Rockchip RK3588 Linux Edge SDK Release Note

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Preface

Overview

The document mainly introduces the Rockchip RK3588 Linux Edge SDK release notes, aiming to help engineers get started with the Rockchip RK3588 Linux Edge SDK development and debugging faster.

Product Version

Chipset	Debian Version	Kernel Version
RK3588	11	5.10

Revision History

Date	Version	Author	Change Description
2022-01-27	V0.0.1	Addy Ke	Alpha version
2022-05-10	V0.1.0	Addy Ke	Beta version

Intended Audience

This document (this guide) is mainly intended for:

Technical support engineers

Software development engineers

Contents

1. Overview

This SDK is based on Debian11 and kernel 5.10, U-boot v2017.09. It is suitable for RK3588 EVB development board and all other edge computing products based on it.

This SDK support VPU hardware codec, RGA image processing, GPU Wayland display, Docker, ROS2, Python SDK, RKNN AI acceleration and other edge computing functions. For details about debugging and interface introduction, please refer the project directory below docs/.

2. Main Function

Functions	**Module name**
ocker virtual machine	Docker
Ros1 robot	Ros1
Ros2 robot	Ros2-foxy
Media services and image processing based on Python3	Python-SDK
NPU accelerate	RKNN
Two machines are connected through PCIE	PCIE Connet

3. How to Get the SDK

The SDK is released by Rockchip server. Please refer to Software Development Guide to build a development environment.

3.1 Get RK3588 Linux Edge SDK

3.1.1 Get Repo and Copy to System Path

Get the system path to the repo and copy it

1. Download the repo

   Repo, a tool built on Python script by Google to help manage git repositories, 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
   ```

2. Copy to system path:

```
sudo cp repo/repo /usr/local/bin/
```

3.1.2 Get Source Code from Rockchip Code Server

To get RK3588 Linux Edge software package, customers need an account to access Rockchip source code lib. The customers apply SDK from Rockchip FAE contact, please provides the SSH public key for server authentication and authorization, and will be able to sync code after obtaining the server certificate authorization. For more details about Rockchip code server SSH public key authorization, please refer to Section 8 SSH public key instrcutions.

RK3588_Linux_Edge_SDK download command is as follows:

```
repo init --repo-url ssh://git@www.rockchip.com.cn/repo/rk/tools/repo -u \
ssh://git@www.rockchip.com.cn/edge/manifests -b master -m rk3588_linux_edge.xml
.repo/repo/repo sync --force-sync
```

3.1.3 Get Source Code from Local Compression Package

For quick access to SDK source code, Rockchip FAE contact usually provides corresponding version of SDK initial compression package. In this way, developers can get SDK source code through decompressing the initial compression package, which is the same as the one downloaded by repo.

Take RK3588_LINUX_Edge_SDK_Release_V0.1.0_20220429.tar.gz as an example, you can sync the source code through the following command after getting the initial package:

```
mkdir edge
tar xvf RK3588_Linux_Edge_SDK_V0.1.0_20220429.tar.xz -C edge
cd edge
.repo/repo/repo sync -l
.repo/repo/repo sync -c --no-tags
```

Developers can sync updates through the `.repo/repo/repo sync -c --no-tags` command, according to the update instructions regularly released by the FAE contact.

4. Software Development Guide

4.1 Development guide

Related documents are released with SDK in order to help developers to get started with sdk development and debugging faster, which can be obtained under docs directory, and will be continuously improved and updated.

4.2 Software Update Records

The software release version upgrade can be viewed through the project xml, and the method is as follows:

```
.repo/manifests$ realpath rk3588_linux_edge.xml
# For example: the printed version number is v0.1.0 and the update time is 20220510
# <SDK>/.repo/manifests/rk3588_linux_edge_release_v0.1.0_20220510.xml
```

The software release version upgrade and update content can be viewed through "Rockchip_RK3588_Linux_Edge_SDK_Release_Note.pdf", which can be obtained under docs/edge.

4.3 Boot Mode

RK3588 Linux Edge SDK support extlinux and fit boot mode.

The boot mode can be changed by modifying the bootmode configuration item, more detail please refer to "Rockchip_RK3588_Quick_Start_Linux_Edge_CN.pdf", which can be obtained under docs/edge/quick-start.

4.3.1 Extlinux Boot Mode

Extlinux boot mode: Uboot uses extlinux to boot the kernel image boot_linux.img in ext2 file system format. After the system started, the kernel partition is mounted to the /boot directory.

The extlinux boot mode support kernel image upgrade in three ways:

1. Flash the kernel image with the flash tool.
2. Copy extlinux.conf, Image and toybrick.dtb to /boot/extlinux using scp or wget directory.
3. Copy extlinux.conf, Image, and toybrick.dtb to /boot/ extlinux directory as a deb package, using apt/dpkg command to install and upgrade.

   The deb package of the kernel image can be added with the Mali, RGA and MPP system library dependencies to achieve kernel and hardware related system library synchronous upgrade.

4.3.2 Fit Boot Mode

Fit boot mode: uboot boots the kernel image boot.img in fit mode. The kernel Image boot.img include Image, dtb file, and resource.

For more detail about fit boot mode please refer to "Rockchip_Developer_Guide_UBoot_Nextdev_CN.pdf" section 12, which can be obtained from docs/common/u-boot.

Fit boot mode support kernel image upgrade in two ways.

- Flash the kernel image with the flash tool.
- Upgrade the kernel image in OTA.

4.3.3 Comparison of Boot Modes

Function	Advantage	Disadvantage	Application scene
extlinux	Support upgrade online, operation flexible	When upgrade is interrupted or abnormal power failure may cause file damage.	Development board
fit	Fast startup speed and support safe startup	The upgrade can only through OTA mode or flash image.	Products that don't need frequent upgrades.

4.4 System Partition Description

1. extlinux boot mode

Number	Start (sector)	End (sector)	Size	Name
1	0x2000	0x6000	8M	uboot
2	0x6000	0x2000	4M	misc
3	0x8000	0x28000	64M	boot
4	0x28000	0x68000	128M	recovery
5	0x68000	0x78000	32M	**resource**
6	0x78000	-	-	rootfs

2. fit boot mode

Number	Start(sector)	End(setor)	Size	Name
1	0x2000	0x6000	8M	uboot
2	0x6000	0x2000	4M	misc
3	0x8000	0x28000	64M	boot
4	0x28000	0x68000	128M	recovery
5	0x68000	0x78000	32M	**backup**
6	0x78000	0x1c78000	14G	rootfs
7	0x1c78000	0x1cb8000	128M	oem
8	0x1cb8000	-	-	userdata

4.5 SDK Compilation and Image Flash Instruction

Please refer to "Rockchip_RK3588_Quick_Start_Linux_Edge_CN.pdf", which can be found in the project directory docs/edge/quick-start.

4.6 Docker Instruction

Please refer to "Rockchip_Developer_Guide_Linux_Edge_Docker_CN.pdf", which can be found in the project directory docs/edge/docker.

4.7 ROS2 Installation and Operation Instruction

Please refer to "Rockchip_Developer_Guide_Linux_Edge_Ros2_CN.pdf", which can be found in the project directory docs/edge/ros2.

4.8 Python SDK Instruction

Please refer to "Rockchip_Developer_Guide_Linux_Edge_Python_SDK_CN.pdf", which can be found in the project directory docs/edge/python-sdk.

4.9 RGA Instruction

Please refer to "RGA_API_Instruction_CN.pdf", which can be found in the project directory docs/edge/rga.

4.10 MPP Instruction

Please refer to "MPP_API_Developer_Guide_CN.md", which can be found in the project directory docs/edge/rga.

4.11 RKNN Instruction

Please refer to "Rockchip_Developer_Guide_Linux_Edge_Python_RKNN_CN.pdf", which can be found in the project directory docs/edge/rknn.

4.12 Debian11 System Instruction

Please refer to "Rockchip_Developer_Guide_Linux_Edge_Debian_CN.pdf", which can be found in the project directory docs/edge/debian.

5. Hardware Development Guide

5.1 RK3588 EVB Harward Design Guide

Please refer to "Rockchip_RK588_Hardware_Design_Guide_V1.0_CN.pdf", which can be found in the project directory docs/edge/hardware.

5.2 RK3588 EVB Hardward Development Guide

Please refer to "Rockchip_RK3588_User_Manual_EVB_V1.0_CN.pdf", which can be found in the project directory docs/edge/hardware.

6. SDK Project Directories Introduction

The SDK project directory include build, docs, external, kernel, patches, prebuilts, rkbin, rootfs, tools, uboot, test and vendor directories. Each directory or its subdirectories corresponds to a git project, and submissions need to be made in their respective directories.

- build: Save the SDK compilation, flash and package scripts.
- externel: Save the third party related directory, including security related library.
- kernel: Save the code developed by Kernel 5.10.
- patches: Save kernel、uboot and rkbin differential patch.
- docs: Save development guides, platform support lists, tool usage documents, Linux development guides, etc.
- prebuilts: Save the cross-compilation tool chain.
- rkbin: Save Rockchip related Binary and tool.
- rootfs: Save Debian basic images, system software packages, and initrd.
- tools: Save common tools under Linux and Windows OS.
- u-boot: Save u-boot code developed based on V2017.09 version.
- test: Save functional and stress testing tools and code.
- vendor: Save vendor related configurations and root file system installation scripts.
- out: Save compiled firmware.
- mkcombinedroot: Save the script for compiling boot.img android kernel image

7. SSH Public Key Operation Introduction

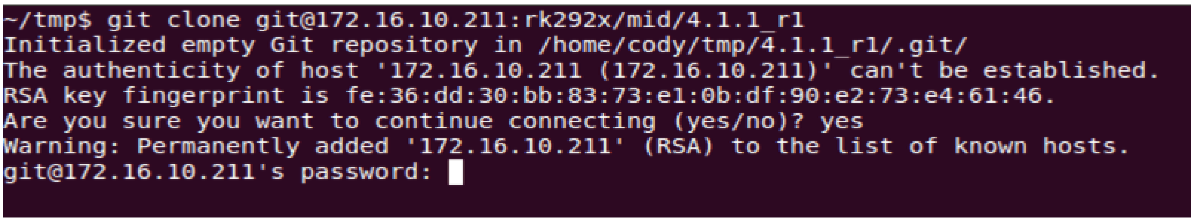
Please follow the introduction in the "Rockchip_User_Guide_SDK_Application_And_Synchronization_CN" to generate an SSH public key and send the email to fae@rock-chips.com, to get the SDK code.

This document will be released to customers during the process of applying for permission.

7.1 Multiple Machines Use the Same SSH Public Key

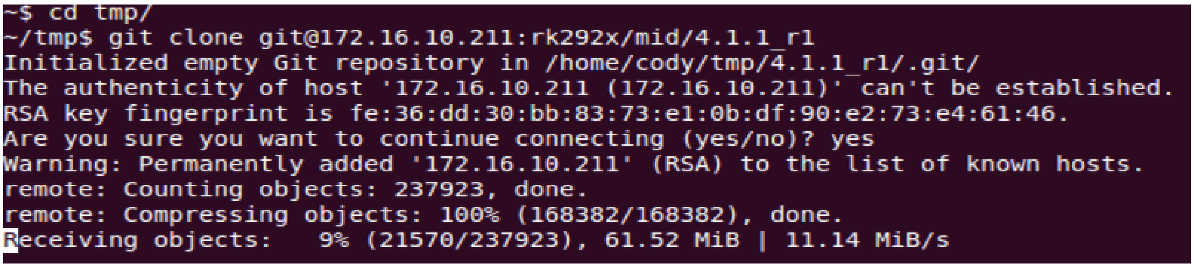
If the same SSH public key should be used in different machines, you can copy the SSH private key file id_rsa to "~/.ssh/id_rsa" of the machine you want to use.

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 failture to sign using the key
```

