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RK3399_ANDROID7.1-TABLET-SDK_V1

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(版本所有, 翻版必究)

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1 概述

本 SDK 是基于谷歌 Android7.1 64bit 系统，适配瑞芯微 RK3399 芯片的软件包，适用于 RK3399 TABLET 开发板以及基于其上所有开发产品。

2 主要支持功能

参数	模块名
数据通信	Wi-Fi、USB 以太网卡、3G Dongle、USB、SDCARD
应用程序	设置、图库、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](#)。

RK3399_ANDROID7.1-TABLET-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/rk3399-nougat/manifests.git -m
rk3399_nougat_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 Rk3399_Android7.1-Tablet-sdk.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 rk3399
tar zxvf Rk3399_Android7.1-Tablet-sdk.tar.gz -C rk3399
cd rk3399
.repo/repo/repo sync -l
.repo/repo/repo sync -c
```

3.2 补充说明

Android7.1 SDK 已不再支持 UMS 功能，平台设备皆使用合并分区；

Android7.1 SDK 已支持全盘加密功能；

Android7.1 SDK 已支持 Verified boot 的功能。

4 SDK 编译说明

4.1 JDK 安装

Android7.1 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 ,adb disable-verity 关闭 system 分区的 verity**

特性，重启后再执行 **adb root, adb remount**，进而进行 **push** 操作来 **debug**。

4.3 代码编译

4.3.1 Laptop 编译

uboot 编译:

```
cd u-boot
make rk3399_defconfig
make ARCHV=aarch64
```

kernel 编译:

```
cd kernel
make ARCH=arm64 rockchip_defconfig -j8
make ARCH=arm64 rk3399-tve1205g.img -j12
```

android 编译:

```
source build/envsetup.sh
lunch rk3399_laptop-userdebug
make -j12
./mkimages.sh
```

4.3.2 Tablet 编译

uboot 编译:

```
cd u-boot
make rk3399_defconfig
make ARCHV=aarch64
```

kernel 编译:

```
cd kernel
make ARCH=arm64 rockchip_defconfig -j8
make ARCH=arm64 rk3399-mid-818-android.img -j12
```

android 编译:

```
source build/envsetup.sh
lunch rk3399_mid-userdebug
make -j12
./mkimages.sh
```

4.3.3 EVB 板编译

uboot 编译:

```
cd u-boot
make rk3399_defconfig
make ARCHV=aarch64
```

kernel 编译:

```
cd kernel
```

```
make ARCH=arm64 rockchip_defconfig -j8
make ARCH=arm64 rk3399-evb-rev3-android-edp-next.img -j12
android 编译:
source build/envsetup.sh
lunch rk3399_mid-userdebug
make -j12
./mkimages.sh
```

4.3.4 挖掘机编译

uboot 编译:

```
cd u-boot
make rk3399_defconfig
make ARCHV=aarch64
```

kernel 编译:

```
cd kernel
make ARCH=arm64 rockchip_defconfig -j8
make ARCH=arm64 rk3399-sapphire-excavator-edp.img -j12
```

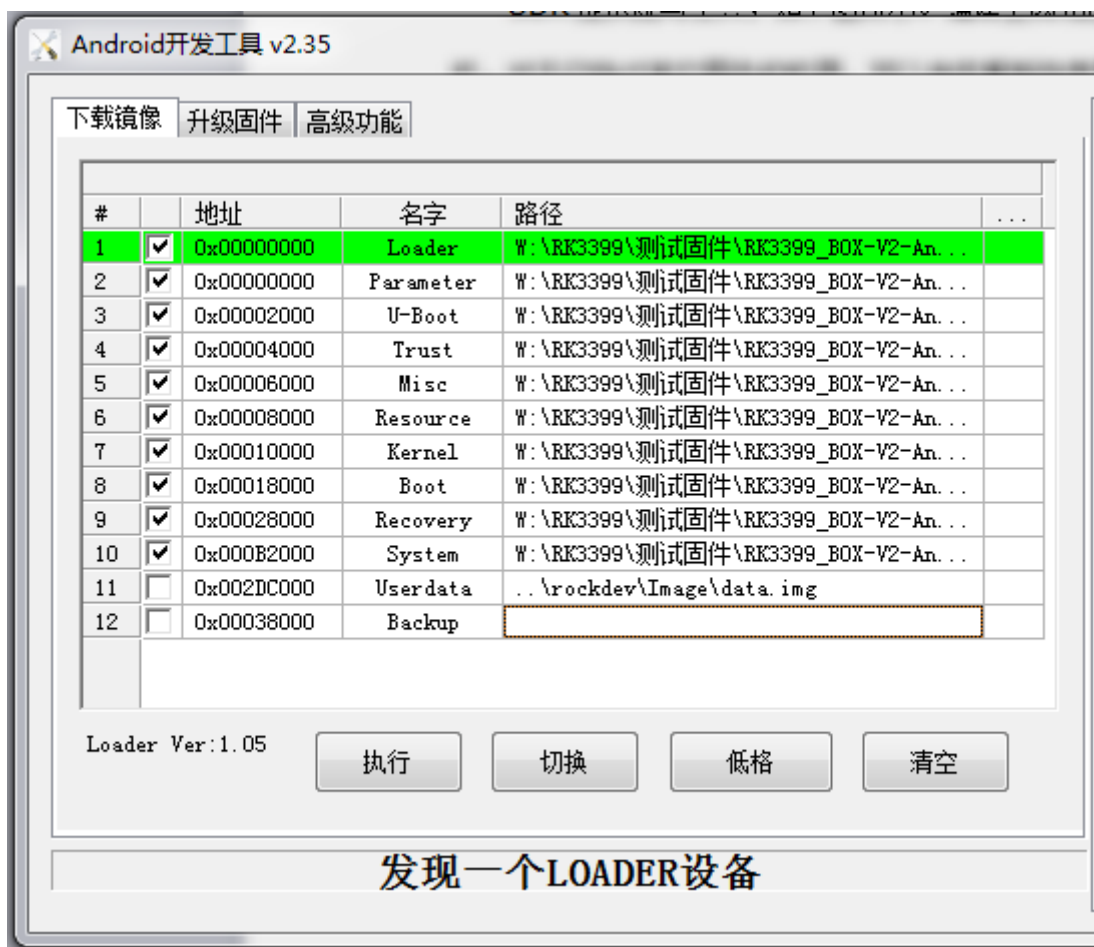
android 编译:

```
source build/envsetup.sh
lunch rk3399_mid-userdebug
make -j12
./mkimages.sh
```

完成编译后, 执行 SDK 根目录下的 mkimage.sh 后在 rockdev/Image-xxx/ 目录生成完整的固件包(xxx 是具体 lunch 的产品名)

4.4 刷机说明

SDK 提供烧写工具, 如下图所示。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。



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 will need to use Linux or Mac OS. Building under Windows is not currently supported.

Note: The source download is approximately 35GB in size. You will need over 45GB free to complete a single build, and up to 100GB (or more) for a full set of builds.

For an overview of the entire code-review and code-update process, see [Life of a Patch](#).

2. Choosing a Branch

Some of the requirements for your build environment are determined by which

version of the source code you plan to compile. See [Build Numbers](#) for a full listing of branches you may choose from. You may 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.

Once 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 (10.04), but most distributions should have the required build tools available. Reports of successes or failures on other distributions are welcome.

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: It is also possible to build Android in a virtual machine. If you are running Linux in a virtual machine, you will need at least 16GB of RAM/swap and 30GB or more of disk space in order to build the Android tree.

Detailed instructions for Ubuntu and MacOS follow. In general you will need:

- A. Python 2.6 -- 2.7, which you can download from [python.org](#).
- B. GNU Make 3.81 -- 3.82, which you can download from [gnu.org](#),
- C. JDK 6 if you wish to build Gingerbread or newer; JDK 5 for Froyo or older. You can download both from [java.sun.com](#).
- D. Git 1.7 or newer. You can find it at [git-scm.com](#).

4. Installing the JDK

The master branch of Android in the Android Open Source Project (AOSP) requires Java 8. On Ubuntu, use OpenJDK. Java 8: For the latest version of Android

\$ sudo apt-get update

\$ sudo apt-get install openjdk-8-jdk

Optionally, update the default Java version by running:

\$ sudo update-alternatives --config java

\$ sudo update-alternatives --config javac

If you encounter version errors for Java, set its path as described in the Wrong Java Version section.

To develop older versions of Android, download and install the corresponding version of the Java JDK:

Java 8: for Gingerbread through Nougat

Java 7: for Gingerbread through Laptop & Marshmallow

Java 6: for Gingerbread through KitKat

Java 5: for Cupcake through Froyo

5. Installing required packages (Ubuntu 12.04)

You will need a 64-bit version of Ubuntu. Ubuntu 12.04 is recommended. Building using an older version of Ubuntu is not supported on master or recent releases.

