Qualcomm Technologies, Inc.

Android P Migration Guide

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Revision history

Revision	Date	Description
A	August 2018	Initial release
B	September 2018	Added: ▪ Section 3.7, *Flags* ▪ Section 5.2, *DTBO enablement*

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1 Introduction

1.1 Purpose

This document explains about the architectural changes in Android P, features and flags, compliance test impact. It also explains the patches for over the air (OTA) build and device tree blob overlay (DTBO) enablement.

1.2 Conventions

Function declarations, function names, type declarations, attributes, and code samples appear in a different font, for example, `cp armcc armcpp`.

Code variables appear in angle brackets, for example, `<number>`.

Commands to be entered appear in a different font, for example, **`copy a:*.* b:`**.

Button and key names appear in bold font, for example, click **Save** or press **Enter**.

Shading indicates content that has been added or changed in this revision of the document.

1.3 Technical assistance

For assistance or clarification on information in this document, submit a case to Qualcomm Technologies, Inc. (QTI) at https://createpoint.qti.qualcomm.com/.

If you do not have access to the CDMATech Support website, register for access or send email to support.cdmatech@qti.qualcomm.com.

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2 Architectural changes in Android P

2.1 Standard and new changes in Android P

Standard changes	New changes
▪ Android P system-vendor interfaces work ▪ Android P vendor Android compliance (compatibility test suite (CTS), Android open source project (AOSP) CTS, and vendor test suite (VTS))	▪ Enforces versioned HAL interface description language (HIDL) interfaces (AOSP and Qualcomm Technologies, Inc. (QTIs)). ▪ Requires backward compatibility handling in system/P with vendor/O interfaces.

Figure 2-1 Shows the architectural changes in Android P

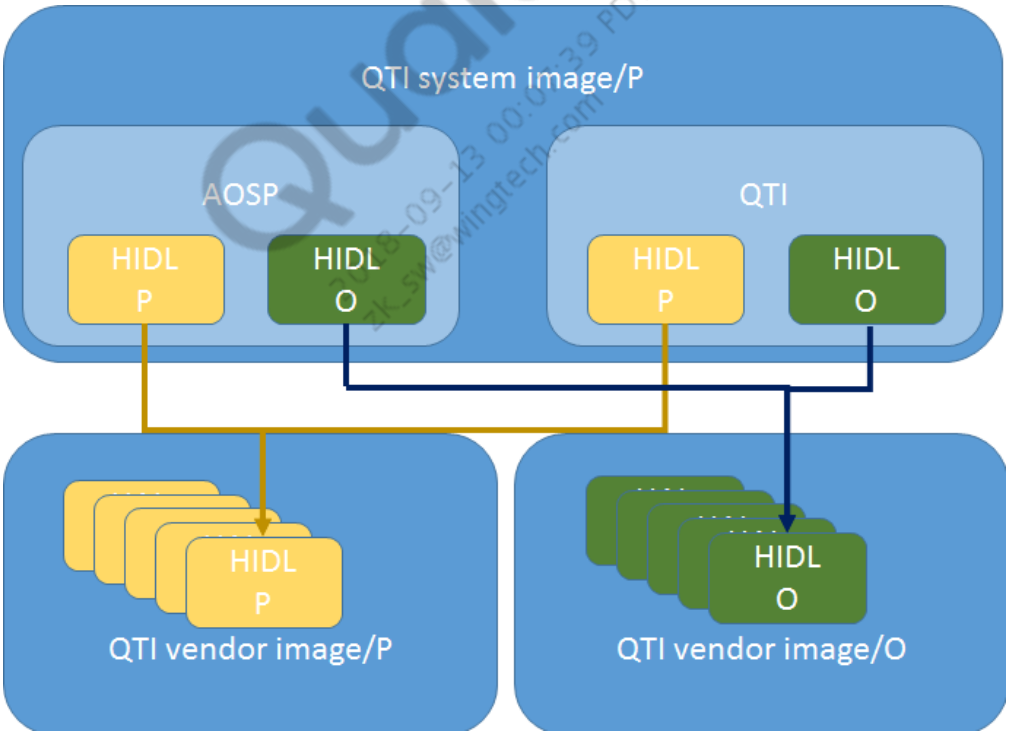

Figure 2-1 Architectural changes in Android P

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3 Features and flags

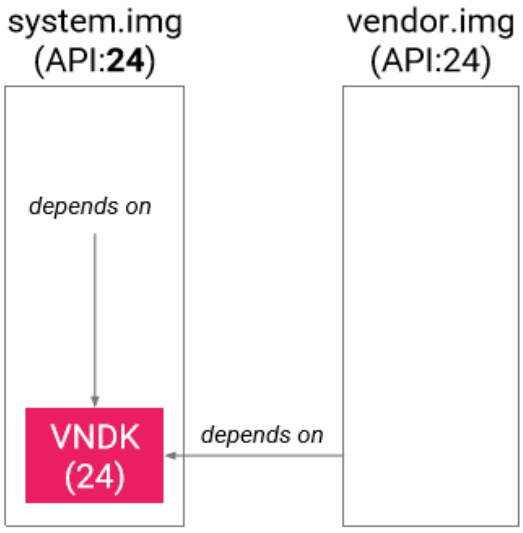
The Android P system features consist of the following:

- Vendor native development kit (VNDK) compliance
- Vendor Init
- System property compatibility
- Vendor created Android properties
- System-as-root
- System SDK

3.1 VNDK compliance

The VNDK is set of AOSP libraries, which are exposed to vendor (partition) for development.

