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RK3399PRO Linux SDK Release Note

（Technical Department, Dept.Ⅲ）

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2020-03-12	V1.2.2	Support rk3399pro evb v14	Caesar Wang	Eddie Cai

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Chapter 1 Overview

This SDK is based on 3 Linux systems: Buildroot 2018.02-rc3, Yocto Thud 2.6, Debian 9, with kernel 4.4 and U-boot v2017.09. It is applicable to the development of RK3399Pro EVB and all other Linux products developed based on it.

This SDK supports NPU TensorFlow/Caffe model, VPU hardware decoding, GPU 3D, Wayland display, QT and other functions. For detailed function debugging and interface instructions, please refer to related documents under the project's docs/ directory.

Chapter 2 Main Functions

Functions	Module Names
Data Communication	Wi-Fi, Ethernet Card, USB, SDCARD
Application	Multimedia playback, settings, camera, file management

Chapter 3 How to Obtain the SDK

SDK is released by Rockchip server or obtained from Github open source website. Please refer to Chapter 7 SDK Compilation Instruction to build a development environment.

First method to obtain the SDK: get source code from Rockchip code server:

To get RK3399Pro Linux software package, customers need an account to access the source code repository provided by Rockchip. In order to be able to obtain code synchronization, please provide SSH public key for server authentication and authorization when apply for SDK from Rockchip technical window. About Rockchip server SSH public key authorization, please refer to Chapter 10 SSH Public Key Instruction.

RK3399Pro_Linux_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/linux/rk/platform/manifests -b linux
-m rk3399pro_linux_release.xml
```

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
```

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

Take rk3399pro_linux_sdk_release_v1.2.0_20191224.tgz as an example. After copying initialization package, you can get source code by running the following command:

```
mkdir rk3399pro
tar xvf rk3399pro_linux_sdk_release_v1.2.0_20191224.tgz -C rk3399pro
```

```
cd rk3399pro
.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.

Second method to obtain the SDK: get source code from Github open source website:

Download repo tools

```
git clone https://github.com/rockchip-linux/repo.git
```

Make an rk3399pro linux work directory:

```
mkdir rk3399pro_linux
```

Enter the rk3399pro linux work directory

```
cd rk3399pro_linux/
```

Initialize repo repository:

```
../repo/repo init --repo-url=https://github.com/rockchip-linux/repo -u
https://github.com/rockchip-linux/manifests -b master -m
rk3399pro_linux_release.xml
```

Synchronize the whole project:

```
../repo/repo sync
```

Note: If your project has already started, please choose the first Method to get the code first. Unlike Github, it has passed by internal stress testing and version control. The second method is more suitable for enthusiasts and project evaluation.

Chapter 4 Software Development Guide

4.1 Development Guide

RK3399Pro Linux SDK Kernel version is Linux4.4, Rootfs is Buidlroot (2018.02-rc3), Yocto(thud 2.6) and Debian9 respectively. To help engineers quick start of SDK development and debugging, "Rockchip Linux Software Development Guide" is released with the SDK. It can be obtained in the docs/ directory and will be continuously updated.

4.2 NPU Development Tool

The SDK NPU development tool includes the following items:

RKNN_DEMO(MobileNet SSD)：

For RKNN Demo, please refer to the directory "external/rknn_demo/". See the project directory "docs/Soc_public/RK3399PRO/ Rockchip_Developer_Guide_Linux_RKNN_DEMO_CN.pdf" for details.

RKNN-TOOLKIT：

Development tools are in project directory “external/rknn-toolkit”. Which is used to model conversion, model reasoning, model performance evaluation functions, etc. Please refer to documents in the docs/ directory for details.

├── Rockchip_Developer_Guide_RKNN_Toolkit_Custom_OP_CN.pdf
├── Rockchip_Developer_Guide_RKNN_Toolkit_Custom_OP_EN.pdf
├── Rockchip_Quick_Start_RKNN_Toolkit_V1.3.0_CN.pdf
├── Rockchip_Quick_Start_RKNN_Toolkit_V1.3.0_EN.pdf
├── Rockchip_Trouble_Shooting_RKNN_Toolkit_V1.3_CN.pdf
├── Rockchip_Trouble_Shooting_RKNN_Toolkit_V1.3_EN.pdf
├── Rockchip_User_Guide_RKNN_Toolkit_V1.3.0_CN.pdf
├── Rockchip_User_Guide_RKNN_Toolkit_V1.3.0_EN.pdf
├── Rockchip_User_Guide_RKNN_Toolkit_Visualization_CN.pdf
├── Rockchip_User_Guide_RKNN_Toolkit_Visualization_EN.pdf

RKNN-DRIVER:

RKNN DRIVER development materials are in the project directory “external/rknpu”.

RKNPUTools:

RKNN API development materials are in the project directory “external/NRKNPUTool”.

NPU software setup instructions：

RK3399Pro NPU software setup instructions, please refer to the project directory docs/Soc_public/RK3399PRO/ Rockchip_RK3399Pro_Instruction_Linux_NPU_CN.pdf

4.3 Software Update History

Software release version upgrade can be checked through project xml file by the following command:

