华为模块

Android 内核驱动集成指导

华为技术有限公司为客户提供全方位的技术支持，用户可与就近的华为办事处联系，也可直接与公司总部联系。

华为技术有限公司

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关于本文档

修订记录

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V1.2.9	2013-12-30		第一次发布

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1 目的

本文档主要是针对华为模块设备基于 Android 系统的内核驱动集成开发活动进行相关的指导说明。本文档主要面向基于 Android 系统的产品开发商的驱动开发人员。

2 范围

本文档适用于：

- 嵌入式 Linux 系统（Linux-2.6.35 内核）及以上版本[1]

- Android 2.3（Linux-2.6.35 内核）及以上版本的 Android 系统

- Huawei LTE、WCDMA 和 CDMA 模块

📖 说明

[1]:如果不使用华为模块的电源管理，则适用在内核版本 2.6.18 及以上的 Linux 系统上。

3 总体概述

3.1 Android 系统的 Linux 内核支持华为模块设备的驱动架构

华为模块设备和 Android 系统主要通过 USB 接口进行数据通信。Android 系统上的 Linux 内核需要根据华为模块设备上报的 USB 设备接口加载 USB 驱动，USB 驱动正确加载后，华为模块才能正常工作。

Android 系统中支持华为模块设备相关的 Linux 内核驱动架构，如下图所示：
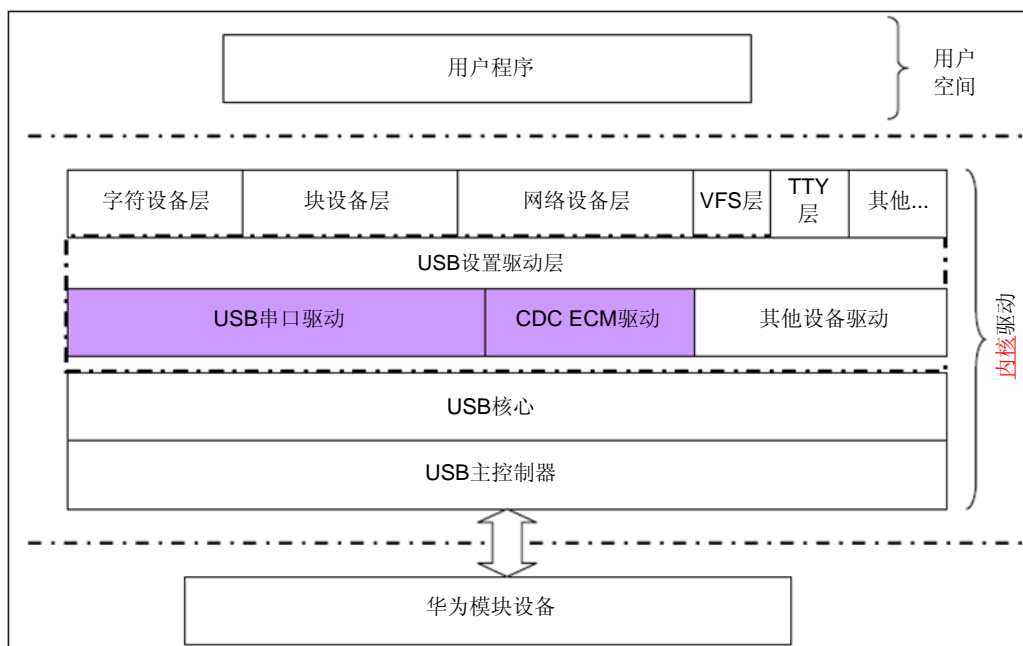
如上图所示，在 Linux 系统中的 USB 驱动架构中，跟华为模块设备相关的驱动模块是 USB 串口驱动模块和 CDC ECM 驱动模块。

其中：

- **USB 串口驱动**：USB 的串口驱动，支持如 modem 端口，AT 端口等；该驱动模块的代码（**option.c**）已经内置在 Linux 内核的源码中。
- **CDC ECM 驱动**：USB 的标准 ECM 网口驱动，主要用于传输网络数据。

4 Android 系统的 Linux 内核驱动集成方案

4.1 Android 内核的 USB 串口驱动

这部分集成方案涉及到的 Linux 内核源码文件是：

- drivers/usb/serial/option.c
- drivers/usb/serial/usb_wwan.c

4.1.1 USB 串口驱动集成

1. 因 Linux-2.6.35 以上的内核已经自带有 selective suspend 电源管理特性，所以我们只需将电源管理的开关打开，USB 串口驱动就将支持 selective suspend 电源管理。

2. 串口驱动修改部分：在**/drivers/usb/serial/option.c** 中的 **option_attach**（）函数内加入红框部分语句，即可支持 selective suspend 特性。如下图所示：（先增加宏 `#define HUAWEI_VENDOR_ID 0x12d1`）

```
if (serial->dev->descriptor.idVendor == HUAWEI_VENDOR_ID) {
    if ( 0 != (serial->dev->config->desc.bmAttributes & 0x20)){
        usb_enable_autosuspend(serial->dev);
    }
}
data = serial->private = kzalloc(sizeof(struct usb_wwan_intf_private), GFP_KERNEL);

if (!data)
    return -ENOMEM;
```

详文如下：

```
if (serial->dev->descriptor.idVendor == HUAWEI_VENDOR_ID) {
   if ( 0 != (serial->dev->config->desc.bmAttributes & 0x20)){
      usb_enable_autosuspend(serial->dev);
   }

}
```

3. 增加对 **reset_resume** 函数的调用，加入红框部分语句如下图所示：（部分版本已取消，没有则不需添加）

```c
static struct usb_driver option_driver = {
    .name       = "option",
    .probe      = usb_serial_probe,
    .disconnect = usb_serial_disconnect,
#ifdef CONFIG_PM
    .suspend    = usb_serial_suspend,
    .resume     = usb_serial_resume,
    .reset_resume = usb_serial_resume,
    .supports_autosuspend = 1,
```

详文如下：

```
.reset_resume = usb_serial_resume,
```

4. 增加新的接口类型的支持，修改部分如下：

- 增加下图红框部分宏定义：

```c
#include "usb-wwan.h"

/* Function prototypes */
static int option_probe(struct usb_serial *serial,
                const struct usb_device_id *id);
static int option_send_setup(struct usb_serial_port *port);
static void option_instat_callback(struct urb *urb);

#define HW_USB_DEVICE_AND_INTERFACE_INFO(vend, cl, sc, pr) \
    .match_flags = USB_DEVICE_ID_MATCH_INT_INFO \
        | USB_DEVICE_ID_MATCH_VENDOR, \
    .idVendor = (vend), \
    .bInterfaceClass = (cl), \
    .bInterfaceSubClass = (sc), \
    .bInterfaceProtocol = (pr)
```

