Power Management Debugging Guide

TCCxxxx-Android-ALL-V1.03E

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Telechips

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Revision History

Date	Version	Description
2011-03-07	1.00	1st draft.
2012-02-29	1.01	Update to Android 4.0 (Ice Cream Sandwitch)
2013-12-13	1.02	Update to Android 4.2 (Jelly Bean)
2014-02-25	1.03	Update to Android 4.4 (Kitkat)

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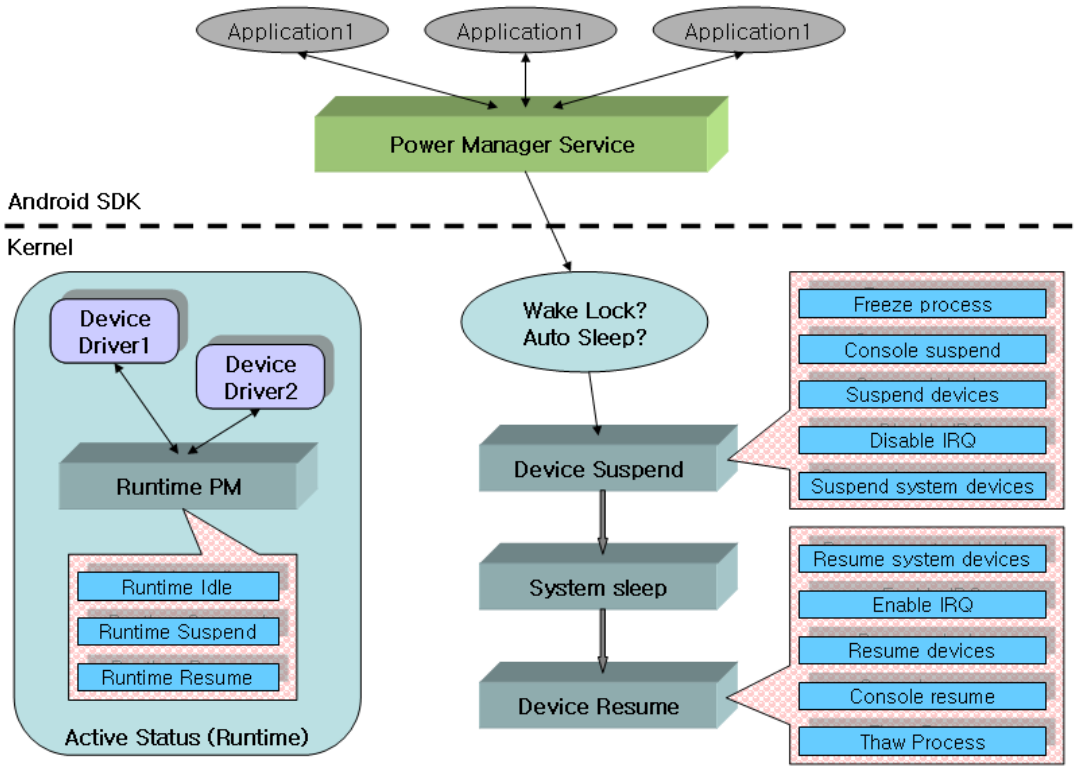
1 Introduction

This guide shows Android power management – especially Suspend and Resume feature which is based on Linux “Suspend to RAM” and how to setup kernel options to debug Android PM system.
This guide is made for Telechips Android Platform based on Kitkat version.

2 Android Power Management

This chapter shows how to suspend system and resume from suspend mode.
Android suspends system based on Linux “Suspend to RAM” and Runtime-PM.

2.1 State Transition



2.2 Runtime PM

Turn off (stop clock or remove power) hardware components that aren’t going to be used in the near future, transparently from the user space’s viewpoint.

Runtime PM framework uses abstract states of devices

- ACTIVE
  Device can do I/O (presumably in the full-power state)
- SUSPENDED
  Device cannot do I/O (presumably in a low-power state)
- SUSPENDING
  Device state is changing from ACTIVE to SUSPENDED
- RESUMING
  Device state is changing from ACTIVE to SUSPENDED

2.3 Device Suspend

If there is no wake-locked applications, the system enters into suspend mode.
Before entering suspend mode, all device drivers have to be suspended and it is the main process to enter sleep mode.
To enter sleep mode, following operations are performed.

① Freeze Process
  User space process and other tasks are stopped.

② Console Suspend
Disabling UART console.
This can be skipped by changing kernel option for debugging purpose.

③ Suspend Devices
Performs call back function to suspend all non-syscore device including platform devices.

④ Disable IRQ

⑤ Suspend System Devices
Performs call back function to suspend syscore device.

