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RK1808_Linux_V1.0.0

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Chapter 1 Overview

This SDK is based on Buildroot-2018.02 with its kernel based on kernel 4.4 and contains system source code, drivers, tools and application packages for Linux system development. The SDK also includes NPU development related tools, including rknn_demo (MobileNet SSD), rknn-toolkit and related development documentation, adapted to RK1808 chip platform and is suitable for RK1808 EVB board and its product development.

Chapter 2 Main Functions

Functions	Module Names
Data Communication	Wi-Fi、SDCARD, Ethernet Card, USB
NPU related tools	RKNN_DEMO(MobileNet SSD), rknn-toolkit

Chapter 3 How to Acquire SDK

SDK is released by ROCKCHIP server. Please refer to [chapter 4 SDK compile note](#) to Build development environment.

To get RK1808 Linux software package, customers need an account to access the source code repository provided by Rockchip. Customers apply SDK from ROCKCHIP technology window, must provide SSH public key synchronization server certificate authority to get synchronization code after authorized at the same time. About ROCKCHIP server SSH public key authorization, please refer to [chapter 9 SSH public key instruction](#).

RK1808_LINUX_SDK download address is as follows:

```
repo init --repo-url ssh://git@www.rockchip.com.cn/repo/rk/tools/repo -u
ssh://git@www.rockchip.com.cn/linux/rk/platform/manifests -b linux -m
rk1808_linux_release.xml
```

Repo is a script that google uses Python script to call git. It is mainly used to download and manage software repository of projects. The download address is as follows:

```
git clone ssh://git@www.rockchip.com.cn/repo/rk/tools/repo
```

For customers' convenience to quickly access SDK source code, Rockchip Technology Window usually provides corresponding version of SDK initial compression package. In this way, developers can obtain SDK source code from decompression the initial compression package, which is the same as the one downloaded by repo.

Take rk1808_linux_v1.0.0_20181227.tgz as an example. After copying initialization package, you can get source code by the following command:

```
mkdir rk1808
tar xvf rk1808_linux_v1.0.0_20181227.tgz -C rk1808
cd rk1808
.repo/repo/repo sync -l
.repo/repo/repo sync
```

Developers can update via ".repo/repo/repo sync" command according to update instructions that are regularly released by FAE window.

Chapter 4 SDK Compiling Instruction

Ubuntu 16.04 system:

The installation commands for compiling the packages on which Buildroot environment is built are as follows:

```
sudo apt-get install repo git-core gitk git-gui gcc-arm-linux-gnueabi u-boot-tools device-tree-compiler gcc-aarch64-linux-gnu mtools parted libudev-dev libusb-1.0-0-dev python-linaro-image-tools linaro-image-tools autoconf autotools-dev libsigsegv2 m4 intltool libdrm-dev curl sed make binutils build-essential gcc g++ bash patch gzip bzip2 perl tar cpio python unzip rsync file bc wget libncurses5 libqt4-dev libglib2.0-dev libgtk2.0-dev libglade2-dev cvs git mercurial rsync openssh-client subversion asciidoc w3m dlatex graphviz python-matplotlib libc6:i386
```

Ubuntu 17.04 system:

In addition to the above, the following dependencies is needed:

```
sudo apt-get install lib32gcc-7-dev g++-7 libstdc++-7-dev
```

4.1 Uboot Compiling

Enter project u-boot directory and execute make.sh to get rk1808_loader_v1.01.101.bin trust.img uboot.img:

RK1808 evb board:

```
cd u-boot
./make.sh rk1808
```

The compiled file is in u-boot directory:

```
u-boot/
├── rk1808_loader_v1.01.101.bin
├── trust.img
└── uboot.img
```

4.2 Kernel Compiling Steps

Enter project root directory and execute the following command to automatically compile and package kernel:

RK1808 evb board:

```
cd kernel
make rk1808_linux_defconfig
make rk1808-evb-v10.img -j12
```

After compiling, generate boot.img in kernel directory, including image and dtb of kernel.

4.3 Recovery Compiling Steps

Enter project root directory and execute the following command to automatically complete compiling and packaging of Recovery.

