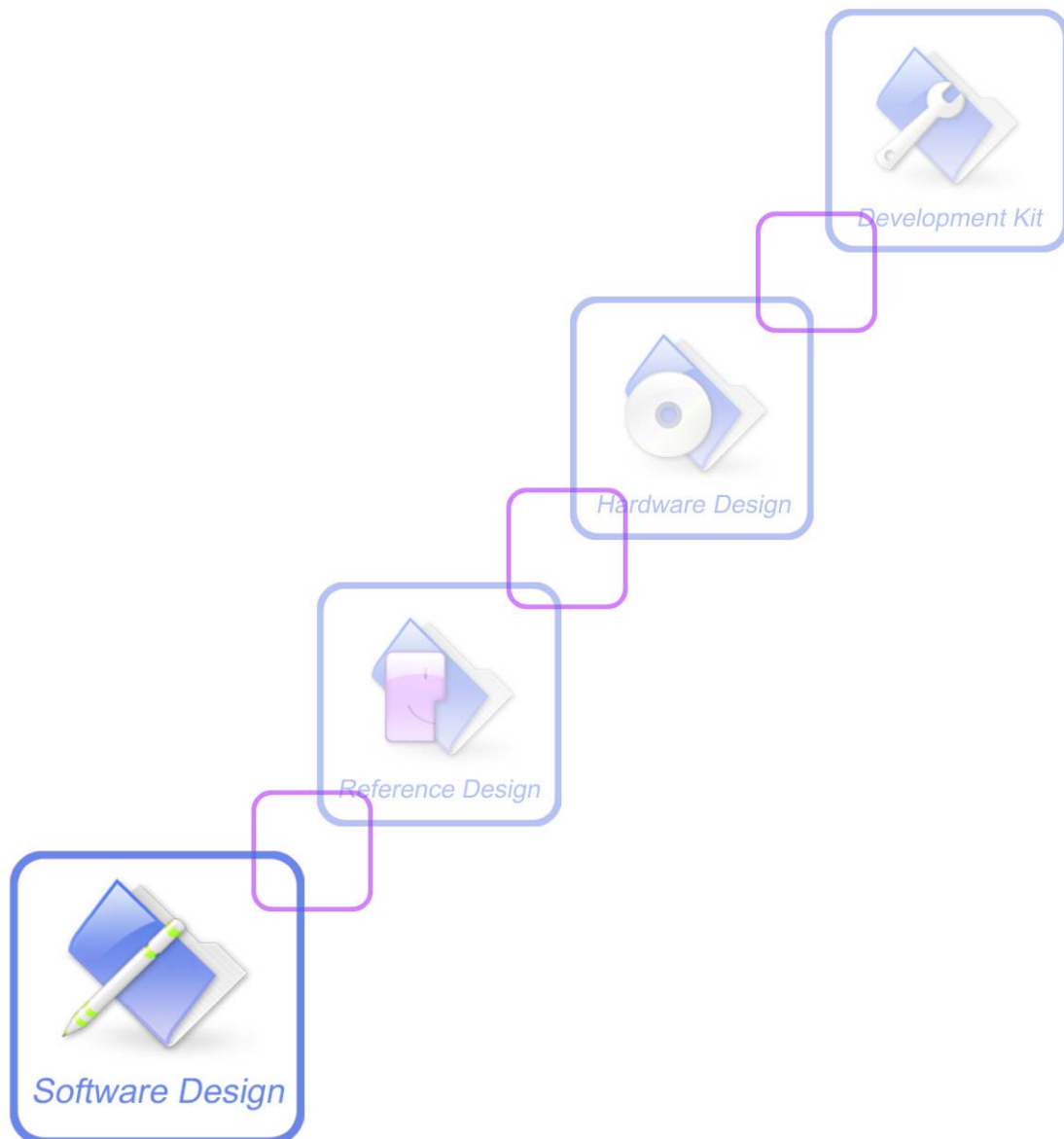




# How to use Linux driver



<b>Document Title:</b>	How to use Linux driver
<b>Version:</b>	1.0
<b>Date:</b>	2014-02-24
<b>Status:</b>	Release
<b>Author</b>	

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## Version History

Version	Chapter	Author	Comments
V1.0	New Version		New version

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## SCOPE

This document is a brief description on:

1. How to modify, build and use the driver on Linux issued by Linux kernel in order to use SIMCom devices.

## 1 Driver issued by Linux kernel

In fact the kernel with version of 2.6.20 and later has a common driver named usbserial which can also be used by SIMCom device.

Succeeding sections will use the kernel code of 2.6.35 as an example to depict how to modify, build and use kernel driver for SIMCom device in full detail.

