EC2X&AG35-QuecOpen

USB suspend 指导说明

LTE 系列

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前言

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文档历史

修订记录

版本	日期	作者	变更表述
1.0	2018-3-21	高飞虎	初始版本

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1 引言

文档介绍了 QuecOpen 模块与上位机间的 usb suspend 功能；usb suspend 可以用来作为休眠唤醒的另一种方案，但局限的是有的上位机并不支持 usb suspend（这与操作系统 kernel 版本，usb controller 等都有关系）。

2 Usb suspend 影响因素

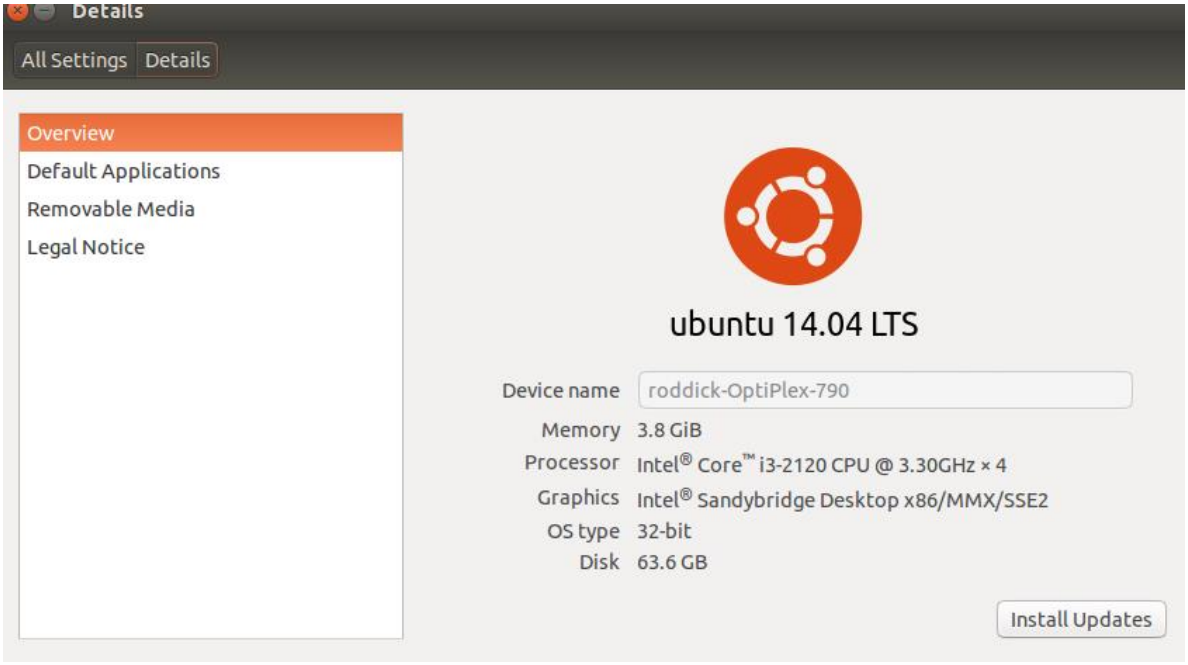
1. QuecOpen EC2X, AG35 项目默认开启 adb 调试模式，usb 是无法进入 low power mode 的，导致模块无法进入休眠；用户若确认需要使用到 usb suspend 功能，则请参考《QuecOpen_EC2X&AG35_关闭默认 ADB_指导说明》文档来关闭 adb。
2. 经测试发现，有的上位机并不支持 usb suspend（这与操作系统 kernel 版本，usb controller 等都有关系），具体不支持 usb suspend 的设备硬件，软件型号目前未做确切统计。

