

RK3399 Android7.1 SDK Memory Optimization

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前言 Preface

本文档提供了一些内存优化方面的建议。

This document provides some suggestions on the memory optimization.

内存评估 Memory evaluation

收集内存使用情况：

Collect the memory usage status:

```
1 echo 3 > /proc/sys/vm/drop_caches
2 cat /proc/meminfo
3 cat /proc/zoneinfo
4 cat /d/dri/0/mm_dump
5 cat /d/mali0/gpu_memory
6 echo 'm' > /proc/sysrq-trigger && dmesg | busybox tail -n 50
7 dumpsys meminfo -a
8 procrank
9 dumpsys SurfaceFlinger
```

- 可用内存 Usable memory

数据取自：dumpsys meminfo 命令得到的 Free RAM

Data fetch: Free RAM acquired from the command dumpsys meminfo

- Total/Free/Available

数据取自：cat /proc/meminfo 得到的 MemTotal/MemFree/MemAvailable

Data fetch: MemTotal/MemFree/MemAvailable acquired from cat /proc/meminfo

- PSS

数据取自：procrank 命令输出的总的 PSS

Data fetch: total PSS output by the command procrank

- SurfaceFlinger

数据取自：dumpsys SurfaceFlinger 命令输出的 Total allocated

Data fetch: Total allocated output by the command dumpsys SurfaceFlinger

优化 Optimization

以下的优化，客户应该依据实际产品需要进行调整。

The following optimizations can be adjusted by customers according to the actual product requirements.

1. 32bit版本 32bit version

打上32bit补丁并重新编译，补丁位于：RKDocs/rk3399/patches/rk3399_7.1_32bit_patch.rar

Apply 32bit patch and re-compile. The patch is in RKDocs/rk3399/patches/rk3399_7.1_32bit_patch.rar

2. 开启low_ram Enable low_ram

修改device/rockchip/common/BoardConfig.mk:

Modify device/rockchip/common/BoardConfig.mk:

```
1 | BOARD_USE_LOW_MEM ?= true
```

3. 语言裁剪 Language cropping

修改 build/target/product/languages_full.mk 和 build/target/product/locales_full.mk，去掉不用的语言

Modify build/target/product/languages_full.mk and build/target/product/locales_full.mk to delete the unused languages.

4. dpi资源裁剪 dpi resource cropping

修改device/rockchip/rk3399/rk3399_all.mk:

Modify device/rockchip/rk3399/rk3399_all.mk:

```
1 | PRODUCT_AAPT_CONFIG := normal tvdpi hdpi
```

5. 删除多余的服务 Delete unnecessary services

修改frameworks/base/services/java/com/android/server/SystemServer.java，去除一些不必要的服务，可以参考BOX的修改

Modify frameworks/base/services/java/com/android/server/SystemServer.java to remove some unnecessary services. You can refer to the BOX modification:

```
1 |         if(!isBox){
2 |             traceBeginAndSlog("StartVibratorService");
3 |             vibrator = new VibratorService(context);
4 |             ServiceManager.addService("vibrator", vibrator);
5 |             Trace.traceEnd(Trace.TRACE_TAG_SYSTEM_SERVER);
6 |         }
```

6. 删除不用的应用 Delete unused application

请根据实际产品需求删减不需要的应用

Please delete unnecessary applications according to the actual product requirements.

- 在 out/target/product/[产品]/system/app/ 文件夹下执行

Execute in the folder out/target/product/[product]/system/app/

```
1 | $ rm -r BasicDreams \
2 | RkExplorer \
3 | Gallery2 \
4 | SoundRecorder \
5 | DeskClock \
6 | LiveWallpapersPicker \
7 | Rk4kVideoPlayer \
8 | MediaFloat \
9 | Music \
10 | HTMLViewer \
11 | Calendar \
```

```

12 Camera2 \
13 EasterEgg \
14 PrintSpooler \
15 RKUpdateService \
16 RFTTestTool \
17 QuickSearchBox \
18 Lightning \
19 DownloadProviderUi \
20 BookmarkProvider \
21 PicoTts \
22 UserDictionaryProvider \
23 PrintRecommendationService \
24 WAPPushManager \
25 ExactCalculator \
26 Email \
27 Bluetooth \
28 WallpaperPicker \
29 WallpaperBackup \
30 PhotoTable \
31 CaptivePortalLogin \
32 BluetoothMidiService