### 1.1 Modify the driver

One needs to add the vendor ID and product ID of SIMCom to kernel driver in order to support SIMCom device.

drivers\usb\serial\option.c:

```
#define OLIVETTI_VENDOR_ID      0x003C
#define OLIVETTI_PRODUCT_OLICARD100  0xc000

/*add by simcom*/
#define SIMCOM_WCDMA_VENDOR_ID      0x05C6
#define SIMCOM_WCDMA_PRODUCT_ID      0x9000
/*end by simcom*/

/* some devices interfaces need special handling due to a number of reasons */
enum option_blacklist_reason {
    OPTION_BLACKLIST_NONE = 0,
    OPTION_BLACKLIST_SENDSERIAL = 1,
    OPTION_BLACKLIST_RESERVED_IF = 2
};

struct option_blacklist_info {
    const u32 infolen; /* number of interface numbers on blacklist */
    const u8 *ifaceinfo; /* pointer to the array holding the numbers */
    enum option_blacklist_reason reason;
};

static const u8 four_g_w14_no_sendsetup[] = { 0, 1 };
static const struct option_blacklist_info four_g_w14_blacklist = {
    .infolen = ARRAY_SIZE(four_g_w14_no_sendsetup),
    .ifaceinfo = four_g_w14_no_sendsetup,
    .reason = OPTION_BLACKLIST_SENDSERIAL
};

static const struct usb_device_id option_ids[] = {
    { USB_DEVICE(SIMCOM_WCDMA_VENDOR_ID, SIMCOM_WCDMA_PRODUCT_ID) }, /*add by simcom*/
    { USB_DEVICE(OLIVETTI_VENDOR_ID, OLIVETTI_PRODUCT_OLICARD100) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_LIGHT) }
};
```

#### 1.1.1 Support system suspend/resume

Add .reset\_resume call-back function if kernel support, for some USB HOST controller issue a bus reset to USB devices when system resume, USB port will be unloaded, and loaded later, the reset\_resume call-back function will avoid the port unloading when system resume, for more detail please refer to kernel USB driver documents`.

<pre> 974 static struct usb_driver option_driver = { 975     .name      = "option", 976     .probe     = usb_serial_probe, 977     .disconnect = usb_serial_disconnect, 978 #ifdef CONFIG_PM 979     .suspend   = usb_serial_suspend, 980     .resume    = usb_serial_resume, 981     .supports_autosuspend = 1, 982 #endif 983     .id_table  = option_ids, 984     .no_dynamic_id = 1, 985 }; </pre>	<pre> 968 static struct usb_driver option_driver = { 969     .name      = "option", 970     .probe     = usb_serial_probe, 971     .disconnect = usb_serial_disconnect, 972 #ifdef CONFIG_PM 973     .suspend   = usb_serial_suspend, 974     .resume    = usb_serial_resume, 975     .reset_resume = usb_serial_resume, 976     .supports_autosuspend = 1, 977 #endif 978     .id_table  = option_ids, 979     .no_dynamic_id = 1, 980 }; </pre>
--	---

### 1.1.2 Support low power mode

For kernel 2.6.36, add the follow highlight code to end of option\_probe function:

```

1070 /* Don't bind network interfaces on Huawei K3765 & K4505 */
1071 if (serial->dev->descriptor.idVendor == HUAWAI_VENDOR_ID &&
1072     (serial->dev->descriptor.idProduct == HUAWAI_PRODUCT_K3765 ||
1073      serial->dev->descriptor.idProduct == HUAWAI_PRODUCT_K4505) &&
1074     serial->interface->cur_altsetting->desc.bInterfaceNumber == 1)
1075     return -ENODEV;
1076
1077 if (serial->dev->descriptor.idVendor == SIMCOM_WCDMA_VENDOR_ID &&
1078     serial->dev->descriptor.idProduct == SIMCOM_WCDMA_PRODUCT_ID)
1079 {
1080 #ifdef CONFIG_PM
1081     serial->interface->needs_remote_wakeup = 1 /* autosuspend (15s delay) */
1082     device_init_wakeup(&serial->interface->dev, 1);
1083     serial->dev->autosuspend_delay = 15 * HZ; /* for kernel 2.6.36 */
1084     usb_enable_autosuspend(serial->dev);
1085 #endif /* CONFIG_PM */
1086 }
1087
1088 data = serial->private = kzalloc(sizeof(struct usb_wwan_intf_private), GFP_KERNEL);
1089
1090 if (!data)
1091     return -ENOMEM;
1092 data->send_setup = option_send_setup;
1093 spin_lock_init(&data->susp_lock);
1094 data->private = (void *)id->driver_info;
1095 return 0;
1096 }