详文如下：

```c
#define HW_USB_DEVICE_AND_INTERFACE_INFO(vend, cl, sc, pr) \
        .match_flags = USB_DEVICE_ID_MATCH_INT_INFO \
            | USB_DEVICE_ID_MATCH_VENDOR, \
        .idVendor = (vend), \
        .bInterfaceClass = (cl), \
        .bInterfaceSubClass = (sc), \
        .bInterfaceProtocol = (pr)
```

- 在 static const struct usb_device_id option_ids[ ] id 列表中增加如下语句：

```c
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0xff, 0xff) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x01) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x02) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x03) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x04) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x05) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x06) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x31) },
```

```
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x32) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x33) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x34) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x35) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x36) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x61) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x62) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x63) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x64) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x65) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x66) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x0A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x0B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x0D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x0E) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x0F) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x3A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x3B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x3D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x3E) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x3F) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x6A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x6B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x6D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x6E) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x6F) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x10) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x12) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x13) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x14) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x15) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x17) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x18) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x19) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x1A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x1B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x1C) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x1D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x48) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x49) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x4A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x4B) },
```

```
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x4C) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x4D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x72) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x73) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x74) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x75) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x78) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x79) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x7A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x7B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x7C) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01, 0x7D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x01) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x02) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x03) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x04) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x05) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x06) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x31) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x32) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x33) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x34) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x35) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x36) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x61) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x62) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x63) },
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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x66) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x0A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x0B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x0D) },
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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x3B) },
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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x6B) },
```

```
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x6D) },

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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x1C) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x1D) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x48) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x49) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x4A) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x4B) },

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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x4D) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x72) },

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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x74) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x75) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x78) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x79) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x7A) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x7B) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x7C) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02, 0x7D) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x01) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x02) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x03) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x04) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x05) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x06) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x31) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x32) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x33) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x34) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x35) },
```

```
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x36) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x61) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x62) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x63) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x64) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x65) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x66) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x0A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x0B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x0D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x0E) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x0F) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x3A) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x3B) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x3D) },
{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03, 0x3E) },
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{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x49) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x4A) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x4B) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x4C) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x4D) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x72) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x73) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x74) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x75) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x78) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x79) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x7A) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x7B) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x7C) },

{ HW_USB_DEVICE_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06, 0x7D) },
```

5. 添加零包机制，以解决模块升级问题，修改文件为 **drivers/usb/serial/usb_wwan.c**。

- 增加对 bcdUSB 值的定义：#define HW_bcdUSB 0x0110，增加对华为 vid 值的定义：

  #define HUAWEI_VENDOR_ID 0x12d1，如下图红框位置所示：

  详文如下：

  ```
  #define HW_bcdUSB 0x0110
  #define HUAWEI_VENDOR_ID 0x12d1
  ```

- 先在 **usb_wwan_write** 函数内增加定义：struct usb_host_endpoint *ep；然后在 **usb_wwan_write** 函数增加对零包的判断，增加部分如红框所示：

```
/* send the data */
memcpy(this_urb->transfer_buffer, buf, todo);
this_urb->transfer_buffer_length = todo;

if ((HUAWEI_VENDOR_ID== port->serial->dev->descriptor.idVendor)
    && (HW_bcdUSB != port->serial->dev->descriptor.bcdUSB)) {
    ep = usb_pipe_endpoint(this_urb->dev, this_urb->pipe);
    if (ep && (0 != this_urb->transfer_buffer_length)
        && (0 == this_urb->transfer_buffer_length % ep->desc.wMaxPacketSize)) {
        this_urb->transfer_flags |= URB_ZERO_PACKET;
    }
}

spin_lock_irqsave(&intfdata->susp_lock, flags);
```

详文如下：

```
if((HUAWEI_VENDOR_ID == port->serial->dev->descriptor.idVendor)
    && (HW_bcdUSB != port->serial->dev->descriptor.bcdUSB)){
    ep = usb_pipe_endpoint(this_urb->dev, this_urb->pipe);
    if(ep && (0 != this_urb->transfer_buffer_length)
        && (0 == this_urb->transfer_buffer_length % ep->desc.wMaxPacketSize)){
        this_urb->transfer_flags |= URB_ZERO_PACKET;
    }
}
```

