密级状态： 绝密(　　) 秘密(　　) 内部资料(　　) 公开(　√)

Security Class: Top-Secret (　　) Secret (　　) Internal (　　) Public (√)

Rockchip_AB_System_OTA_from_Android9.0_Android 10.0_to_Android11.0_Introduction

（第二系统产品部）

(Technical Department, R & D Dept. II）

文件状态： **Status:** [　] 草稿 [　] Draft [　] 正在修改 [　] Modifying [√] 正式发布 [√] Released	**文件标识：** **File No.:**	RK-SM-YF-278
	当前版本： **Current Version:**	V1.0
	作　　者： **Author:**	纪大峣 Ji Dayao
	完成日期： **Finish Date:**	2020-12-09
	审　　核： **Auditor:**	
	审核日期： **Finish Date:**	

瑞芯微电子股份有限公司

Rockchip Electronics Co., Ltd.

免责声明

本文档按“现状”提供，瑞芯微电子股份有限公司（“本公司”，下同）不对本文档的任何陈述、信息和内容的准确性、可靠性、完整性、适销性、特定目的性和非侵权性提供任何明示或暗示的声明或保证。本文档仅作为使用指导的参考。

由于产品版本升级或其他原因，本文档将可能在未经任何通知的情况下，不定期进行更新或修改。

Disclaimer

THIS DOCUMENT IS PROVIDED “AS IS”. ROCKCHIP ELECTRONICS CO., LTD.(“ROCKCHIP”) DOES NOT PROVIDE ANY WARRANTY OF ANY KIND, EXPRESSED, IMPLIED OR OTHERWISE, WITH RESPECT TO THE ACCURACY, RELIABILITY, COMPLETENESS, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY REPRESENTATION, INFORMATION AND CONTENT IN THIS DOCUMENT. THIS DOCUMENT IS FOR REFERENCE ONLY. THIS DOCUMENT MAY BE UPDATED OR CHANGED WITHOUT ANY NOTICE AT ANY TIME DUE TO THE UPGRADES OF THE PRODUCT OR ANY OTHER REASONS.

商标声明

“Rockchip”、“瑞芯微”、“瑞芯”均为本公司的注册商标，归本公司所有。

本文档可能提及的其他所有注册商标或商标，由其各自拥有者所有。

Trademark Statement

“Rockchip”, “瑞芯微”, “瑞芯” shall be Rockchip’s registered trademarks and owned by Rockchip. All the other trademarks or registered trademarks mentioned in this document shall be owned by their respective owners.

版权所有 © 2020 瑞芯微电子股份有限公司

超越合理使用范畴，非经本公司书面许可，任何单位和个人不得擅自摘抄、复制本文档内容的部分或全部，并不得以任何形式传播。

Copyright © 2020 Rockchip Electronics Co., Ltd.

Beyond the scope of fair use, neither any entity nor individual shall extract, copy, or distribute this document in any form in whole or in part without the written approval of Rockchip.

瑞芯微电子股份有限公司
Rockchip Electronics Co., Ltd.
地址： 福建省福州市铜盘路软件园 A 区 18 号
网址： www.rock-chips.com
客户服务电话： +86-4007-700-590
客户服务传真： +86-591-83951833
客户服务邮箱： fae@rock-chips.com

Rockchip Electronics Co., Ltd.
Address: No. 18 Building, A District, No.89, software Boulevard Fuzhou, Fujian, PRC
Website: www.rock-chips.com
Customer service Tel.: +86-4007-700-590
Customer service Fax: +86-591-83951833
Customer service e-mail: fae@rock-chips.com

版 本 历 史 Revision History

版本号 Version no.	作者 Author	修改日期 Revision Date	修改说明 Revision description	备注 Remark
V1.0	纪大峣	2020/12/9	初始版本 Initial version release	

目 录 Contents

1 概述 Overview

本文档描述了如何从 Rockchip Android 9.0 和 Rockchip Android 10.0 A/B 系统通过 OTA 的方式升级到 Android 11.0 A/B 系统。

This document describes how to upgrade from Rockchip Android9.0 and Rockchip Android10.0 A/B system to Android11.0 A/B system through OTA.