```

For kernel 2.6.38, add the follow highlight code to end of option\_probe function:

```

1070 /* Don't bind network interfaces on Huawei K3765 & K4505 */
1071 if (serial->dev->descriptor.idVendor == HUAWAI_VENDOR_ID &&
1072     (serial->dev->descriptor.idProduct == HUAWAI_PRODUCT_K3765 ||
1073      serial->dev->descriptor.idProduct == HUAWAI_PRODUCT_K4505) &&
1074     serial->interface->cur_altsetting->desc.bInterfaceNumber == 1)
1075     return -ENODEV;
1076
1077 if (serial->dev->descriptor.idVendor == SIMCOM_WCDMA_VENDOR_ID &&
1078     serial->dev->descriptor.idProduct == SIMCOM_WCDMA_PRODUCT_ID)
1079 {
1080 #ifdef CONFIG_PM
1081     pm_runtime_set_autosuspend_delay(&serial->dev, 12 * 1000); /* for kernel 2.6.38 and above */
1082     usb_enable_autosuspend(serial->dev);
1083 #endif /* CONFIG_PM */
1084 }
1085
1086 data = serial->private = kzalloc(sizeof(struct usb_wwan_intf_private), GFP_KERNEL);
1087
1088 if (!data)
1089     return -ENOMEM;
1090 data->send_setup = option_send_setup;
1091 spin_lock_init(&data->susp_lock);
1092 data->private = (void *)id->driver_info;
1093 return 0;
1094 }

```

### 1.1.3 Add short packet flag

Since the max packet size of BULK endpoint on SIMCOM module in High USB speed

is 512 bytes, in Full USB speed is 64 bytes, in addition the USB protocol says :

An endpoint must always transmit data payloads with a data field less than or equal to the endpoint's reported *wMaxPacketSize* value. When a bulk IRP involves more data than can fit in one maximum-sized data payload, all data payloads are required to be maximum size except for the last data payload, which will contain the remaining data. A bulk transfer is complete when the endpoint does one of the following:

- Has transferred exactly the amount of data expected
- Transfers a packet with a payload size less than *wMaxPacketSize* or transfers a zero-length packet

When a bulk transfer is complete, the Host Controller retires the current IRP and advances to the next IRP. If a data payload is received that is larger than expected, all pending bulk IRPs for that endpoint will be aborted/retired.

So one needs to send an zero-length packet additional if one wants to transmit the data stream with length exactly multiple of *wMaxPacketSize*.

Fortunately one needs not to send zero packet manually, one only needs to modify a little driver code:

drivers\usb\serial\usb\_wwan.c:

```
/* Setup urbs */
static void usb_wwan_setup_urbs(struct usb_serial *serial)
{
    int i, j;
    struct usb_serial_port *port;
    struct usb_wwan_port_private *portdata;

    dbg("%s", __func__);

    for (i = 0; i < serial->num_ports; i++) {
        port = serial->port[i];
        portdata = usb_get_serial_port_data(port);

        /* Do indat endpoints first */
        for (j = 0; j < N_IN_URB; ++j) {
            portdata->in_urbs[j] = usb_wwan_setup_urb(serial,
                port->
                bulk_in_endpointAddress,
                USB_DIR_IN,
                port,
                portdata->
                in_buffer[j],
                IN_BUFLen,
                usb_wwan_indat_callback);
        }

        /* outdat endpoints */
        for (j = 0; j < N_OUT_URB; ++j) {
            portdata->out_urbs[j] = usb_wwan_setup_urb(serial,
                port->
                bulk_out_endpointAddress,
                USB_DIR_OUT,
                port,
                portdata->
                out_buffer
                [j],
                OUT_BUFLen,
                usb_wwan_outdat_callback);

            portdata->out_urbs[j]->transfer_flags |= URB_ZERO_PACKET; //add by simcom
        }
    }
}

} ? end for i=0;i<serial->num_por... ?
} ? end usb_wwan_setup_urbs ?
```

