The Cable Modem HOWTO

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Revision History

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Completed draft.		

This document was written to assist the Linux user in configuring a cable modem for internet access using a cable network.

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1. Introduction

This document was written to assist the Linux user in setting up their cable modem, and includes information on configuring a DHCP client, enabling the device with or without USB support and troubleshooting. I have successfully configured Motorola and Toshiba brand cable modems with the methods herein, and others have informed me that the configuration methods of other manufacturers' hardware is almost identical. A mostly−complete laundry list of hardware specific tidbits is addressed in Section 4; if you have a model working that is not listing or have some specific informtion that you think will be helpful, please send it along via the address in Section 1.5

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1.3. New Versions

This is the initial release.

The latest version number of this document can be found here.

1.4. Credits

I would like to thank Brad Hards, the primary author of the Linux CDCEther kernel driver for graciously volunteering several useful bits of information, as well as Rob McGee and Jess Portnoy for encouraging me to morph this document into the new Cable−Modem HOWTO and contributing useful suggestions.

Also, I would like to thank Marla, who has stood by me confidently even when the outlook was dimmest and others unforgiving. I'm yours forever.

1.5. Feedback

Please send any additions or comments pertaining to this document to the following email address: <hshane[AT]austin.rr.com>.

1.6. Conventions Used in this Document

The following conventions are used in this document and are outlined here for those who may not yet have a complete understanding of how to access and control the underlying operating system in Linux, which is almost always the bash shell.

First, filenames are referenced in a paragraph like so: `/path/file`

Commands in Linux are executed (or 'called') at the command prompt, otherwise known as the 'command line.' If you are in the non−graphical (text−based) environment you will usually be presented the bash shell prompt which is a dollar sign:

```
$
```

...or the hash mark:

```
#
```

...if you have logged in as root or have acquired root, or 'superuser' privileges. You can also access the bash shell in the X window system, otherwise known as X or X11, with an xterm or similar X−terminal−emulator. Commands to be performed at the bash prompt, but referenced in a paragraph of this document, usually look like this: **do this now**

Commands and/or the resulting output of commands may also be outlined with screen output in their own paragraph or heading:

```
$
date Sun Jul 27 22:37:11 CDT 2003
```

When a command is written in front of the bash prompt (e.g. **$ date** above), it is assumed the [Return] or [Enter] key has been depressed after the command, possibly followed by the output (e.g., the date).

2. Prerequisites

2.1. Networking and Ethernet Support

Most, if not all, cable modems are easily configured for use with Linux. Most cable modems have two possible interfaces for connection to your computer: Ethernet or USB. If your version of Linux is like most, there is very little you will need to do to to get your cable modem working with an Ethernet interface as long as you have support for networking and the driver for your specific networking hardware installed.

2.2. Ethernet Support

An open Ethernet interface is the most likely means that a cable provider will use or recommend when setting up your cable internet service. Your ISP may even deliver and/or install a new NIC card to access the modem if you have no open Ethernet cards available.The cable connects to the modem, which then connects to your NIC using ordinary 10BaseT/100BaseT Ethernet cable. If you are uncertain about any of the above, and your modem and/or NIC are not already physically installed for you, read the Ethernet HOWTO and your cable modem's instruction manual before proceeding any further.

Do not try to install an NIC by yourself unless you are already familiar with the process or are assisted by someone who is.

For software support, most base installs of Linux distributions come enabled for TCP/IP networking and common Ethernet hardware drivers 'out of the box,' so if you are using a preconfigured kernel from a boxed or downloaded version of a Linux distribution you can probably skip to Section 2.4. If you don't know what a kernel is and/or are curious about it, see the Kernel HOWTO for more information.

The (Linux kernel) networking support requirements for use of a cable modem include the following, and which you will need to select using whatever kernel configuration front–end application (whether **make config**, **make menuconfig** or **make xconfig**) prior to compiling a custom kernel. For 2.4.x and earlier kernels under the heading 'Networking options' you will require 'TCP/IP Networking' along with 'Network Device Support,' go to 'Ethernet (10 or 100Mbit) Support' and enable your specific NIC driver. If you use the 2.6.x series, the heading 'Drivers' has a sub–heading 'Networking Support,' where you should enable 'Network Device Support' and 'Ethernet Connection Support/Ethernet (10 or 100Mbit), as well as your specific NIC hardware driver.

If you are interested in how to configure the USB interface go to Section 2.3; otherwise you can go to Section 2.4.