RK1808 evb board:

```
./build.sh recovery
```

Recovery.img is generated in Buildroot directory /output/rockchip_rk1808_recovery/images after compilation.

4.4 rootfs system compiling

Enter project root directory and execute the following commands to automatically complete compilation and packaging of Rootfs.

RK1808 evb board:

```
./build.sh rootfs
```

After compiling, generate rootfs.ext4 in Buildroot directory /output/rockchip_rk1808/images.

Note:

If you need to compile a single module or a third-party application, you need to configure cross-compilation environment.

Cross-compiler tool is located in buildroot/output/rockchip_rk1808/host/usr directory. You need to set bin/ directory of tools and aarch64-rockchip-linux-gnueabi/bin/ directory to environment variables, and execute auto-configuration environment variable script in the top-level directory (only valid for current console):

```
source envsetup.sh
```

Enter the command to view:

```
aarch64-linux-gcc --version
```

When the following log will be printed, configuration is successful:

```
aarch64-linux-gcc.br_real (Buildroot 2018.02-rc3-05646-g17bb6ab) 6.4.0
```

4.5 Fully automatic compiling

Compile various parts of Kernel/Uboot/Recovery/Rootfs above, enter root directory of project directory and execute the following commands to automatically complete all compilation:

```
./build.sh
```

Detail parameter usage, you can help to search, such as

```
Rk1808$ ./build.sh --help
```

Can't found build config, please check again

```
====USAGE: build.sh modules====
```

```
uboot      -build uboot
```


kernel	-build kernel
rootfs	-build default rootfs, currently build buildroot as default
buildroot	-build buildroot rootfs
yocto	-build yocto rootfs, currently build ros as default
ros	-build ros rootfs
debian	-build debian rootfs
pcba	-build pcba
all	-build uboot, kernel, rootfs, recovery image
default	-build all modules

4.6 Firmware Packaging Steps

After compiling various parts of Kernel/Uboot/Recovery/Rootfs above, enter root directory of project directory and execute the following command to automatically complete all firmware packaged into rockdev directory: **`./mkfirmware.sh`**

Chapter 5 Update Instruction

5.1 Windows update Instruction

SDK provides windows update tools (**tools need V2.61 or later version**) which are located in project root directory:

```
tools/
└─ windows/AndroidTool
```

As shown below, after compiling the corresponding firmware, device needs to enter MASKROM mode for update. After connecting usb cable, long press the button "MSROM" and press reset button "RST" and release "Maskrom" button about 2 seconds later, device will enter MASKROM Mode. Then you should load the paths of the corresponding images and click "Run" to start update. Partition offset and update files of MASKROM Mode are shown as follows (Note: Window PC needs to run tools as an administrator to execute):