6. 修改 Android 内核的编译配置（在 kernel 根目录下的.config 文件中），确保下面的配置项已经被选定。具体的配置操作请参考4.1.2 。

   - USB 电源管理特性的相关配置项：

     CONFIG_USB_SUSPEND=y

   - USB 串口驱动相关的配置项：

     CONFIG_USB_SERIAL=y

     CONFIG_USB_SERIAL_OPTION=y

     CONFIG_USB_SERIAL_WWAN=y

   - PPP 拨号的相关配置项：

     CONFIG_PPP=y
     CONFIG_PPP_MULTILINK=y
     CONFIG_PPP_FILTER=y
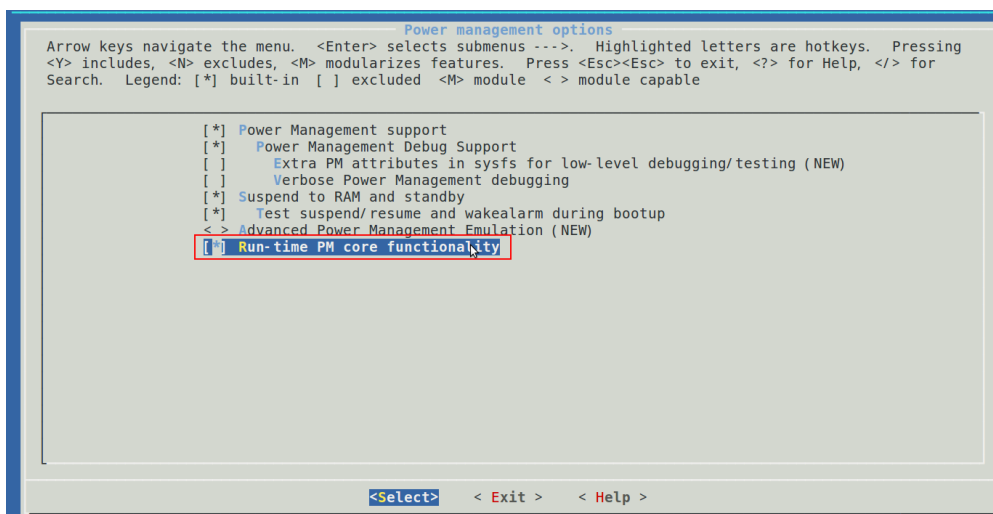   CONFIG_PPP_ASYNC=y
     CONFIG_PPP_SYNC_TTY=y
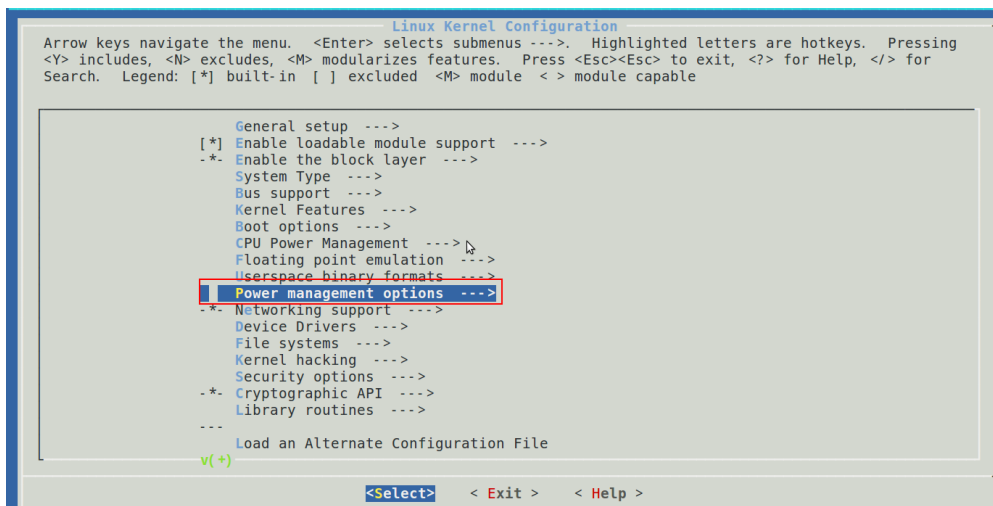   CONFIG_PPP_DEFLATE=y
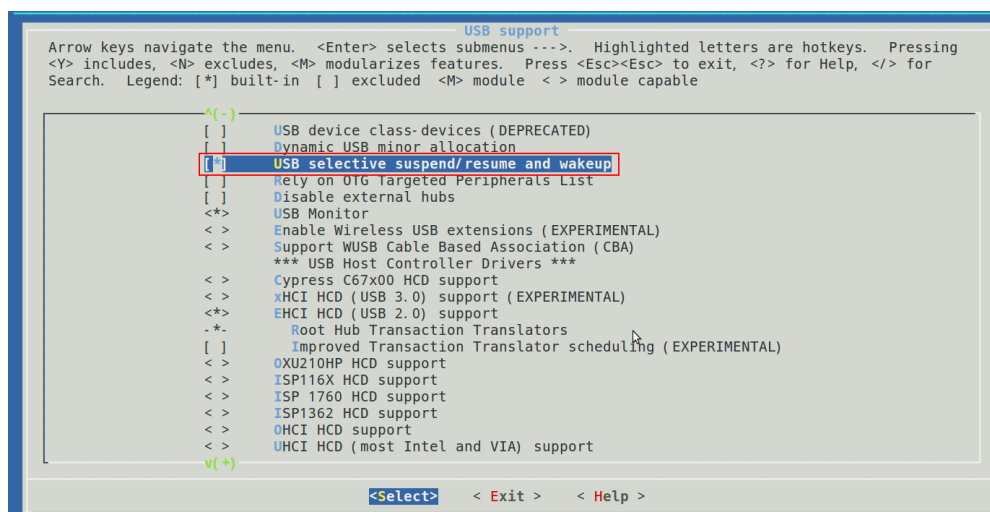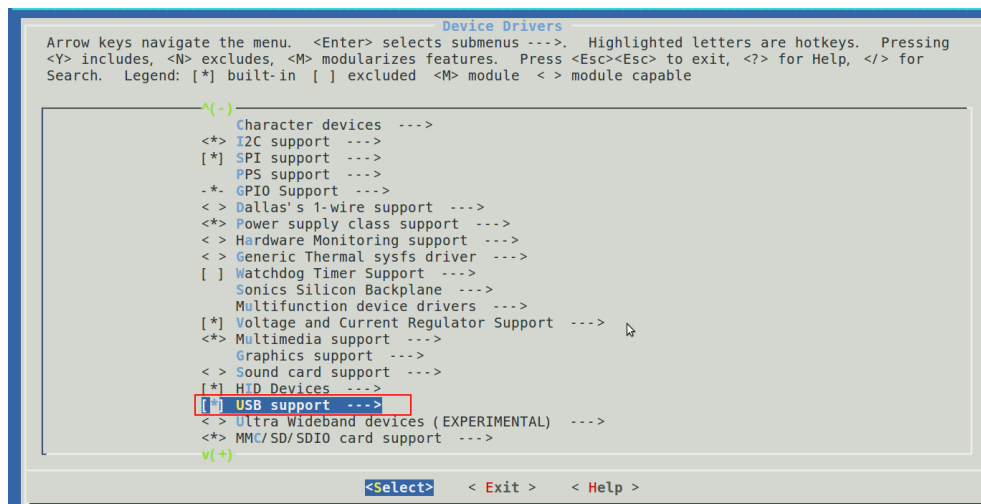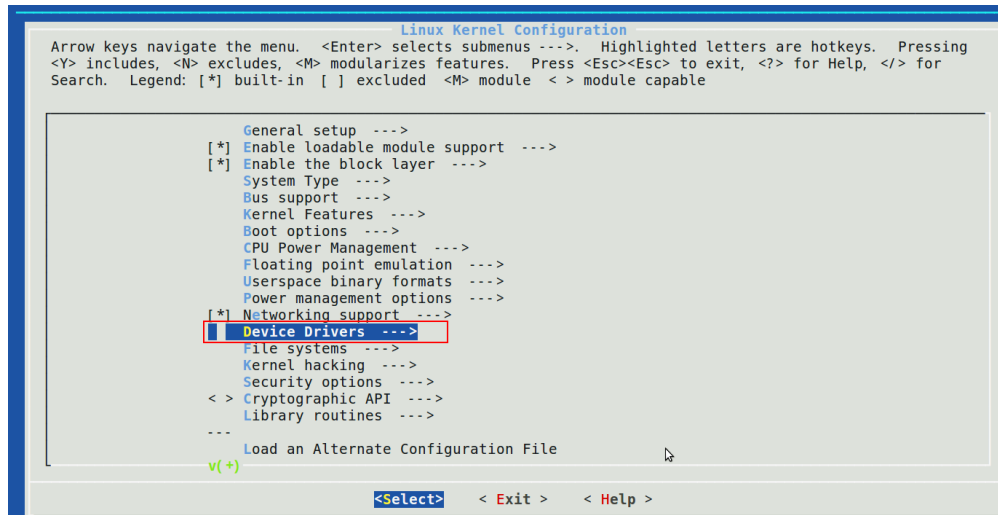   CONFIG_PPP_BSDCOMP=y

