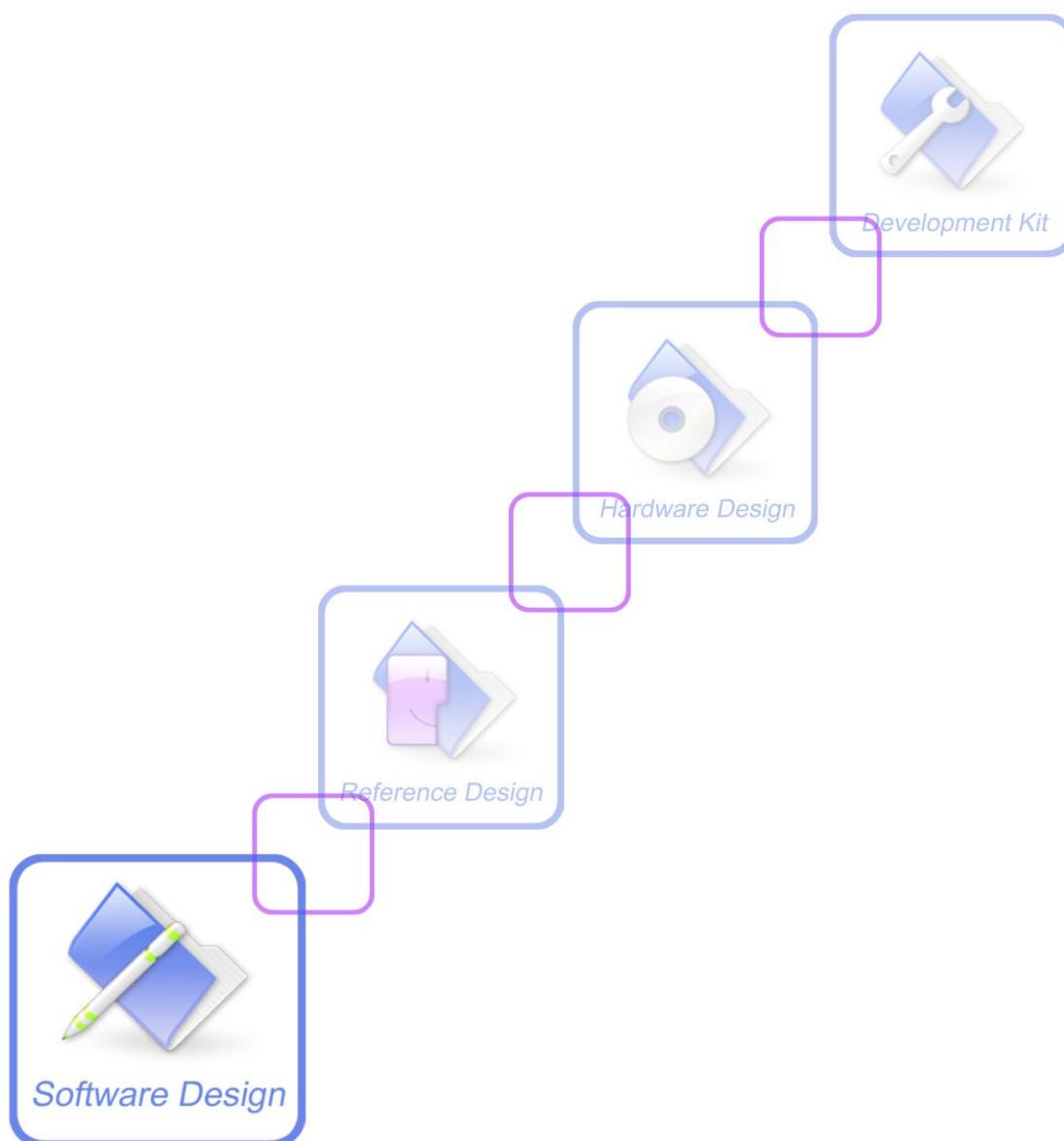




How to use Linux driver



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Version History

Version	Chapter	Author	Comments
V1.0	New Version	aaron	New version
V1.1	Chapter 2	aaron	We recommend to use the driver option instead of driver generic
V1.2	Chapter 1.1.3	aaron	Add flag for short packet transmission in some case

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SCOPE

This document is a brief description on:

1. How to build and use the driver on Linux issued by SIMCom in order to use SIMCom devices.
2. 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 fail 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:`

```

-----
00395: /*SIMCom product*/
00396: #define SIMCOM_VENDOR_ID          0x0E8D
00397: #define SIMCOM_PRODUCT_ID        0x00A5
00398:
00399: /* some devices interfaces need special handling due to a number of reasons */
00400: enum option_blacklist_reason {
00401:     OPTION_BLACKLIST_NONE = 0,
00402:     OPTION_BLACKLIST_SENDCONFIG = 1,
00403:     OPTION_BLACKLIST_RESERVED_IF = 2
00404: };
00405:
00406: struct option_blacklist_info {
00407:     const u32 infolen; /* number of interface numbers on blacklist */
00408:     const u8 *ifaceinfo; /* pointer to the array holding the numbers */
00409:     enum option_blacklist_reason reason;
00410: };
00411:
00412: static const u8 four_g_w14_no_sendsetup[] = { 0, 1 };
00413: static const struct option_blacklist_info four_g_w14_blacklist = {
00414:     .infolen = ARRAY_SIZE(four_g_w14_no_sendsetup),
00415:     .ifaceinfo = four_g_w14_no_sendsetup,
00416:     .reason = OPTION_BLACKLIST_SENDCONFIG
00417: };
00418:
00419: static const struct usb_device_id option_ids[] = {
00420:     { USB_DEVICE(SIMCOM_VENDOR_ID, SIMCOM_PRODUCT_ID) },
00421:     { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_ID) },
00422:     { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_ID) }

```

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:

```

1101     if (serial->dev->descriptor.idProduct == SIMCOM_SIM5320_PRODUCT ||
1102         serial->dev->descriptor.idProduct == SIMCOM_SIM5320_PRODUCT)
1103     {
1104 #ifdef CONFIG_PM
1105         serial->interface->needs_remote_wakeup = 1; /* autosuspend (15s delay) */
1106         device_init_wakeup(&serial->interface->dev, 1);
1107         serial->dev->autosuspend_delay = 15 * HZ; /* for kernel 2.6.36 */
1108         usb_enable_autosuspend(serial->dev);
1109 #endif
1110     }
1111
1112     data = serial->private = kzalloc(sizeof(struct usb_wwan_intf_private), GFP_KERNEL);
1113
1114     if (!data)
1115         return -ENOMEM;
1116     data->send_setup = option_send_setup;
1117     spin_lock_init(&data->susp_lock);
1118     data->private = (void *)id->driver_info;
1119     return 0;
1120 }

```

For kernel 2.6.38, add the follow highlight code to end of option_probe function:

```

1094 /* Don't bind network interfaces on Huawei K3765 & K4505 */
1095 if (serial->dev->descriptor.idVendor == HUAWAI_VENDOR_ID &&
1096     (serial->dev->descriptor.idProduct == HUAWAI_PRODUCT_K3765 ||
1097     serial->dev->descriptor.idProduct == HUAWAI_PRODUCT_K4505) &&
1098     serial->interface->cur_altsetting->desc.bInterfaceNumber == 1)
1099     return -ENODEV;
1100
1101     if (serial->dev->descriptor.idProduct == SIMCOM_SIM5320_PRODUCT ||
1102         serial->dev->descriptor.idProduct == SIMCOM_SIM5320_PRODUCT)
1103     {
1104 #ifdef CONFIG_PM
1105         pm_runtime_set_autosuspend_delay(&serial->dev, 12 * 1000); /* for kernel 2.6.38 and above */
1106         usb_enable_autosuspend(serial->dev);
1107 #endif
1108     }
1109
1110     data = serial->private = kzalloc(sizeof(struct usb_wwan_intf_private), GFP_KERNEL);
1111
1112     if (!data)
1113         return -ENOMEM;
1114     data->send_setup = option_send_setup;
1115     spin_lock_init(&data->susp_lock);
1116     data->private = (void *)id->driver_info;
1117     return 0;
1118 }

```

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_BUFLLEN,
                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_BUFLLEN,
                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.