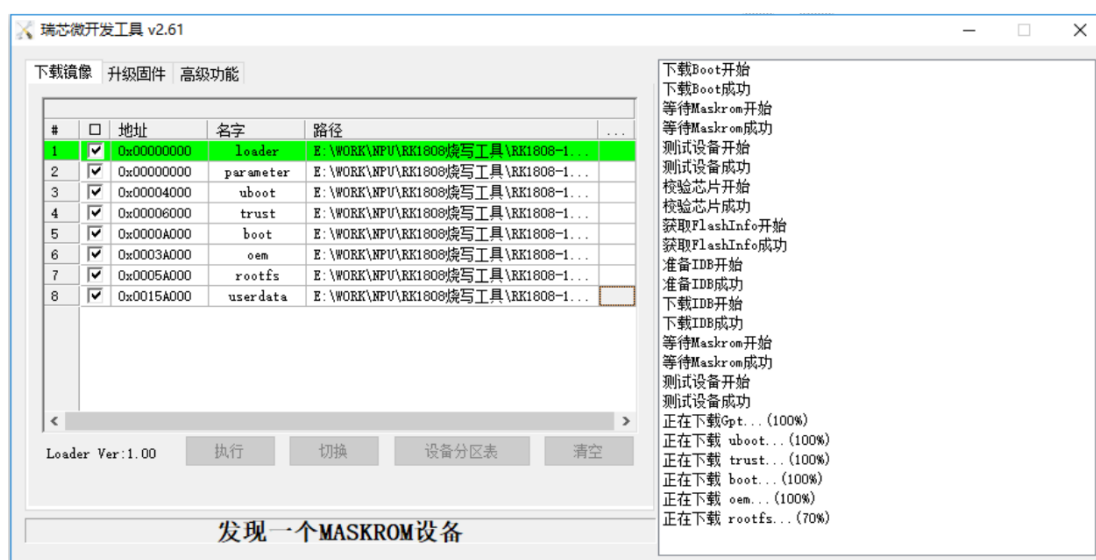


Figure 2 Download tool **AndroidTool.exe**

Note : Before update, need to install the latest USB driver, which is in under the below directory:

```
tools/windows/DriverAssitant_v4.7
```

5.2 Linux update Instruction

The Linux update tool (**Linux_Upgrade_Tool needs v1.38 or later versions**) is located in tools/linux directory. Please make sure your board is connected to maskrom/loader rockusb, if the compiled firmware is in rockdev directory, update commands are as below:

```
sudo ./upgrade_tool ul          rockdev/MiniLoaderAll.bin
sudo ./upgrade_tool di -p       rockdev/parameter.txt
```

```
sudo ./upgrade_tool di -u      rockdev/uboot.img
sudo ./upgrade_tool di -t      rockdev/trust.img
sudo ./upgrade_tool di -misc   rockdev/misc.img
sudo ./upgrade_tool di -b      rockdev/boot.img
sudo ./upgrade_tool di -r      rockdev/recovery.img
sudo ./upgrade_tool di -oem     rockdev/oem.img
sudo ./upgrade_tool di -rootfs  rockdev/rootfs.img
sudo ./upgrade_tool di -userdata rockdev/userdata.img
sudo ./upgrade_tool rd
```

Or in root directory, machine run the following command to upgrade in maskrom state:

```
./rkflash.sh
```

5.3 System partition description

Default partition description (below is RK1808 evb partition reference):

Number	Start (sector)	End (sector)	Size	Code	Name
1	16384	24575	4096K	0700	uboot
2	24576	32767	4096K	700	trust
3	32768	40959	4096K	0700	misc
4	40960	106495	32.0M	0700	boot
5	106496	172031	32.0M	0700	recovery
6	172032	237567	32.0M	0700	backup
7	237568	368639	64.0M	0700	oem
8	368640	3514367	1536M	0700	rootfs
9	3514368	30535646	12.8G	0700	userdata

Uboot partition: update uboot.img Compiled by uboot.

trust partition: update trust.img Compiled by uboot.

misc partition: update misc.img. Use for recovery.

boot partition: update boot.img Compiled by kernel.

recovery partition: update recovery.img.

backup partition: Reserved, temporarily useless. Used for backup of recovery like android in future.

oem partition: Used by manufacturer to store manufacturer's app or data. Read only. Replace the data partition of original speakers. Mounted in /oem directory

rootfs partition: Store rootfs.img compiled by buildroot or debian, read only.

userdata partition: Store files temporarily generated by app or for end users. Read and write, mounted in /userdata directory.

Chapter 6 RK1808 Linux project directory introduction

There are buildroot、app、kernel、u-boot、device、docs、external and other directories in the project directory. Each directory or its sub-directories will correspond to a git project, and the submission should be done in the respective directory.

- 1) buildroot: customize root file system;
- 2) app: store the upper application app, mainly some test applications;
- 3) external: related libraries, including audio, video, network and so on;
- 4) kernel: kernel source code.
- 5) device/rockchip/rk1808: Store some scripts and prepared files for compiling and packaging firmware.
- 6) docs: Store project help files.
- 7) prebuilts: Store cross-compilation toolchain.
- 8) rkbin: Store firmware and tools.
- 9) rockdev: Store compiled output firmware
- 10) tools: Store some common tools.
- 11) u-boot: uboot code

Chapter 7 RK1808 SDK firmware

RK1808_Linux_V1.0.0_20181227 firmware can be downloaded from the following address:

<https://eyun.baidu.com/s/3dnvh90>

Chapter 8 RK1808 NPU related development tools

This SDK contains a rknn_demo (MobileNet SSD). For details, see docs/SoC platform relate/RK1808/Rockchip RKNN_DEMO Module Development Guide V0.1.pdf in project directory.