4.1.2 USB 串口驱动集成配置的操作步骤

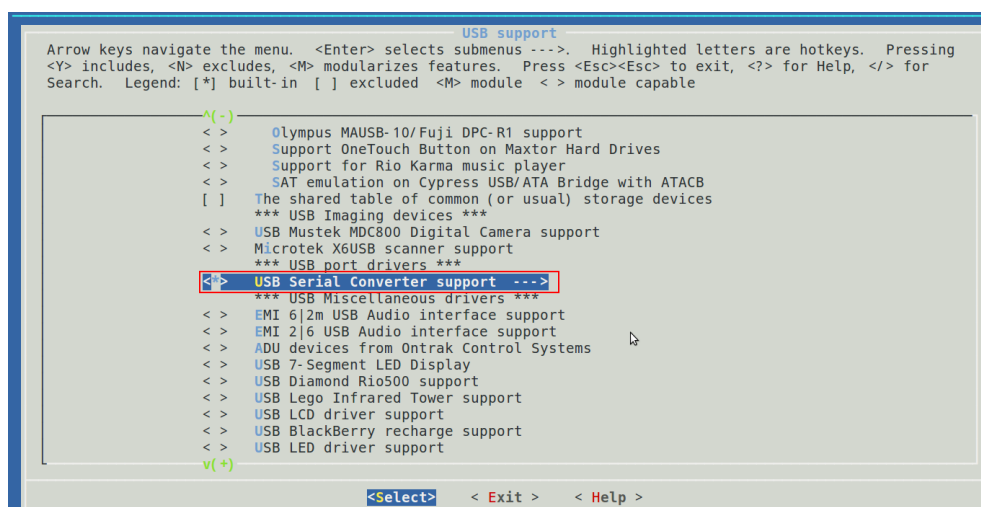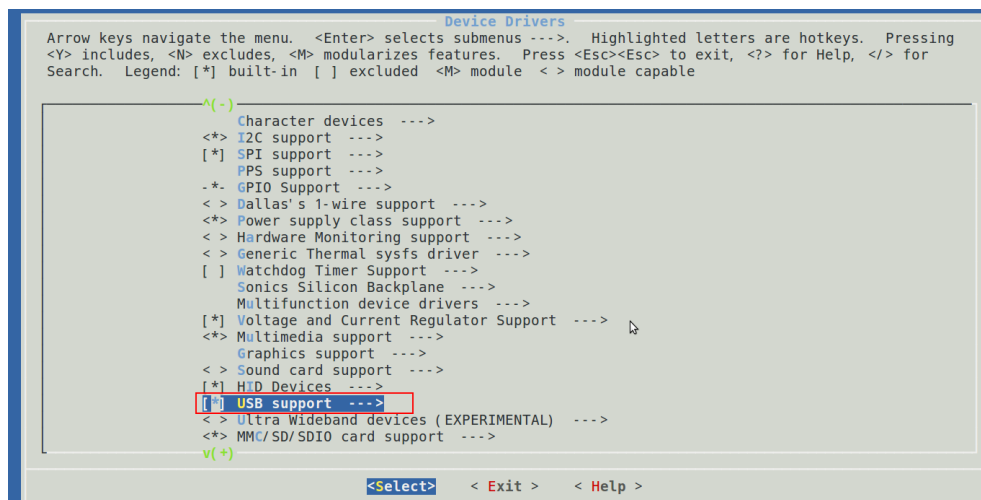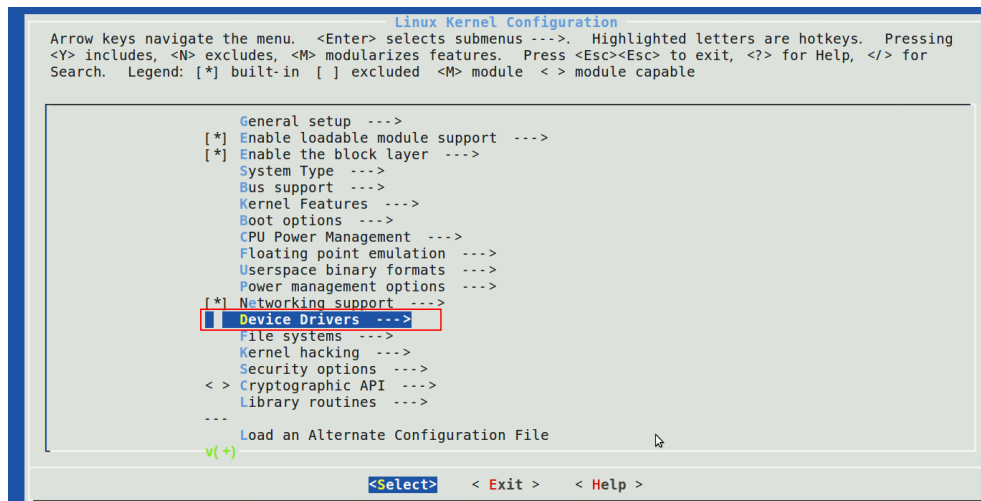步骤1 打开 **Terminal** 工具，进入 **kernel** 目录（假定 **kernel** 在**/usr/src/mydroid/**目录下，即 **cd /usr/src/mydroid/kernel**），然后执行 **make <configuration>**命令（在本文中，假定使用标准的 **make menuconfig**）。