```
.repo/manifests$ ls -l -h rk3399pro_linux_release.xml
```

Software release version updated information can be checked through the project text file by the following command:

```
.repo/manifests$ cat rk3399pro_linux_v0.01/RK3399PRO_Release_Note.txt
```

Or refer to the project directory:

docs/SoC platform related/RK3399PRO/RK3399PRO_Linux_SDK_Release_Note.pdf

Chapter 5 Hardware Development Guide

Hardware development please refer to user guides in the project directory “docs/Soc_public/RK3399PRO/ Rockchip_RK3399Pro_User_Guide_Hardware_xx.pdf”.

Chapter 6 SDK Project Directory Introduction

There are buildroot, debian, recovery, 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 commit should be done in the respective directory.

1) app: store application apps like qcamera/qfm/qplayer/qseting and other applications.

2) buildroot: root file system based on Buildroot (2018.02-rc3).

3) debian: root file system based on Debian 9.

4) device/rockchip: store board-level configuration for each chip and some scripts and prepared files for compiling and packaging firmware.

5) docs: stores development guides, platform support lists, tool usage, Linux development guides, and so on.

6) distro: a root file system based on Debian 10.

7) IMAGE: stores compile time, XML, patch and firmware directory every time.

8) external: stores some third-party libraries, including audio, video, network, recovery and so on.

9) kernel: stores kernel4.4 development code.

10) npu: store npu code.

11) prebuilts: stores cross-compilation toolchain.

12) rkbin: stores Rockchip Binary and tools.

13) rockdev: stores compiled output firmware.

14) tools: stores some commonly used tools under Linux and Windows system.

15) u-boot: store U-Boot code developed based on v2017.09 version.

16) yocto: stores the root file system developed based on YoctoThud 2.6.

Chapter 7 SDK Compilation Instructions

Ubuntu 16.04 system:

Please install software packages with below commands to setup Buildroot compiling environment:

```
sudo apt-get install repo git-core gitk git-gui gcc-arm-linux-
gnueabihf 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 dblatex
graphviz python-matplotlib libc6:i386 libssl-dev texinfo liblz4-tool
genext2fs expect patchelf
```

Please install software packages with below commands to setup Debian compiling environment:


```
sudo apt-get install repo git-core gitk git-gui gcc-arm-linux-gnueabih
f u-boot-tools device-tree-compiler gcc-aarch64-linux-gnu mtools parte
d libudev-dev libusb-1.0-0-dev python-linaro-image-tools linaro-image-
tools gcc-4.8-multilib-arm-linux-gnueabihf gcc-arm-linux-gnueabihf lib
ssl-dev gcc-aarch64-linux-gnu  g+conf autotools-dev libsigsegv2 m4 int
ltool libdrm-dev curl sed make binutils build-essential gcc g++ bash p
atch gzip bzip2 perl tar cpio python unzip rsync file bc wget libncurs
es5 libqt4-dev libglib2.0-dev libgtk2.0-dev libglade2-dev cvs git merc
urial rsync openssh-client subversion asciidoc w3m dblatex graphviz py
thon-matplotlib libc6:i386 libssl-dev texinfo liblz4-tool genext2fs
```

Ubuntu 17.04 or later version system:

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

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

(gcc-4.8-multilib-arm-linux-gnueabihf is not needed)

Note: NPU firmware will be uploaded when RK3399pro Power on. The default NPU firmware is pre-compiled into "/usr/share/npu_fw" directory of rootfs. For NPU firmware flashing and setup methods, please refer to the document under "docs/Soc_public/RK3399PRO/ Rockchip_RK3399Pro_Instruction_Linux_NPU_CN.pdf".

NPU and RK3399Pro firmware compiling methods will be described below:

7.1 NPU Compilation Instruction

7.1.1 Uboot Compilation

Enter project npu/u-boot directory and run "make.sh" to get rknpu_lion_loader_v1.03.103.bin trust.img uboot.img:

rk3399pro-npu：

```
./make.sh rknpu-lion
```

The compiled files are in u-boot directory:

```
u-boot/
├── rknpu_lion_loader_v1.03.103.bin
├── trust.img
└── uboot.img
```

7.1.2 Kernel Compilation Steps

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

rk3399Pro EVB V10/V11/V12 boards：