NOTE: This modification is only for the driver option.ko

## 1.2 Build the driver

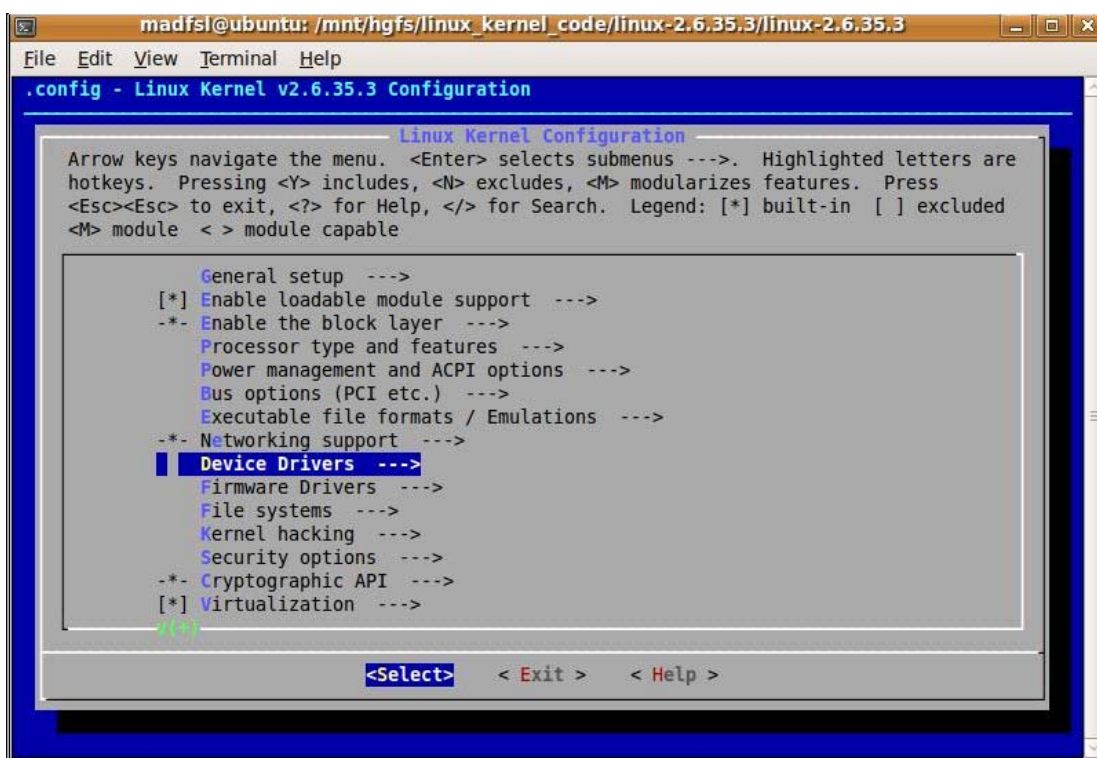
One needs to setup the kernel development environment first which include kernel source code and cross compiler environment.

Following is a step-by-step instruction on how to build the driver into kernel.

- 1) Use “sudo make menuconfig” to configure the kernel.

```
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$ ls
arch      crypto    fs        Kbuild    Makefile  REPORTING-BUGS  sound
block     Documentation  include  kernel    mm        samples        tools
COPYING   drivers   init      lib       net       scripts        usr
CREDITS   firmware  ipc       MAINTAINERS  README    security        virt
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$ sudo make menuconfig
```

- 2) Enter into menu “Device Drivers”



```
madfsl@ubuntu: /mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3
File Edit View Terminal Help
.config - Linux Kernel v2.6.35.3 Configuration

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 --->
Processor type and features --->
Power management and ACPI options --->
Bus options (PCI etc.) --->
Executable file formats / Emulations --->
-* Networking support --->
[*] Device Drivers --->
Firmware Drivers --->
File systems --->
Kernel hacking --->
Security options --->
-* Cryptographic API --->
[*] Virtualization --->

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

- 3) Continue enter into menu “USB support”



```

madfsl@ubuntu: /mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3
File Edit View Terminal Help
.config - Linux Kernel v2.6.35.3 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 <> module capable

[*] Power supply class support --->
[*] Hardware Monitoring support --->
[*] Generic Thermal sysfs driver --->
[*] Watchdog Timer Support --->
    Sonics Silicon Backplane --->
[*] Multifunction device drivers (NEW) --->
[*] Voltage and Current Regulator Support --->
<> Multimedia support (NEW) --->
    Graphics support --->
<M> Sound card support --->
[*] HID Devices --->
[*] USB support --->
    [M] Ultra Wideband devices (EXPERIMENTAL) --->
    <*> MMC/SD/SDIO card support --->
    <> Sony MemoryStick card support (EXPERIMENTAL) --->

<Select> < Exit > < Help >

```

- 4) Continue enter into menu “USB Serial Converter support”

```

madfsl@ubuntu: /mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3
File Edit View Terminal Help
.config - Linux Kernel v2.6.35.3 Configuration