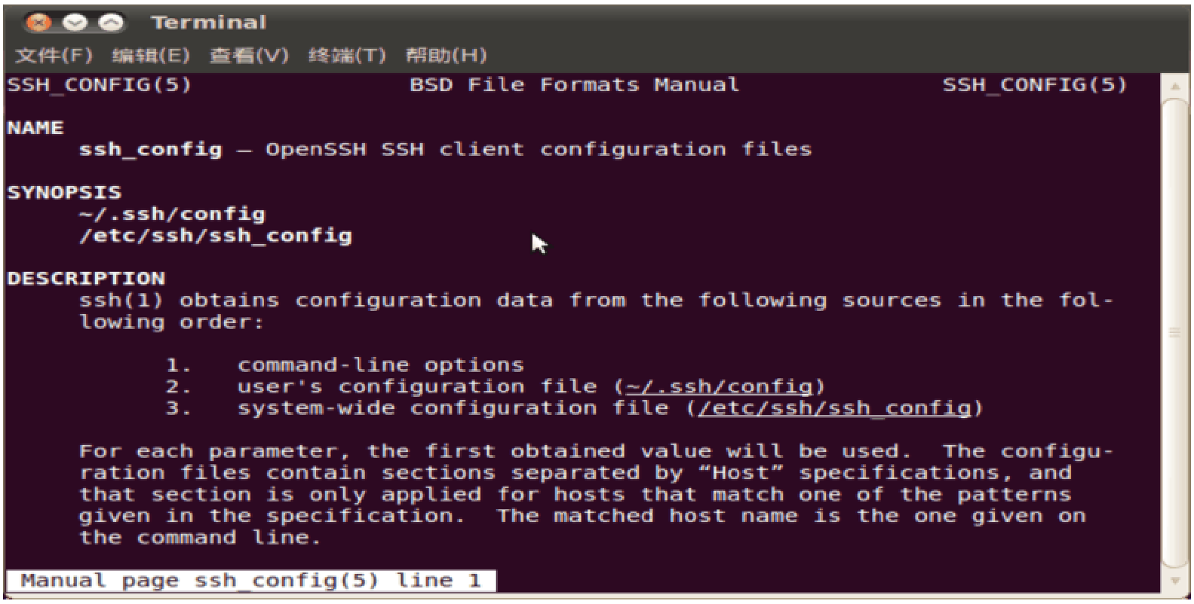
Enter the following command in console to solve.