```
cd kernel  //change to stable-4.4-rk3399pro_npu-linux branch
make ARCH=arm64 rk3399pro_npu_defconfig
make ARCH=arm64 rk3399pro-npu-evb-v10.img -j12
```

rk3399Pro EVB V13/V14 board：

```
cd kernel  //change to stable-4.4-rk3399pro_npu-pcie-linux branch
make ARCH=arm64 rk3399pro_npu_pcie_defconfig
make ARCH=arm64 rk3399pro-npu-evb-v10-multi-cam.img -j12
```


7.1.3 Boot.img and NPU Firmware Generation Steps

Enter project npu directory and run the following command to automatically compile and package boot.img:

RK3399Pro EVB V10/V11/V12 boards：

```
cd npu
./build.sh ramboot
./mkfirmware.sh rockchip_rk3399pro-npu
```

RK3399Pro EVB V13/V14 board：

```
cd npu/device/rockchip
ln –sf rk3399pro-npu-multi-cam/BoardConfig.mk .BoardConfig.mk
cd / && cd npu
./build.sh ramboot
./mkfirmware.sh rockchip_rk3399pro-npu-multi-cam
```

7.1.4 Full Automatic Compilation

After compiling various parts of Kernel/U-Boot/Rootfs above, enter root directory of project directory and execute the following commands to automatically complete all compilation:

RK3399Pro EVB V10/V11/V12 boards：

```
cd npu/device/rockchip
cp rk3399pro-npu/BoardConfig.mk .BoardConfig.mk
cd - && cd npu
./build.sh uboot
./build.sh kernel
./build.sh ramboot
./mkfirmware.sh rockchip_rk3399pro-npu
```

RK3399Pro EVB V13/V14 boards：

```
cd npu/device/rockchip
cp rk3399pro-npu-multi-cam/BoardConfig.mk .BoardConfig.mk
cd ../../
./build.sh uboot
./build.sh kernel
./build.sh ramboot
./mkfirmware.sh rockchip_rk3399pro-npu-multi-cam
```

After compiling, boot.img, uboot.img, trust.img, MiniLoaderAll.bin are generated in rockdev directory.

Note that the generated npu firmware under rockdev should be placed in the specified directory of rootfs "/usr/share/npu_fw".

7.2 RK3399pro Compilation Instruction

7.2.1 U-Boot Compilation

Enter project u-boot directory and execute "make.sh" to get rk3399pro_loader_v1.23.115.bin trust.img uboot.img:

RK3399Pro EVB：

```
./make.sh rk3399pro
```

The compiled file is in u-boot directory:


```
u-boot/
├── rk3399pro_loader_v1.24.119.bin
├── trust.img
└── uboot.img
```

7.2.2 Kernel Compilation

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

RK3399Pro EVB V10 boards：

```
cd kernel
make ARCH=arm64 rockchip_linux_defconfig
make ARCH=arm64 rk3399pro-evb-v10-linux.img -j12
```

RK3399Pro EVB V11/V12 boards:

```
cd kernel
make ARCH=arm64 rockchip_linux_defconfig
make ARCH=arm64 rk3399pro-evb-v11-linux.img -j12
```

RK3399pro EVB V13 boards:

```
cd kernel
make ARCH=arm64 rockchip_linux_defconfig
make ARCH=arm64 rk3399pro-evb-v13-linux.img -j12
```

RK3399pro EVB V14 boards:

```
cd kernel
make ARCH=arm64 rockchip_linux_defconfig
make ARCH=arm64 rk3399pro-evb-v14-linux.img -j12
```

After compiling, boot.img which contains image and DTB of kernel will be generated in kernel directory.

7.2.3 Recovery Compilation

Enter project root directory and run the following command to automatically complete compilation and packaging of Recovery.

RK3399Pro EVB board：

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

The recovery.img is generated in Buildroot directory “output/rockchip_rk3399pro_recovery/images” after compiling.

7.2.4 Buildroot rootfs and APP Compilation

Enter project root directory and run the following commands to automatically complete compiling and packaging of Rootfs.

RK3399Pro EVB V10/V11/V12 boards：

```
cd device/rockchip/rk3399pro
cp BoardConfig_rk3399pro_usb.mk ../.BoardConfig.mk
```