- Library list – development/vndk/tools/definition-tool/datasets/eligible-list-master.csv
- Impact – Remove any library dependency, which is outside of VNDK set from vendor partition
- Verification for compliance:



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- Tool – VNDK definition tool (vendor to system linkage)

```
python development/vndk/tools/definition-tool/vndk_definition_tool.py
check-dep --system out/target/product/sdm845/system --vendor
out/target/product/sdm845/vendor/ --tag-file
development/vndk/tools/definition-tool/datasets/eligible-list-master.csv
2>&1 | tee log.vndk-error
```

The following are the examples of errors:

- QTI vendor-partition library uses lib outside VNDK from the system.
  - Error: vendor lib "/vendor/lib/libeffects.so" depends on non-eligible lib "/system/lib/libeffectsconfig.so".
- For the following error, remove android.hidl.base@1.0.so linkage and ensure that you are linking to libhidltransport.
  - Error: vendor lib "/vendor/bin/vppipcunittest" depends on non-eligible lib "/system/lib/vndk-sp/android.hidl.base@1.0.so".

3.1.1 Access for AOSP or Google projects headers

Vendor modules cannot refer AOSP header paths with absolute or global paths instead add the corresponding header library.

The following is the indicative list for the paths, which cannot be referenced in Android P:

- frameworks/av/include
- frameworks/native/include
- frameworks/native/opengl/include
- hardware/libhardware/include
- hardware/libhardware_legacy/include
- hardware/ril/include
- libnativehelper/include
- libnativehelper/include_deprecated
- system/media/audio/include
- system/core/include

List of header paths examples that are not allowed:

- $(TOP)/frameworks/av/include/media/stagefright
- $(TOP)/frameworks/av/include/media/stagefright/foundation
- $(TOP)/frameworks/native/include/media/hardware

Solution

If a module depends on the headers from the directories that are not allowed, the author must explicitly specify the dependencies with header_libs, static_libs, and/or shared_libs .

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For example:

frameworks/av/include/media/stagefright headers can be included via libstagefright_headers

```
cc_library_headers  {
name: "libstagefright_headers“
, export_include_dirs: ["include"],
 vendor_available: true,   -→ Make sure vendor_available is true
 }
```

The enforcement flag is BOARD_VNDK_VERSION : = current

3.1.2 LOCAL_COPY_HEADERS and LOCAL_COPY_HEADERS_TO flags

LOCAL_COPY_HEADERS and LOCAL_COPY_HEADERS_TO flags are deprecated for modules present in system. This applies to QTI modules present in system partition.

Solution to enable flags:

The header files can now be linked via the header lib and can be included using #include <foo/xyz.h>

For example: LOCAL_HEADER_LIBRARIES := libxyz_headers (in Android.mk)
header_libs: ["libxyz_headers"] (in Android.bp)

```
include $(CLEAR_VARS)
LOCAL_MODULE := libFoo_headers
LOCAL_EXPORT_C_INCLUDE_DIRS := $(LOCAL_PATH)  # group export headers into a
directory
LOCAL_PROPRIETARY_MODULE := true
include $(BUILD_HEADER_LIBRARY)
```

or in Android.bp

```
cc_library_headers {:
name: "libxyz_headers"
vendor_available: true,   // Only if the headers should be accessible from
both system and vendor partitions export_include_dirs: ["."],
          }
```

The enforcement flag is BOARD_VNDK_VERSION : = current

3.2 Vendor init

Vendor init forks a subprocess of init early in the boot process with the SELinuxcontextu:r:vendor_init:s0. This SELinux context has considerably fewer permissions than the default initcontext.

- Restricted file access – Cannot access any content outside /data/vendor inside data partition (both read and write)
- Restricted property access or triggers has the following init files:
  - vendor-init-readable
  - vendor-init-settable

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  - vendor-init-actionable
  - public-readable
- Impacted modules – All scripts and .rc present inside the vendor image.

3.3 System property compatibility

System property compatibility for vendor process (processes originated from /vendor/bin):

- Vendor processes can only read system properties, which are marked as **public-readable**
- Vendor processes cannot write any system properties, which is enforced through PRODUCT_COMPATIBLE_PROPERTY_OVERRIDE := true

3.4 Vendor created Android properties

Vendor properties need to be prefixed with vendor keyword irrespective of modules present in vendor or system (any property added by vendor).

The following are the example for prefixes:

- vendor.*
- ro.vendor.*
- ctl.vendor.*
- persist.vendor.*

Vendor modules access is limited to /data/vendor file path:

- All vendor (partition) modules can now access only /data/vendor file path for read and write inside data partition.
- System modules cannot read and write to /data/vendor file path.

The following changes are required to add vendor properties:

- Move the folders from /data/* to /data/vendor/.
  For example, /data/sensors/ to /data/vendor/sensors
- Change path in each module wherever accessing for reading or writing.
- Take care of data migration for OTA's.
- Change selinuxRules (mostly path related).

3.5 System-as-root

All devices launching with Android P must use system-as-root, which merges ramdisk.img into system.img, which in turn are mounted as rootfs.

Move QTI-specific directories to /vendor partition.

Figure 3-1 shows the comparison of image content between ramdisk (before Andriod P) and system-as-root (after Andriod P).