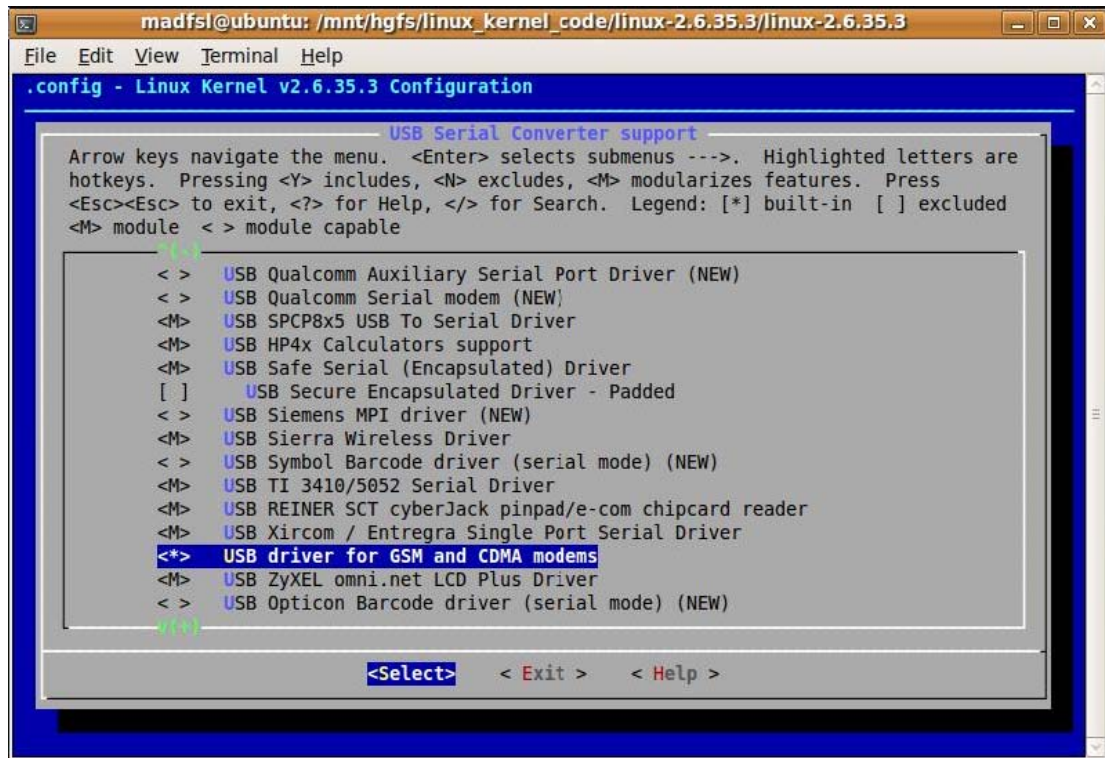
USB support
Arrow keys navigate the menu. <Enter> selects submenus --->. Highlighted letters are
hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press
<Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [*] built-in [ ] excluded
<M> module <> module capable

<M> SanDisk SDDR-09 (and other SmartMedia, including DPCM) support
<M> SanDisk SDDR-55 SmartMedia support
<M> Lexar Jumpshot Compact Flash Reader
<M> Olympus MAUSB-10/Fuji DPC-R1 support
<> Support OneTouch Button on Maxtor Hard Drives
<M> Support for Rio Karma music player
<> SAT emulation on Cypress USB/ATA Bridge with ATACB
[*] The shared table of common (or usual) storage devices
    *** USB Imaging devices ***
    USB Mustek MDC800 Digital Camera support
    USB Microtek X6USB scanner support
    *** USB port drivers ***
    USB720 parport driver
    <*> USB Serial Converter support --->
    *** USB Miscellaneous drivers ***