2.3. USB Interface Support

There seems to be no reliable data regarding testing bandwidth or performance of an Ethernet connection vs. the USB port of cable modems. In theory they should be equivalent, though some believe there is poorer performance (at least in Linux) using USB. Unless you have no way to use an Ethernet interface, have no ability to add a cheap NIC, or are just plain determined, there is probably no advantage to using USB. If so, you will need the following, in addition to Networking support outlined above: 1) USB Subsystem support 2) your host controller driver (UHCI, OHCI or EHCI) and one of the following:

Kernel Version 2.4.x

- CDC Ethernet Support

For kernel 2.6.x you will need

- Multi−purpose USB Networking Framework (CONFIG_USB_USBNET) with
- CDC Ethernet support (CONFIG_USB_CDCETHER)

See Section 3.3 for instructions on how to load modules when time to test the modem.

2.4. The Modem Device

First, plug in and turn on the cable modem. Connect your Ethernet card to the modem with 10BaseT/100BaseT cable into the non−USB interface if this was not already done for you. Be sure the modem isn't on standby mode or turned off; this should be obvious looking at the LEDs. The standby button is on the top of the device on most models. Note that your cable internet provider should be able to tell remotely whether your modem is connected and functioning properly, which is helpful to differentiate hardware from configuration problems on your end. They will also need the MAC (Media Access Control) hardware address of your modem to allow the device access to their network. If at any time you substitute one modem for another you will need to inform them so the MAC address can be updated and your access to the cable network restored.

Your modem will be assigned an IP address once connected for the first time that may remain the same or may change periodically depending on the IP address turnover of your ISP's DHCP server and how long you remain offline if you disconnect.

2.5. The DHCP Client

2.5.1. Installation on a Debian System

Debian requires you have a DHCP client package installed and running. As of this writing there are two user−space programs for this. In Woody (stable), there is the dhcp−client package, automatically installed as a part of the base packages as `/sbin/dhclient`. For Sarge (testing) and up, this has been replaced by the dhcpcd package. The latter has its configuration files under `/etc/dhcpc`, but nothing really needs to be modified if you have only one Ethernet card you will be using for the cable internet service. The dhcpcd daemon is easily installed for those using testing branch as root with **apt−get install dhcpcd** .

2.5.2. Installing on .rpm− or .tgz−Based Systems

For .rpm− or .tgz−based distributions, I offer the following link that walks you through the setup of a DHCP client, in the DHCP mini−HOWTO.

Just run **/sbin/dhclient** or whichever client you use to get a dynamic IP address.

3. Configuration

3.1. Ready to Start With an Ethernet–Modem connection

Once you are plugged into the system, your modem is on and your dhcp server is running as outlined in Section 2.5, you should be provided your own IP address that doesn't change unless you drop the lease (i.e. are offline) for a while. To confirm that the DHCP client is working and you have a new IP address, execute (as root) **ifconfig** without any other arguments, and you should see the following:

```
eth0 Link encap:Ethernet HWaddr 00:D0:09:DE:D4:6F
        inet addr:66.190.XXX.XXX Bcast:255.255.255.255 Mask:255.255.255.0 UP BROADCAST
        RUNNING MULTICAST MTU:1500 Metric:1 RX packets:2591777 errors:0 dropped:0
        overruns:0 frame:0 TX packets:5589 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:100 RX bytes:168673636 (160.8 MiB) TX bytes:1752872
        (1.6 MiB) Interrupt:12 Base address:0xc400
```

```
lo Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0 UP LOOPBACK RUNNING MTU:16436 Metric:1 RX
        packets:5168 errors:0 dropped:0 overruns:0 frame:0 TX packets:5168 errors:0
        dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:0 RX bytes:1695104
        (1.6 MiB) TX bytes:1695104 (1.6 MiB)
```

...which shows the system loopback device, *lo*, and also *eth0*, the cable modem having successfully acquired an IP address (the 'inet addr') provided by our cable internet service provider.

A simple Ethernet−based configuration should be complete at this step. If you have more than one Ethernet interface available and want to select a specific one for the cable service, go on to Section 3.2.

3.2. Grabbing A Specific Interface

Let's say we want to select a specific Ethernet interface (*ethX*) to be the recipient of the DHCP cable internet service. If you run **ifconfig** as root you get a list of open devices:

```
eth0 Link encap:Ethernet
HWaddr 00:D0:09:DE:D4:6F
        inet addr:192.168.1.1 Bcast:192.168.1.255 Mask:255.255.255.0 BROADCAST RUNNING
        MULTICAST MTU:1500 Metric:1 RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:100
        RX bytes:0 (0.0 b) TX bytes:0 (0.0 b) Interrupt:12 Base address:0xc400
```

```
lo Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0 UP LOOPBACK RUNNING MTU:16436 Metric:1 RX
        packets:5168 errors:0 dropped:0 overruns:0 frame:0 TX packets:5168 errors:0
        dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:0 RX bytes:1695104
        (1.6 MiB) TX bytes:1695104 (1.6 MiB)
```

...where eth0 is a standard NIC that we have preconfigured to the IP address 192.168.1.1.

