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RK3288(W-Version)_ANDROID9.0_ SDK 发布说明

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Fuzhou Rockchips Electronics Co., Ltd

(版本所有,翻版必究)

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1 概述

本 SDK 基于谷歌 Android 9.0 最新系统，只适配瑞芯微 RK3288(W 版本芯片)，只适用于 RK3288(W 版本芯片)平台及基于其上开发的产品。

注：本 SDK 软件包仅支持 RK3288（W 版本芯片），不支持旧 RK3288 芯片。

2 主要支持功能

参数	模块名
数据通信	Wi-Fi、USB 以太网卡、USB、SDCARD
应用程序	Launcher3、APK 安装器、浏览器、计算器、日历、相机、闹钟、下载、电子邮件、资源管理器、GMS 应用、音乐、录音、设置、视频播放器

3 SDK 获取说明

3.1 获取 SDK

SDK 通过瑞芯微代码服务器对外发布。其编译开发环境，参考[附录 A 编译开发环境搭建](#)。

客户向瑞芯微技术窗口申请 SDK，需同步提供 SSH 公钥进行服务器认证授权，获得授权后即可同步代码。关于瑞芯微代码服务器 SSH 公钥授权，请参考[附录 B SSH 公钥操作说明](#)。

RK3288(W-Version)_ANDROID9.0_SDK 下载地址如下：

```
$ repo init --repo-url=ssh://git@www.rockchip.com.cn:2222/repo-release/tools/repo.git -u ssh://git@www.rockchip.com.cn:2222/Android_pie_stable/platform/rk3288/manifests.git -m RK3288_Android_Pie_release.xml
```

如果需要包含 GMS 包的 SDK(需要开通权限)，使用如下地址：

```
$ repo init --repo-url=ssh://git@www.rockchip.com.cn:2222/repo-release/tools/repo.git -u ssh://git@www.rockchip.com.cn:2222/Android_pie_stable/platform/rk3288/manifests.git -m RK3288_Android_Pie_Express_release.xml
```

注：Repo 是 Google 用 Python 脚本写的调用 Git 的一个脚本，主要是用来下载、管理 Android 项目的软件仓库，其下载地址如下：

```
$ git clone ssh:// git@www.rockchip.com.cn:2222/repo-release/tools/repo
```

为方便客户快速获取 SDK 源码，瑞芯微技术窗口通常会提供对应版本的 SDK 初始压缩包。以 Rk3288_Android_Pie_release_20190410.tar.gz 为例，拷贝到该初始化包后，通过如下命令可检出源码：

```
$ mkdir RK3288
$ tar zxvf Rk3288_Android_Pie_release_20190410.tar.gz -C RK3288
$ cd RK3288
$ .repo/repo/repo sync -l
$ .repo/repo/repo sync
```

3.2 补充说明

Android 9.0 SDK 已不再支持 UMS 功能，平台设备皆使用合并分区；

Android 9.0 SDK 已支持全盘加密功能；

Android 9.0 SDK 已支持 Verified boot 2.0 (avb)的功能。

4 SDK 编译说明

4.1 JDK 安装

Android 9.0 系统编译依赖于 JAVA 8。编译之前需安装 OpenJDK。

安装命令如下：

```
sudo apt-get install openjdk-8-jdk
```

配置 JAVA 环境变量，例如，安装路径为/usr/lib/jvm/java-8-openjdk-amd64，可在终端执行如下命令配置环境变量：

```
$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
$ export PATH=$JAVA_HOME/bin:$PATH
$ export CLASSPATH=.:$JAVA_HOME/lib:$JAVA_HOME/lib/tools.jar
```

4.2 编译模式

SDK 默认以 userdebug 模式编译。

使用 adb 时，需要先执行 adb root 使 shell 获取 root 权限，进而执行其它像 adb remount、adb push 等操作，其中 adb remount 前要先 disable-verity，执行 adb disable-verity。

4.3 代码编译

4.3.1 uboot 编译步骤

```
$ cd u-boot  
$ make clean  
$ make mrproper  
$ ./make.sh rk3288
```