在 Rockchip Android 11.0 平台上，通过对应 lunch 项来实现对应 9.0 系统升级到 11.0 系统，以及 10.0 系统升级到 11.0。如 rk3326 11.0 平台上 lunch 项 rk3326_pie 就实现了 Android 9.0 的 rk3326_pie 通过 OTA 升级到 rk3326 11.0 系统；rk3326 11.0 平台上 lunch 项 rk3326_q 就实现了 Android 10.0 的 rk3326_q 通过 OTA 升级到 rk3326 11.0 系统。

On Rockchip Android11.0 platform, the corresponding lunch option can implement upgrading from the system Android9.0 to Android11.0 and Android10.0 to Android 11.0. For example, on rk3326 11.0 platform, lunch option rk3326_pie can implement rk3326 upgrading from Android9.0 to 11.0 system through OTA, and lunch option rk3326_q can implement rk3326 upgrading from Android10.0 to 11.0 system through OTA.

下面第 2 节介绍如何从 Android 9.0 AB 系统升级到 Android 11.0 AB 系统；第 3 节介绍如何从 Android 10.0 AB 系统升级到 Android 11.0 AB 系统。

The section 2 in this document describes how to upgrade from Android 9.0 AB system to Android 11.0 AB system, and the section 3 describes how to upgrade from Android 10.0 AB system to Android 11.0 AB system.

2 Android 9.0 升级到 Android 11.0 Upgrading from Android 9.0 to Android 11.0

注：本节仅针对 Android 9.0 升级到 Android 11.0。如果是从 Android 10.0 升级到 Android 11.0, 请直接参考“3 Android 10.0 升级到 Android 11.0”。

Note: This section is only for upgrading from Android 9.0 to Android 11.0. If you are upgrading from Android 10.0 to Android 11.0, directly jump to “3 Upgrading from Android 10.0 to Android 11.0”.

2.1 Android 9.0 AB 系统所需补丁说明 Patch required for Android9.0 AB system

在 Andriod 9.0 AB 系统上需增加如下补丁，并确保升级 11.0 之前，设备中的 9.0 固件包含该补丁。

The following patch needs to be added on Android9.0 AB system. Please confirm Android9.0 image in the device includes this patch before upgrading to Android11.0.

1.关闭 libvintf 升级包兼容性检查

Disable the compatibility check for libvintf upgrading package

system/libvintf：

```
diff --git a/VintfObject.cpp b/VintfObject.cpp
index 604f7cb..afea999 100644
--- a/VintfObject.cpp
+++ b/VintfObject.cpp
@@ -528,7 +528,7 @@ int32_t checkCompatibility(const std::vector<std::string>& xmls, bool mount,
             }
             return INCOMPATIBLE;
         }
-
+#if 0
         if ((disabledChecks & DISABLE_RUNTIME_INFO) == 0) {
             if (!updated.runtimeInfo->checkCompatibility(*updated.fwk.matrix, error, disabledChecks)) {
                 if (error) {
@@ -538,6 +538,7 @@ int32_t checkCompatibility(const std::vector<std::string>& xmls, bool mount,
                 return INCOMPATIBLE;
             }
         }
+#endif

         return COMPATIBLE;
         }
```

2.2 Android 11.0 AB 系统所需补丁说明 Patch required for Android11.0 AB system

在 Rockchip Android 11.0 系统上，需要按本节描述的步骤进行顺序配置。并且本节的所有配置**仅针对需要将 9.0 AB 系统升级到 11.0 AB 系统的 11.0 项目代码工程，正常的 11.0 代码工程不能添加本节描述的补丁。**

On Rockchip Android11.0 system, it requires to configure step by step according to the description of this chapter. And all the configurations in this chapter are only applicable for the 11.0 project which is going to upgrade AB system from 9.0 to 11.0. The patch described in this chapter cannot be added to the normal 11.0 project.

11.0 平台所需的配置包括两大方面，分别是 Android 系统配置和 U-Boot 配置。

The configurations required for the 11.0 platform include two aspects, which are Android system configuration and U-Boot configuration.