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

7.2 One Machine Switches Different SSH Public Keys

You can configure SSH by referring to ssh_config documentation.

```
~$ man ssh_config
```

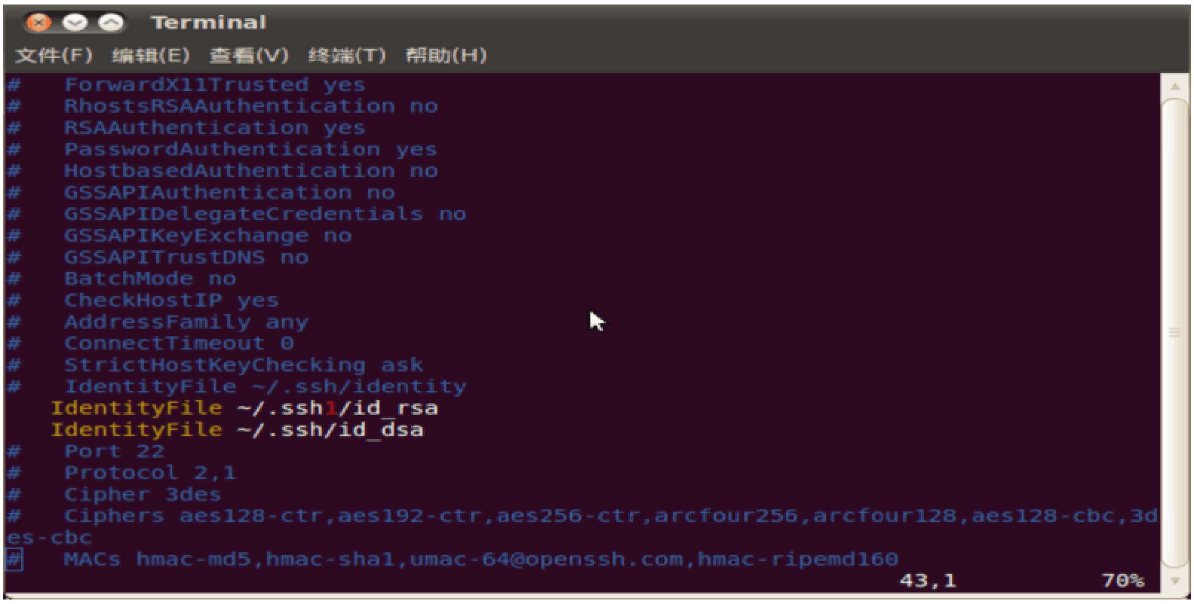


```
SSH_CONFIG(5)              BSD File Formats Manual              SSH_CONFIG(5)

NAME
     ssh_config — OpenSSH SSH client configuration files

SYNOPSIS
     ~/.ssh/config
     /etc/ssh/ssh_config

DESCRIPTION
     ssh(1) obtains configuration data from the following sources in the fol-
     lowing order:

           1.   command-line options
           2.   user's configuration file (~/.ssh/config)
           3.   system-wide configuration file (/etc/ssh/ssh_config)

     For each parameter, the first obtained value will be used.  The configu-
     ration files contain sections separated by “Host” specifications, and
     that section is only applied for hosts that match one of the patterns
     given in the specification.  The matched host name is the one given on
     the command line.

 Manual page ssh_config(5) line 1
```

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.



```
#   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 ~/.ssh1/id_rsa
  IdentityFile ~/.ssh/id_dsa
#   Port 22
#   Protocol 2,1
#   Cipher 3des
#   Ciphers aes128-ctr,aes192-ctr,aes256-ctr,arcfour256,arcfour128,aes128-cbc,3d
es-cbc
#   MACs hmac-md5,hmac-sha1,umac-64@openssh.com,hmac-ripemd160
                                                            43,1          70%
```

7.3 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.

Keep the private key file properly. Do not grant second authorization to third parties.

7.4 Reference Documents

For more details, please refer to document

"/docs/edge/other/Rockchip_User_Guide_SDK_Application_And_Synchronization_CN.pdf"