Note the HWaddr field, or hardware address, on the first line. This is the same as the MAC, or Media Access Control address, and is how we will specify the interface for each action.

3.2.1. Manually Assigning MAC to Interface Name

Whatever distribution you use, you can always use the command line to designate an Ethernet device (via the MAC) to be interface '*ethX*' with or without a particular IP address. This may be necessary when you change your settings, swap out hardware or for just plain testing. Use ifconfig:

```
# ifconfig ethX hw ether 00:D0:09:DE:D4:6F up
```

You can check if it worked by calling **ifconfig** without options after your next reboot. See **man ifconfig** for more options.

3.2.2. Automatic Configuration of Devices

The method for automatically assigning a particular interface name *ethX*, to a specific hardware interface (Media Access Control address) differs by distribution.

3.2.2.1. Debian

If you are running a Debian system, you can alter the `/etc/network/interfaces` file to look like this:

```
        # /etc/network/interfaces -- configuration file for ifup(8), ifdown(8) # The
        loopback interface auto lo iface lo inet loopback auto eth0 iface eth0 inet
        static address 192.168.1.1 netmask 255.255.255.0 network 192.168.1.0 hwaddress
        ether 00:D0:09:DE:D4:6F

        auto eth1 iface eth1 inet dhcp hwaddress ether 00:04:BD:DE:42:0B
```

The **auto eth0** and **auto eth1** are required to have the interfaces configured at boot−up. Note that some versions of dhcp clients by default always grab eth0 for the dhcpc interface. So even after doing all the above, unless you specifically run **/sbin/dhcpcd−bin eth1** it won't work. The easy way to do this at boot up is to make an init script to load the dhcp address to the correct interface, which should be placed in `/etc/init.d`. Then run **update−rc.d** as root with the correct arguments (see **man update−rc.d**).

3.2.2.2. Red Hat

The file to edit will of the form `ifcfg−ethX`, located in `/etc/sysconfig/network−scripts/`. The contents are typically of the form:

```
 DEVICE=eth1
# Device name. This is the interface your cable modem will use.
ONBOOT=yes
# load at boot BOOTPROTO=dhcp
# sets the device to receive an IP address from a DHCP server
HWADDR=00:04:BD:DE:42:0B
# the hardware MAC
```

Edit the relevant sections with your favorite text editor program as root to reflect your interface name and MAC and save it. If the file doesn't exist for the interface you need you can create it, for example `ifcfg−eth1`. You can then use **ifconfig eth1 up** from the command line to use it immediately. Upon reboot the correct hardware settings should be loaded automatically.

3.2.2.3. Slackware

Slackware has a configuration utility named 'netconfig' that you can use at the command line as root to modify your network settings and configure interfaces by static IP addresses or dhcp. You can rerun it at any time to reconfigure things once you have installed your modem.

3.2.2.4. Other Distributions

Feel free to contribute if you have distribution−specific information to add; see Section 1.5. Consult your distribution documentation where appropriate.

3.3. Using the USB interface instead of an Ethernet card

3.3.1. USB CDCEther

If you wish to use the USB interface to accept data you will need USB subsystem support in your kernel as discussed in Section 2.1, whether USB−ohci, USB−ehci, or whatever USB host controller driver required by your system. For a more in−depth discussion of this, I direct you to the Linux−USB project site.

In addition the CDCEther (Communications Device Class Ethernet) protocol common to cable modems.

There are two ways your kernel may support a device driver: either by being statically (always on) compiled within that kernel or loaded (at boot time or later by a script or manually) as a module. You can find out if a driver is statically compiled in the kernel by checking the log of messages at boot up using **dmesg | less** on the command line. Experienced users may want to take an easier route and check the configuration file for the currently running kernel in `/boot`, usually of the form `config-2.X.x`, which is a text file that can be grepped. On the command line, try **grep −e** followed by **CONFIG_USB_CDCETHER** in 2.4.x kernels or **CONFIG_USB_ETH** in 2.6.x kernels followed by the filename; you should see a '=*y* or =*m* at the end of this string for static or modular status, respectively.