2.4 System Sleep

System enters into shut-down mode. If there is hardware reset or RTC wake-up, wake-up operation will be started.
The detailed operation will be different according to machine type and board.

2.5 Device Resume

After wake-up, the required operation for each driver will be done to resume pervious status.
Operation procedure is as follows.

① Resuem System devices
Performs call back function to resume syscore device.

② Enable IRQ

③ Resume devices
Performs call back for all non-syscore device.

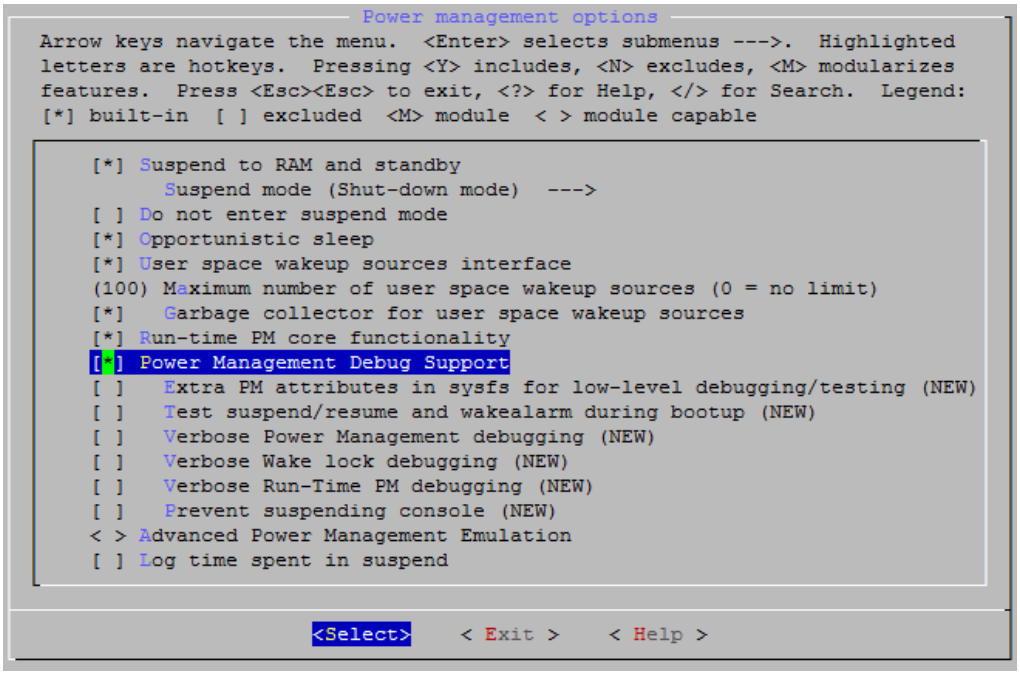
④ Console resume
Activate Console.

⑤ Thaw process
Activate user process and all tasks.

3 Setting Power Management Debugging Option

There is several options to debug power management in kernel menu configuration.
By selecting this option, you can show various events which are happened during state transition.
This chapter shows those options in detail.

After executing kernel menuconfig, select Power management option → Power Management Debug Support.
Various sub-menu will be displayed.



Options to be used to debug is as follows.

- Verbose Power Management debugging
- Verbose Wake lock debugging
- Verbose Run-Time PM debugging
- Prevent suspending console
- Test suspend/resume and wakealarm during bootup