```
cd - && ./build.sh rootfs
```

RK3399Pro EVB V13 boards：

```
cd device/rockchip/rk3399pro
cp Boardconfig_rk3399pro_multi_cam_pcie.mk ../.BoardConfig.mk
cd - && cd ./build.sh rootfs
```

RK3399Pro EVB V14 boards：

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

After compiling, rootfs.ext4 is generated in Buildroot directory "output/rockchip_rk3399pro_combine/images".

Note：

If you need to compile a single module or a third-party application, you need to setup the cross-compiling environment.

Cross-compiling tool is located in "buildroot/output/rockchip_rk3399pro_combine/host/usr" directory. You need to set bin/ directory of tools and aarch64-buildroot-linux-gnu/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 check:

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

When the following logs are printed, configuration is successful:

```
aarch64-linux-gcc.br_real (Buildroot 2018.02-rc3-01797-gcd6c508) 6.5.0
```

7.2.5 Debian rootfs Compilation

Enter rootfs/directory firstly:

```
cd debian/ && ./build.sh debian
```

The following compilation and debian firmware generation, you can refer to "debian/readme.md" in the current directory.

7.2.5.1 Building base debian system

```
sudo apt-get install binfmt-support qemu-user-static live-build
sudo dpkg -i ubuntu-build-service/packages/*
sudo apt-get install -f
```

Compile 32-bit debian:

```
RELEASE=stretch TARGET=desktop ARCH=armhf  ./mk-base-debian.sh
```

Or compile 64-bit debian

```
RELEASE=stretch TARGET=desktop ARCH=arm64  ./mk-base-debian.sh
```

After compiling, linaro-stretch-alip-xxxxx-1.tar.gz (xxxxx is generated timestamp) will be generated in debian/ directory.

FAQ:

If you encounter the following problem during above compiling:

```
noexec or nodev issue /usr/share/debootstrap/functions: line 1450: ...
./rootfs/ubuntu-build-service/stretch-desktop-armhf/chroot/test-dev-nu
ll: Permission denied E: Cannot install into target '/home/foxluo/work
3/rockchip/rk_linux/rk3399_linux/rootfs/ubuntu-build-service/stretch-d
esktop-armhf/chroot' mounted with noexec or nodev
```

Solution：

```
mount -o remount,exec,dev xxx (xxx is the mount place), then rebuild
it.
```

In addition, if there are other compilation issues, please check firstly that the compiler system is not ext2/ext4

7.2.5.2 Building rk-debian rootfs

Compile 32-bit Debian:

```
VERSION=debug ARCH=armhf ./mk-rootfs-stretch.sh
```

(The “debug” behind is recommended in the development process)

Compile 64-bit Debian:

```
VERSION=debug ARCH=arm64 ./mk-rootfs-stretch.sh
```

(The “debug” behind is recommended in the development process)

7.2.5.3 Creating the ext4 image(linaro-rootfs.img)

```
./mk-image.sh
```

Will generate linaro-rootfs.img.

7.2.6 Yocto rootfs Compilation

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

RK3399Pro EVB boards：

```
./build.sh yocto
```

After compiling, rootfs.img is generated in yocto directory “/build/lastest”.

FAQ:

```
Please use a locale setting which supports UTF-8 (such as LANG=en_US.U
TF-8).
Python can't change the filesystem locale after loading so we need a U
TF-8
when Python starts or things won't work。
```

Solution:

```
locale-gen en_US.UTF-8
export LANG=en_US.UTF-8 LANGUAGE=en_US.en LC_ALL=en_US.UTF-8
```

Or refer to https://webkul.com/blog/setup-locale-python3

The image generated after compiling is in “yocto/build/lastest/rootfs.img”.

The default login username is root.

Refer to Rockchip Wiki for more detailed information of Yocto

7.2.7 Full Automatic Compilation

After compiling various parts of Kernel/U-Boot/Recovery/Rootfs above, enter root directory of project directory and execute the following commands to automatically complete all compilation:

```
$./build.sh all
```

It is Buildroot by default, you can specify rootfs by setting the environment variable RK_ROOTFS_SYSTEM.

If Yocto is needed, you can generate with the following commands:

```
$export RK_ROOTFS_SYSTEM=yocto
$./build.sh all
```

Detailed parameter usage, you can use help to search, for example

```
rk3399pro$ ./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
recovery        -build recovery
all             -build uboot, kernel, rootfs, recovery image
....
default         -build all modules
```

Board level configurations of each board need to be configured in the "/device/rockchip/rk3399pro/Boardconfig.mk".

Main configurations of RK3399Pro EVB are as follows:


```
# Target arch
export RK_ARCH=arm64
# Uboot defconfig
export RK_UBOOT_DEFCONFIG=rk3399pro
# Kernel defconfig
export RK_KERNEL_DEFCONFIG=rockchip_linux_defconfig
# Kernel dts
export RK_KERNEL_DTS=rk3399pro-evb-v11-linux
# boot image type
export RK_BOOT_IMG=boot.img
# kernel image path
export RK_KERNEL_IMG=kernel/arch/arm64/boot/Image
# parameter for GPT table
export RK_PARAMETER=parameter-buildroot.txt
# Buildroot config
export RK_CFG_BUILDROOT=rockchip_rk3399pro
# Recovery config
export RK_CFG_RECOVERY=rockchip_rk3399pro_recovery
```

7.2.8 Firmware Package Steps

After compiling various parts of Kernel/U-Boot/Recovery/Rootfs above, enter root directory of project directory and run the following command to automatically complete all firmware packaged into rockdev directory:

Generate firmware:

```
./mkfirmware.sh
```

Chapter 8 Upgrade Instruction

There are V10/V11/V12/V13/V14 Five versions of current rk3399Pro EVB, V10 version board is green, and V10/V11/V12/V13/V14 version board is black. Board function positions are the same. The following is the introduction of RK3399Pro EVB V12 board, as shown in the following figure.

Serial port for debugging with 1.5M baud rate

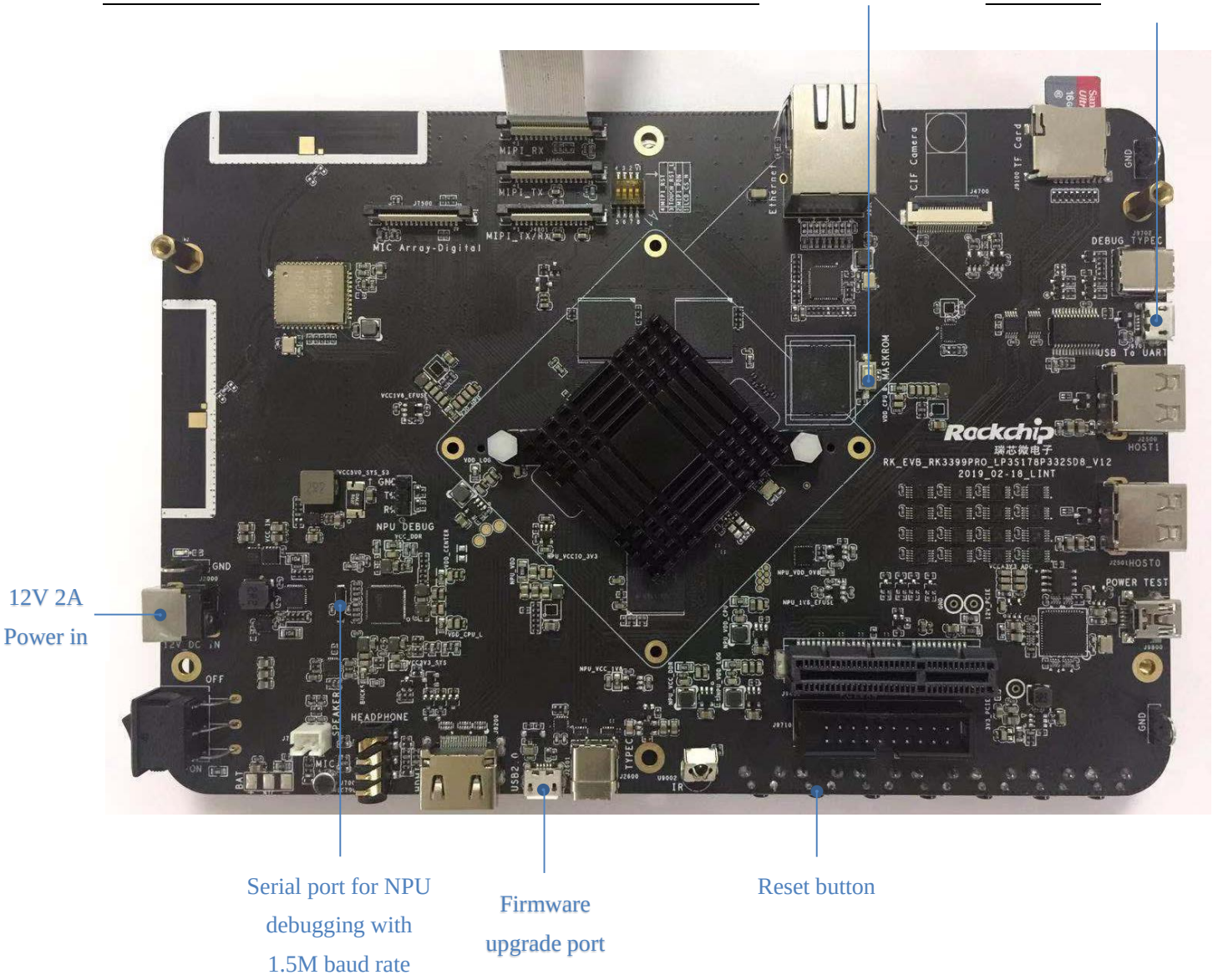


Figure 1 RK3399Por EVB

8.1 Windows Upgrade Instruction

SDK provides windows upgrade tool (this tool should be V2.55 or later version) which is located in project root directory:

```
tools/
├── windows/AndroidTool
```

As shown below, after compiling the corresponding firmware, device should enter MASKROM (aka BootROM) mode for update. After connecting USB cable, long press the button “MASKROM” and press reset button "RST" at the same time and then release, device will enter MASKROM Mode. Then you should load the paths of the corresponding images and click “Run” to start upgrade. You can also press the “recovery” button and press reset button “RST”then release to enter loader mode to upgrade. Partition offset and update files of MASKROM Mode are shown as follows (Note: Window PC needs to run the tool as an administrator):

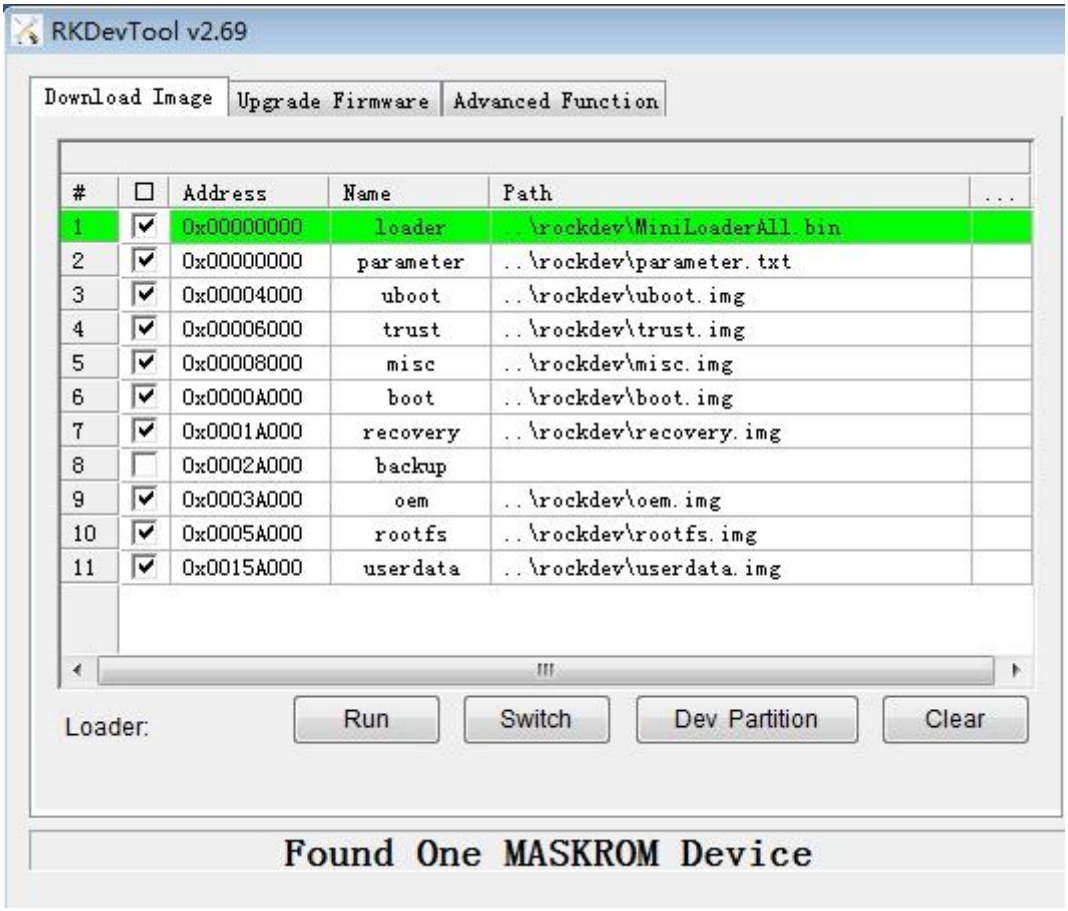


Figure 2 Upgrade tool **AndroidTool.exe**

Note：Before upgrade, please install the latest USB driver, which is in the below directory:

```
tools/windows/DriverAssitant_v4.8.zip
```

8.2 Linux Upgrade Instruction

The Linux upgrade tool (Linux_Upgrade_Tool should be v1.33 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, upgrade 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       -recovery   rockdev/recovery.img
sudo ./upgrade_tool di -oem        rockdev/oem.img
sudo ./upgrade_tool di -rootfs     rocdev/rootfs.img
sudo ./upgrade_tool di -userdata   rockdev/userdata.img
sudo ./upgrade_tool rd
```