编译完成，会生成 rk3288_loader_vx_xx_xxx.bin、trust.img、uboot.img 三个文件。

4.3.2 kernel 编译步骤

RK3288(W-Version) EVB 样机配置和编译命令如下：

```
$ cd kernel  
$ make ARCH=arm rockchip_defconfig  
$ make ARCH=arm rk3288-evb-android-rk808-edp-avb.img -j8
```

4.3.3 Android 编译及固件生成步骤

客户按实际编译环境配置好 JDK 环境变量后，按照以下步骤配置完后，执行 make 即可。

```
$ source build/envsetup.sh  
$ lunch  
You're building on Linux  
Lunch menu... pick a combo:  
1. aosp_arm-eng  
2. aosp_arm64-eng  
3. aosp_mips-eng  
4. aosp_mips64-eng  
5. aosp_x86-eng  
6. aosp_x86_64-eng
```

7. rk3288-userdebug

8. rk3288-user

选择 rk3288-userdebug，输入对应序号 7。

\$ make -j8

Android 编译成功后，执行 SDK 根目录下的 mkimage.sh 脚本生成固件，所有烧写所需的镜像将都会拷贝于 rockdev/Image-rk3288xxx 目录。

rockdev/Image-rk3288xxx

```
├── boot.img
├── kernel.img
├── MiniLoaderAll.bin
├── vbmeta.img
├── dtbo.img
├── misc.img
├── oem.img
├── parameter.txt
├── pcba_small_misc.img
├── pcba_whole_misc.img
├── recovery.img
├── resource.img
├── system.img
├── trust.img
├── uboot.img
└── vendor.img
```

得到所有镜像文件后，为了方便烧写及量产，通常可手动将这些单独的镜像通过脚本打包成为 update.img。

4.3.4 自动化编译脚本

SDK 中集成了全自动化编译脚本。方便固件编译及备份。

1) 该全自动化编译脚本原始文件存放于：

device/rockchip/RK3288/build.sh

2) 在 repo sync 的时候，通过 manifest 中的 copy 选项拷贝至工程根目录下：

<project path="device/rockchip/rk3288" ... >

```
<copyfile src="buildspec.mk" dest="buildspec.mk"/>
    <copyfile src="build.sh" dest="build.sh"/>
</project>
```

3) 修改 build.sh 脚本中的特定变量以编出对应产品固件。

```
KERNEL_DTS=rk3288-evb-android-rk808-avb
```

变量请按实际项目情况，对应修改：

KERNEL_DTS 变量指定编译 kernel 的产品板极配置；

Android 编译需要指定对应的 lunch 选项，请在执行 build.sh 之前执行 lunch 操作，确保使用了正确的 lunch 选项，例如：

```
lunch rk3288-userdebug
```