步骤 2 选择相关的配置项。

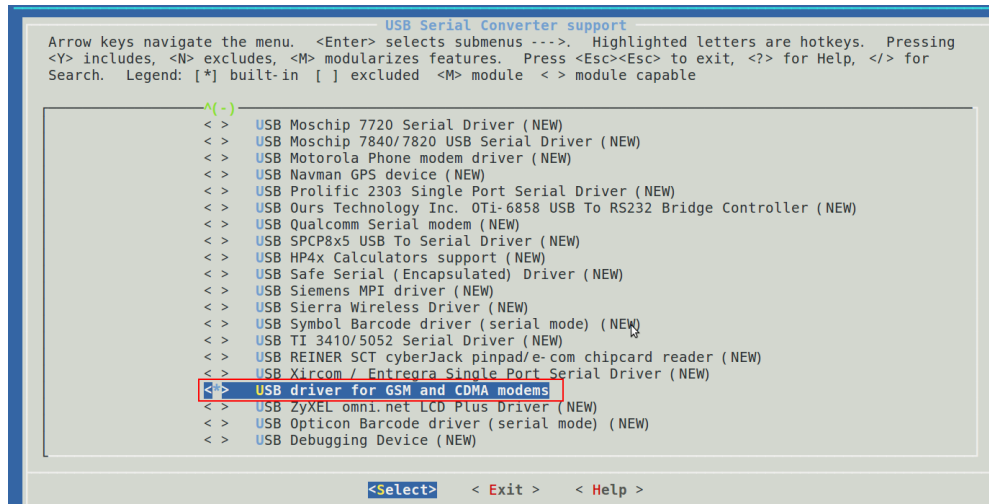- USB 电源管理特性的相关配置项：

– USB 串口驱动相关的配置项：

```
                          USB Serial Converter support
Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are hotkeys.  Pressing
<Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for
Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable

                    ^(-)
              < >    USB Moschip 7720 Serial Driver (NEW)
              < >    USB Moschip 7840/7820 USB Serial Driver (NEW)
              < >    USB Motorola Phone modem driver (NEW)
              < >    USB Navman GPS device (NEW)
              < >    USB Prolific 2303 Single Port Serial Driver (NEW)
              < >    USB Ours Technology Inc. OTi-6858 USB To RS232 Bridge Controller (NEW)
              < >    USB Qualcomm Serial modem (NEW)
              < >    USB SPCP8x5 USB To Serial Driver (NEW)
              < >    USB HP4x Calculators support (NEW)
              < >    USB Safe Serial (Encapsulated) Driver (NEW)
              < >    USB Siemens MPI driver (NEW)
              < >    USB Sierra Wireless Driver (NEW)
              < >    USB Symbol Barcode driver (serial mode) (NEW)
              < >    USB TI 3410/5052 Serial Driver (NEW)
              < >    USB REINER SCT cyberJack pinpad/e-com chipcard reader (NEW)
              < >    USB Xircom / Entregra Single Port Serial Driver (NEW)
              <*>    USB driver for GSM and CDMA modems
              < >    USB ZyXEL omni.net LCD Plus Driver (NEW)
              < >    USB Opticon Barcode driver (serial mode) (NEW)
              < >    USB Debugging Device (NEW)

                    <Select>     < Exit >     < Help >
```

– PPP 拨号的相关配置项：

```
                          Linux Kernel Configuration
Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are hotkeys.  Pressing
<Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for
Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable

                   General setup  --->
              [*] Enable loadable module support  --->
              [*] Enable the block layer  --->
                   System Type  --->
                   Bus support  --->
                   Kernel Features  --->
                   Boot options  --->
                   CPU Power Management  --->
                   Floating point emulation  --->
                   Userspace binary formats  --->
                   Power management options  --->
              [*] Networking support  --->
                   Device Drivers  --->
                   File systems  --->
                   Kernel hacking  --->
                   Security options  --->
              < > Cryptographic API  --->
                   Library routines  --->
                   ---
                   Load an Alternate Configuration File
                   v(+)

                    <Select>     < Exit >     < Help >
```

```
                              Device Drivers
Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are hotkeys.  Pressing
<Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for
Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable

                    ^(-)
              < > Parallel port support  --->
              [ ] Block devices  --->
              [*] Misc devices  --->
              < > ATA/ATAPI/MFM/RLL support  --->
                   SCSI device support  --->
              < > Serial ATA (prod) and Parallel ATA (experimental) drivers  --->
              [ ] Multiple devices driver support (RAID and LVM)  --->
              [ ] Fusion MPT device support  --->
                   IEEE 1394 (FireWire) support  --->
              < > I2O device support  --->
              [*] Network device support  --->
              [ ] ISDN support  --->
              < > Telephony support  --->
                   Input device support  --->
                   Character devices  --->
              <*> I2C support  --->
              [*] SPI support  --->
                   PPS support  --->
              -*- GPIO Support  --->
              < > Dallas's 1-wire support  --->
                   v(+)

                    <Select>     < Exit >     < Help >
```
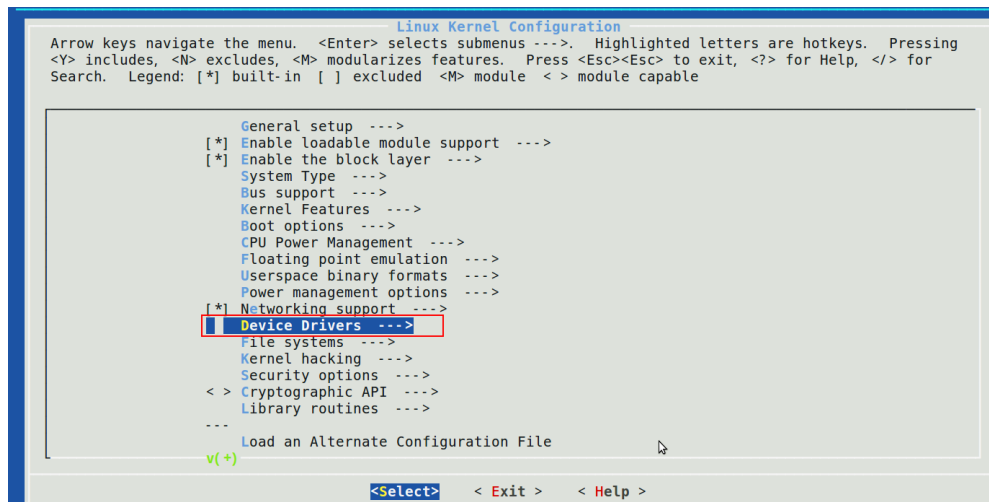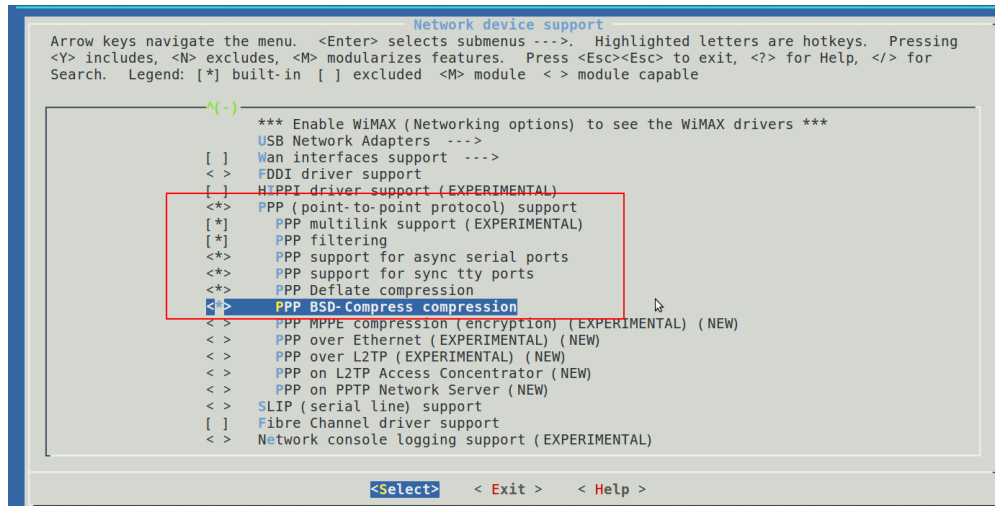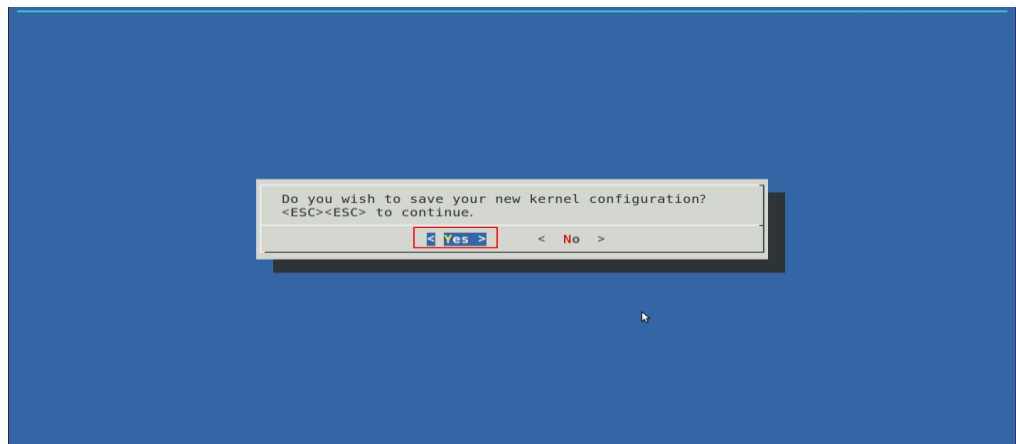
23