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

```
./rkflash.sh
```


8.3 System Partition Instruction

Default partition (below is RK3399Pro EVB reference partition):

Number	Start (sector)	End (sector)	Size	Code	Name
1	16384	24575	4096K	0700	uboot
2	24576	32767	4096K	0700	trust
3	32768	40959	4096K	0700	misc
4	40960	106495	32.0M	0700	boot
5	106496	303104	96.0M	0700	recovery
6	303104	368639	32.0M	0700	backup
7	368640	499711	64.0M	0700	oem
8	499712	13082623	6144M	0700	rootfs
9	13082624	30535646	8521M	0700	userdata

uboot partition: update uboot.img compiled by uboot.

trust partition: update trust.img compiled by uboot.

misc partition: update misc.img for recovery.

boot partition: update boot.img compiled by kernel.

recovery partition: update recovery.img.

backup partition: reserved, temporarily useless. Will be used for backup of recovery as 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 , Yocto or Debian.

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

Chapter 9 RK3399Pro SDK Firmware and Simple Demo Test

9.1 RK3399Pro SDK Firmware

RK3399PRO_LINUX_SDK_V1.2.0_20191224 firmware download links are as follows:
(Including Buildroot,Debian and Yocto firmware)

V10 (green) development board:
Buildroot: https://eyun.baidu.com/s/3jJU8WD4
Debian: https://eyun.baidu.com/s/3c3Z4SKS
Yocto: https://eyun.baidu.com/s/3ghcM6AZ

V11/V12 (black) development board:
Buildroot: https://eyun.baidu.com/s/3rae5Xes
Debian: https://eyun.baidu.com/s/3nxqh5ax

Yocto: https://eyun.baidu.com/s/3c3G8ahM

V13 (black) development board:

Buildroot: https://eyun.baidu.com/s/3kWAoci7

Debian: https://eyun.baidu.com/s/3qZw6Jec

Yocto: https://eyun.baidu.com/s/3mj0IGiO

V14 (black) development board:

Buildroot: https://eyun.baidu.com/s/3qYZ6kEw

Debian: https://eyun.baidu.com/s/3qZZg0Rq

9.2 RKNN_DEMO Test

Firstly, insert usb camera, run **rknn_demo** in Buildroot system or run **test_rknn_demo.sh** in Debian system.

Refer to project document "docs/Soc_public/RK3399PRO/ Rockchip_Developer_Guide_Linux_RKNN_DEMO_CN.pdf module developer guide.pdf" for details, the results of running in Buildroot are as follows：

```
[root@rk3399pro:/]# rknn_demo
librga:RGA_GET_VERSION:3.02,3.020000
ctx=0x2e834c20,ctx->rgaFd=3
Rga built version:version:+2017-09-28 10:12:42
Success build
size = 12582988, g_bo.size = 13271040
size = 12582988, cur_bo->size = 13271040
size = 12582988, cur_bo->size = 13271040
...
read model:/usr/share/rknn_demo/mobilenet_ssd.rknn, len:32002449
Please configure uvc...
D RKNNAPI: ==========================================
D RKNNAPI: RKNN VERSION:
D RKNNAPI:   API: 1.3.0 (933b767 build: 2019-11-27 14:43:32)
D RKNNAPI:   DRV: 1.3.0 (c4f8c23 build: 2019-11-25 10:39:29)
D RKNNAPI: ==========================================
```

It will display as follows：

Chapter 10 SSH Public Key Operation Instruction

Please follow the instructions in the “Rockchip SDK Application and Synchronization Guide” 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.