3.1 Verbose Power Management debugging

By enabling this option, the detailed operating status during Device Suspend and Device Resume will be out.
You can check suspend/resume call back function of most device driver include platform device.

```
[    71.922329] tcc-adc tcc-adc: bus suspend
[    71.922373] tcc-i2c tcc-i2c.3: bus suspend
[    71.922410] tcc-i2c tcc-i2c.2: bus suspend
[    71.922444] tcc-i2c tcc-i2c.1: bus suspend
[    71.922479] tcc-i2c tcc-i2c.0: bus suspend
[    71.922513] tcc-i2c tcc-i2c.4: bus suspend
[    71.922544] tcc-uart tcc-uart.4: bus suspend
[    71.922592] tcc-uart tcc-uart.1: bus suspend
[    71.922635] tcc-uart tcc-uart.0: bus suspend
[    71.947736] platform tcc_mtd: bus suspend
[    71.947773] tcc-ts tcc-ts: bus suspend
[    71.947812] android-battery android-battery: bus suspend
[    71.947859] reg-dummy reg-dummy: bus suspend
[    71.947959] PM: suspend of devices complete after 155.387 msecs
[    71.948544] PM: late suspend of devices complete after 0.554 msecs
[    71.949254] PM: noirq suspend of devices complete after 0.681 msecs
[    71.949274] Disabling non-boot CPUs ...
[    71.950005] PM: noirq resume of devices complete after 0.447 msecs
[    71.950407] PM: early resume of devices complete after 0.265 msecs
```

```
[    71.950751] reg-dummy reg-dummy: bus resume
[    71.950792] android-battery android-battery: bus resume
[    71.950817] tcc-ts tcc-ts: bus resume
[    71.950844] platform tcc_mtd: bus resume
[    71.950867] tcc-uart tcc-uart.0: bus resume
[    71.950919] [UART00] setting ulcon: 00000003, umcon: 00000002, brddiv to 26, baud 115200, uart_clk 48000000
[    71.950991] [UART00] setting ulcon: 00000003, umcon: 00000002, brddiv to 26, baud 115200, uart_clk 48000000
[    71.951052] tcc-uart tcc-uart.1: bus resume
[    71.951093] tcc-uart tcc-uart.4: bus resume
[    71.951127] tcc-i2c tcc-i2c.4: bus resume
[    71.951153] tcc-i2c tcc-i2c.0: bus resume
[    71.951236] tcc-i2c tcc-i2c.1: bus resume
[    71.951277] tcc-i2c tcc-i2c.2: bus resume
[    71.951312] tcc-i2c tcc-i2c.3: bus resume
[    71.951346] tcc-adc tcc-adc: bus resume
[    71.951385] tcc-rtc tcc-rtc: bus resume
```

3.2 Verbose Wake Lock debugging

Android PM uses wake lock to control power state. By checking wake-lock messge, you can investigate overall operation of suspend system.

```
[  125.346919] wakeup_source_deactivate: name:eventpoll
[  125.355607] wakeup_source_deactivate: name:PowerManagerService.WakeLocks
[  125.892864] wakeup_source_deactivate: name:mmc1_detect
[  125.897842] PM: suspend entry 2014-02-13 11:58:03.074893833 UTC
[  125.903782] PM: Syncing filesystems ... done.
[  125.940290] TCC cpufreq suspend: setting frequency to 342000 kHz
[  125.947010] Freezing user space processes ... (elapsed 0.001 seconds) done.
[  125.955636] Freezing remaining freezable tasks ... (elapsed 0.001 seconds) done.
```

You can check wake lock/unlock of each device and PowerManagerService. You can also find when suspend operation begins.

