Partition Layout Customization Guide

Customization Guide

Customer Support

Common Platform

Doc No: CS6000-AW2B-CGD-V1.3EN
Version: V1.3
Release date: 2019-09-03
Classification: Standard

Keywords
Customization Guide

CS6000-AW2B-CGD-V1.3EN V1.3 (2019-09-03)

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Document Revision History

Revision	Date	Author	Description
V1.0	2016-12-30	Chang-An Chen	Initial Partition Layout Customization Guide
V1.1	2017-02-20	Chang-An Chen	Update Doc No Format
V1.2	2019-09-03	Will Shiu	Add by project partition size adjustment
V1.3	2019-11-05	Will Shiu	Add in dynamic partition using introduction

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1   Introduction

1.1   Purpose

This document provides the programming guidelines for partition layout customization. It describes how to add new partitions to platform. This manual also elaborates what should be notices while changing partition layout.

1.2   Scope

The document provide the programming details of partition layout customization, where the partition table is with GPT format. It is independent of Android platform and kernel version.

Table 1-1. Reference Information beyond Scope

Modules	Reference information
Partition	Source code: device/mediate/build/build/tools/ptgen/[Platform]/

1.3   Who Should Read This Document

This document is primarily intended for:

- Engineers with technical knowledge of the partition layout
- Customers who integrate the partition layout with user-defined applications

1.4   How to Use This Manual

This segment explains how information is distributed in this document, and presents some cues and examples to simplify finding and understanding information in this document. Table 1-2 presents an overview of the chapters and appendices in this document.

Table 1-2. Chapter Overview

#	Chapter	Contents
1	Introduction	Describes the scope and layout of this document.
2	References	Provide the references which needed by this document.
5	OverView	An overview of partition layout
6	Add a Partition	Describes how to add a new partition.
7	Example	Exapmles to add a new partition, mount this partition and set permission for it.

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1.4.1   Terms and Conventions

This document uses special terms and typographical conventions to help you easily identify various information types in this document. These cues are designed to simply finding and understanding the information this document contains.

Table 1-3. Conventions

Convention	Usage	Example
[Platform]	Indicate platform code	This should be replaced as MTxxxx, depends on target chip

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2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1]   Power On Write Protect Customization Guild, http://dms.mediatek.inc/

3   Definitions

4   Abbreviations

Please note the abbreviations and their explanations provided in Table 4-1. They are used in many fundamental definitions and explanations in this document and are specific to the information that this document contains.

Table 4-1. Abbreviations

Abbreviations	Explanation
MTK	MediaTek, Asia's largest fabless IC design company.
FS	File System
GPT	GUID Partition Table
OTA	Over-The-Air

5 Overview

This chapter first gives a brief description of the modules of the system and the relationship of the modules.

5.1 Partition Layout Illustration

Figure 5-1 shows the overview of the partition layout in out platform
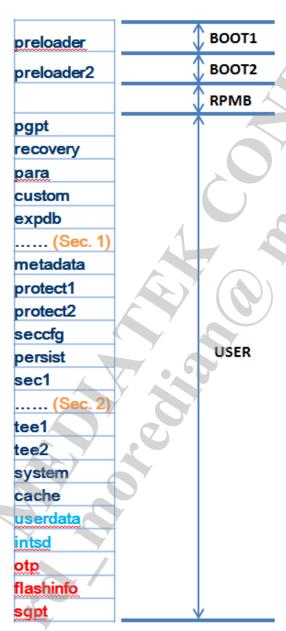
Partition EMMC Internal Layout

Partition		EMMC Internal Layout
preloader		BOOT1
preloader2		BOOT2
		RPMB
pgpt		
recovery		
para		
custom		
expdb		
...... (Sec. 1)		
metadata		
protect1		
protect2		
seccfg		
persist		USER
sec1		
...... (Sec. 2)		
tee1		
tee2		
system		
cache		
userdata		
intsd		
otp		
flashinfo		
sgpt		

Figure 5-1. Source Code Directory Structure

5.2　　　Partition Table Information

Figure 5-2 figures out the partition table information of our platform.

Partition_Name	Type	Size_KB		Region	Reserved	Download	Download_File
		eng	user				

OTA_Update	EmptyBoot_Needed	FastBoot_Erase		FastBoot_Download		Operation_Type
		eng	user	eng	user	

Figure 5-2. Partition Table Information

Here is the detailed description of each column:

- Partition Name: Partition name shown in GPT
- Type: Figure out partition is raw partition (RAW) or filesystem with it (EXT4)
- Size: Partition size in KB. Be noticed that it need to be block size aligned, block size will be different between different storage type. Moreover, minimum partition size should also be considered for corresponding file system if it's not a raw partition.