4) 执行自动编译脚本：

```
./build.sh -U -K -A -u -p -v userdebug
```

该脚本会自动配置 JDK 环境变量，编译 u-boot，编译 kernel，编译 Android，继而生成固件和版本信息，并打包成 update.img。

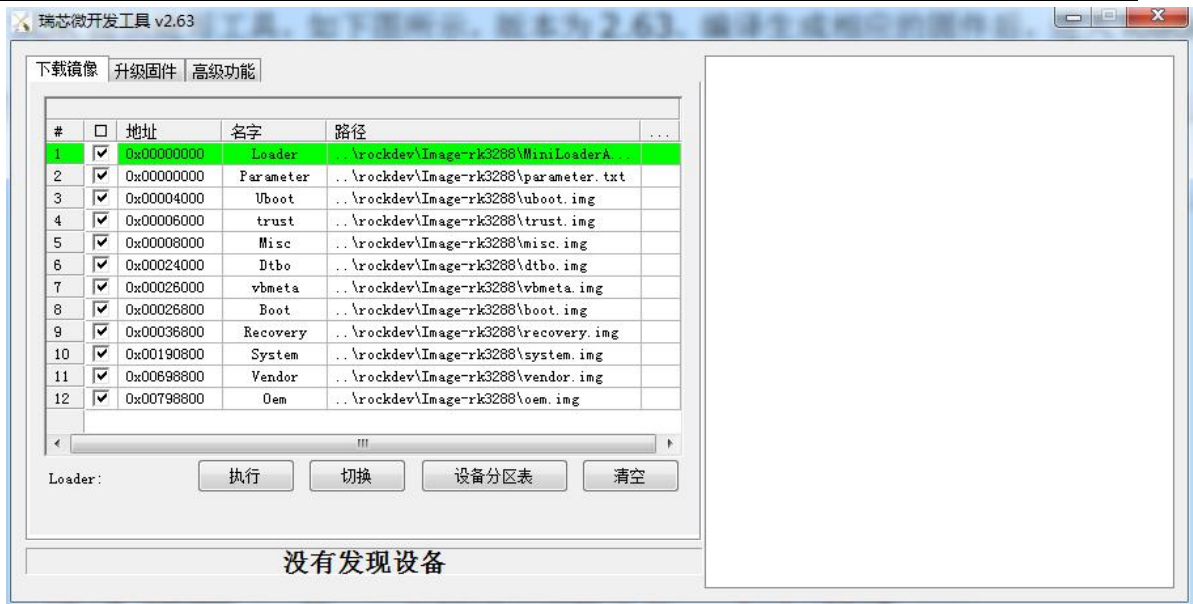
5) 脚本生成内容：

脚本会将编译生成的固件拷贝至：IMAGE/RK3288 *****_RELEASE_TEST/IMAGES 目录下，具体路径以实际生成为准。每次编译都会新建目录保存，自动备份调试开发过程的固件版本，并存放固件版本的各类信息。建议在每次大版本编译的时候，使用这个编译脚本生成固件，里面包含了很多的版本信息，便于追查问题的时候定位代码的状态。

该目录下的 update.img 可直接用于 Android 开发工具及工厂烧写工具下载更新。

4.4 刷机说明

SDK 提供烧写工具，如下图所示，版本为 2.63。编译生成相应的固件后，进入 loader 模式，即可进行刷机。对于已烧过其它固件的机器，请选择低格设备，擦除 idb，然后进行刷机。



注：烧写工具必须使用 2.63 及以上版本的工具，量产工具使用 1.6 及以上版本；Linux 下的烧写工具使用 1.34 及以上版本。

附录 A 编译开发环境搭建

1. Initializing a Build Environment

This section describes how to set up your local work environment to build the Android source files. You must use Linux or Mac OS; building under Windows is not currently supported.

For an overview of the entire code-review and code-update process, see Life of a Patch.

Note: All commands in this site are preceded by a dollar sign (\$) to differentiate them from output or entries within files. You may use the Click to copy feature at the top right of each command box to copy all lines without the dollar signs or triple-click each line to copy it individually without the dollar sign.

2. Choosing a Branch

Some requirements for the build environment are determined by the version of the source code you plan to compile. For a full list of available branches, see Build Numbers. You can also choose to download and build the latest source code (called master), in which case you will simply omit the branch specification when you initialize the repository.

After you have selected a branch, follow the appropriate instructions below to set up your build environment.

3. Setting up a Linux build environment

These instructions apply to all branches, including master.

The Android build is routinely tested in house on recent versions of Ubuntu LTS (14.04) and Debian testing. Most other distributions should have the required build tools available.

For Gingerbread (2.3.x) and newer versions, including the master branch, a 64-bit environment is required. Older versions can be compiled on 32-bit systems.

Note: See Requirements for the complete list of hardware and software requirements, then follow the detailed instructions for Ubuntu and Mac OS below.

4. Installing the JDK

The master branch of Android in the Android Open Source Project (AOSP) comes with prebuilt versions of OpenJDK below prebuilts/jdk/ so no additional installation is required.

Older versions of Android require a separate installation of the JDK. On Ubuntu, use OpenJDK. See JDK Requirements for precise versions and the sections below for instructions.