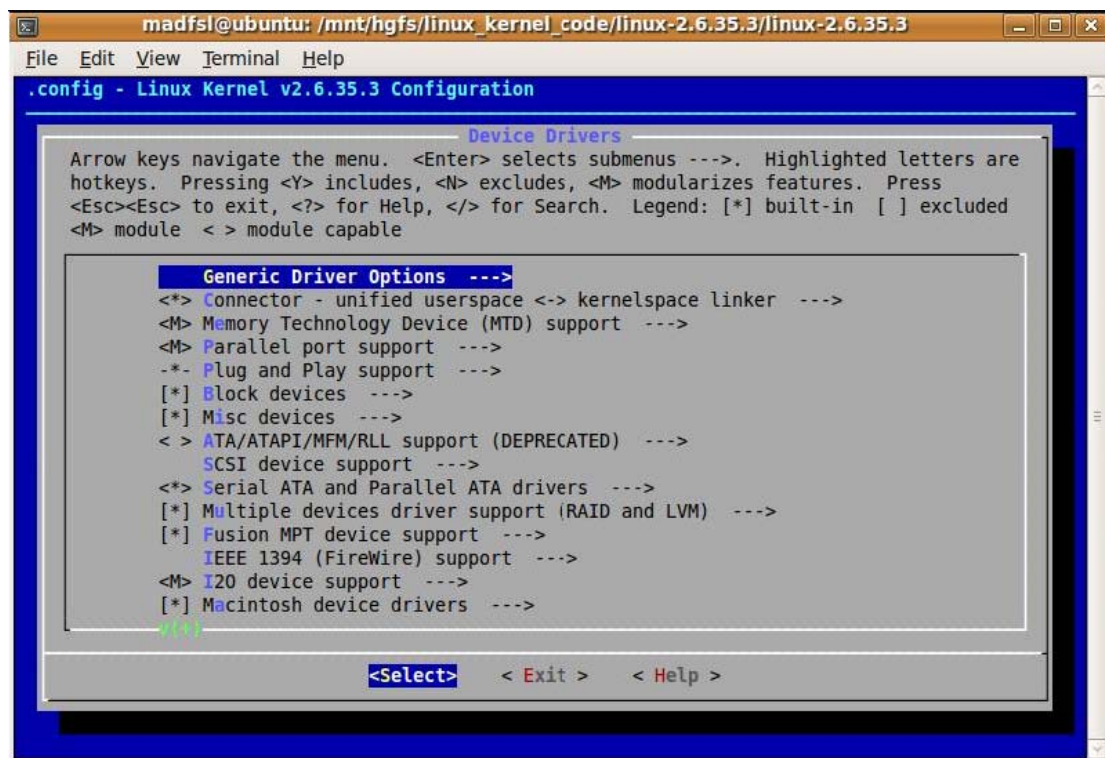
<Select> < Exit > < Help >

```

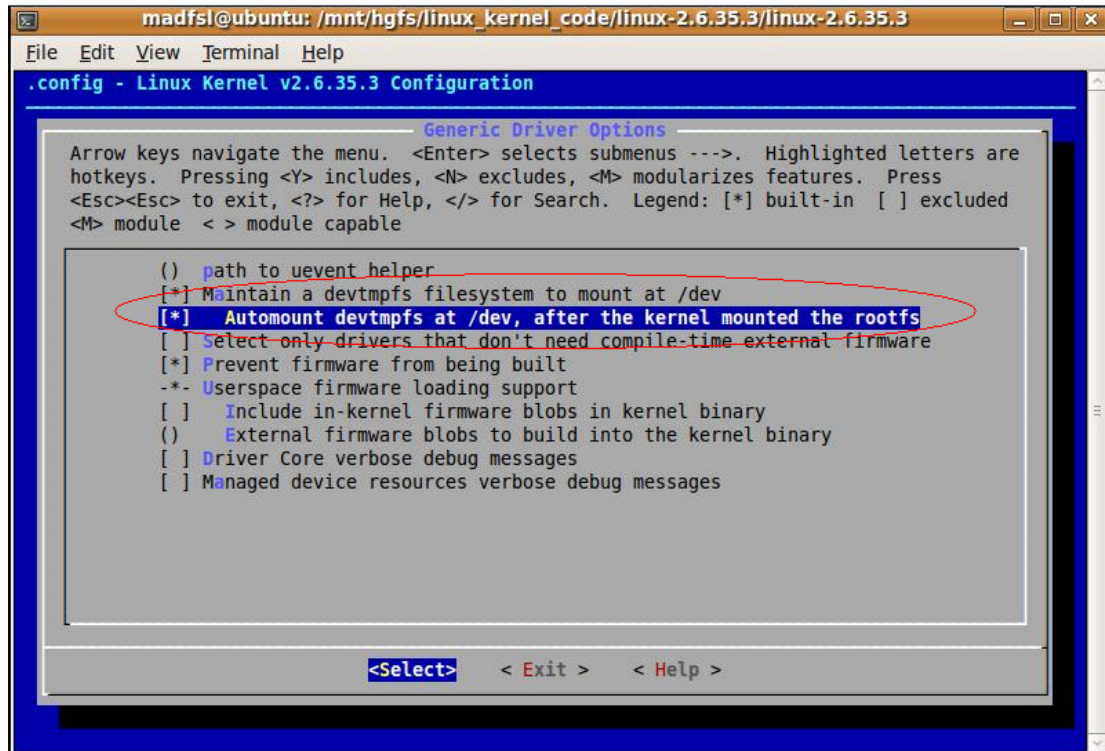
- 5) Type “y” to select menu “USB driver for GSM and CDMA modems”, of course one can type “m” to compile the driver as a module.



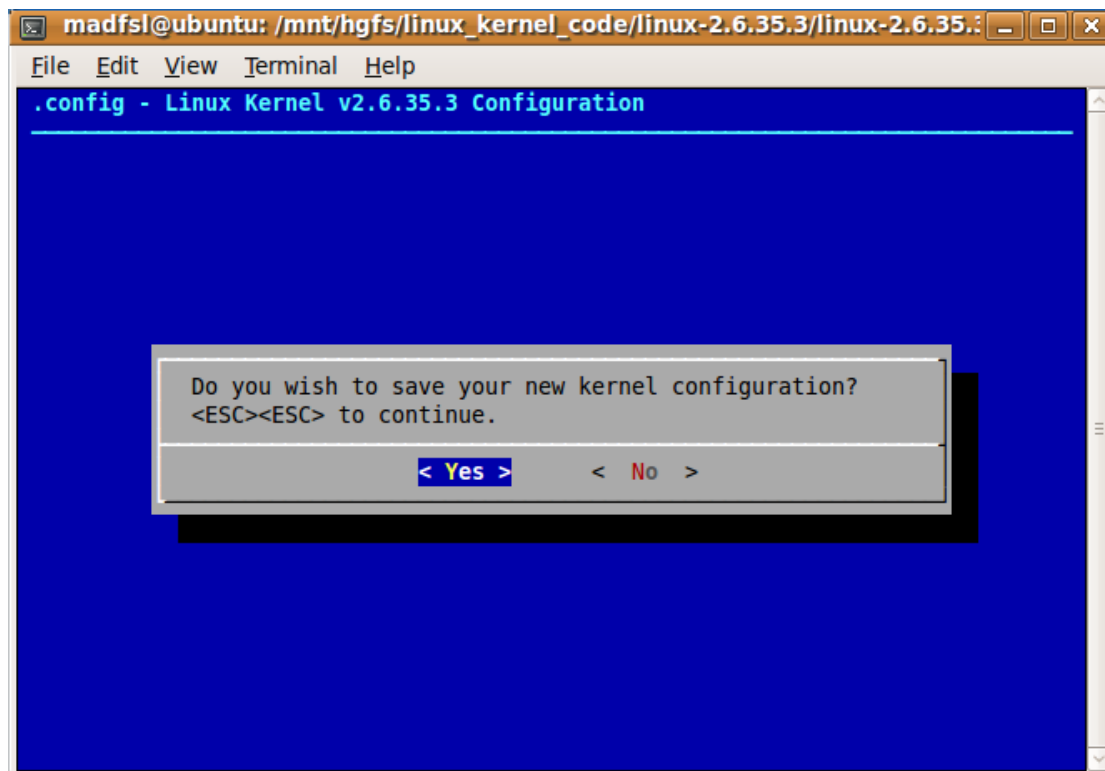
- 6) Some other options need to be configured, so please enter into menu “Device Drivers -> Generic Driver Options”



- 7) Type “y” to select the following two options.



8) Exit and save the configuration.



After configuration, these items will be configured:

CONFIG\_USB = y

CONFIG\_USB\_SERIAL=y

CONFIG\_USB\_SERIAL\_OPTION=y