```

- 在 `out/target/product/[产品]/system/priv-app/` 文件夹下执行
Execute in the folder `out/target/product/[product]/system/priv-app/`

```

1 $ rm -r CalendarProvider \
2 Contacts \
3 ContactsProvider \
4 MusicFX \
5 StressTest \
6 DownloadProvider \
7 WallpaperCropper \
8 VpnDialogs \
9 BlockedNumberProvider \
10 DeviceTest \
11 MtpDocumentsProvider \
12 FusedLocation \
13 MmsService \
14 RetailDemo \
15 Provision \
16 Shell \
17 TeleService \
18 Telecom \
19 TelephonyProvider \
20 ProxyHandler \
21 DocumentsUI

```

7. 开启KSM/ZRAM Enable KSM/ZRAM

在init.rc文件中添加下面的参数配置

Add the following parameter configuration in the init.rc file

- 开启ksm: 合并相同内容的页面
Enable ksm: merge the pages with the same contents

```
1 write /sys/kernel/mm/ksm/pages_to_scan 100
2 write /sys/kernel/mm/ksm/sleep_millisecs 20
3 write /sys/kernel/mm/ksm/run 1
```

- 提高zram分区利用率

Improve the utilization rate of zram partition

```
1 write /proc/sys/vm/swappiness 100
```

8. 视频解码优化 Video decoding optimization

根据参考帧动态申请内存 `setprop sys.video.refFrameMode 1`

Dynamically apply for the memory according to the reference frame `setprop sys.video.refFrameMode 1`

9. 内核裁减 Kernel cropping

1. RGA驱动关闭RGA2_DEBUGFS可节省1250KB

Disable RGA2_DEBUGFS in RGA driver can save 1250KB

`drivers/video/rockchip/rga2/rga2.h #define RGA2_DEBUGFS 0`

2. 去掉nand驱动， 250KB

Remove nand driver, 250KB

`CONFIG_RK_NAND`

3. 去掉多余的GPU驱动

Remove the unnecessary GPU drivers

`CONFIG_MALI400 CONFIG_MALI450 CONFIG_POWERVR_ROGUE_N`

4. 其它驱动需要根据具体的板子硬件做优化，比如声卡／Camera等，但收益不大。

Other drivers should be optimized based on the specific board hardware, such as audio card/camera and so on, but the effect may be not very good.

附 Appendix

一些与low_ram相关的配置 Some low_ram related configurations

- `device/rockchip/common/overlay_lowram/frameworks/base/core/res/res/values/config.xml`
应用运行需要加载odex和一些资源文件，低内存的时候，会频繁做内存交换。出现反复释放，加载，导致I/O读操作频繁。IOWAIT较高。

Application running requires to load odex and some resource files, and it will frequently switch the memory in low memory case. Release, load will occur repeatedly, which will cause the frequent I/O read operation. IOWAIT is relatively high.

表现为调出音量调节框滞后、卡顿或无响应，腾讯视频播放界面操作卡顿。

The phenomenon is that when clicking the volume adjustment box there may be delay, stuck or no response, and the operation on tencent video player interface may be stuck.

解决方法：添加系统核心服务依赖文件至`config_defaultPinnerServiceFiles`，缓存后不释放，减少低内存情况下的反复I/O读操作。

The solution is to add the system core service dependent file to config_defaultPinnerServiceFiles, not release the buffer, reduce the frequent I/O read operation in low memory circumstance.

- device/rockchip/common/lowmem_package_filter.xml

用于限制后台应用或服务的自启动，其配置描述如下：

Used to limit the auto start of background application or service, with the configuration described as below:

- 1 <app -----表示开机不让自动启动的APK means the APK not allowed to auto start after boot up
- 2 <service-----表示开机不让自动启动的service means the service not allowed to auto start after boot up
- 3 <game-----表示运行游戏之前和退出游戏之后，系统会自动进行一次内存清理 means the system will automatically clear the memory once before running the game and after exiting the game
- 4 <prev-----表示这些应用进入后台的时候不会被杀死 means these applications will not be killed after they enter background
- 5 <next-----表示这些应用起来的时候不会杀死之前的应用 means the previous application will not be killed when these applications are started
- 6 <empty -----表示这些服务或者应用在empty的时候不会被杀掉 means these services or application will not be killed when they are empty