For Ubuntu >= 15.04

Run the following:

```
sudo apt-get update
```

```
sudo apt-get install openjdk-8-jdk
```

For Ubuntu LTS 14.04

There are no available supported OpenJDK 8 packages for Ubuntu 14.04. The Ubuntu 15.04 OpenJDK 8 packages have been used successfully with Ubuntu 14.04. Newer package versions (e.g. those for 15.10, 16.04) were found not to work on 14.04 using the instructions below.

1. Download the .deb packages for 64-bit architecture from

old-releases.ubuntu.com:

[openjdk-8-jre-headless_8u45-b14-1_amd64.deb](#) with SHA256

0f5aba8db39088283b51e00054813063173a4d8809f70033976f83e214ab56c0

[openjdk-8-jre_8u45-b14-1_amd64.deb](#) with SHA256

9ef76c4562d39432b69baf6c18f199707c5c56a5b4566847df908b7d74e15849

[openjdk-8-jdk_8u45-b14-1_amd64.deb](#) with SHA256

6e47215cf6205aa829e6a0a64985075bd29d1f428a4006a80c9db371c2fc3c4c

2. Optionally, confirm the checksums of the downloaded files against the SHA256 string listed with each package above. For example, with the sha256sum tool:

```
sha256sum {downloaded.deb file}
```

3. Install the packages:

```
sudo apt-get update
```

Run dpkg for each of the .deb files you downloaded. It may produce errors due to missing dependencies:

```
sudo dpkg -i {downloaded.deb file}
```

To fix missing dependencies:

```
sudo apt-get -f install
```

Update the default Java version - optional

Optionally, for the Ubuntu versions above update the default Java version by running:

```
sudo update-alternatives --config javasudo update-alternatives --config javac
```

Note: If, during a build, you encounter version errors for Java, see Wrong Java version for likely causes and solutions.

Installing required packages (Ubuntu 14.04)

You will need a 64-bit version of Ubuntu. Ubuntu 14.04 is recommended.

```
sudo apt-get install git-core gnupg flex bison gperf build-essential zip curl
```

```
zlib1g-dev gcc-multilib g++-multilib libc6-dev-i386 lib32ncurses5-dev
x11proto-core-dev libx11-dev lib32z-dev ccache libgl1-mesa-dev libxml2-utils
xsltproc unzip
```

Note: To use SELinux tools for policy analysis, also install the python-networkx package. Note: If you are using LDAP and want to run ART host tests, also install the libnss-sss:i386 package.

5. Configuring USB Access

Under GNU/Linux systems (and specifically under Ubuntu systems), regular users can't directly access USB devices by default. The system needs to be configured to allow such access.

The recommended approach is to create a file `/etc/udev/rules.d/51-android.rules` (as the root user) and to copy the following lines in it. `<username>` must be replaced by the actual username of the user who is authorized to access the phones over USB.

```
# adb protocol on passion (Rockchip products)

SUBSYSTEM=="usb",                                ATTR{idVendor}=="2207",
ATTR{idProduct}=="0010", MODE="0600", OWNER="<username>"
```

Those new rules take effect the next time a device is plugged in. It might therefore be necessary to unplug the device and plug it back into the computer.

This is known to work on both Ubuntu Hardy Heron (8.04.x LTS) and Lucid Lynx (10.04.x LTS). Other versions of Ubuntu or other variants of GNU/Linux might require different configurations.