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<table>
<tr><th>Component</th><th>Image</th><th>ramdisk (before P)</th><th>system-as-root (after P)</th></tr>
<tr><td rowspan="3">Image Content</td><td>boot.img</td><td>Contains a kernel and a ramdisk.img:
<pre>ramdisk.img
-/
- init.rc
- init
- etc -> /system/etc
- system/ (mount point)
- vendor/ (mount point)
- odm/ (mount point)
...</pre></td><td>Contains a normal boot kernel only.</td></tr>
<tr><td>recovery.img</td><td colspan="2">Contains a recovery kernel and a recovery-ramdisk.img.</td></tr>
<tr><td>system.img</td><td>Contains the following:
<pre>system.img
-/
- bin/
- etc
- vendor -> /vendor
- ...</pre></td><td>Contains the merged content of original system.img and ramdisk.img:
<pre>system.img
-/
- init.rc
- init
- etc -> /system/etc
- system/
- bin/
- etc/
- vendor -> /vendor
- ...
- vendor/ (mount point)
- odm/ (mount point)
...</pre></td></tr>
</table>

Figure 3-1 Ramdisk (before Andriod P) vs. system-as-root (after Andriod P)

Impact (not limited to non A/B) – On flashing GSI the following mount points will not be available. Hence the mount points need to be moved to vendor image, which are currently present in system image:

- /bt_firmware
- /firmware
- /firmware/radio
- /persist
- /dsp

Any references to the preceding paths will change to /vendor/*.

For example: /bt_firmware/abc need to be accessed as /vendor/bt_firmware/abc

The following actions are taken to achieve the conformance:

- New firmware directories will be created by the Android core team (temporary symlinks created for backward compatibility).
- Tech teams will be relocated.
- Temporary symlinks will be removed at specified cutoff date. Any non-migrated modules will fail.

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3.6 System SDK

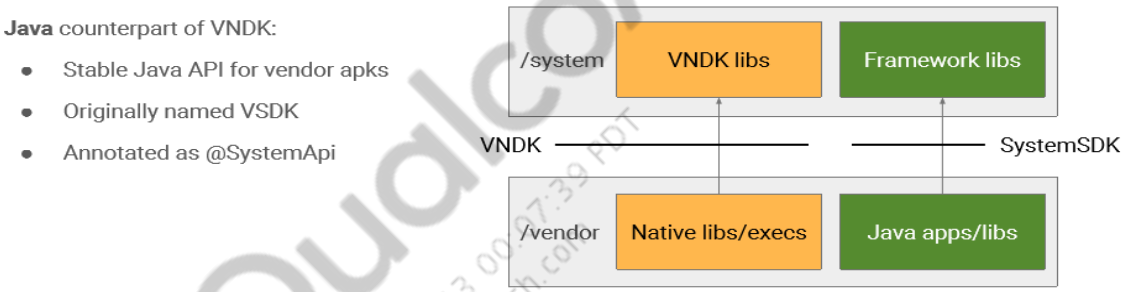
The impact of the system SDK is that the vendor APKs cannot access APIs outside of SDK and system API.

The solution is to create JAVA HAL in system image and communicate through IPC. JAVA HAL module can call other framework API's.

The following are the global enforcements:

- BOARD_SYSTEMSDK_VERSIONS:= P (Boardconfig.mk)
- LOCAL_SDK_VERSION := system_current (Android.mk)

Perform the following CTS tests to detect issues if any:
com.android.cts.api.UnofficialApisUsageTest#testNonApiReferences
cts/tests/signature/api-check/system-annotations (CtsSystemApiAnnotationTestCasea)



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3.7 Flags

NOTE: This section was added to this document revision.

Table 3-1 lists the flags that are continued from Android O and new in Android P. It also shows if the flags are enabled on new devices and OTA.

Table 3-1 List of flags enabled on new devices and OTA

Flags		Enabled on new devices	Enabled on OTA	
			N > O > P	O > P
Continued from Android O	PRODUCT_FULL_TREBLE_OVERRIDE	Yes	No	Yes
	ENABLE_VENDOR_IMAGE	Yes	No	Yes
	PRODUCT_TREBLE_LINKER_NAMESPACES	Yes	No	Yes
	PRODUCT_SEPOLICY_SPLIT	Yes	No	Yes
	PRODUCT_ENFORCE_VINTF_MANIFEST	Yes	No	Yes
New in Android P	BOARD_SYSTEMSDK_VERSIONS	Yes	No	No
	BOARD_VNDK_VERSION	Yes	No	No
	PRODUCT_COMPATIBLE_PROPERTY_ OVERRIDE	Yes	No	No

NOTE: The build system takes care of the flags enablement depending on PRODUCT_SHIPPING_API_LEVEL.

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4 Compliance test impact

4.1 Tests for Google certification

Table 4-1 Checklist and compliance tests

Device launch configuration	Build flavor	CTS	CTS-V	GTS	CTS-AOSP reference package	VTS
New launch	OEM system + OEM vendor image	Yes	Yes	Yes	No	No
	Google reference system + OEM vendor image	No	No	No	Yes	Yes
OTA (N > O)	OEM build (vendor present in system image only)	Yes	Yes	Yes	No	No

NOTE: CTS-instant and STS are added from Android P release.

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5 Patches

5.1 OTA build recommendation

NOTE: The main changes are mentioned here; for the latest instructions follow the OTA build instructions in the respective chipset release notes and the software user manual documents.