This SDK contains rknn-toolkit, and tools are placed in project directory external/rknpu/rknn-toolkit. For details instructions, please refer to document docs/SoC platform relate/RK1808/RKNN-Toolkit User Guide_V0.9.6.pdf.

RK1808 RKNN interfaces description please refer to document docs/SoC platform relate/RK1808/RK1808_RKNN_SDK development guide_V0.9.6.pdf

Chapter 9 SSH Public Key Operation

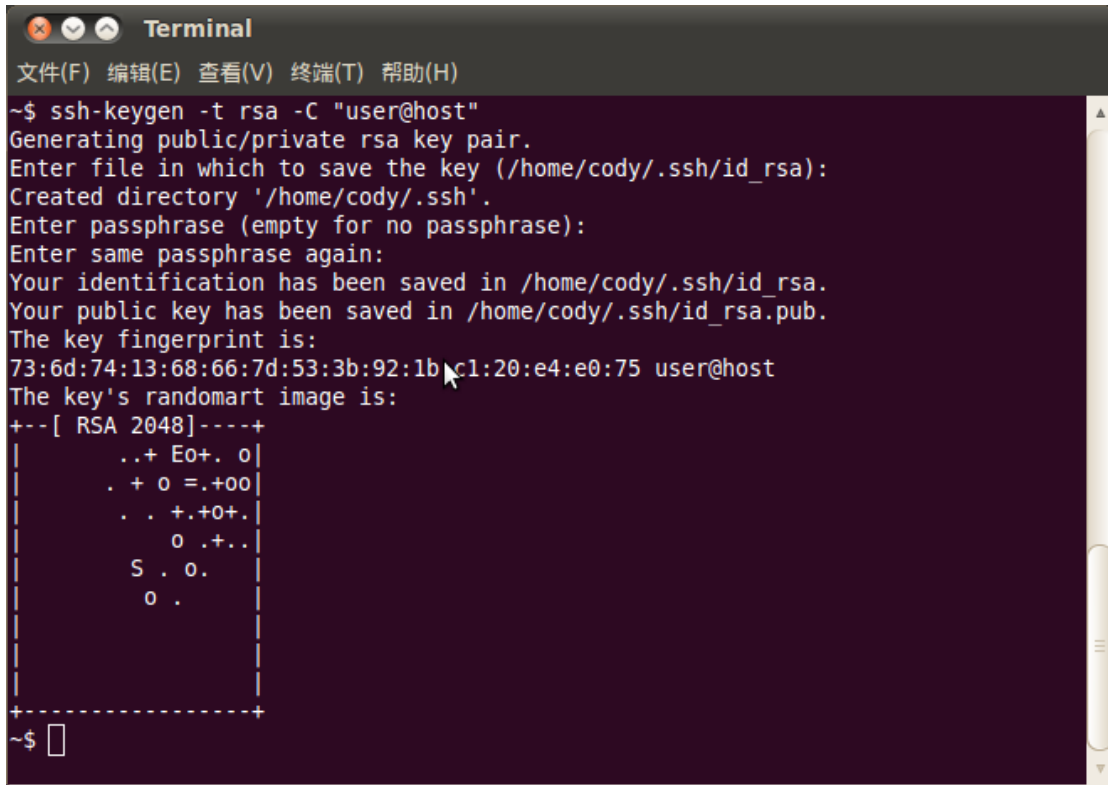
Instruction

9.1 SSH Public Key Generation

Use the following command to generate::

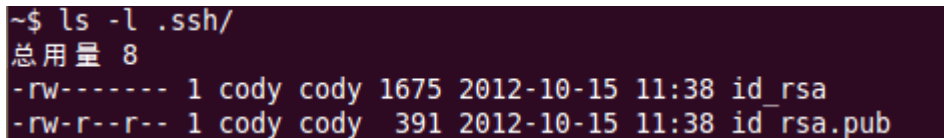
```
ssh-keygen -t rsa -C "user@host"
```