3 usb suspend 功能测试

首先根据第 2 节关闭 adb 功能；

3.1. 上位机信息

Intel Sandybridge, Ubuntu 14.04 支持 usb suspend



3.2. 上位机检查 4G 模块

dmesg 检查发现 4G 模块插入上位机所注册的 usb 节点 1-1.3，进入该节点；

```
1068748.967934] usb 1-1.3: new high-speed USB device number 100 using ehci-pci
1068749.069949] usb 1-1.3: New USB device found, idVendor=2c7c, idProduct=0125
1068749.069954] usb 1-1.3: New USB device strings: Mfr=1, Product=2, SerialNumber=0
1068749.069957] usb 1-1.3: Product: Android
1068749.069960] usb 1-1.3: Manufacturer: Android
1068749.071104] option 1-1.3:1.0: GSM modem (1-port) converter detected
1068749.071255] usb 1-1.3: GSM modem (1-port) converter now attached to ttyUSB1
1068749.071347] option 1-1.3:1.1: GSM modem (1-port) converter detected
1068749.071437] usb 1-1.3: GSM modem (1-port) converter now attached to ttyUSB2
1068749.071536] option 1-1.3:1.2: GSM modem (1-port) converter detected
1068749.071629] usb 1-1.3: GSM modem (1-port) converter now attached to ttyUSB3
1068749.071712] option 1-1.3:1.3: GSM modem (1-port) converter detected
1068749.071811] usb 1-1.3: GSM modem (1-port) converter now attached to ttyUSB4
1068749.073154] GobiNet 1-1.3:1.4 eth1: register 'GobiNet' at usb-0000:00:1a.0-1.3, GobiN
1068749.075024] creating qcqmi1
oot@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1/1-1.3/power#
```

3.3. 上位机通知模块休眠和唤醒

3.3.1. 上位机通知模块休眠

模块端：

首先模块端使能 autosleep 机制（api 方式或者命令行方式）；

echo mem > /sys/power/autosleep

为了方便调试，这里我打开了 log 输出：

echo 1 > /sys/module/printk/parameters/perf_mode_console

```
root@mdm9607-perf:~#
root@mdm9607-perf:~# echo 1 > /sys/module/printk/parameters/perf_mode_console
root@mdm9607-perf:~# echo mem > /sys/power/autosleep
root@mdm9607-perf:~#
root@mdm9607-perf:~# [   82.167304] gser_suspend: Un-supported transport: TTY
[   82.171415] msm_otg 78d9000.usb: Avail curr from USB = 2
[   82.176679] msm_hsusb msm_hsusb: CI13XXX_CONTROLLER_SUSPEND_EVENT received
[   82.183872] android_work: android_work: sent uevent USB_STATE=SUSPENDED
[   83.188985] PM: suspend entry 2018-03-20 16:07:49.259793253 UTC
[   83.194077] msm_otg 78d9000.usb: USB in low power mode
[   83.199114] PM: Syncing filesystems ... done.
[   83.226391] Freezing user space processes ...
[   83.231550] Error: returning -512 value
[   83.238220] mbim_read: Waiting failed
[   83.255539] (elapsed 0.025 seconds) done.
[   83.258530] Freezing remaining freezable tasks ... (elapsed 0.002 seconds) done.
[   83.268083] Suspending console(s) (use no_console_suspend to debug)
```

上位机端：

通知模块允许挂起：echo auto > level

3ms 总线都处于空闲状态，则 usb 设备进入休眠

```
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# ls
active_duration       connected_duration  runtime_active_kids  runtime_suspend
async                 control             runtime_active_time  runtime_usage
autosuspend           level               runtime_enabled      wakeup
autosuspend_delay_ms  persist             runtime_status       wakeup_abort_co
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# echo auto > level
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
```

3.3.2. 上位机唤醒模块

上位机端：

唤醒模块，解除 usb 总线的挂起状态 echo on > level

```
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# echo auto > level
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# echo on > level
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
```