References : <http://source.android.com/source/initializing.html>

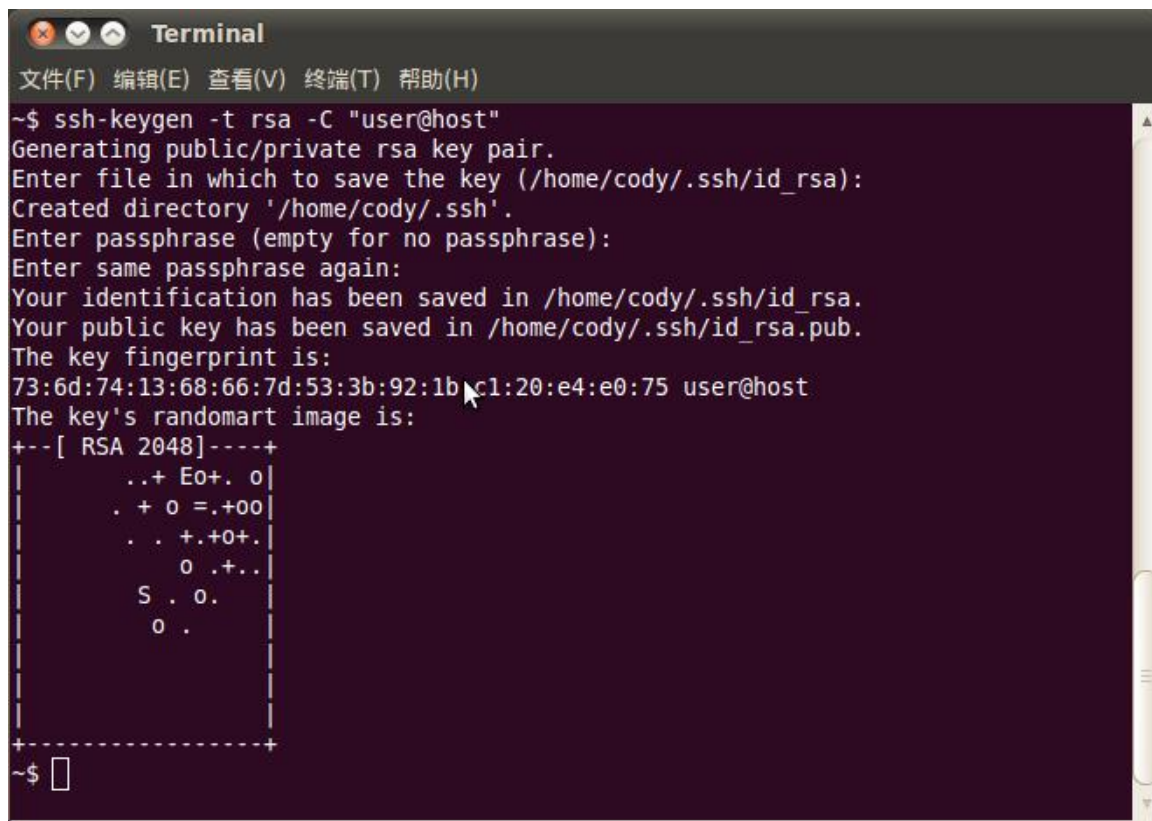
附录 B SSH 公钥操作说明

附录 B-1 SSH 公钥生成

使用如下命令生成：

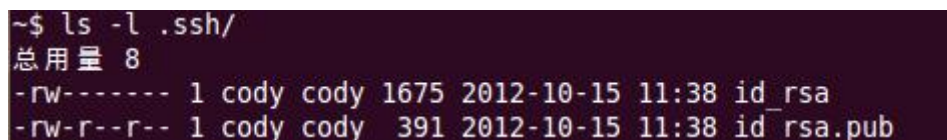
```
ssh-keygen -t rsa -C "user@host"
```

请将 **user@host** 替换成您的邮箱地址。



```
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:53:3b:92:1b:c1:20:e4:e0:75 user@host
The key's randomart image is:
+--[ RSA 2048 ]-----+
|      ..+ Eo+. o      |
|      . + 0 =.+00     |
|      . . +.+0+.     |
|      o .+. .        |
|      S . o.         |
|      o .            |
|                      |
+-----+
~$
```

命令运行完成会在你的目录下生成 **key** 文件。



```
~$ 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
```

请妥善保存生成的私钥文件 **id_rsa** 和密码，并将 **id_rsa.pub** 发邮件给 SDK 发布服务器的管理员。

附录 B-2 使用 **key-chain** 管理密钥

推荐您使用比较简易的工具 **keychain** 管理密钥。

具体使用方法如下：

1. 安装 keychain 软件包:

```
$sudo aptitude install keychain
```

2. 配置使用密钥:

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

增加下面这行:

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

其中, `id_rsa` 是私钥文件名称。

以上配置以后, 重新登录控制台, 会提示输入密码, 只需输入生成密钥时使用的密码即可, 若无密码可不输入。

另外, 请尽量不要使用 `sudo` 或 `root` 用户, 除非您知道如何处理, 否则将导致权限以及密钥管理混乱。

附录 B-3 多台机器使用相同 ssh 公钥

在不同机器使用, 可以将你的 `ssh` 私钥文件 `id_rsa` 拷贝到要使用的机器的“`~/.ssh/id_rsa`”即可。

使用错误的私钥会出现如下提示, 请注意替换成正确的私钥。

```
~/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: █
```

添加正确的私钥后, 就可以使用 `git` 克隆代码, 如下图:

```
~$ 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
```

添加 `ssh` 私钥可能出现如下提示错误:

Agent admitted failure to sign using the key

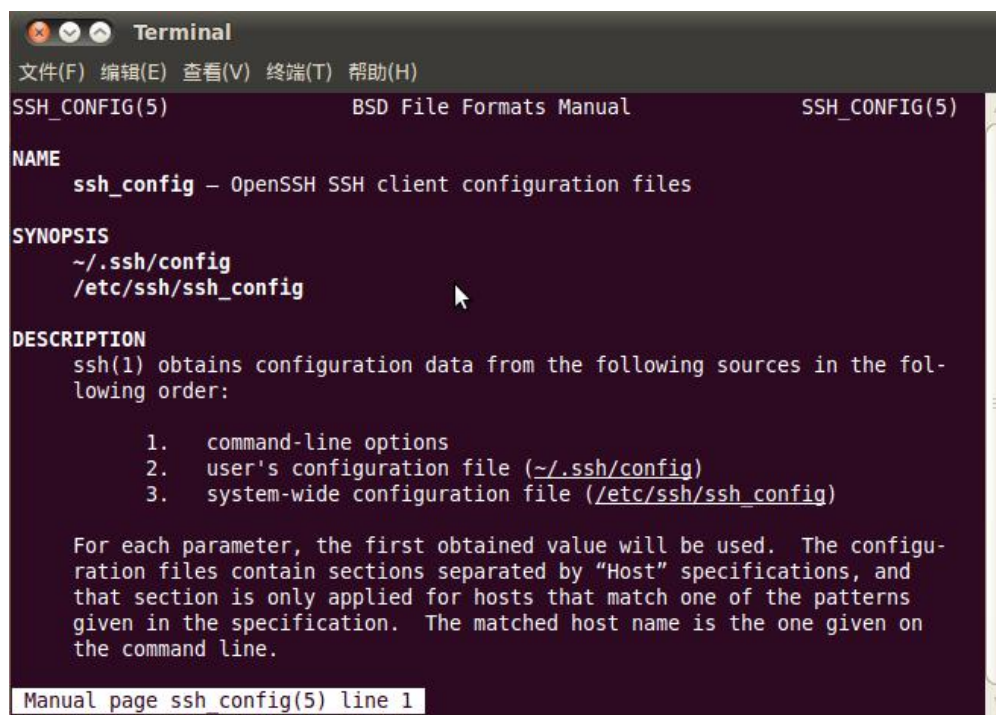
在 console 输入如下命令即可解决。

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

附录 B-4 一台机器切换不同 ssh 公钥

可以参考 ssh_config 文档配置 ssh。

```
~$ man ssh_config
```

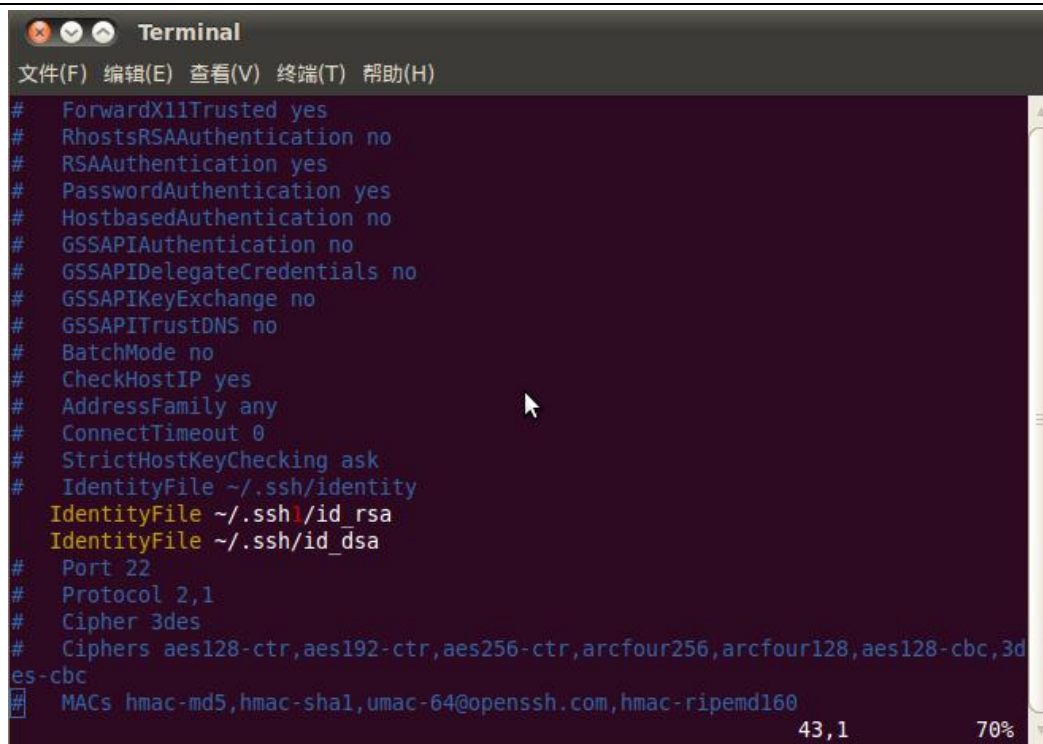


通过如下命令，配置当前用户的 ssh 配置。

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

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

如图，将 ssh 使用另一个目录的文件“~/.ssh1/id_rsa”作为认证私钥。通过这种方法，可以切换不同的密钥。