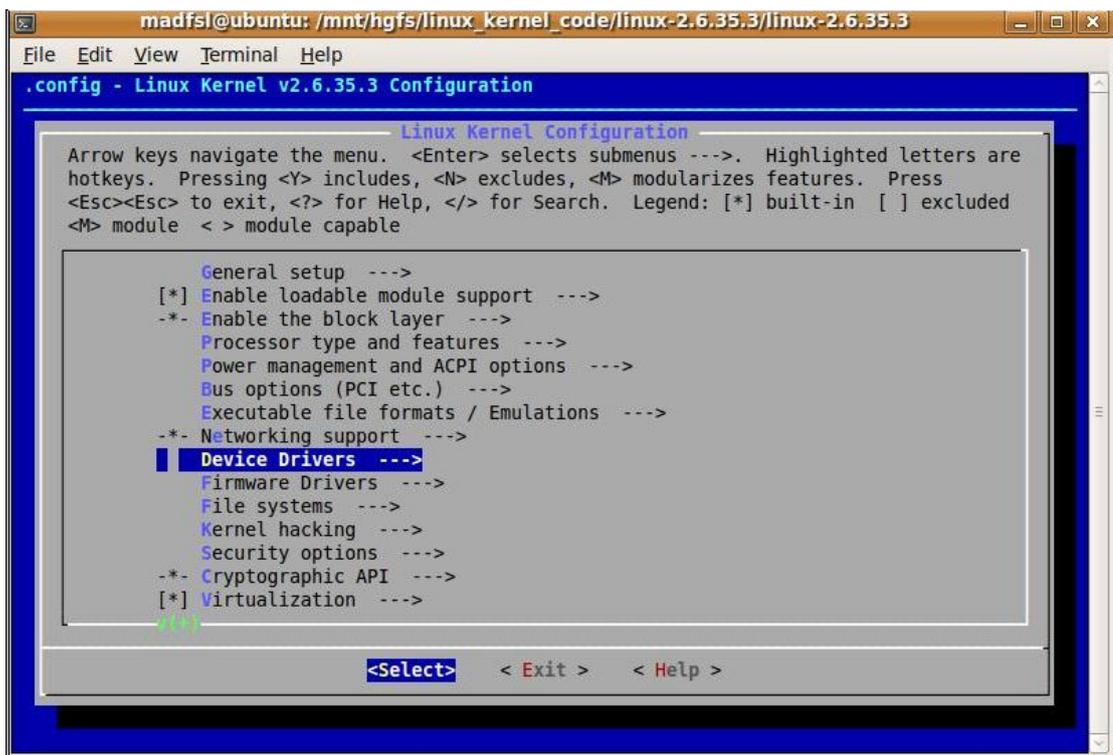
```

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  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”



The screenshot shows a terminal window titled "madfsl@ubuntu: /mnt/hgfs/linux_kernel_code/linux-2.6.35.3/linux-2.6.35.3". The terminal displays the "Linux Kernel Configuration" menu for v2.6.35.3. The menu is a text-based interface with a blue border. At the top, it says ".config - Linux Kernel v2.6.35.3 Configuration". Below that, it provides instructions: "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". The menu items are listed as follows:

- 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 --->

At the bottom of the menu, there are three options: "<Select>", "< Exit >", and "< 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 ***
<M> USB Mustek MDC800 Digital Camera support
<M> Microtek X6USB scanner support
    *** USB port drivers ***
<M> USS720 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.

```

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 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 Qualcomm Auxiliary Serial Port Driver (NEW)
< > USB Qualcomm Serial modem (NEW)
<M> USB SPCP8x5 USB To Serial Driver
<M> USB HP4x Calculators support
<M> USB Safe Serial (Encapsulated) Driver
[ ] USB Secure Encapsulated Driver - Padded
< > USB Siemens MPI driver (NEW)
<M> USB Sierra Wireless Driver
< > USB Symbol Barcode driver (serial mode) (NEW)
<M> USB TI 3410/5052 Serial Driver
<M> USB REINER SCT cyberJack pinpad/e-com chipcard reader
<M> USB Xircom / Entegra Single Port Serial Driver
<*> USB driver for GSM and CDMA modems
<M> USB ZyXEL omni.net LCD Plus Driver
< > USB Opticon Barcode driver (serial mode) (NEW)

<Select> < Exit > < Help >

```

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