Patch 1

```
File: device/qcom/sdm845/BoardConfig.mk
--- a/BoardConfig.mk
+++ b/BoardConfig.mk
@@ -204,5 +204,5 @@ TARGET_ENABLE_MEDIADRM_64 := true
#Flag to enable System SDK Requirements.
#All vendor APK will be compiled against system_current API set.
-BOARD_SYSTEMSDK_VERSIONS:=28
-BOARD_VNDK_VERSION:= current
+#BOARD_SYSTEMSDK_VERSIONS:=28
+#BOARD_VNDK_VERSION:= current
```

Patch 2

```
File:  device/qcom/sdm845/manifest.xml
--- a/manifest.xml
+++ b/manifest.xml
@@ -199,7 +199,7 @@ IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.
<hal format="hidl">
<name>android.hardware.keymaster</name>
<transport>hwbinder</transport>
- <version>4.0</version>
+ <version>3.0</version>
<interface>
<name>IKeymasterDevice</name>
<instance>default</instance>
```

Patch 3

```
File: device/qcom/sdm845/sdm845.mk
--- a/sdm845.mk +++ b/sdm845.mk
@@ -237,7 +237,7 @@ PRODUCT_PROPERTY_OVERRIDES += \
PRODUCT_PROPERTY_OVERRIDES += \
vendor.qcom.bluetooth.soc=cherokee
```

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```
-PRODUCT_FULL_TREBLE_OVERRIDE := true
+#PRODUCT_FULL_TREBLE_OVERRIDE := true
PRODUCT_VENDOR_MOVE_ENABLED := true
PRODUCT_PROPERTY_OVERRIDES += rild.libpath=/vendor/lib64/libril-qc-hal-
qmi.so
@@ -249,7 +249,7 @@ PRODUCT_PROPERTY_OVERRIDES +=
ro.vendor.qti.sys.fw.bg_apps_limit=60
KMGK_USE_QTI_SERVICE := true
#Enable KEYMASTER 4.0
-ENABLE_KM_4_0 := true
+ENABLE_KM_4_0 := false
ifneq ($(strip $(TARGET_USES_QSSI)),true)
DEVICE_PACKAGE_OVERLAYS += device/qcom/sdm845/overlay
@@ -278,9 +278,9 @@ SDM845_DISABLE_MODULE := true
ENABLE_VENDOR_RIL_SERVICE := true
# Enable vndk-sp Libraries
-PRODUCT_PACKAGES += vndk_package
+#PRODUCT_PACKAGES += vndk_package
-PRODUCT_COMPATIBLE_PROPERTY_OVERRIDE:=true
+#PRODUCT_COMPATIBLE_PROPERTY_OVERRIDE:=true
#Enable WIFI AWARE FEATURE
WIFI_HIDL_FEATURE_AWARE := true
@@ -292,7 +292,6 @@ WIFI_HIDL_FEATURE_DUAL_INTERFACE := true
QC_WIFI_HIDL_FEATURE_DUAL_AP := true
TARGET_USES_MKE2FS := true
-$(call inherit-product,
build/make/target/product/product_launched_with_p.mk)
TARGET_MOUNT_POINTS_SYMLINKS := false
@@ -303,3 +302,4 @@ TARGET_MOUNT_POINTS_SYMLINKS := false
ifeq ($(ENABLE_VENDOR_IMAGE)),true)
VENDOR_SECURITY_PATCH := 2018-06-05
endif
+$(call inherit-product, build/make/target/product/product_launched
```

5.2 DTBO enablement

NOTE: This section was added to this document revision.

NOTE: By default, the DTBO feature is enabled on MSM8953, MSM8937, SDM710, and targets released after SDM845 with Android P. For other targets, DTBO had to be enabled for Android P new devices and is not applicable for OTA devices.

This section describes the patches or changes to be made to enable the DTBO. For example, SDM636.

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Patch 1 – Enable DTBO VB meta in kernel

```
---
 arch/arm/boot/dts/qcom/sdm630.dtsi | 7 ++++++-
 arch/arm/boot/dts/qcom/sdm660.dtsi | 7 ++++++-
 2 files changed, 12 insertions(+), 2 deletions(-)

diff --git a/arch/arm/boot/dts/qcom/sdm630.dtsi
b/arch/arm/boot/dts/qcom/sdm630.dtsi
index 8873627..42bf093 100644
--- a/arch/arm/boot/dts/qcom/sdm630.dtsi
+++ b/arch/arm/boot/dts/qcom/sdm630.dtsi
@@ -302,6 +302,11 @@
    firmware: firmware {
         android {
              compatible = "android,firmware";
+                        vbmeta {
+                                compatible = "android,vbmeta";
+                                parts = "vbmeta,boot,system,vendor,dtbo";
+                        };
+
              fstab {
                   compatible = "android,fstab";
                   vendor {
@@ -309,7 +314,7 @@
                        dev = "/dev/block/platform/soc/c0c4000.sdhci/by-
name/vendor";
                        type = "ext4";
                        mnt_flags = "ro,barrier=1,discard";
-                       fsmgr_flags = "wait,slotselect,verify";
+                       fsmgr_flags = "wait,slotselect,avb";
                        status = "ok";
                   };
              };
diff --git a/arch/arm/boot/dts/qcom/sdm660.dtsi
b/arch/arm/boot/dts/qcom/sdm660.dtsi
index 30d23cb..59a3f56 100644
--- a/arch/arm/boot/dts/qcom/sdm660.dtsi
+++ b/arch/arm/boot/dts/qcom/sdm660.dtsi
@@ -300,6 +300,11 @@
    firmware: firmware {
         android {
              compatible = "android,firmware";
+                        vbmeta {
+                                compatible = "android,vbmeta";
+                                parts = "vbmeta,boot,system,vendor,dtbo";
+                        };
+
```

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```
             fstab {
                  compatible = "android,fstab";
                  vendor {
@@ -307,7 +312,7 @@
                       dev = "/dev/block/platform/soc/c0c4000.sdhci/by-
name/vendor";
                       type = "ext4";
                       mnt_flags = "ro,barrier=1,discard";
-                      fsmgr_flags = "wait,slotselect,verify";
+                      fsmgr_flags = "wait,slotselect,avb";
                       status = "ok";
                  };
             };
--
```