此时模块被唤醒，且持有唤醒锁

```
4,1069,6614093872,-;Resume: sysfs_notify wakeup_in
6,1070,6614117033,-;msm_hsusb msm_hsusb: CI13XXX_CONTROLLER_RESUME_EVENT received
 SUBSYSTEM=platform
 DEVICE=+platform:msm_hsusb
3,1071,6614117139,-;gser_resume: Un-supported transport: TTY
6,1072,6614117217,-;msm_otg 78d9000.usb: Avail curr from USB = 500
 SUBSYSTEM=platform
 DEVICE=+platform:78d9000.usb
6,1073,6614117471,-;android_work: android_work: sent uevent USB_STATE=RESUMED
6,1074,6614157849,-;PM: resume of devices complete after 74.639 msecs
4,1075,6614159113,-;Restarting tasks ... done.
6,1076,6614168861,-;PM: suspend exit 2017-12-07 09:33:30.736907077 UTC
4,1075,6614159113,-;Restarting tasks ... done.
6,1076,6614168861,-;PM: suspend exit 2017-12-07 09:33:30.736907077 UTC
```

```
root@mdm9607-perf:~#
root@mdm9607-perf:~#
root@mdm9607-perf:~# awk '$6 != 0 {print $1"  "$6}' /sys/kernel/debug/wakeup_sou
rces
name  active_since
msm_otg  24504
root@mdm9607-perf:~#
```

3.4. 双向休眠唤醒

第二节说明了上位机单方面使模块进入休眠或者唤醒，其实模块也是可以唤醒上位机；

配置上位机 echo enabled > wakeup，当上位机休眠时，模块向总线上发数据可唤醒上位机；

1. 开启上位机远程唤醒功能 echo enabled > wakeup

```
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# cat wakeup
disabled
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# echo enabled > wakeup
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# cat wakeup
enabled
root@roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
```

2. 使上位机进入休眠：echo mem > /sys/power/state

```
roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power# echo mem > /sys/power/state
roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
roddick-OptiPlex-790:/sys/bus/usb/devices/1-1.3/power#
```

3. 模块端向总线发数据可唤醒上位机（/dev/ttyGS0 为 usb 虚拟设备）

```
root@mdm9607-perf:~#
root@mdm9607-perf:~# echo df > /dev/ttyGS0
root@mdm9607-perf:~# [  518.945679] msm_hsusb msm_hsusb: CI13XXX_CONTROLLER_RESUME_EVENT received
[  518.951545] gser_resume: Un-supported transport: TTY
[  518.956450] msm_otg 78d9000.usb: Avail curr from USB = 500
[  518.962361] android_work: android_work: sent uevent USB_STATE=RESUMED
[  523.310237] gser_suspend: Un-supported transport: TTY
[  523.314336] msm_otg 78d9000.usb: Avail curr from USB = 2
[  523.319601] msm_hsusb msm_hsusb: CI13XXX_CONTROLLER_SUSPEND_EVENT received
[  523.326654] android_work: android_work: sent uevent USB_STATE=SUSPENDED
[  525.009555] PM: suspend entry 2018-03-20 16:38:00.156767503 UTC
[  525.014657] msm_otg 78d9000.usb: USB in low power mode
[  525.019679] PM: Syncing filesystems ... done.
[  525.047138] Freezing user space processes ...
[  525.052806] Error: returning -512 value
[  525.059583] mbim_read: Waiting failed
[  525.064669] (elapsed 0.013 seconds) done.
[  525.067662] Freezing remaining freezable tasks ... (elapsed 0.002 seconds) done.
[  525.076978] Suspending console(s) (use no_console_suspend to debug)
```

3.5. 使用案例

1. 使能模块 autosleep：
   echo mem > /sys/power/autosleep
2. 上位机通知模块准备进入休眠，并设置支持模块远程唤醒上位机，同时使上位机自己也进入休眠
   echo auto > level
   echo enabled > wakeup
   echo mem > /sys/power/state
3. 此时使用电话，短信，或者 ip 数据可以唤醒模块，app 代码进行 wakelock，然后给 usb 总线发送数据，即可唤醒上位机；