2.2.1 Android 系统配置 Android system configuration

Android 系统配置包括 build 配置、device/rockchip/common 配置和 device/rockchip/rkxxx 具体芯片的配置（如 device/rockchip/rk3326）。该部分的配置补丁和相关参考可从如下的百度网盘链接提取：

Android system configurations include build configuration, device/rockchip/common configuration and device/rockchip/rkxxx the specific chip configuration (such as device/rockchip/rk3326). The configuration patch and relative reference are available through the following baidu cloud link:

链接：https://pan.baidu.com/s/1lRwhrTqdKcQ0WegH7jFsBA

Link: https://pan.baidu.com/s/1lRwhrTqdKcQ0WegH7jFsBA

提取码：92cj

Code: 92cj

补丁包 Rockchip_AB_9.0_to_11.0_patches_JDY.rar 的结构如下图 1 所表示：

The structure of the patch package Rockchip_AB_9.0_to_11.0_patches_JDY.rar is as shown in Picture 1:

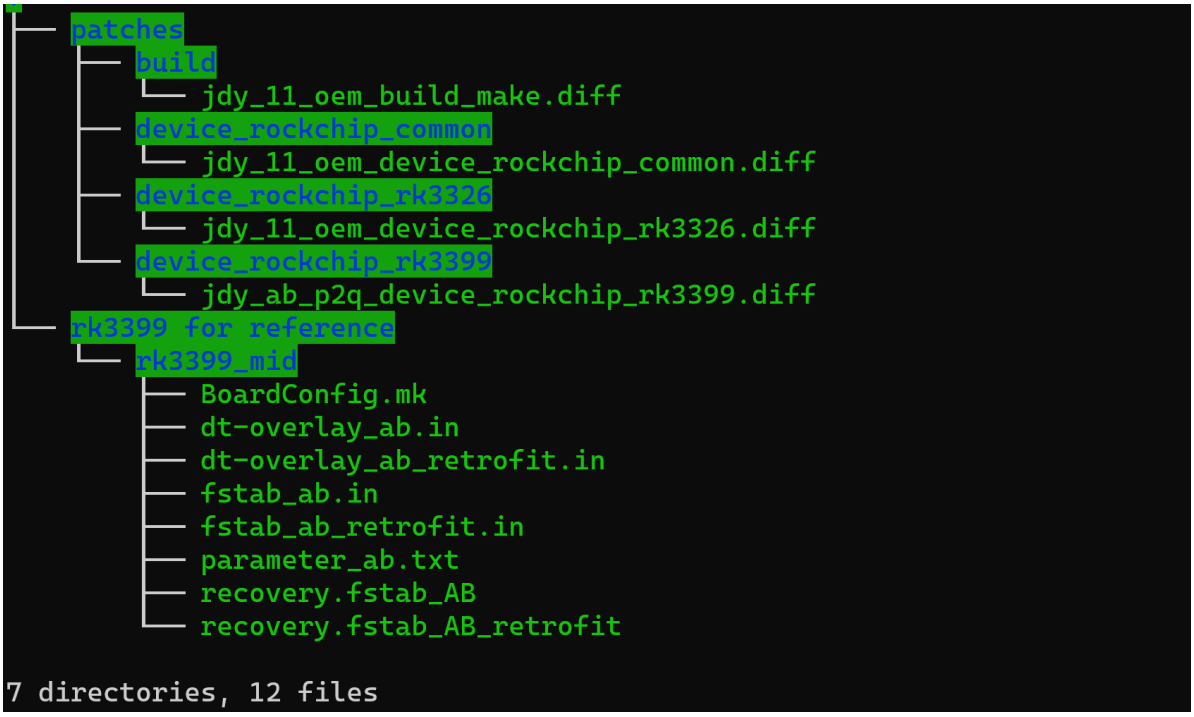

图 1 补丁包 Rockchip_AB_9.0_to_11.0_patches_JDY.rar 的结构

Picture 1 The structure of the patch package Rockchip_AB_9.0_to_10.0_patches_JDY.rar

2.2.1.1 build 配置 build configuration

打补丁 Rockchip_AB_9.0_to_11.0_patches_JDY/patches/build/jdy_11_oem_build_make.diff。如果补丁冲突，请手动按照补丁修改。

Apply the patch Rockchip_AB_9.0_to_11.0_patches_JDY/patches/build/jdy_11_oem_build_make.diff. If there is conflict, please manually modify the patch.