```
$ sudo apt-get install git gnupg flex bison gperf build-essential \
```

```
zip curl libc6-dev libncurses5-dev:i386 x11proto-core-dev \
```

```
libx11-dev:i386 libreadline6-dev:i386 libgl1-mesa-glx:i386 \
```

```
libgl1-mesa-dev g++-multilib mingw32 tofrodos \
```

```
python-markdown libxml2-utils xsltproc zlib1g-dev:i386
```

```
$ sudo ln -s /usr/lib/i386-linux-gnu/mesa/libGL.so.1 /usr/lib/i386-linux-gn
```

```
u/libGL.so
```

6. Installing required packages (Ubuntu 10.04 -- 11.10)

Building on Ubuntu 10.04-11.10 is no longer supported, but may be useful for building older releases of AOSP.

```
$ sudo apt-get install git-core gnupg flex bison gperf build-essential \  
zip curl zlib1g-dev libc6-dev lib32ncurses5-dev ia32-libs \  
x11proto-core-dev libx11-dev lib32readline5-dev lib32z-dev \  
libgl1-mesa-dev g++-multilib mingw32 tofrodos python-markdown \  
libxml2-utils xsltproc
```

On Ubuntu 10.10:

```
$ sudo ln -s /usr/lib32/mesa/libGL.so.1 /usr/lib32/mesa/libGL.so
```

On Ubuntu 11.10:

```
$ sudo apt-get install libx11-dev:i386
```

7. 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>

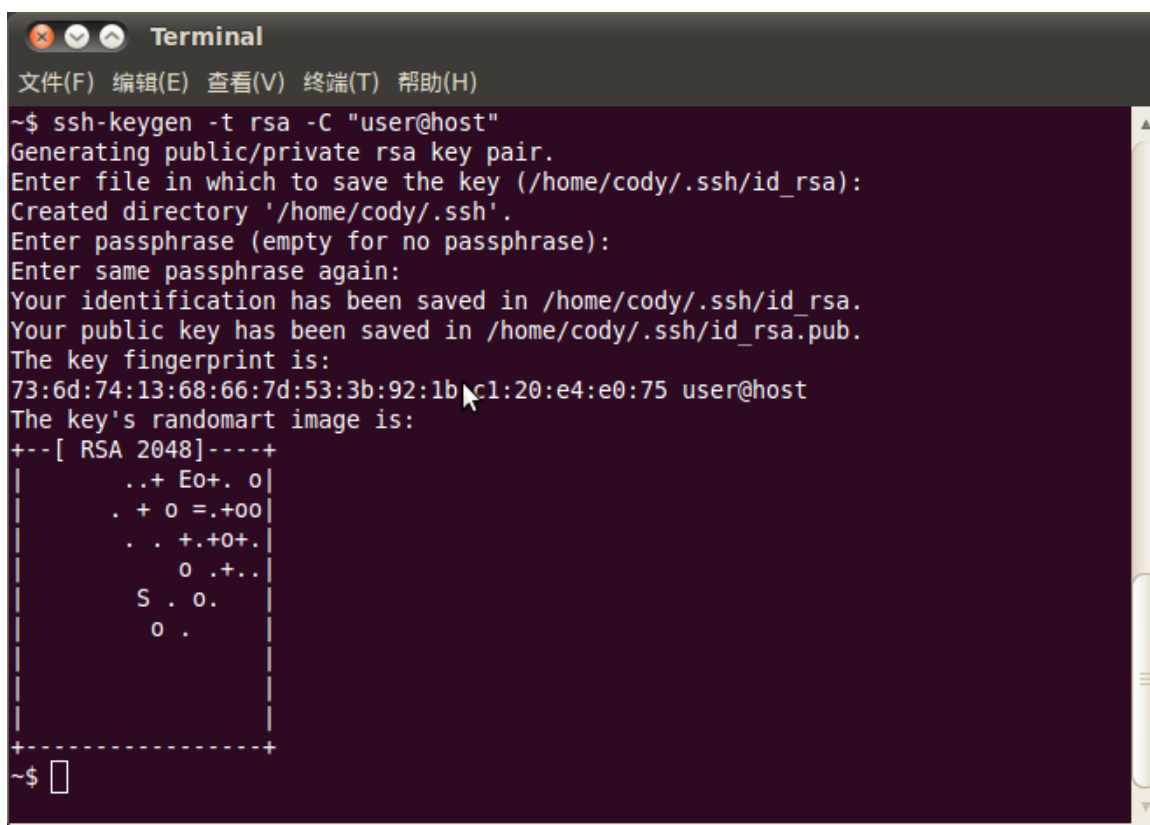
附录 B SSH 公钥操作说明

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。

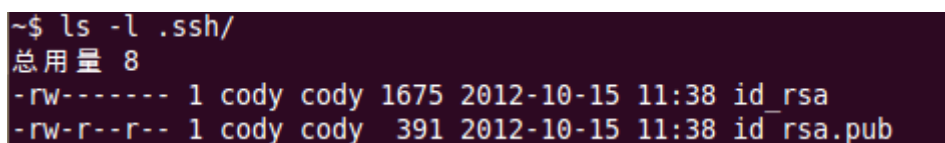