Please replace user@host with your email address

A terminal window titled "Terminal" with a menu bar in Chinese (文件(F), 编辑(E), 查看(V), 终端(T), 帮助(H)). The terminal shows the command `ssh-keygen -t rsa -C "user@host"` being executed. The output includes: "Generating public/private rsa key pair.", "Enter file in which to save the key (/home/cody/.ssh/id_rsa):", "Created directory '/home/cody/.ssh'.", "Enter passphrase (empty for no passphrase):", "Enter same passphrase again:", "Your identification has been saved in /home/cody/.ssh/id_rsa.", "Your public key has been saved in /home/cody/.ssh/id_rsa.pub.", "The key fingerprint is:", "73:6d:74:13:68:66:7d:53:b9:21:20:e4:e0:75 user@host", "The key's randomart image is:", and a randomart image for RSA 2048. The terminal ends with a prompt `~$`.

```
Terminal
文件(F) 编辑(E) 查看(V) 终端(T) 帮助(H)
~$ ssh-keygen -t rsa -C "user@host"
Generating public/private rsa key pair.
Enter file in which to save the key (/home/cody/.ssh/id_rsa):
Created directory '/home/cody/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/cody/.ssh/id_rsa.
Your public key has been saved in /home/cody/.ssh/id_rsa.pub.
The key fingerprint is:
73:6d:74:13:68:66:7d:53:b9:21:20:e4:e0:75 user@host
The key's randomart image is:
+--[ RSA 2048 ]-----+
|      .+ Eo+. o |
|    . + o =.+oo |
|   . . +.+o+. |
|      o .+.. |
|     S . o. |
|      o . |
+-----+
~$
```

Completing Command will generate public key files in your directory.

A terminal window showing the command `ls -l .ssh/` being executed. The output shows two files: `id_rsa` and `id_rsa.pub`, both owned by `cody` with permissions `-rw-r--r--`.

```
~$ ls -l .ssh/
总用量 8
-rw----- 1 cody cody 1675 2012-10-15 11:38 id_rsa
-rw-r--r-- 1 cody cody 391 2012-10-15 11:38 id_rsa.pub
```

Please keep the private key file id_rsa and password generated, and email the public key id_rsa.pub to SDK server administrator.

9.2 Use key-chain to manage keys

It is recommended to use a simple tool keychain to manage keys.

The detail usage is as follows:

1. Install keychain package:

```
$sudo aptitude install keychain
```

2. Configure the key:

```
$vim ~/.bashrc
```

Add the following line:

```
eval `keychain --eval ~/.ssh/id_rsa`
```

id_rsa is private key file name among them.

After the above configuration, log in to console again and it will prompt to enter password.

Just enter password used to generate the key. If there is no password, you can not enter it.

In addition, try not to use sudo or root users unless you know how to deal with them, which will lead to permission and key management confusion.

9.3 Multiple machines use the same SSH public key

Use on different machines, you can copy ssh private key file id_rsa to "~/.ssh/id_rsa" of machines you want to use.

The following prompt will appear when using a wrong private key, please be careful to replace it with the correct private key.

```
~/tmp$ git clone git@172.16.10.211:rk292x/mid/4.1.1 r1
Initialized empty Git repository in /home/cody/tmp/4.1.1_r1/.git/
The authenticity of host '172.16.10.211 (172.16.10.211)' can't be established.
RSA key fingerprint is fe:36:dd:30:bb:83:73:e1:0b:df:90:e2:73:e4:61:46.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '172.16.10.211' (RSA) to the list of known hosts.
git@172.16.10.211's password: █
```

After adding the correct private key, you can use git to clone code, as shown below.

```
~$ cd tmp/
~/tmp$ git clone git@172.16.10.211:rk292x/mid/4.1.1 r1
Initialized empty Git repository in /home/cody/tmp/4.1.1_r1/.git/
The authenticity of host '172.16.10.211 (172.16.10.211)' can't be established.
RSA key fingerprint is fe:36:dd:30:bb:83:73:e1:0b:df:90:e2:73:e4:61:46.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '172.16.10.211' (RSA) to the list of known hosts.
remote: Counting objects: 237923, done.
remote: Compressing objects: 100% (168382/168382), done.
Receiving objects: 9% (21570/237923), 61.52 MiB | 11.14 MiB/s
```