10.1 Multiple Machines Use The Same SSH Public Key

If the same SSH public key should be used in different machines, you can copy ssh private key file id_rsa to “~/.ssh/id_rsa” of the 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 failture to sign using the key
```

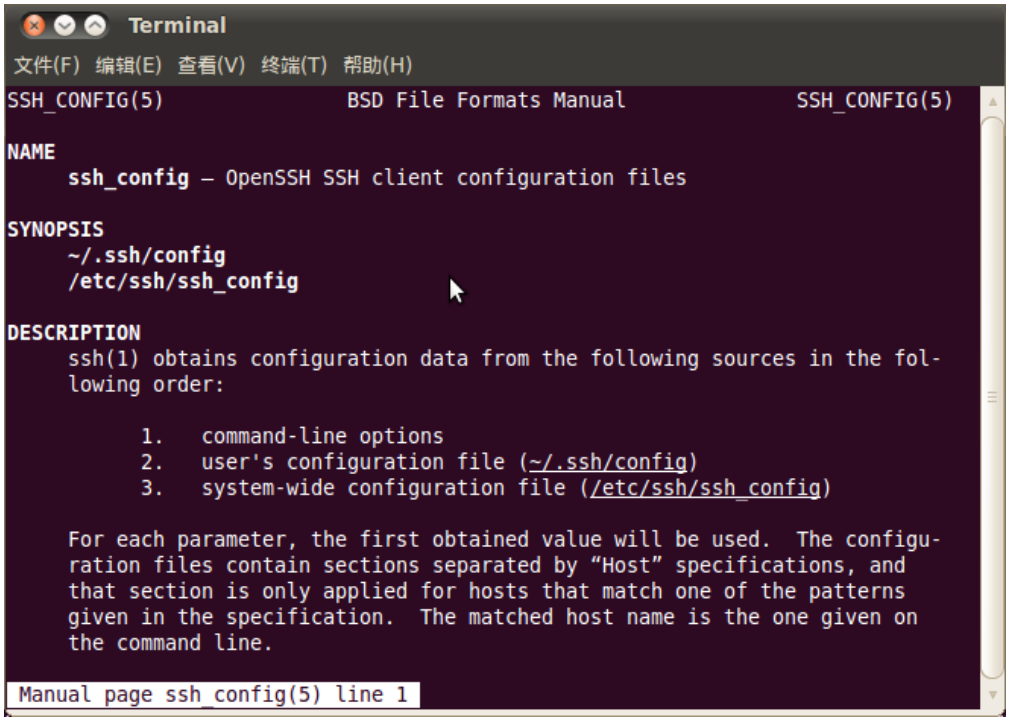
Enter the following command in console to solve:

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

10.2 One Machine Switches Different SSH Public Keys

You can configure SSH by referring to ssh_config documentation.

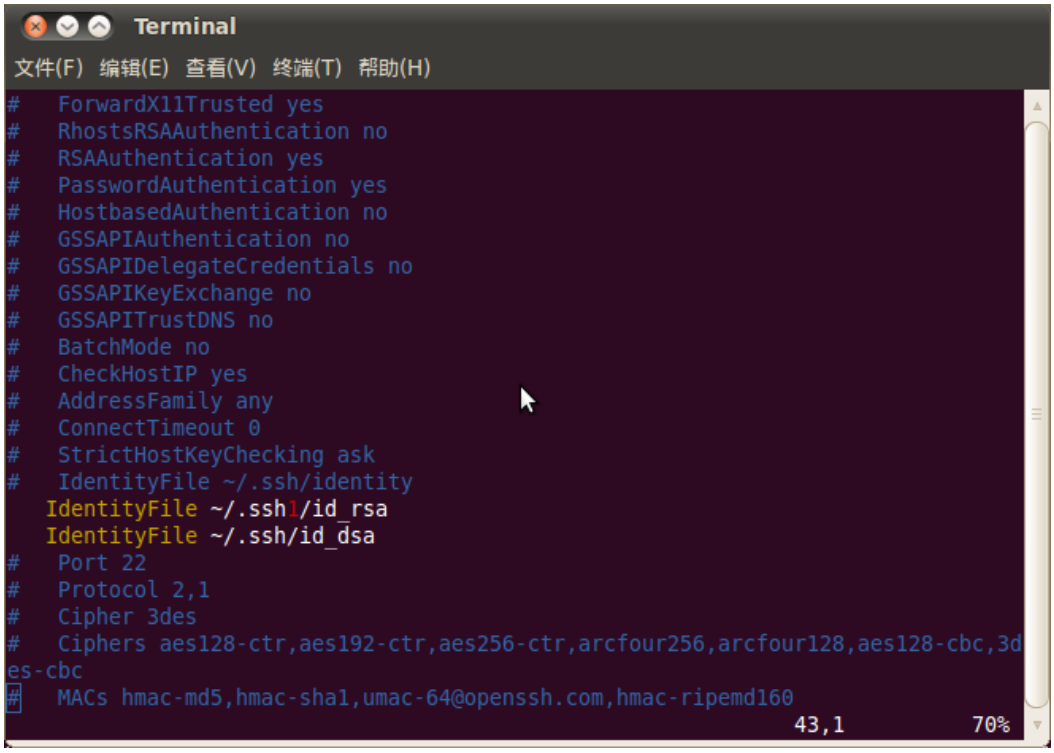
```
~$ man ssh_config
```



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.



10.3 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.

10.4 Reference Documents

For more details, please refer to document “sdk/docs/RKTools manuals/Rockchip SDK Kit 申请指南 V1.6-201905.pdf”.