```
Terminal
文件(F) 编辑(E) 查看(V) 终端(T) 帮助(H)

~$ 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+. 0 |
|      . + 0 =.+00 |
|      . . +.+0+. |
|      0 .+. . |
|      S . 0. |
|      0 . |
+-----+

~$
```

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
```

请妥善保管生成的私钥文件 **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。

在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
```

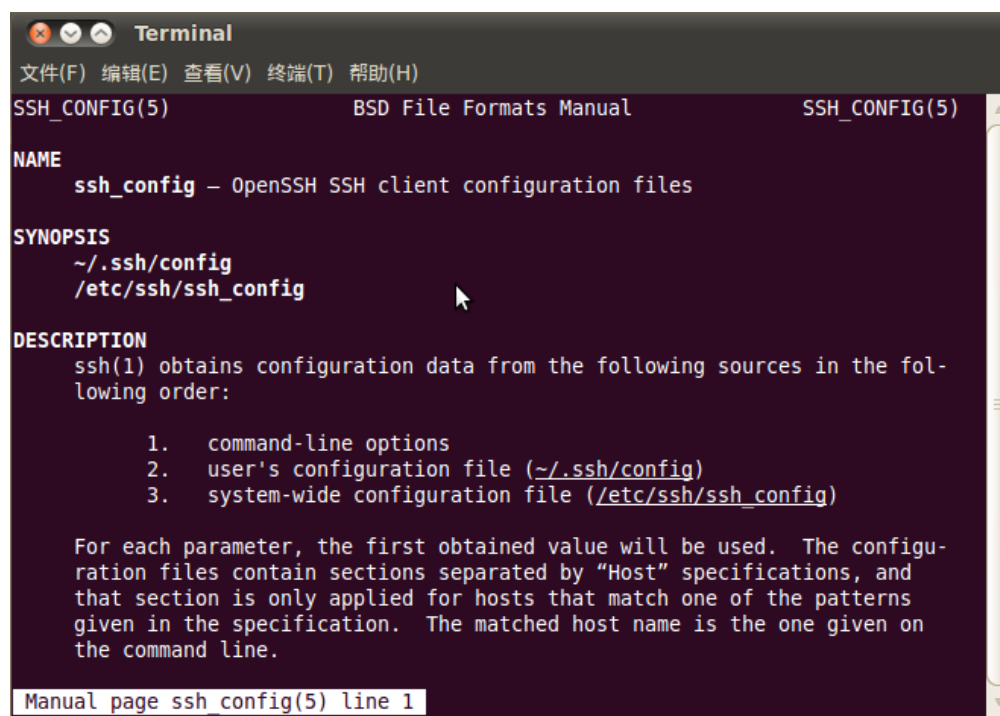
在 console 输入如下命令即可解决。