A screenshot of a macOS Terminal window titled "Terminal". The window has a menu bar with "文件(F)", "编辑(E)", "查看(V)", "终端(T)", and "帮助(H)". The terminal content shows the output of the 'ssh -T' command, listing various SSH configuration options and their values. The options include ForwardX11Trusted, RhostsRSAAuthentication, RSAAuthentication, PasswordAuthentication, HostbasedAuthentication, GSSAPIAuthentication, GSSAPIDelegatedCredentials, GSSAPIKeyExchange, GSSAPITrustDNS, BatchMode, CheckHostIP, AddressFamily, ConnectTimeout, StrictHostKeyChecking, IdentityFile, Port, Protocol, Cipher, Ciphers, and MACs. The IdentityFile is shown twice, once for the default path and once for the actual path ~/.ssh/id_rsa. The Port is 22, Protocol is 2,1, Cipher is 3des, Ciphers is a list of supported ciphers, and MACs is a list of supported MACs. The terminal status bar at the bottom right shows "43,1" and "70%".

```
# ForwardX11Trusted yes
# RhostsRSAAuthentication no
# RSAAuthentication yes
# PasswordAuthentication yes
# HostbasedAuthentication no
# GSSAPIAuthentication no
# GSSAPIDelegatedCredentials 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
```

附录 B-5 密钥权限管理

服务器可以实时监控某个 key 的下载次数、IP 等信息，如果发现异常将禁用相应的 key 的下载权限。

请妥善保管私钥文件。并不要二次授权与第三方使用。

附录 B-6 Git 权限申请说明

参考上述章节，生成公钥文件，发邮件至 fae@rock-chips.com，申请开通 SDK 代码下载权限。