```
CONFIG_DEVTMPFS=y
CONFIG_DEVTMPFS_MOUNT=y
```

- 2) Use “sudo make” to compile the kernel or use “sudo make modules” to compile the driver as a module

```
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$
madfsl@ubuntu:/mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3$ sudo ma
ke
[sudo] password for madfsl:
HOSTLD scripts/kconfig/conf
scripts/kconfig/conf -s arch/x86/Kconfig
```

### 1.3 Use the driver

As you move through this chapter new kernel firmware or new driver: option.ko(compiled as module) is ready.

#### 1.3.1 Install the driver(driver as module only)

If one compiles the driver as a module one needs to install it first. one can use the following command to install the driver:

**modprobe option.ko**

This command will install all the needed drivers.

```
USB-Serial-COM4
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$ ls
option.ko  usb_wwan.ko  usbserial.ko
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$ mod
probe option.ko
usbcore: registered new interface driver usbserial
usbserial: USB Serial Driver core
USB Serial support registered for GSM modem (1-port)
usbcore: registered new interface driver option
option: v0.7.2:USB Driver for GSM modems
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$
```

If all right the driver will be installed to the system, one can use the following command to query the result:

**lsmod |grep option**

```
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$ lsmod
|grep option
option                12548  0
usb_wwan               7381  1 option
usbserial             23430  2 option,usb_wwan
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$
```

*Note: this installation procedure is invalid when rebooting the system, so if one wants to install the driver automatically when starting the system, one should better put the installation instruction to the startup script.*

#### 1.3.2 Use the driver

After the driver installed one can use SIMCom device via the driver, now plug the SIMCom device to the host device via USB connector, and if the device is identified by the driver, 5 device files named ttyUSB0, ttyUSB1, ttyUSB2, ttyUSB3 and ttyUSB4 will be created in directory /dev



The relationship between the device files and SIMCom composite device is like this:

Device file	SIMCom composite device
ttyUSB0	DIAG interface
ttyUSB1	NMEA interface
ttyUSB2	ATCOM interface
ttyUSB3	MODEM interface
ttyUSB4	Wireless Ethernet Adapter interface

SIMCom device is plugged in:

```
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$ usb 2-1: new full speed USB device us
ing fsl-ehci and address 2
option 2-1:1.0: GSM modem (1-port) converter detected
usb 2-1: GSM modem (1-port) converter now attached to ttyUSB0
option 2-1:1.1: GSM modem (1-port) converter detected
usb 2-1: GSM modem (1-port) converter now attached to ttyUSB1
option 2-1:1.2: GSM modem (1-port) converter detected
usb 2-1: GSM modem (1-port) converter now attached to ttyUSB2
option 2-1:1.3: GSM modem (1-port) converter detected
usb 2-1: GSM modem (1-port) converter now attached to ttyUSB3
option 2-1:1.4: GSM modem (1-port) converter detected
usb 2-1: GSM modem (1-port) converter now attached to ttyUSB4
```

Device files are created:

```
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$ ls
/dev |grep USB
ttyUSB0
ttyUSB1
ttyUSB2
ttyUSB3
ttyUSB4
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$
```

#### NOTE:

- 1 In some composite devices of SIMCom not all of the interfaces are existed, so the relationship is dynamic.
- 2 Only the NMEA, ATCOM and MODEM interface can be worked correctly with this driver.

If one gets the device files ready one can use tools such as minicom, wvdial etc to use the device.

## ATCOM interface

The screenshot shows a Windows Shell - Console window. The title bar reads "Shell - Console". The menu bar includes "Session", "Edit", "View", "Bookmarks", "Settings", and "Help". The main text area contains a repeating pattern of hexadecimal data, likely representing a captured packet stream. The pattern consists of the following lines repeated five times:

```
$GPGGA,,0,,,,,*66
$GPRMC,,V,,,,,N*53
$GPGSA,A,1,,,,,*32
$GPVTG,,T,M,N,K*4E
$GPGSV,1,1,00*79
$GPGGA,,0,,,,,*66
$GPRMC,,V,,,,,N*53
$GPGSA,A,1,,,,,*32
$GPVTG,,T,M,N,K*4E
$GPGSV,1,1,00*79
$GPGGA,,0,,,,,*66
$GPRMC,,V,,,,,N*53
$GPGSA,A,1,,,,,*32
$GPVTG,,T,M,N,K*4E
$GPGSV,1,1,00*79
$GPGGA,,0,,,,,*66
$GPRMC,,V,,,,,N*53
$GPGSA,A,1,,,,,*32
$GPVTG,,T,M,N,K*4E
$GPGSV,1,1,00*79
$GPGGA,,0,,,,,*66
$GPRMC,,V,,,,,N*53
$GPGSA,A,1,,,,,*32
$GPVTG,,T,M,N,K*4E
$GPGSV,1,1,00*79
```

The status bar at the bottom of the window displays the text: "CTRL-A Z for help | 115200 8N1 | NDR | Minicom 2.1 | VT102 | Offline".

## NMEA interface

### 1.3.3 Remove the driver

One can use the following command to uninstall the driver:

## rmmod option

```
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$ rmm
od option.ko
usbcore: deregistering interface driver option
option: option_instat_callback: error -108
option1 ttyUSB4: GSM modem (1-port) converter now disconnected from ttyUSB4
option 2-1:1.4: device disconnected
option: option_instat_callback: error -108
option1 ttyUSB3: GSM modem (1-port) converter now disconnected from ttyUSB3
option 2-1:1.3: device disconnected
option1 ttyUSB2: GSM modem (1-port) converter now disconnected from ttyUSB2
option 2-1:1.2: device disconnected
option1 ttyUSB1: GSM modem (1-port) converter now disconnected from ttyUSB1
option 2-1:1.1: device disconnected
option1 ttyUSB0: GSM modem (1-port) converter now disconnected from ttyUSB0
option 2-1:1.0: device disconnected
USB Serial deregistering driver GSM modem (1-port)
root@freescale /lib/modules/2.6.35.3-571-gcca29a0/kernel/drivers/usb/serial$
```

After removed one can use “`lsmod |grep option`” to check if the driver has been removed correctly.

*Note: when removing the driver one must disconnect the device and close all the tools using the device first.*