Adding ssh private key may result in the following error.

```
Agent admitted failure to sign using the key
```

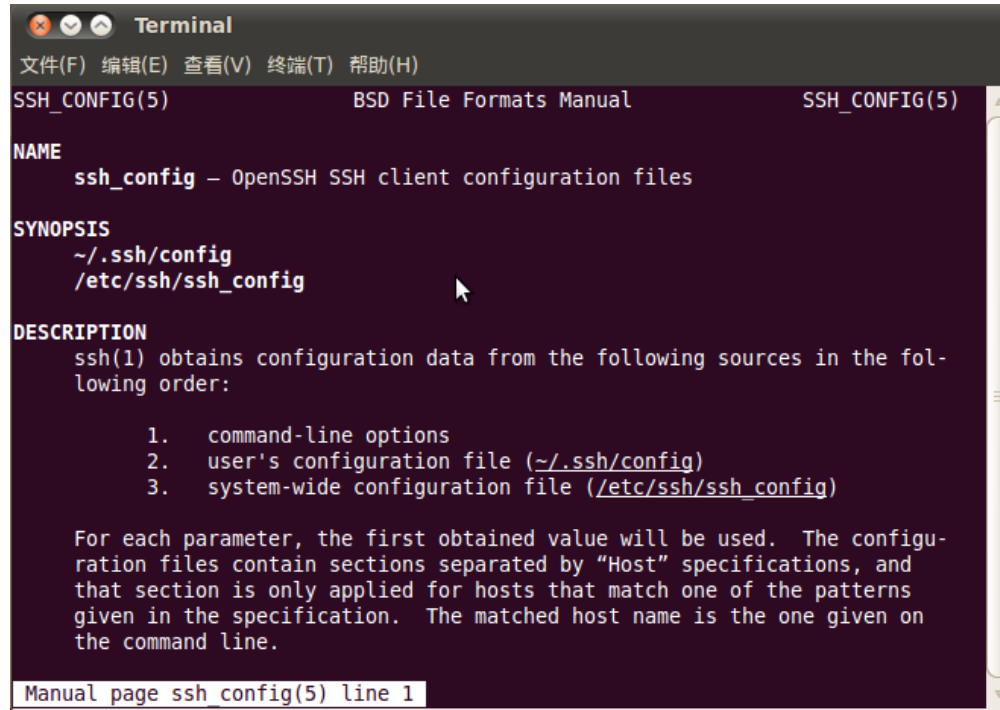
Enter the following command in console to solve

```
ssh-add ~/.ssh/id_rsa
```

9.4 One machine switches different SSH public keys

You can configure SSH by referring to ssh_config documentation.

```
~$ man ssh_config
```

