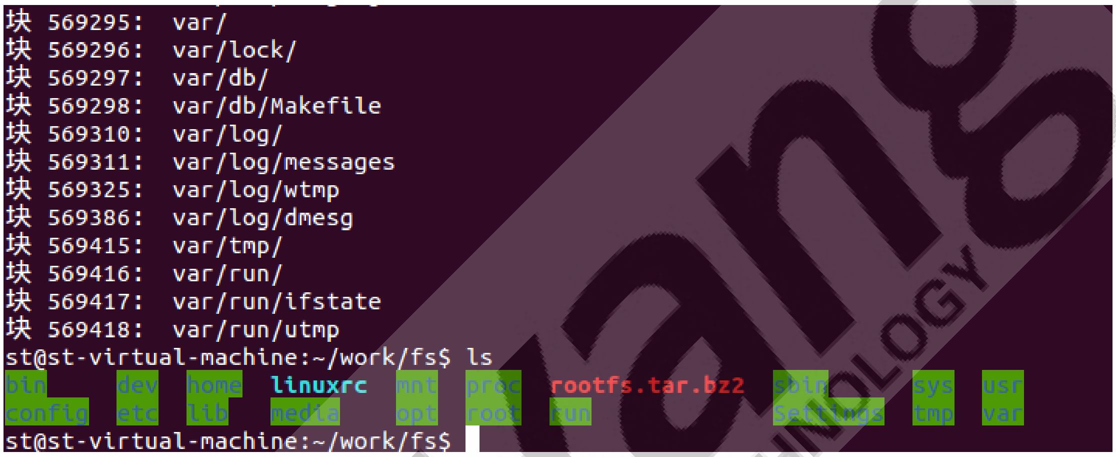
Delete the original file system[rootfs.tar.bz2].

```
$ rm qiyang_filesystem_QY_IMX6S_V1.2_XXXX.tar.bz2
```

Compress file system again.

```
$ sudo tar -jcvf rootfs.tar.bz2 -R *
```

After compressing, generate [rootfs.tar.bz2]file in[fs]directory.



```
块 569295:  var/
块 569296:  var/lock/
块 569297:  var/db/
块 569298:  var/db/Makefile
块 569310:  var/log/
块 569311:  var/log/messages
块 569325:  var/log/wtmp
块 569386:  var/log/dmesg
块 569415:  var/tmp/
块 569416:  var/run/
块 569417:  var/run/ifstate
块 569418:  var/run/utmp
st@st-virtual-machine:~/work/fs$ ls
bin     dev  home  linuxrc  mnt  proc  rootfs.tar.bz2  sbin      sys  usr
config  etc  lib   media    opt  root  run             settings  tmp  var
st@st-virtual-machine:~/work/fs$
```

picture 2

Burn the files into the mainboard, after booting, the mainboard, the application programs, libraries and configuration files are in the corresponding directory in file system.

X .Conclusion

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