Patch 2 – Enable DTBO and AVB.2.0

```
---
 AndroidBoard.mk                          |  8 ++++++++
 BoardConfig.mk                           |  9 +++++++++
 fstab_AB_variant.qcom                    |  2 +-
 fstab_non_AB_variant.qcom                |  2 +-
 recovery_AB_non-split_variant.fstab      |  2 +-
 recovery_AB_split_variant.fstab          |  4 ++--
 recovery_non-AB_non-split_variant.fstab |  2 +-
 recovery_non-AB_split_variant.fstab      |  4 ++--
 sdm660_64.mk                             | 10 +++++-------
 9 files changed, 28 insertions(+), 15 deletions(-)

diff --git a/AndroidBoard.mk b/AndroidBoard.mk
index 4dba5ad..fe04ab7 100644
--- a/AndroidBoard.mk
+++ b/AndroidBoard.mk
@@ -30,7 +30,15 @@ ifeq ($(TARGET_KERNEL_SOURCE),)
      TARGET_KERNEL_SOURCE := kernel
 endif

+DTC := $(HOST_OUT_EXECUTABLES)/dtc$(HOST_EXECUTABLE_SUFFIX)
+UFDT_APPLY_OVERLAY :=
$(HOST_OUT_EXECUTABLES)/ufdt_apply_overlay$(HOST_EXECUTABLE_SUFFIX)
+
+TARGET_KERNEL_MAKE_ENV := DTC_EXT=dtc$(HOST_EXECUTABLE_SUFFIX)
+TARGET_KERNEL_MAKE_ENV +=
DTC_OVERLAY_TEST_EXT=$(ANDROID_BUILD_TOP)/$(UFDT_APPLY_OVERLAY)
+TARGET_KERNEL_MAKE_ENV += CONFIG_BUILD_ARM64_DT_OVERLAY=y
+
 include $(TARGET_KERNEL_SOURCE)/AndroidKernel.mk
+$(TARGET_PREBUILT_KERNEL): $(DTC) $(UFDT_APPLY_OVERLAY)
```


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```
 $(INSTALLED_KERNEL_TARGET): $(TARGET_PREBUILT_KERNEL) | $(ACP)
   $(transform-prebuilt-to-target)
diff --git a/BoardConfig.mk b/BoardConfig.mk
index a597b0c..94cd0f3 100644
--- a/BoardConfig.mk
+++ b/BoardConfig.mk
@@ -36,6 +36,9 @@ BOARD_USE_LEGACY_UI := true
 TARGET_USERIMAGES_USE_EXT4 := true
 BOARD_BOOTIMAGE_PARTITION_SIZE := 0x04000000

+BOARD_DTBOIMG_PARTITION_SIZE := 0x0800000
+BOARD_KERNEL_SEPARATED_DTBO := true
+
 ifeq ($(ENABLE_AB), true)
 #A/B related defines
 AB_OTA_UPDATER := true
@@ -53,6 +56,12 @@ BOARD_CACHEIMAGE_FILE_SYSTEM_TYPE := ext4
 # Enable System As Root even for non-A/B from P onwards
 BOARD_BUILD_SYSTEM_ROOT_IMAGE := true
 #TARGET_RECOVERY_UPDATER_LIBS += librecovery_updater_msm
+ifeq ($(BOARD_AVB_ENABLE), true)
+   BOARD_AVB_RECOVERY_KEY_PATH :=
external/avb/test/data/testkey_rsa4096.pem
+   BOARD_AVB_RECOVERY_ALGORITHM := SHA256_RSA4096
+   BOARD_AVB_RECOVERY_ROLLBACK_INDEX := 1
+   BOARD_AVB_RECOVERY_ROLLBACK_INDEX_LOCATION := 1
+endif
 endif

 ifeq ($(ENABLE_AB), true)
diff --git a/fstab_AB_variant.qcom b/fstab_AB_variant.qcom
index b08bdad..0cda545 100644
--- a/fstab_AB_variant.qcom
+++ b/fstab_AB_variant.qcom
@@ -7,7 +7,7 @@