步骤 3 如上操作选完所须选项后，通过选择**<Exit>**按钮，逐层退出各个配置界面。最后在保存配置界面中，选择**<Yes>**选项并退出。

步骤 4 完成配置后，即可运行 **make** 命令，开始编译修改后的内核。

4.2 Android 内核的 CDC ECM 驱动

4.2.1 CDC ECM 驱动修改部分

CDC ECM 驱动修改部分：在 **drivers/net/usb/usbnet.c** 中的 **usbnet_probe ()**函数内加入红色框部分语句，即可支持 selective suspend 特性。如下图所示：

（先增加宏#define HUAWEI_VENDOR_ID 0x12d1）

详文如下：

```
if(xdev->descriptor.idVendor == HUAWEI_VENDOR_ID){
    if( 0 != (xdev->config->desc.bmAttributes & 0x20)){
      usb_enable_autosuspend(xdev);
        }
}
```

4.2.2 CDC ECM 驱动集成配置的操作步骤
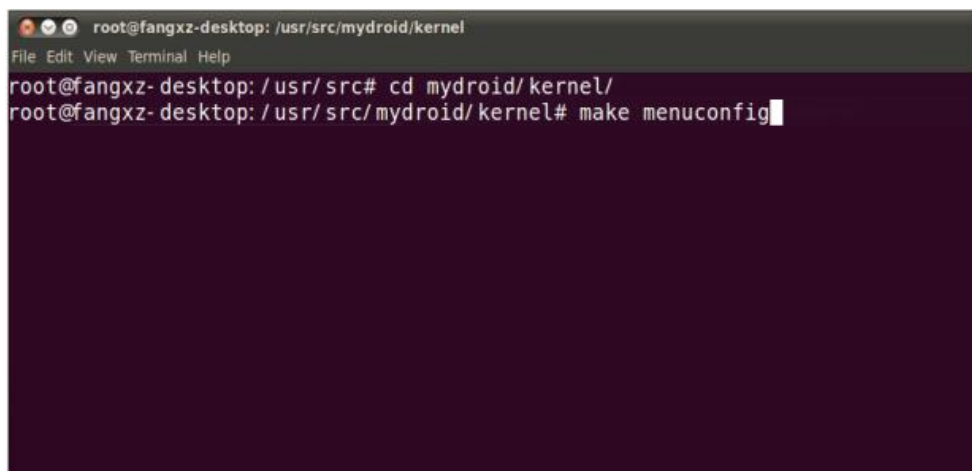
步骤 1 修改 Android 内核的编译配置（在 **kernel** 根目录下的**.config** 文件中），确保下面的的配置项已经被选定。