```
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
```

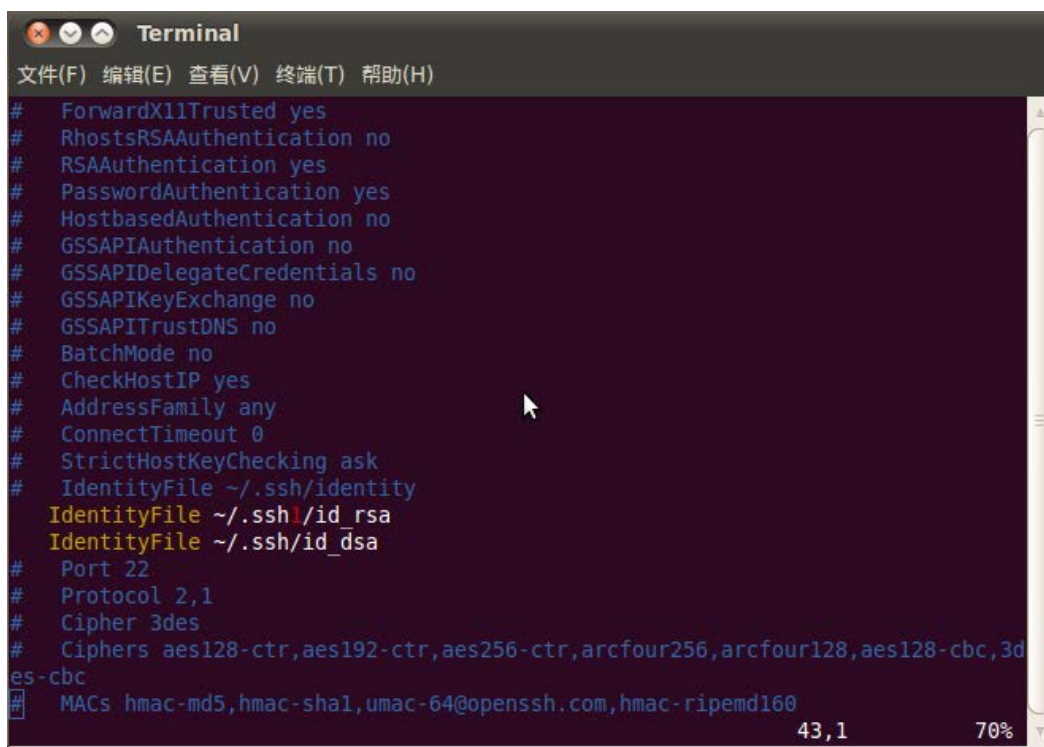


通过如下命令，配置当前用户的 ssh 配置。

```
~$ 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，可以切换不同的的密钥。

A screenshot of a macOS Terminal window titled "Terminal". The menu bar at the top shows "文件(F)", "编辑(E)", "查看(V)", "终端(T)", and "帮助(H)". The terminal content displays a list of SSH configuration options, each preceded by a hash symbol (#). The options include ForwardX11Trusted, RhostsRSAAuthentication, RSAAuthentication, PasswordAuthentication, HostbasedAuthentication, GSSAPIAuthentication, GSSAPIDelegateCredentials, GSSAPIKeyExchange, GSSAPITrustDNS, BatchMode, CheckHostIP, AddressFamily, ConnectTimeout, StrictHostKeyChecking, IdentityFile, Port, Protocol, Cipher, Ciphers, and MACs. The IdentityFile option is shown twice with different values. The terminal has a dark purple background and a white cursor is visible. 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
```

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。