 # A/B fstab.qcom variant
 #<src>                                  <mnt_point>          <type>
<mnt_flags and options>                        <fs_mgr_flags>
-/dev/block/bootdevice/by-name/system    /                    ext4
ro,barrier=1,discard                           wait,slotselect,verify
+/dev/block/bootdevice/by-name/system    /                    ext4
ro,barrier=1,discard                           wait,slotselect,avb
 /dev/block/bootdevice/by-name/userdata   /data                ext4
nosuid,nodev,barrier=1,noauto_da_alloc,discard,noatime,lazytime
wait,check,forceencrypt=footer,crashcheck,quota,reservedsize=128M
```


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```
 /devices/soc/c084000.sdhci/mmc_host*     /storage/sdcard1      vfat
nosuid,nodev
wait,voldmanaged=sdcard1:auto,encryptable=footer
 /dev/block/bootdevice/by-name/misc       /misc                 emmc
defaults                                        defaults
diff --git a/fstab_non_AB_variant.qcom b/fstab_non_AB_variant.qcom
index 2328017..7609f52 100644
--- a/fstab_non_AB_variant.qcom
+++ b/fstab_non_AB_variant.qcom
@@ -7,7 +7,7 @@

 # Non-A/B fstab.qcom variant
 #<src>                                  <mnt_point>            <type>
<mnt_flags and options>                         <fs_mgr_flags>
-/dev/block/bootdevice/by-name/system     /                      ext4
ro,barrier=1,discard                            wait,verify
+/dev/block/bootdevice/by-name/system     /                      ext4
ro,barrier=1,discard                            wait,avb
 /dev/block/bootdevice/by-name/userdata   /data                  ext4
nosuid,nodev,barrier=1,noauto_da_alloc,discard,noatime,lazytime
wait,check,forceencrypt=footer,crashcheck,quota,reservedsize=128M
 /devices/soc/c084000.sdhci/mmc_host*     /storage/sdcard1       vfat
nosuid,nodev
wait,voldmanaged=sdcard1:auto,encryptable=footer
 /dev/block/bootdevice/by-name/misc       /misc                 emmc
defaults                                        defaults
diff --git a/recovery_AB_non-split_variant.fstab b/recovery_AB_non-
split_variant.fstab
index 874a81a..6e965e2 100644
--- a/recovery_AB_non-split_variant.fstab
+++ b/recovery_AB_non-split_variant.fstab
@@ -29,7 +29,7 @@

 #device         mount point      fstype        [device2] [length=]

-/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1
wait,slotselect,verify
+/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1
wait,slotselect,avb
 /dev/block/bootdevice/by-name/userdata     /data           ext4
noatime,nosuid,nodev,barrier=1,data=ordered,noauto_da_alloc
wait,check,encryptable=footer
 /dev/block/mmcblk1p1                       /sdcard         vfat
nosuid,nodev                                                    wait
 /dev/block/bootdevice/by-name/boot         /boot           emmc
defaults                                                        defaults
```


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```
diff --git a/recovery_AB_split_variant.fstab
b/recovery_AB_split_variant.fstab
index 7998fa7..870c438 100644
--- a/recovery_AB_split_variant.fstab
+++ b/recovery_AB_split_variant.fstab
@@ -29,8 +29,8 @@

 #device         mount point      fstype        [device2] [length=]

-/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1
wait,slotselect,verify
-/dev/block/bootdevice/by-name/vendor       /vendor         ext4
ro,barrier=1
wait,slotselect,verify
+/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1
wait,slotselect,avb
+/dev/block/bootdevice/by-name/vendor       /vendor         ext4
ro,barrier=1
wait,slotselect,avb
 /dev/block/bootdevice/by-name/userdata     /data           ext4
noatime,nosuid,nodev,barrier=1,data=ordered,noauto_da_alloc
wait,check,encryptable=footer
 /dev/block/mmcblk1p1                       /sdcard         vfat
nosuid,nodev                                                   wait
 /dev/block/bootdevice/by-name/boot         /boot           emmc
defaults                                                       defaults
diff --git a/recovery_non-AB_non-split_variant.fstab b/recovery_non-AB_non-
split_variant.fstab
index 70c6289..8e0b7fc 100644
--- a/recovery_non-AB_non-split_variant.fstab
+++ b/recovery_non-AB_non-split_variant.fstab
@@ -29,7 +29,7 @@

 #device         mount point      fstype        [device2] [length=]

-/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1                                                   wait,verify
+/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1                                                   wait,avb
 /dev/block/bootdevice/by-name/cache        /cache          ext4
noatime,nosuid,nodev,barrier=1,data=ordered                    wait,check
 /dev/block/bootdevice/by-name/userdata     /data           ext4
noatime,nosuid,nodev,barrier=1,data=ordered,noauto_da_alloc
wait,check,encryptable=footer
 /dev/block/mmcblk1p1                       /sdcard         vfat
nosuid,nodev                                                   wait
```

Qualcomm 2018-09-13 01:09:39 PDT k_swwingtech.com

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```
diff --git a/recovery_non-AB_split_variant.fstab b/recovery_non-
AB_split_variant.fstab
index ce5791a..be24d07 100644
--- a/recovery_non-AB_split_variant.fstab
+++ b/recovery_non-AB_split_variant.fstab
@@ -29,8 +29,8 @@

 #device         mount point      fstype        [device2] [length=]

-/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1                                                    wait,verify
-/dev/block/bootdevice/by-name/vendor       /vendor         ext4
ro,barrier=1                                                    wait,verify
+/dev/block/bootdevice/by-name/system       /               ext4
ro,barrier=1                                                    wait,avb
+/dev/block/bootdevice/by-name/vendor       /vendor         ext4
ro,barrier=1                                                    wait,avb
 /dev/block/bootdevice/by-name/cache        /cache          ext4
noatime,nosuid,nodev,barrier=1,data=ordered                     wait,check
 /dev/block/bootdevice/by-name/userdata     /data           ext4
noatime,nosuid,nodev,barrier=1,data=ordered,noauto_da_alloc
wait,check,encryptable=footer
 /dev/block/mmcblk1p1                       /sdcard         vfat
nosuid,nodev                                                    wait
diff --git a/sdm660_64.mk b/sdm660_64.mk
index cfcbef4..8588e20 100644
--- a/sdm660_64.mk
+++ b/sdm660_64.mk
@@ -1,3 +1,6 @@
+# Enable AVB 2.0
+BOARD_AVB_ENABLE := true
+
 TARGET_USES_AOSP := true

 DEVICE_PACKAGE_OVERLAYS := device/qcom/sdm660_64/overlay
@@ -233,13 +236,6 @@ PRODUCT_COPY_FILES +=
device/qcom/sdm660_64/msm_irqbalance.conf:$(TARGET_COPY_OU
 # MSM IRQ Balancer configuration file for SDM630
 PRODUCT_COPY_FILES +=
device/qcom/sdm660_64/msm_irqbalance_sdm630.conf:$(TARGET_COPY_OUT_VENDOR)/
etc/msm_irqbalance_sdm630.conf

-# dm-verity configuration
-PRODUCT_SUPPORTS_VERITY := true
-PRODUCT_SYSTEM_VERITY_PARTITION := /dev/block/bootdevice/by-name/system
-ifeq ($(ENABLE_VENDOR_IMAGE), true)
-PRODUCT_VENDOR_VERITY_PARTITION := /dev/block/bootdevice/by-name/vendor
-endif
```