CDC ECM 驱动的相关配置项：

CONFIG_USB_USBNET=y

CONFIG_NETDEVICES=y

CONFIG_USB_NET_CDCETHER=y

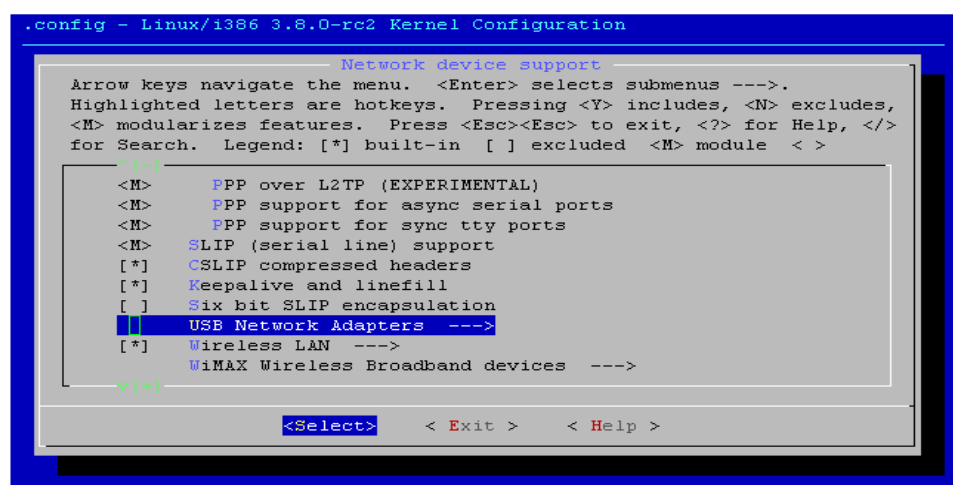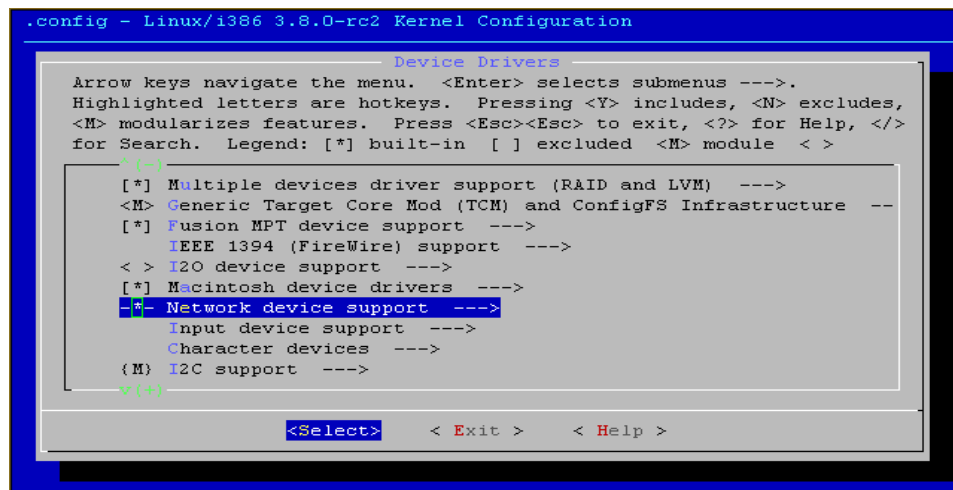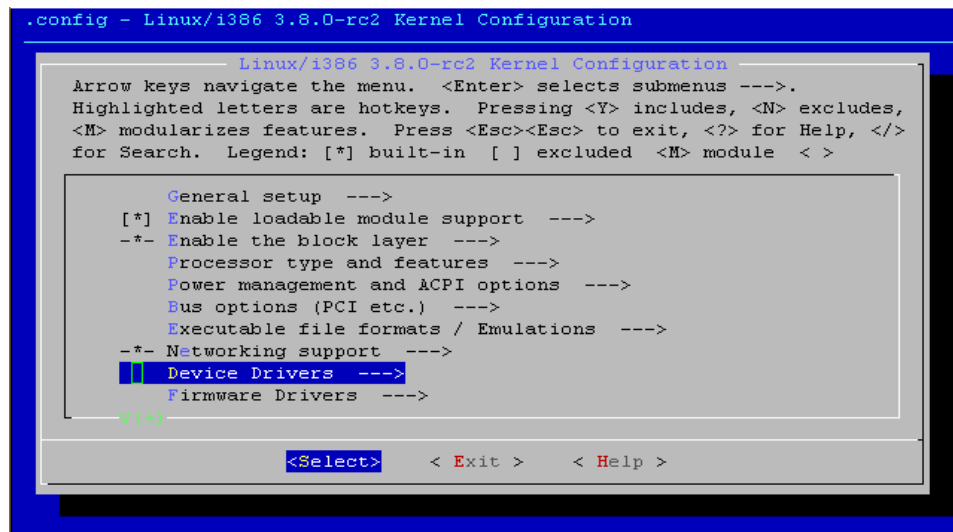**步骤 2** 具体的配置操作。

- 打开 **Terminal** 工具，进入 **kernel** 目录（假定 **kernel** 在**/usr/src/mydroid/**目录下，即 **cd /usr/src/mydroid/kernel**），然后执行 **make <configuration>**命令（在本文中，假定使用标准的 **make menuconfig**）。

– CDC ECM 驱动配置项，按照下列图指引完成配置：

```
.config - Linux/i386 3.8.0-rc2 Kernel Configuration
┌─────────── Linux/i386 3.8.0-rc2 Kernel Configuration ───────────┐
│  Arrow keys navigate the menu.  <Enter> selects submenus --->.   │
│  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes, │
│  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> │
│  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >│
│ ┌─────────────────────────────────────────────────────────────┐ │
│ │        General setup  --->                                   │ │
│ │    [*] Enable loadable module support  --->                  │ │
│ │    -*- Enable the block layer  --->                          │ │
│ │        Processor type and features  --->                     │ │
│ │        Power management and ACPI options  --->               │ │
│ │        Bus options (PCI etc.)  --->                          │ │
│ │        Executable file formats / Emulations  --->            │ │
│ │    -*- Networking support  --->                              │ │
│ │        Device Drivers  --->                                  │ │
│ │        Firmware Drivers  --->                                │ │
│ └─────────────────────────────────────────────────────────────┘ │
│              <Select>      < Exit >     < Help >                 │
└─────────────────────────────────────────────────────────────────┘
```
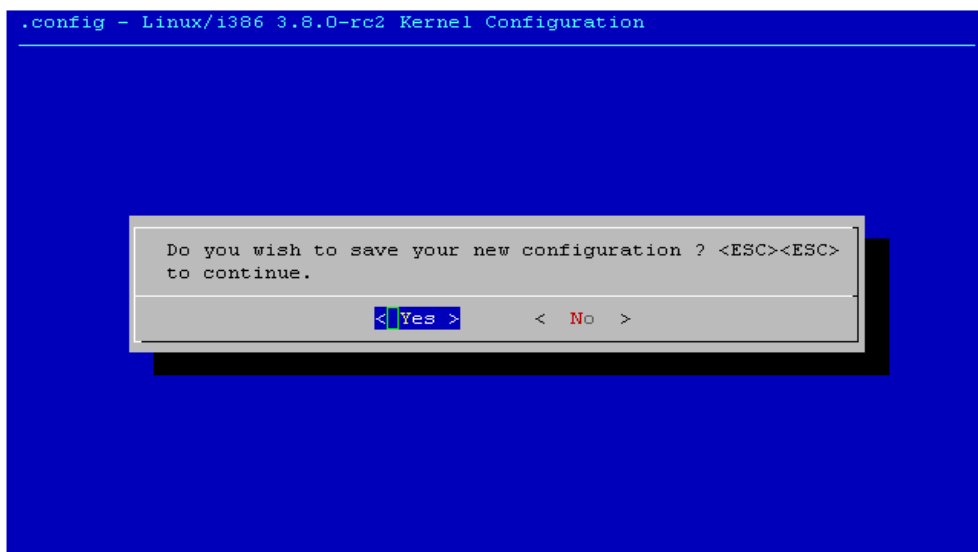
```
.config - Linux/i386 3.8.0-rc2 Kernel Configuration
┌──────────────────────── Device Drivers ─────────────────────────┐
│  Arrow keys navigate the menu.  <Enter> selects submenus --->.   │
│  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes, │
│  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> │
│  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >│
│ ┌─────────────────────────────────────────────────────────────┐ │
│ │    [*] Multiple devices driver support (RAID and LVM)  --->  │ │
│ │    <M> Generic Target Core Mod (TCM) and ConfigFS Infrastructure -- │ │
│ │    [*] Fusion MPT device support  --->                       │ │
│ │        IEEE 1394 (FireWire) support  --->                    │ │
│ │    < > I2O device support  --->                              │ │
│ │    [*] Macintosh device drivers  --->                        │ │
│ │    -*- Network device support  --->                          │ │
│ │        Input device support  --->                            │ │
│ │        Character devices  --->                               │ │
│ │    {M} I2C support  --->                                     │ │
│ └─────────────────────────────────────────────────────────────┘ │
│              <Select>      < Exit >     < Help >                 │
└─────────────────────────────────────────────────────────────────┘
```

```
.config - Linux/i386 3.8.0-rc2 Kernel Configuration
┌──────────────────────── Network device support ─────────────────┐
│  Arrow keys navigate the menu.  <Enter> selects submenus --->.   │
│  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes, │
│  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> │
│  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >│
│ ┌─────────────────────────────────────────────────────────────┐ │
│ │    <M>      PPP over L2TP (EXPERIMENTAL)                     │ │
│ │    <M>      PPP support for async serial ports              │ │
│ │    <M>      PPP support for sync tty ports                  │ │
│ │    <M> SLIP (serial line) support                           │ │
│ │    [*]    CSLIP compressed headers                          │ │
│ │    [*]    Keepalive and linefill                            │ │
│ │    [ ]    Six bit SLIP encapsulation                        │ │
│ │           USB Network Adapters  --->                        │ │
│ │    [*]    Wireless LAN  --->                                 │ │
│ │           WiMAX Wireless Broadband devices  --->            │ │
│ └─────────────────────────────────────────────────────────────┘ │
│              <Select>      < Exit >     < Help >                 │
└─────────────────────────────────────────────────────────────────┘
```