  EMMC　　　　　　　　Size had to be 512 byte aligned, minimum size is 512
  　　　　　　　　　　　byte (0.5KB in partition table notation)

  UFS　　　　　　　　　Size had to be 4096 byte aligned, minimum size is 4096
  　　　　　　　　　　　byte (4KB in partition table notation)

- Region: Target storage region where this partition located, EMMC_USER if partition is not preloader.

  BOOT1/BOOT2/RPMB　Special region in emmc, preloader image in boot1 and
  　　　　　　　　　　　boot2 region are the same and using as backup for OTA
  　　　　　　　　　　　upgrade.

  USER　　　　　　　　This region is used to store all partitions other than
  　　　　　　　　　　　preloader.

- Reserved: Y if this partition is added from the end of storage, N otherwise. Notice that all reserved partition should be put together in the end of the partition table (sgpt must be the last partition)
- Download / Download File: Y if this partition had to be downloaded from file. N otherwise.
- OTA_Update: Y if this partition is able to be upgraded by Mediatek OTA solution. N otherwise.
- EmptyBoot_Needed: Y if this partition is needed by empty download, N otherwise.
- FastBoot Erase / FastBoot Download: Y if this partition is abled to be erased or downloaded by fastboot, N otherwise.
- Operation Type: AUTO means this partition will be erased by flashtool firmware upgrade. PROTECTED and BINREGION means this partition will be backuped and restored by flashtool firmware upgrade. RESERVED means this partition will be added from the end of storage, the same as Reserved column in this sheet. BOOTLOADERS only used for preloader partition.

6   Add a New Partition

This chaptor describes how to add a new partition without filesystem into partition table.

6.1   Partition Table Modifications

6.1.1   Modify partition_table_[Platform].xls

Partition table excel file located in folder alps/device/mediatek/build/build/tools/ptgen/[Platform]/

There might be lots of sheets which shown as storage type in this file. Choosing corresponding sheet by storage type.

6.1.2   Resize the partition entry by BoardConfig.mk

In some case, we still need to resize the partition entry while compile time, through there is a method to set the entry size by modifying the .xls file we introduced in section 6.1.1.

Using the veriable , BOARD_MTK_[partition_name]_SIZE_KB := [KB] in BoardConfig.mk located in device folder, to change the size we set in .xls file. After the compiling, we could get the new partition layout with new size.

6.2   Modify Corresponding Work Sheet

6.2.1   Non-Protected Partition

If the new added partition does not need to be protected by "Power on Write Protect" feature, which means it can be written in kernel, It had to be added in "Sec. 1" segment shown in Figure 5-1

6.2.2   Protected Partition

If the new added partition had to be protected by "Power on Write Protect" feature, which means it is not writable in kernel, It had to be added in "Sec. 2" segment shown in Figure 5-1

6.3 Mount the New Added Partitions

Mount behavior and be done with fstab or manully mount in init.rc files

6.3.1 Manually Mount the New Partition

Add mount behavior in inir.rc files. The init files for different boot mode are located at:

- Normal Mode : alps/device/mediatek/[Platform]/init.[Platform].rc
- Meta Mode: alps/device/mediatek/[Platform]/meta_init.rc
- Factory Mode: alps/device/mediatek/[Platform]/factory_init.rc

Add mkdir and mount command into rc files. (refer alps/system/core/init/readme.txt for more detailed usages)

mkdir <mount_point>

mount <fs_type> <device_path> <mount_point> <flags> <options>

- ➢ <fs_type> : ext4, raw data or other supported file system
- ➢ <device_path> : device node created by kernel, can also be filled with GPT name
- ➢ <mount_point>: target mount point to mount the selected device
- ➢ <flags>: mount flags, such as "ro", "rw"…etc.
- ➢ <options>: alternative mount options, which supported by fs_mgr, such as "wait"…etc

6.3.2 Add partition into fstab

Except for mounting new partition manually, it can also be managed by fs_mgr. Adding the new added partition into fstab and it can be auto mounted when booting.

6.4 Partition Permission Configuration

After the target partition is created and mounted. Some operations might be taken. Some errors occurred during partition operations because of non-permitted operation. Permission configuration is needed for partitions which are accessed after device power on.

6.4.1 Configure Partition selinux permissions

Path of selinux files are /device/mediate/common/sepolicy/basic/*.te.

- Adding new device type to device.te
- Adding label for the new added partition to file_context
- Add corresponding access policy to *.te if needed

6.4.2 Configure Partition Permissions

To configure partition DAC(file permissions), some command are added to ueventd.rc, which located at /device/mediatek/[Platform]/ueventd_[Platform].rc

- Add file owner, group and mode bits with the following format
  - \> <device path> <mode bits> <owner> <group>

6.5 Super Partition

According to the new google feature on Android Q, the PTGEN could able to generate the super partition layout to fit the methodology of dynamic partition. This section would describe the configuration on PTGEN and show the methods we designed.