Qualcomm 2018-09-13 00:07:3 PDT zk_sw@wingtech.com

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```
-
 PRODUCT_FULL_TREBLE_OVERRIDE := true

 PRODUCT_VENDOR_MOVE_ENABLED := true
--
```

Patch 3 – Arm: dts: msm: Add DTBO support for sdm660 mtp/cdp

```
---
 arch/arm/boot/dts/qcom/Makefile               |  9 ++++++
 arch/arm/boot/dts/qcom/sdm660-cdp-overlay.dts | 43
++++++++++++++++++++++++
 arch/arm/boot/dts/qcom/sdm660-mtp-overlay.dts | 45
+++++++++++++++++++++++++++
 arch/arm/boot/dts/qcom/sdm660.dts             | 22 ++++++++++++
 4 files changed, 119 insertions(+)
 create mode 100644 arch/arm/boot/dts/qcom/sdm660-cdp-overlay.dts
 create mode 100644 arch/arm/boot/dts/qcom/sdm660-mtp-overlay.dts
 create mode 100644 arch/arm/boot/dts/qcom/sdm660.dts

diff --git a/arch/arm/boot/dts/qcom/Makefile
b/arch/arm/boot/dts/qcom/Makefile
index 9a7be59..33ca756 100644
--- a/arch/arm/boot/dts/qcom/Makefile
+++ b/arch/arm/boot/dts/qcom/Makefile
@@ -182,6 +182,14 @@ endif

 dtb-$(CONFIG_ARCH_MSMHAMSTER) += msmhamster-rumi.dtb

+ifeq ($(CONFIG_BUILD_ARM64_DT_OVERLAY),y)
+dtbo-$(CONFIG_ARCH_SDM660) += \
+   sdm660-mtp-overlay.dtbo \
+   sdm660-cdp-overlay.dtbo
+
+sdm660-mtp-overlay.dtbo-base :=  sdm660.dtb
+sdm660-cdp-overlay.dtbo-base :=  sdm660.dtb
+else
 dtb-$(CONFIG_ARCH_SDM660) += sdm660-sim.dtb \
    sdm660-internal-codec-cdp.dtb \
    sdm660-internal-codec-mtp.dtb \
@@ -260,6 +268,7 @@ dtb-$(CONFIG_ARCH_SDM660) += sdm660-sim.dtb \
    sda636-pm660a-mtp.dtb \
    sda636-pm660a-qrd-hdk.dtb \
    sda636-pm660a-rcm.dtb
+endif

 dtb-$(CONFIG_ARCH_SDM630) += sdm630-rumi.dtb \
    sdm630-pm660a-rumi.dtb \
```


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```
diff --git a/arch/arm/boot/dts/qcom/sdm660-cdp-overlay.dts
b/arch/arm/boot/dts/qcom/sdm660-cdp-overlay.dts
new file mode 100644
index 0000000..2faa4be
--- /dev/null
+++ b/arch/arm/boot/dts/qcom/sdm660-cdp-overlay.dts
@@ -0,0 +1,43 @@
+/* Copyright (c) 2018, The Linux Foundation. All rights reserved.
+ *
+ * This program is free software; you can redistribute it and/or modify
+ * it under the terms of the GNU General Public License version 2 and
+ * only version 2 as published by the Free Software Foundation.
+ *
+ * This program is distributed in the hope that it will be useful,
+ * but WITHOUT ANY WARRANTY; without even the implied warranty of
+ * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
+ * GNU General Public License for more details.
+ */
+
+
+/dts-v1/;
+/plugin/;
+
+#include <dt-bindings/clock/qcom,cpu-osm.h>
+#include <dt-bindings/clock/qcom,rpmcc.h>
+#include <dt-bindings/clock/qcom,mmcc-sdm660.h>
+#include <dt-bindings/regulator/qcom,rpm-smd-regulator.h>
+#include <dt-bindings/interrupt-controller/arm-gic.h>
+
+#include "sdm660-cdp.dtsi"
+#include "sdm660-external-codec.dtsi"
+
+/ {
+  model = "Qualcomm Technologies, Inc. SDM 660 PM660 + PM660L CDP";
+  compatible = "qcom,sdm660-cdp", "qcom,sdm660", "qcom,cdp";
+  qcom,board-id = <1 0>;
+  qcom,pmic-id = <0x0001001b 0x0101011a 0x0 0x0>,
+            <0x0001001b 0x0201011a 0x0 0x0>,
+            <0x0001001b 0x0102001a 0x0 0x0>;
+};
+
+/*&tavil_snd {
+  qcom,msm-mbhc-hphl-swh = <0>;
+  qcom,msm-mbhc-gnd-swh = <0>;
+};
+
+&tasha_snd {
+  qcom,msm-mbhc-hphl-swh = <0>;
```