步骤 3 如上操作选完所须选项后，通过选择**<Exit>**按钮，逐层退出各个配置界面。最后在保存配置界面中，选择**<Yes>**并退出。

步骤 4 完成配置后，即可运行 **make** 命令，开始编译修改后的内核。

4.3 自动休眠延迟时间的修改设置

电源管理开启时，系统默认的自动休眠的延迟时间是 2s，即主机和模块之间的 USB 通信。如果出现空闲的时间超过该时间值，则主机会自动让 USB 模块进入休眠状态。客户可以在下表的基础上，根据自己的需要修改该延迟时间。

产品型号	自动休眠的最小延迟时间	原因
MU736	5s	由于 XMM6260 平台的原因，GPS 定位首次数据上报会概率性较长，5s 能保证首次 GPS 数据上报

在 **drivers\usb\core\usb.c** 中，修改如下：

详文如下：

```
static int usb_autosuspend_delay = 2;/* Default delay value,* in seconds */
```

可通过修改 **usb_autosuspend_delay** 的值来修改延迟时间。

📖 说明

- 需要确保该休眠延迟时间大于模块的 GPS 数据上报周期的时间（确保 GPS 数据上报过程中，系统不会自动让模块进入休眠，避免 GPS 数据传输中断）。
- 模块的 GPS 数据上报周期的时间设置请参考产品 AT 命令手册的 AT^WPDFR。默认情况下，GPS 数据上报周期为 1s，自动休眠的最小延迟时间为 2s。

5 附录

5.1 确认系统中是否已经存在正确的 USB 串口驱动

执行如下命令查看内核的 log 信息：

```
dmesg
```

假如内核的 log 信息中存在如下（或相似）的信息，则说明系统已经存在正确的 USB 串口驱动：

```
[    1.755889] usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[    1.755893] usb usb1: Product: EHCI Host Controller
[    1.755897] usb usb1: Manufacturer: Linux 2.6.36.3 ehci_hcd
[    1.755900] usb usb1: SerialNumber: 0000:00:1a.0
[    1.755994] hub 1-0:1.0: USB hub found
[    1.755998] hub 1-0:1.0: 3 ports detected
[    1.756049] ehci_hcd 0000:00:1d.0: PCI INT A -> GSI 23 (level, low) -> IRQ 23
[    1.756061] ehci_hcd 0000:00:1d.0: EHCI Host Controller
[    1.756066] ehci_hcd 0000:00:1d.0: new USB bus registered, assigned bus number 2
[    1.756085] ehci_hcd 0000:00:1d.0: debug port 2
[    1.760048] ehci_hcd 0000:00:1d.0: irq 23, io mem 0xfe526000
[    1.769818] ehci_hcd 0000:00:1d.0: USB 2.0 started, EHCI 1.00
[    1.769854] usb usb2: New USB device found, idVendor=1d6b, idProduct=0002
[    1.769858] usb usb2: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[    1.769862] usb usb2: Product: EHCI Host Controller
[    1.769866] usb usb2: Manufacturer: Linux 2.6.36.3 ehci_hcd
[    1.769869] usb usb2: SerialNumber: 0000:00:1d.0
[    1.769951] hub 2-0:1.0: USB hub found
[    1.769953] hub 2-0:1.0: 3 ports detected
[    1.770011] usbcore: registered new interface driver usbserial
[    1.770018] USB Serial support registered for generic
[    1.770025] usbcore: registered new interface driver usbserial_generic
[    1.770026] usbserial: USB Serial Driver core
[    1.770032] USB Serial support registered for GSM modem (1-port)
[    1.770044] usbcore: registered new interface driver option
```

5.2 确认系统中是否已经存在正确的 CDC ECM 驱动

执行如下命令查看内核的 log 信息：

```
dmesg
```

如出现下红框部分信息说明存在正确的 CDC ECM 驱动：

5.3 获取单板当前的端口映射信息

查看驱动是否加载成功，同样执行 `dmesg` 命令，假如 log 信息中存在下图红框部分信息，则说明驱动已经被成功加载（idProduct 因产品的不同而不同）。

执行如下命令查询当前模块设备的 modem、pcui 等端口的文件名称：

```
ls /dev/ttyUSB*
```