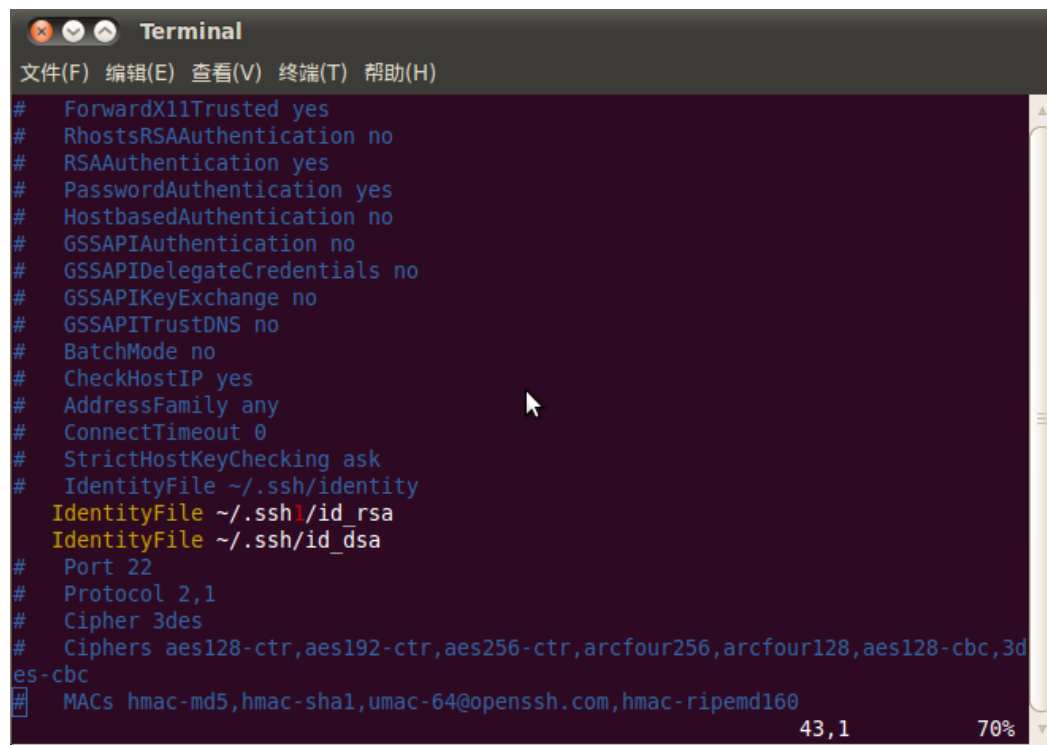


Run the following command to configure SSH configuration of current user.

```
~$ cp /etc/ssh/ssh_config ~/.ssh/config
```

```
~$ vi ~/.ssh/config
```

As shown in the figure, ssh uses the file "`~/.ssh1/id_rsa`" of another directory as an authentication private key. In this way, different keys can be switched.

A screenshot of a terminal window titled "Terminal" with a menu bar in Chinese: "文件(F) 编辑(E) 查看(V) 终端(T) 帮助(H)". The terminal displays a list of SSH configuration options, each preceded by a hash symbol (#). The options and their values are: ForwardX11Trusted yes, RhostsRSAAuthentication no, RSAAuthentication yes, PasswordAuthentication yes, HostbasedAuthentication no, GSSAPIAuthentication no, GSSAPIDelegateCredentials no, GSSAPIKeyExchange no, GSSAPITrustDNS no, BatchMode no, CheckHostIP yes, AddressFamily any, ConnectTimeout 0, StrictHostKeyChecking ask, IdentityFile ~/.ssh/identity, IdentityFile ~/.ssh/id_rsa, IdentityFile ~/.ssh/id_dsa, Port 22, Protocol 2,1, Cipher 3des, Ciphers aes128-ctr,aes192-ctr,aes256-ctr,arcfour256,arcfour128,aes128-cbc,3des-cbc, MACs hmac-md5,hmac-sha1,umac-64@openssh.com,hmac-ripemd160. The terminal has a dark purple background and a light-colored scrollbar on the right. The status bar at the bottom right shows "43,1" and "70%".

```
# ForwardX11Trusted yes
# RhostsRSAAuthentication no
# RSAAuthentication yes
# PasswordAuthentication yes
# HostbasedAuthentication no
# GSSAPIAuthentication no
# GSSAPIDelegateCredentials no
# GSSAPIKeyExchange no
# GSSAPITrustDNS no
# BatchMode no
# CheckHostIP yes
# AddressFamily any
# ConnectTimeout 0
# StrictHostKeyChecking ask
# IdentityFile ~/.ssh/identity
IdentityFile ~/.ssh/id_rsa
IdentityFile ~/.ssh/id_dsa
# Port 22
# Protocol 2,1
# Cipher 3des
# Ciphers aes128-ctr,aes192-ctr,aes256-ctr,arcfour256,arcfour128,aes128-cbc,3des-cbc
# MACs hmac-md5,hmac-sha1,umac-64@openssh.com,hmac-ripemd160
```

9.5 Key authority management

Server can monitor download times and IP information of a key in real time. If an abnormality is found, download permission of the corresponding key will be disabled.

Please keep your private key file in a safe place. Do not grant second authorization to third parties.

9.6 Git Access Application Instruction

Please email the public key file created according to above chapter to fae@rock-chips.com, to apply for SDK code download permission.