2.2.1.2 device/rockchip/common 配置 device/rockchip/common configuration

打 补 丁 Rockchip_AB_9.0_to_11.0_patches_JDY/patches/device_rockchip_common/jdy_11_oem_device_rockchip_common.diff。如果补丁冲突，请手动按照补丁修改。

Apply the patch Rockchip_AB_9.0_to_11.0_patches_JDY/patches/device_rockchip_common/jdy_11_oem_device_rockchip_common.diff. If there is conflict, please manually modify the patch.

注意该步骤完成后，需要将打补丁后的 mkimage_ab.sh 拷贝到 SDK 根目录下使用。

After this step, need to copy mkimage_ab.sh patched to the root directory of SDK for usage.

2.2.1.3 device/rockchip/rkxxxx 配置 device/rockchip/rkxxxx configuration

对于 rk3326 (lunch rk3326_pie)来说，首先 repo sync 到最新代码，然后直接打如下补丁即可（如果冲突请手动打）：

For rk3326 (lunch rk3326_pie), firstly repo sync to the latest code, and then directly apply the following patch (If there is conflict, please manually modify the patch):

Rockchip_AB_9.0_to_11.0_patches_JDY/patches/device_rockchip_rk3326/jdy_11_oem_device_rockchip_rk3326.diff.

对于 rk3399 (lunch rk3399_mid) 来说，首先 repo sync 到最新代码，然后直接打如下补丁即可（如果冲突请手动打）：

For rk3399 (lunch rk3399_mid), firstly repo sync to the latest code, and then directly apply the following patch (If there is conflict, please manually modify the patch):

Rockchip_AB_9.0_to_11.0_patches_JDY/patches/device_rockchip_rk3399/jdy_ab_p2q_device_rockchip_rk3399.diff.

对于其他芯片和项目来说，请按如下步骤顺序配置和确认（以 rk3399 为例，修改位于 device/rockchip/rk3399 和 device/rockchip/rk3399/rk3399_mid）。

For other chipsets and projects, please follow the steps to configure and confirm as below (take rk3399 as example, the modification is in device/rockchip/rk3399 and device/rockchip/rk3399/rk3399_mid)

1.将 9.0 对应的 parameter_ab.txt 文件拷贝到 11.0 中，同时将 parameter_ab.txt 中的 FIRMWARE_VER 由 9.0 改为 10.0。

Copy the parameter_ab.txt file of 9.0 to 11.0, and change FIRMWARE_VER in parameter_ab.txt from 9.0 to 10.0.

2.新增如下 6 个文件：

Add the following 6 files:

(1) dt-overlay_ab.in

(2) dt-overlay_ab_retrofit.in

(3) fstab_ab.in

(4) fstab_ab_retrofit.in

(5) recovery.fstab_AB

(6) recovery.fstab_AB_retrofit

以上 6 个文件请参考“Rockchip_AB_9.0_to_11.0_patches_JDY /rk3399 for reference/rk3399_mid”里的对应文件，基本上可以直接使用。

Please refer to the corresponding files in “Rockchip_AB_9.0_to_11.0_patches_JDY/rk3399 for reference/rk3399_mid” for the above 6 files, which basically can be used directly.

3. device\rockchip\rkxxx 下的 BoardConfig 中导入 AB 相关配置。

Load AB related configurations into BoardConfig in device\rockchip\rkxxx.

以 rk3399 为例。

Take rk3399 as example.