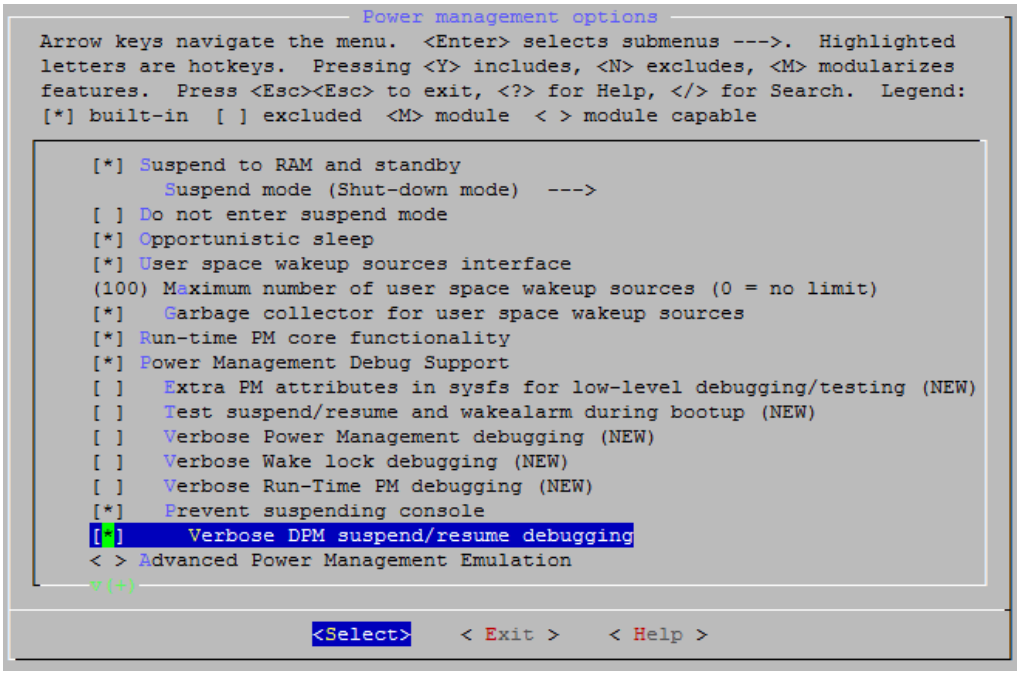
3.3 Verbose PM Runtime debugging

By enabling this option, you can know which device enter the suspend or resume or idle on runtime state.

```
[    43.076524] rpm_idle: rpmflags:0x5
[    43.079883] rpm_resume: dev:mali-utgard, rpmflags:0x4
[    43.087851] rpm_suspend: dev:mali-utgard, rpmflags:0xd
[    43.112400] rpm_resume: dev:mali-utgard, rpmflags:0x4
[    43.117323] rpm_resume: dev:mali-utgard, rpmflags:0x4
[    43.125188] rpm_suspend: dev:mali-utgard, rpmflags:0xd
[    43.385677] rpm_suspend: dev:mali-utgard, rpmflags:0xd
[    44.012696] dwc3_tcc_probe
[    44.064475] time delay = 1
[    44.068938] rpm_resume: dev:dwc3, rpmflags:0x4
[    44.073203] rpm_idle: dev:dwc3, rpmflags:0x1
[    44.077721] rpm_resume: dev:dwc3, rpmflags:0x0
[    44.168855] rpm_idle: rpmflags:0x4
[    44.173172] rpm_idle: dev:tcc-dwc3, rpmflags:0x4
[    44.213797] file system registered
[    44.226225]   gadget: android_usb ready
[    44.238841] android_usb: already disabled
[    44.242861] android_usb: already disabled
[    44.252920] adb_open
[    44.256585] mtp_bind_config
[    44.259232] adb_bind_config
[    44.334503] rpm_suspend: dev:mali-utgard, rpmflags:0x9
[    44.339539] rpm_suspend: dev:mali-utgard, rpmflags:0xa
[    44.362679] rpm_idle: rpmflags:0x1
[    47.027382] rpm_resume: dev:mali-utgard, rpmflags:0x4
```

3.4 Prevent suspending console

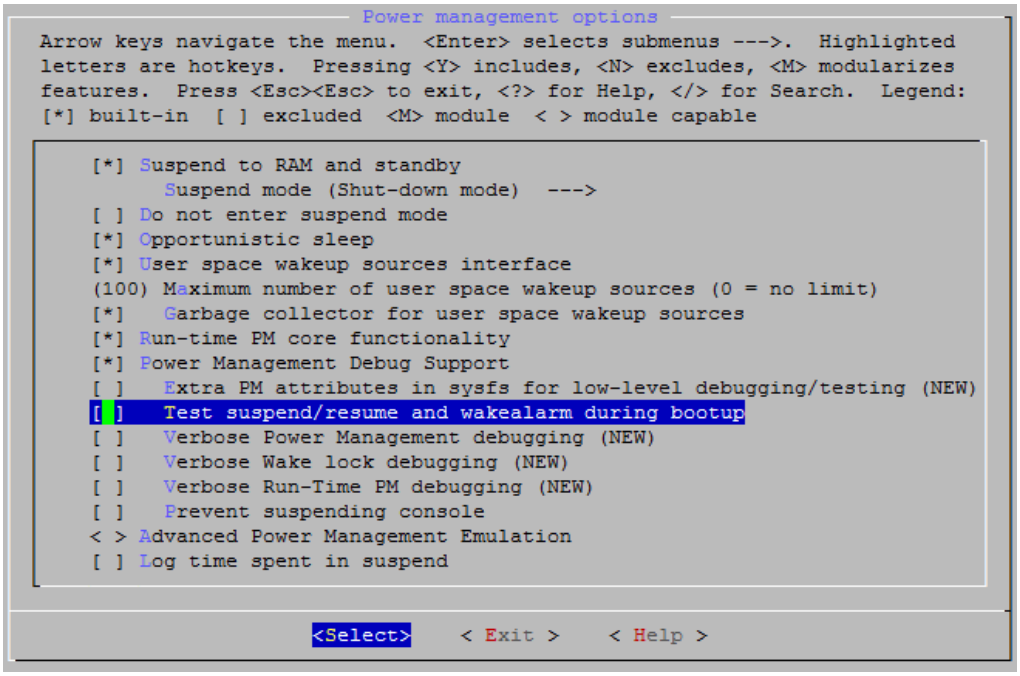
To debug the problem which is happened during suspend/resume, debug message has to bo shown until that point.
However, console will be disabled during the beginning of suspend, the message is not shown.
By enabling this option, PM driver maintains UART console until entering actual suspend state.
During resume, log message will be out from PM driver.



By enabling this option (Verbose DPM suspend/resume debugging), the detailed operating status during DPM Suspend and DPM Resume will be out. (DPM: Dynamic Power Management)

3.5 Time Measurement option

Power management options → Power Management Debug Support → Test suspend/resume and wakealarm during bootup



By enabling this option, we can check elapsed time about suspend and resume.