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```
+  qcom,msm-mbhc-gnd-swh = <0>;
+};*/
diff --git a/arch/arm/boot/dts/qcom/sdm660-mtp-overlay.dts
b/arch/arm/boot/dts/qcom/sdm660-mtp-overlay.dts
new file mode 100644
index 0000000..a6d14e20
--- /dev/null
+++ b/arch/arm/boot/dts/qcom/sdm660-mtp-overlay.dts
@@ -0,0 +1,45 @@
+/* Copyright (c) 2018, The Linux Foundation. All rights reserved.
+ *
+ * This program is free software; you can redistribute it and/or modify
+ * it under the terms of the GNU General Public License version 2 and
+ * only version 2 as published by the Free Software Foundation.
+ *
+ * This program is distributed in the hope that it will be useful,
+ * but WITHOUT ANY WARRANTY; without even the implied warranty of
+ * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
+ * GNU General Public License for more details.
+ */
+
+/dts-v1/;
+/plugin/;
+
+#include <dt-bindings/clock/qcom,cpu-osm.h>
+#include <dt-bindings/clock/qcom,rpmcc.h>
+#include <dt-bindings/clock/qcom,mmcc-sdm660.h>
+#include <dt-bindings/regulator/qcom,rpm-smd-regulator.h>
+#include <dt-bindings/interrupt-controller/arm-gic.h>
+
+#include "sdm660-mtp.dtsi"
+#include "sdm660-external-codec.dtsi"
+
+/ {
+  model = "Qualcomm Technologies, Inc. SDM 660 PM660 + PM660L MTP";
+  compatible = "qcom,sdm660-mtp", "qcom,sdm660", "qcom,mtp";
+  qcom,board-id = <8 0>;
+  qcom,pmic-id = <0x0001001b 0x0101011a 0x0 0x0>,
+           <0x0001001b 0x0201011a 0x0 0x0>,
+           <0x0001001b 0x0102001a 0x0 0x0>;
+};
+
+/*&tavil_snd {
+  qcom,msm-mbhc-moist-cfg = <0>, <0>, <3>;
+};
+
+&slim_aud {
+  /delete-node/tasha_codec;
```


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```
+};
+
+&soc {
+  /delete-node/sound-9335;
+};
+*/
diff --git a/arch/arm/boot/dts/qcom/sdm660.dts
b/arch/arm/boot/dts/qcom/sdm660.dts
new file mode 100644
index 0000000..c9b3a18
--- /dev/null
+++ b/arch/arm/boot/dts/qcom/sdm660.dts
@@ -0,0 +1,22 @@
+/* Copyright (c) 2018, The Linux Foundation. All rights reserved.
+ *
+ * This program is free software; you can redistribute it and/or modify
+ * it under the terms of the GNU General Public License version 2 and
+ * only version 2 as published by the Free Software Foundation.
+ *
+ * This program is distributed in the hope that it will be useful,
+ * but WITHOUT ANY WARRANTY; without even the implied warranty of
+ * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
+ * GNU General Public License for more details.
+ */
+
+
+/dts-v1/;
+
+#include "sdm660.dtsi"
+
+/ {
+  model = "Qualcomm Technologies, Inc. SDM 660 SoC";
+  compatible = "qcom,sdm660";
+  qcom,board-id = <0 0>;
+};
--
```

Meta script changes

- To create the partition for DTBO image, add the following changes in partition.xml file.

```
<partition label="dtbo_a" size_in_kb="8192" type="24d0d418-d31d-4d8d-
ac2c-4d4305188450" bootable="false" readonly="false"
filename="dtbo.img"/>
<partition label="dtbo_b" size_in_kb="8192" type="77036CD4-03D5-42BB-
8ED1-37E5A88BAA34" bootable="false" readonly="false"
filename="dtbo.img"/>
```


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- To flash the DTBO image through fastboot script, add the following changes in contents.xml file.

```
<download_file fastboot_rumi="dtbo_a" fastboot="dtbo_a"
minimized="true">
        <file_name>dtbo.img</file_name>
        <file_path>LINUX/android/out/target/product/sdm660_64/</file_pat
h>
</download_file>

<file_ref ignore="true" minimized="true" secondary_boot="true">
        <file_name>dtbo.img</file_name>
        <file_path>LINUX/android/out/target/product/sdm660_64/secondary-
boot/</file_path>
</file_ref>
```

- To flash the vbmeta image through fasboot script, add the following changes in contents.xml file.

```
<download_file fastboot="vbmeta_a" minimized="true">
        <file_name>vbmeta.img</file_name>
        <file_path>
LINUX/android/out/target/product/sdm660_64/</file_path>
</download_file>

<download_file  fastboot="vbmeta_a" minimized="true">
        <file_name>vbmeta.img</file_name>
        <file_path>
LINUX/android/out/target/product/sdm660_64/</file_path>
</download_file>
```

NOTE: To address VTS test case failure, the **inclusion of dtbo in recovery** changes are yet to be validated and merged.

MAY CONTAIN U.S. AND INTERNATIONAL EXPORT CONTROLLED INFORMATION

A References

A.1 Related documents

Title	Number
Qualcomm Technologies, Inc.	
Android O Migration Overview	80-PC301-1
Resources	
Android Architecture – Android Open Source Project	https://source.android.com/devices/architecture/
Android Go	https://www.android.com/versions/oreo-8-0/go-edition/ https://source.android.com/devices/tech/perf/low-ram https://source.android.com/compatibility/android-cdd.pdf https://developer.android.com/develop/quality-guidelines/building-for-billions-device-capacity.html
Android Neural Network API	https://developer.android.com/about/versions/oreo/android-8.1.html

A.2 Acronyms and terms

Acronym or term	Definition
AOSP	Android open source project
CTS	Compatibility test suite
DTBO	Device tree blob overlay
OTA	Over the air
VNDK	Vendor native development kit
VTS	Vendor test suite

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