device/rockchip/rk3399/rk3399_mid/BoardConfig.mk：

```
 CAMERA_SUPPORT_AUTOFOCUS:= false

-ifeq ($(strip $(BOARD_USES_AB_IMAGE)), true)
-TARGET_RECOVERY_FSTAB := device/rockchip/rk3399/rk3399_mid/fstab.rk30board_AB
-endif
+# AB image definition
+BOARD_USES_AB_IMAGE := false

-# Android Q use odm instead of oem, but for upgrading to Q, partation list cant be changed, odm will m
-BOARD_ODMIMAGE_PARTITION_SIZE := $(shell python device/rockchip/common/get_partition_size.py device/ro
+ifneq ($(strip $(BOARD_USES_AB_IMAGE)), true)
+    # Android Q use odm instead of oem, but for upgrading to Q, partation list cant be changed, odm wi
+    BOARD_ODMIMAGE_PARTITION_SIZE := $(shell python device/rockchip/common/get_partition_size.py device
+endif

 # No need to place dtb into boot.img for the device upgrading to Q.
 BOARD_INCLUDE_DTB_IN_BOOTIMG :=
 BOARD_PREBUILT_DTBIMAGE_DIR :=

-#Need to build system as root for the device upgrading to Q.
-BOARD_BUILD_SYSTEM_ROOT_IMAGE := true
+ifneq ($(strip $(BOARD_USES_AB_LEGACY_RETROFIT)), true)
+    #Need to build system as root for the device upgrading to Q.
+    BOARD_BUILD_SYSTEM_ROOT_IMAGE := true
+endif
+
+ifeq ($(strip $(BOARD_USES_AB_IMAGE)), true)
+    ifeq ($(strip $(BOARD_USES_AB_LEGACY_RETROFIT)), true)
+        PRODUCT_FSTAB_TEMPLATE := device/rockchip/rk3399/rk3399_mid/fstab_ab_retrofit.in
+        PRODUCT_DTBO_TEMPLATE := device/rockchip/rk3399/rk3399_mid/dt-overlay_ab_retrofit.in
+    else
+        PRODUCT_FSTAB_TEMPLATE := device/rockchip/rk3399/rk3399_mid/fstab_ab.in
+        PRODUCT_DTBO_TEMPLATE := device/rockchip/rk3399/rk3399_mid/dt-overlay_ab.in
+    endif
+    include device/rockchip/common/BoardConfig_AB.mk
+    ifeq ($(strip $(BOARD_USES_AB_LEGACY_RETROFIT)), true)
+        TARGET_RECOVERY_FSTAB := device/rockchip/rk3399/rk3399_mid/recovery.fstab_AB_retrofit
+    else
+        TARGET_RECOVERY_FSTAB := device/rockchip/rk3399/rk3399_mid/recovery.fstab_AB
+    endif
+endif
```

图 2 rk3399/rk3399_mid/BoardConfig.mk

Picture 2 rk3399/rk3399_mid/BoardConfig.mk

device/rockchip/rk3399/rk3399_mid/rk3399_mid.mk

```
+# For upgrading device with retrofit
+BOARD_USES_AB_LEGACY_RETROFIT := true
+
+ifeq ($(strip $(BOARD_USES_AB_LEGACY_RETROFIT)), true)
+       include device/rockchip/common/BoardConfig_AB_retrofit.mk
+endif
+
```

注意：

Note:

（1）如上配置基于 rk3399/rk3399_mid，须根据实际芯片和项目修改对应的 device\rockchip\rkxxx 下的对应文件。

The above configurations are based on rk3399/rk3399_mid. Need to modify the corresponding file in device\rockchip\rkxxx according to the actual chipset and project.

（2）须将如上图 2 中的 BOARD_USES_AB_IMAGE 设置为 true，对应的参考 **BoardConfig.mk** 见“Rockchip_AB_9.0_to_11.0_patches_JDY \rk3399 for reference\rk3399_mid\BoardConfig.mk”。

Need to set BOARD_USES_AB_IMAGE as true in picture 2. Refer to “Rockchip_AB_9.0_to_11.0_patches_JDY \rk3399 for reference\rk3399_mid\BoardConfig.mk” for the corresponding reference **BoardConfig.mk.**

（3）须将如上图 2 补丁中的 rk3399/rk3399_mid 改为实际芯片和实际项目。

Need to modify rk3399/rk3399_mid in the patch in picture 2 to the actual chipset and project.

2.2.2 U-boot 配置 U-boot configuration

在 uboot 中，针对具体芯片的配置文件，添加 CONFIG_ANDROID_AB=y 配置项，参考配置如下图 4 所示：

In uboot, add CONFIG_ANDROID_AB=y configuration item for the configuration file of the specific chipset. The reference configuration is shown as Picture 3:

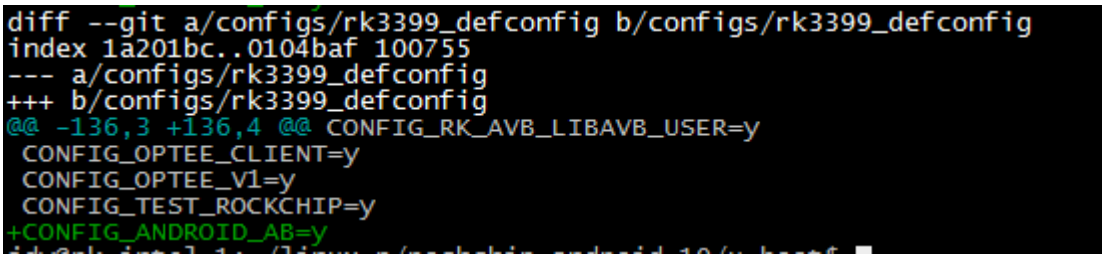

图 3.U-boot 配置

Picture 3 U-boot configuration

2.3 使用说明 Usage

严格按照“2.2 Android 11.0 AB 系统所需补丁说明”的说明完成修改后，在 Rockchip Android 11.0 平台上，按如下方式操作产生对应的 OTA 升级包（rkxxxx-ota-**retrofit**-xx.zip），然后将该升级包放置在 Rockchip Android 9.0 设备上，进行正常的 AB 升级即可。升级前请仔细阅读 “4.注意事项”。

Strictly follow the instruction of “2.2 Patch required for Android 11.0 AB system” to finish the modification. On Rockchip Android11.0 platform, generate the corresponding OTA upgrading package（rkxxxx-ota-**retrofit**-xx.zip） according to the following operation, and then use the upgrading package to do the normal AB upgrading on Rockchip Android9.0 device. Please read "4. Precautions" carefully before upgrading.

1. 选择 9.0 系统升级到 11.0 系统的对应 lunch 项，如 rk3399_mid

   Select the corresponding lunch option for upgrading the system from 9.0 to 11.0, such as rk3399_mid

2. 正常编译系统（编译 uboot、kernel 并且 lunch 后执行如下命令编译）：

Normally compile the system (compile uboot, kernel and execute the following command to compile after lunch):

make clean && make –j32 && make otapackage -j32 && ./mkimage_ab.sh ota

注意：

Note:

(1) 必须 make clean

Must make clean

(2)mkimage_ab.sh 从 device/rockchip/common 下拷贝出来（须按照“2.2 Android 11.0 AB 系统所需补丁说明”操作后，再拷贝出来）

Copy mkimage_ab.sh from device/rockchip/common (need to operate according to “2.2 Patch required for Android 11.0 AB system” before copying)

(3) 用 AndroidTool 以 AB 固件的方式烧写该步骤编译出来的 rockdev/下的对应固件，确保编译出来的固件烧写后可以正常工作。注意 system_a/system_b, vendor_a/vendor_b, oem_a/oem_b 分别烧写 rockdev/下的 super_system.img, super_vendor.img, super_oem.img。

Use AndroidTool to flash the corresponding image under rockdev/ compiled in this step in the way of AB image, and confirm the image can work normally after flashing. Pay attention to that system_a/system_b, vendor_a/vendor_b, oem_a/oem_b separately flash super_system.img, super_vendor.img, super_oem.img under rockdev/.

(4) 升级包需使用带 ota-retrofit 的那个升级包，如 rk3399_mid-ota-retrofit-eng.jdy.zip。

Need to use the upgrading package with ota-retrofit, such as rk3399_mid-ota-retrofit-eng.jdy.zip.

3. 取出第 2 步编译出来的升级包，使用带 ota-retrofit 的那个升级包，如 rk3399_mid-ota-retrofit-eng.jdy.zip。

   Fetch out the upgrading package compiled in step 2, and use the upgrading package with ota-retrofit, such as rk3399_mid-ota-retrofit-eng.jdy.zip.

   注意：首先必须确保上面第 2 步编译出来的固件烧写后可以正常工作，具体见上面第 2 点的“注意”中的第(3)点。

   Note: First must ensure the image compiled in step 2 can work normally after flashing. Refer to the point (3) of note in step 2 above for more details.

4. 将对应的升级包放置在 Android 9.0 设备上进行正常的 AB 系统升级即可。

   Just use the corresponding upgrading package to do the normal AB system upgrading on Android9.0 device.

3 Android 10.0 升级到 Android 11.0 Upgrading from Android 10.0 to Android 11.0

在 Rockchip Android 11.0 平台上，按如下方式操作产生对应的 OTA 升级包，然后将该升级包放置在 Rockchip Android 10.0 设备上，进行正常的 OTA 升级即可。升级前请仔细阅读 “4.注意事项”。

On Rockchip Android11.0 platform, generate the corresponding OTA upgrading package according

to the following steps, and then put the package on Rockchip Android10.0 device to do the normal OTA upgrade. Please read "4. Precautions" carefully before upgrading.