```

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

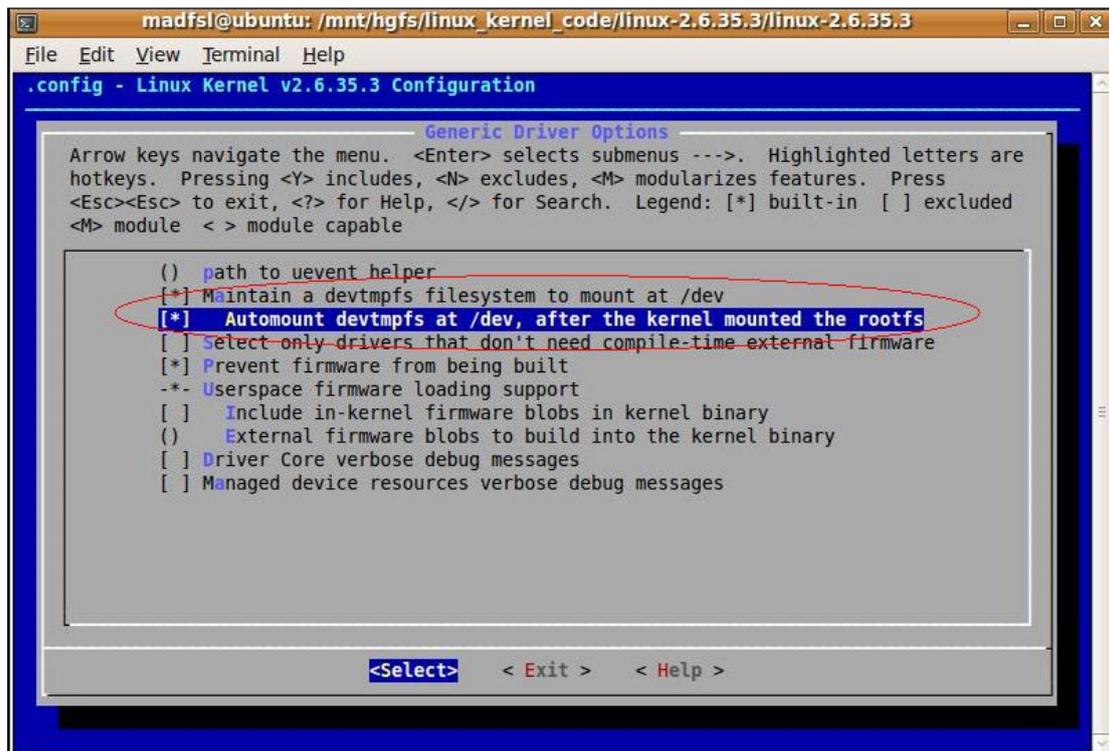
--Device Drivers--
Arrow keys navigate the menu. <Enter> selects submenus ---. Highlighted letters are
hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press
<Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [*] built-in [ ] excluded
<M> module < > module capable

Generic Driver Options --->
<*> Connector - unified userspace <-> kernelspace linker --->
<M> Memory Technology Device (MTD) support --->
<M> Parallel port support --->
-* Plug and Play support --->
[*] Block devices --->
[*] Misc devices --->
< > ATA/ATAPI/MFM/RLL support (DEPRECATED) ---->
SCSI device support --->
<*> Serial ATA and Parallel ATA drivers --->
[*] Multiple devices driver support (RAID and LVM) --->
[*] Fusion MPT device support --->
IEEE 1394 (FireWire) support --->
<M> I2O device support --->
[*] Macintosh device drivers --->