6.5.1 Add Partition into Super

The first stage of setting configuration in PTGEN is that make sure there is an "super" entry in partition excel file with the enough size. PTGEN would not stop the build flow while size miss match between the super partition and the partition inside, because in the step PTGEN running, the inside partitions would not be generated.

Then, we should choose the partition to be packaged in super partition. There is an attribute , **"Group"**, in partition excel file that figure out which group that the partition should be put in. On the other hand, leaving empty in **"Group"** means the partition would not place in super partition.

6.5.2 Pre-size Groups

By defaults, we generate each groups size by the total partition size in the partition excel flie. If there are using case that need to pre-set the group size, we provide the configuration to passing the size into PTGEN.

BOARD_MTK_GROUP_SIZE_KB := <Part_Name>:<Size_KB>

The environment variable, BOARD_MTK_GROUP_SIZE_KB, using to pass the size of the group. PTGEN would check this variable to resize the group size. This variable should be place in BoardConfig.mk which is as same area as the section 6.1.2.

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7   Examples

This chaptor illustrates an example to add a new partition with ext4 file system without write protect.

Assum the new added partition name is "test" without downloaded.

7.1   Modify Partition Table

Partition_Name	Type	Size_KB eng	Size_KB user	Region	Reserved	Download
preloader	Raw data	256		EMMC_BOOT1_BOOT2	N	Y
pgpt	Raw data	32		EMMC_USER	N	N
boot_para	Raw data	1024		EMMC_USER	N	N
recovery	Raw data	24576		EMMC_USER	N	Y
para	Raw data	512		EMMC_USER	N	N
custom	EXT4	56320		EMMC_USER	N	Y
expdb	Raw data	10240		EMMC_USER	N	N
test	EXT4	8192		EMMC_USER	N	N
frp	Raw data	1024		EMMC_USER	N	N
nvcfg	EXT4	8192		EMMC_USER	N	N
nvdata	EXT4	32768		EMMC_USER	N	N
metadata	Raw data	32768		EMMC_USER	N	N

Figure 7-1. Partition Table

Add partition info into partition table as shown in Figure 7-1

7.2   Mount Partitions

7.2.1   Mount PartitionManually mount by init.rc files

Add mount pointer in init.[Platform].rc

- mkdir /test 0711 system system
  - ➢ fs_mgr will also create this folder if not created by init.rc, but the ower and group will be root, root. There might be permission issue occurred.

Add mount information in fstab located in vendor/mediatek/proprietary/hardware/fstab/[Platform]/fstab.in

- /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/test /test ext4 rw
  wait,check,formattable
  - ➢ Flag "rw" means this partition is mounted as read-write

> ➢ option "wait" means that the mount procedure will wait for a while to check if the target device path is created.
> ➢ option "check" means that the mount procedure will perform check disk before mount
> ➢ option "formattable" means that if the target device is wiped, mount process will perform format on target device before mount.

```
diff --git a/mt6757/fstab.in b/mt6757/fstab.in
index 0c9d9ca..b368290 100644
--- a/mt6757/fstab.in
+++ b/mt6757/fstab.in
@@ -51,6 +51,8 @@
 /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/custom      /custom      ext4    ro      wait
 #endif

+/dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/test        /test        ext4    rw      wait,check,formattable
+
```

Figure 7-2. FSTAB configuration

7.3 Initial Partition Permission

7.3.1 Add File Permissions

This example illustrates how to add partition permissions in uevent.rc file, taking "test" partition mentioned in prevous section for example. Assume owern of this partition is root, group of this partition is system, and mode bit is 0660 (owner: rw, group: rw, others: none).

- This step is optional, it depends on the partition usage.
- Open alps/device/mediatek/[Platform]/ueventd.[Platform].rc
- Add the following line
  - ➢ /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/test 0640 root system

```
diff --git a/mt6757/ueventd.mt6757.rc b/mt6757/ueventd.mt6757.rc
index 0030bfc..e88e883 100644
--- a/mt6757/ueventd.mt6757.rc
+++ b/mt6757/ueventd.mt6757.rc
@@ -18,6 +18,7 @@
 /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/md1arm7     0660    root    system
 /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/md3img      0660    root    system
 /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/boot_para   0640    root    system
+/dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name/test        0640    root    system
```

Figure 7-3. File Permission Configuration

7.3.2 Add Selinux Policies

This example illustrates how to add partition selinux policies. Taking "test" partition mentioned in prevous section for example:

- Add device type in alps/device/mediatek/[Platform]/sepolicy/basic/device.te
  - ➢ type test_block_device,dev_type;

```
diff --git a/mt6757/sepolicy/basic/device.te
index b79409f..da0fd2a 100644
--- a/mt6757/sepolicy/basic/device.te
+++ b/mt6757/sepolicy/basic/device.te
@@ -3,3 +3,4 @@
 # ========================================

 type gps_emi_device, dev_type;
+type test_block_device,dev_type;
```

Figure 7-4. Policy of device.te

- Add file_context declaration in alps/device/mediatek/[Platform]/sepolicy/basic/file_context
  - ➢ /dev/block/platform/mtk-msdc\.0/[0-9]+\.msdc0/by-name/test
    u:object_r:test_block_device:s0

```
diff --git a/mt6757/sepolicy/basic/file_contexts b/mt6757/sepolicy/basic/file_contexts
index 5a3b099..de6a4db 100644
--- a/mt6757/sepolicy/basic/file_contexts
+++ b/mt6757/sepolicy/basic/file_contexts
@@ -30,6 +30,7 @@
 /dev/block/platform/mtk-msdc\.0/[0-9]+\.msdc0/by-name/md3img        u:object_r:md_block_device:s0
 /dev/block/platform/mtk-msdc\.0/[0-9]+\.msdc0/by-name/metadata      u:object_r:metadata_block_dev
 /dev/block/platform/mtk-msdc\.0/[0-9]+\.msdc0/by-name/boot_para     u:object_r:boot_para_block_de
+/dev/block/platform/mtk-msdc\.0/[0-9]+\.msdc0/by-name/test          u:object_r:test_block_device:s0
```

Figure 7-5. Policy of file_context

- Add init process access permission in alps/device/mediatek/common/sepolicy/basic/init.te
  - ➢ allow init test_block_device:blk_file w_file_perms;

```
diff --git a/common/sepolicy/basic/init.te b/common/se
index a43964a..6a08f9f 100644
--- a/common/sepolicy/basic/init.te
+++ b/common/sepolicy/basic/init.te
@@ -36,6 +36,7 @@ allow init nvcfg_block_device:blk_fi
 allow init odm_block_device:blk_file rw_file_perms;
 allow init oem_block_device:blk_file rw_file_perms;
 allow init para_block_device:blk_file w_file_perms;
+allow init test_block_device:blk_file rw_file_perms;
```

Figure 7-6. Policy of init.te

- Add check disk permission to perform e2fsck in alps/device/mediatek/common/sepolicy/basic/fsck.te

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```
diff --git a/common/sepolicy/basic/fsck.te b/common/se
index 8cce8bb..c03b3a3 100644
--- a/common/sepolicy/basic/fsck.te
+++ b/common/sepolicy/basic/fsck.te
@@ -12,3 +12,4 @@ allow fsck persist_block_device:blk
 allow fsck nvcfg_block_device:blk_file rw_file_perms;
 allow fsck odm_block_device:blk_file rw_file_perms;
 allow fsck oem_block_device:blk_file rw_file_perms;
+allow fsck test_block_device:blk_file rw_file_perms;
```

Figure 7-7. Policy of fsck.te

7.4 Check the new added partition by ADB tool

After all actions describe in previous sections are taken, the new partition had already added to system and is usable. The easiest way to check if this partition is added successfully is:

- Partitions with filesystem and are mounted
  - Type "adb shell mount", and check if the new added partition is mounted

```
D:\>adb shell "mount | grep \/test"
/dev/block/mmcblk0p5 on /test type ext4 (rw,seclabel,relatime,data=ordered)
```

Figure 7-8. Policy of fsck.te

- Raw Partitions without filesystem
  - Type "adb shell ls /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name", and check if the new added partition is shown

```
D:\>adb shell "ls /dev/block/platform/mtk-msdc.0/11230000.msdc0/by-name
boot        flashinfo logo     md3img    nvram     protect2 system userdata
boot_para frp         md1arm7  metadata  para      recovery tee1
cache       lk          md1dsp   nvcfg     proinfo   sec1     tee2
expdb       lk2         md1img   nvdata    protect1  seccfg   test
```

Figure 7-9. Policy of fsck.te

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8 Frequently Asked Questions

8.1 Debugging Related Questions

8.1.1 Partition Layout Modifications Does Not Work

- Check if modifications applied to scatter file, which located in out folder.
  - Scatter file name: "[Platform]_Android_scatter.txt"
- Check if modifications applied to GPT, which can be readback from LBA 1 of storage.
  - adb shell dd if=/dev/block/mmcblk0 of=/data/gpt bs=512 skip=1 count=33

8.1.2 Accessing partitions meet permission denied

- Check partition DAC(file permission)
- Check partition selinux policy settings

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