1. 选择 10.0 系统升级到 11.0 系统的对应 lunch 项，如 rk3326_q 或者 rk3399_Android10 等
   Select the corresponding lunch option for upgrading from 10.0 to 11.0, such as rk3326_q or rk3399_Android10 etc.
2. 正常编译系统（编译 uboot、kernel 并且 lunch 后执行如下命令编译）：
   Compile the system normally (compile uboot, kernel and execute the following command to compile after lunch):
   make clean && make –j32 && make otapackage -j32 && ./mkimage_ab.sh ota
3. 取出第 2 步编译出来的升级包，命名为 update.zip
   Fetch out the upgrading package compiled by step 2, and name it update.zip.
4. 将对应的 update.zip 放置在 Android 10.0 设备上升级即可。
   Put the corresponding update.zip on Android10.0 device to do upgrading.

注意：如果当前设备的 Android 10.0 系统是通过 Android 9.0 系统升级而来的（通过《Rockchip_Introduction_AB_System_OTA_from_Android9.0_to_Android10.0_CN&EN》），在此基础上如果要将该 Android 10.0 系统进一步升级到 Android 11.0 系统，则操作方法与“2 Android 9.0 升级到 Android 11.0”相同，即在 11.0 系统上选择对应 9.0 的 lunch 项（如 rk3326_pie 或 rk3399_mid 等），正常编译系统，将编译出来的 upddate.zip 放入该 Android 10.0 设备上升级即可。

Note: If the Android 10.0 system of the current device is upgraded from the Android 9.0 system (through " Rockchip_Introduction_AB_System_OTA_from_Android9.0_to_Android10.0_CN&EN"), and if you want to further upgrade from the Android10.0 system to Android 11.0 system, perform the same operation as described in "2 Upgrade from Android 9.0 to Android 11.0" , that is, select the lunch item corresponding to 9.0 on the Android 11.0 system (such as rk3326_pie or rk3399_mid, etc.), compile the system normally, and put the compiled upddate.zip into the Android 10.0 device to upgrade.

4 注意事项 Precautions

1. 验证调试时各 Android 平台（如 Android 9.0/Android10.0/Android11.0）请使用 userdebug 版本，并且设置 BOARD_SELINUX_ENFORCING := false。
   Please use the userdebug version for each Android platform (such as Android 9.0/Android 10.0/Android 11.0) when verifying and debugging, and set BOARD_SELINUX_ENFORCING := false.
2. OTA 升级前确保 parameter 文件分区表必须一致。比如从 Android 9.0 升级到 Android 11.0，需确保编译出来的 11.0 固件使用的 parameter 与 9.0 一致。同理从 Android 10.0 升级到 Android 11.0，需确保编译出来的 11.0 固件使用的 parameter 与 10.0 一致。
   Before OTA upgrade, ensure that the parameter file partition table must be consistent. For example, to upgrade from Android 9.0 to Android 11.0, you need to ensure that the parameters used by the compiled 11.0 firmware are consistent with 9.0. Similarly, when upgrading from Android 10.0 to

Android 11.0, you need to make sure the parameters used by the compiled 11.0 firmware are consistent with 10.0.

3. OTA 升级前需确保编译出来的固件本身必须是正常的。比如从 Android 9.0 升级到 Android 11.0，需确保编译出来的 11.0 固件通过工具（如 AndroidTool）烧写到设备后必须能正常启动，并且各方面功能正常。同理从从 Android 10.0 升级到 Android 11.0，需确保编译出来的 11.0 固件通过工具（如 AndroidTool）烧写到设备后必须能正常启动，并且各方面功能正常。

   Before OTA upgrade, need to make sure that the compiled firmware itself must be normal. For example, to upgrade from Android 9.0 to Android 11.0, you need to ensure that the compiled 11.0 firmware must be able to start normally after it is flashed into the device with a tool (such as AndroidTool), and the functions should work normally. Similarly, when upgrading from Android 10.0 to Android 11.0, you need to make sure that the compiled 11.0 firmware must be able to start normally after it is flashed into the device with a tool (such as AndroidTool), and the functions should work normally.