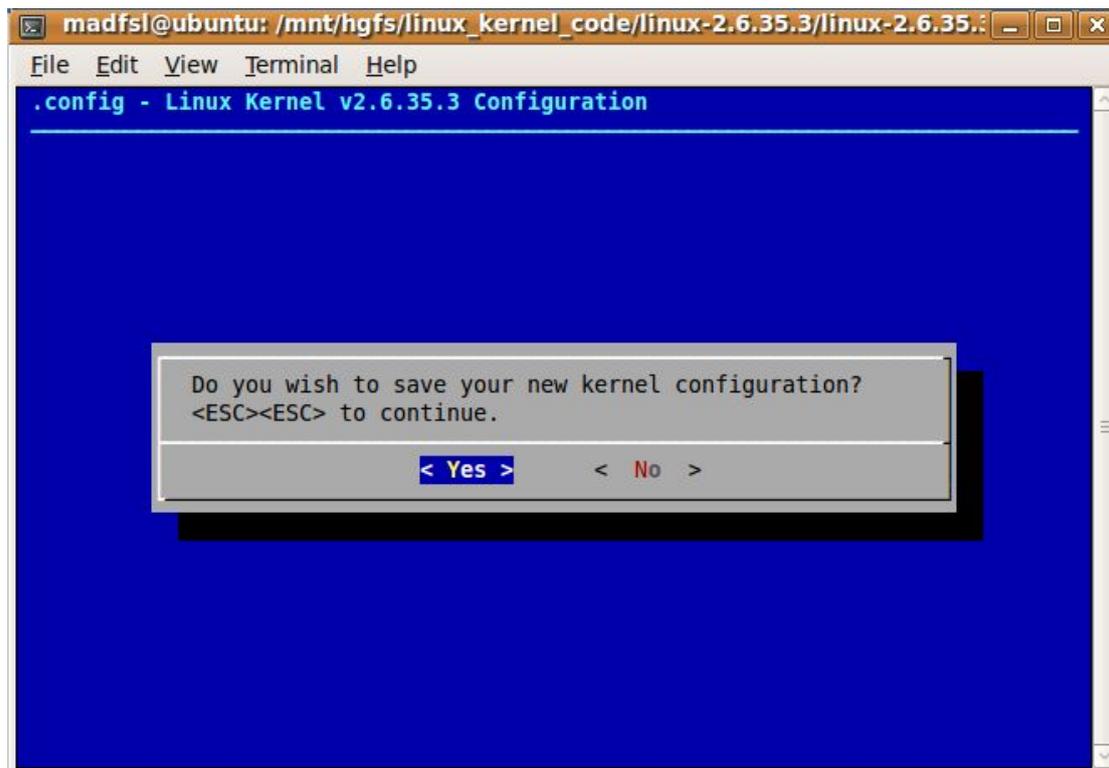
<Select> < Exit > < Help >

```

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	MODEM interface
ttyUSB1	ATCOM interface
ttyUSB2	Speech interface
ttyUSB3	Debug interface
ttyUSB4	Wireless Ethernet Adapter interface

SIMCom device is plugged in:

```
Aug 26 13:25:01 virtual-machine kernel: [ 643.617607] option 1-1:1.2: >GSM mode
m (1-port) converter detected
Aug 26 13:25:01 virtual-machine kernel: [ 643.617769] usb 1-1: >GSM modem (1-po
rt) converter now attached to ttyUSB0
Aug 26 13:25:01 virtual-machine kernel: [ 643.619725] option 1-1:1.3: >GSM mode
m (1-port) converter detected
Aug 26 13:25:01 virtual-machine kernel: [ 643.619811] usb 1-1: >GSM modem (1-po
rt) converter now attached to ttyUSB1
Aug 26 13:25:01 virtual-machine kernel: [ 643.621610] option 1-1:1.4: >GSM mode
m (1-port) converter detected
Aug 26 13:25:01 virtual-machine kernel: [ 643.621698] usb 1-1: >GSM modem (1-po
rt) converter now attached to ttyUSB2
Aug 26 13:25:01 virtual-machine kernel: [ 643.623729] option 1-1:1.5: >GSM mode
m (1-port) converter detected
Aug 26 13:25:01 virtual-machine kernel: [ 643.623811] usb 1-1: >GSM modem (1-po
rt) converter now attached to ttyUSB3
```

Device files are created:

```
root@simcom-desktop:/dev# ls ttyUSB*
ttyUSB0  ttyUSB1  ttyUSB2  ttyUSB3  ttyUSB4
root@simcom-desktop:/dev#
```

NOTE:

- 1 In some composite devices of SIMCom not all of the interfaces are existed, so the relationship is dynamic.
- 2 Only the 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.

```

root@simcom-desktop: /dev
File Edit View Terminal Help

Welcome to minicom 2.4

OPTIONS: I18n
Compiled on Jan 25 2010, 07:02:36.
Port /dev/ttyUSB1

Press CTRL-A Z for help on special keys

AT S7=45 S0=0 L1 V1 X4 &c1 E1 Q0
OK
at
OK
at
OK

```

ATCOM 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.