The output of **dmesg | less** should reveal something similar to the following

```
 Mar 2 11:00:52 K7 kernel: CDCEther.c:
0.98.6 7 Jan 2002 Brad Hards and another
Mar 2 11:00:52 K7 kernel: usb.c: registered new driver CDCEther
```

in the case of a statically compiled driver or a module loaded at boot.

If you don't see it, to find out if your kernel has already loaded the CDCEther (Communications Device Class Ethernet) driver as a module, on the command line issue **lsmod** as root. You should see the module `CDCEther` listed for 2.4.x kernels, or alternatively `usbnet` for 2.6.x kernels.

If you don't see it listed with **lsmod** try loading the module directly as root; for kernel 2.4.x this would be of the form

```
 # modprobe CDCEther
```

whereas for 2.6.x the command would be

```
 # modprobe usbnet
```

If all goes well you should see something like the following at the end of your system log files (`/var/log/messages` or `/var/log/syslog`, you may need to be root to view these) or at the end of **dmesg | less** from the command line:

```
 Mar 2 11:00:52 K7 kernel: CDCEther.c:
0.98.6 7 Jan 2002 Brad Hards and another
Mar 2 11:00:52 K7 kernel: usb.c: registered new driver CDCEther
```

If all goes well you should see something like the following in your system log files or at the end of **dmesg**:

```
 Mar 2 11:00:52 K7 kernel: CDCEther.c:
0.98.6 7 Jan 2002 Brad Hards and another
Mar 2 11:00:52 K7 kernel: usb.c: registered new driver CDCEther
```

If you are unsuccessful with any of the above, and are determined to use the USB conduit of this device, you will need to recompile your kernel to support it. You will need the 2.4.3 kernel or later. For detailed instructions on recompiling your kernel, I direct you to the Kernel−HOWTO. The options required to get USB interface support working on this device have been addressed in Section 2.1.

---

4. Notes on Specific Hardware

Thanks to Jess Portnoy and others for much of the information below. Also, there are some notes specifically pertaining to configuring a cable modem and cable internet service providers in Israel on Jess' webpage for those that live there. I have personally subscribed to two large cable ISPs in the U.S. without any trouble using the instructions outlined above. The previous incarnation of this document had a large catalogue of ISPs listed by geography, but as a rule the identity of the upstream provider should not affect configuration. If your cable ISP claims not to support linux, it is not because of any technical difficulties related to the operating system. Just don't expect them to configure if for you on your end like they do for most other users (that's why you're reading this document, right?).

4.1. Ambit Modems

Supported by Ethernet and CDCEther.

4.2. Broadcom Cable Modems

Supported by Ethernet and CDCEther.

4.3. Ericson PipeRider Modems

Supported by Ethernet and CDCEther.

4.4. Motorola SurfBoard Modems

This model has enjoyed widespread use by cable providers. There is a separate HOWTO, written by your humble author. Supported by both Ethernet and USB CDCEther. Refer to that document for any hardware specific questions. The generic instructions above generally work.

4.5. RCA (Tompson) Modems

Supported with Ethernet, CDCEther untested.

4.6. Terayon Modems

At minimum the tj715 is known to be supported using Ethernet and CDCEther.

4.7. Toshiba PCX–XXXX Cable Modems

The four X's in the name indicate model number. Works with Ethernet, CDCEther untested. 'out–of–the–box' with the above instructions.

4.8. Webstar Modems

Supported with Ethernet, CDCEther untested.

5. Troubleshooting

Q: I get kicked offline about once every 4 days, for no apparent reason, and get the following error, or something similar, in the kernel log:

```
 Feb 20 10:05:12 K7 kernel: CDCEther.c: rx status -110 Feb 20 10:05:12 K7 kernel:
CDCEther.c: no repsonse in BULK IN Feb 20 10:05:12 K7 kernel: CDCEther.c: rx status -110
Feb 20 10:05:12 K7 kernel: CDCEther.c: no repsonse in BULK IN Feb 20 10:05:12 K7 kernel:
CDCEther.c: rx status -110 Feb 20 10:05:12 K7 kernel: CDCEther.c: no repsonse in BULK
IN Feb 20 10:05:12 K7 kernel: CDCEther.c: rx status -110
```

A: There are a number of reasons this may be happening, and future updates to the CDCEther driver may solve some of them. At least one user on the Linux−USB−user mailing list noticed that on at least one occasion data sent to the modem from upstream by the cable provider has triggered it. Also, the modem itself is very sensitive to power interruptions and can lose the connection if this occurs. The fix is to run **ifdown ethX**, where *ethX* is the Ethernet interface (eth0, eth1 etc.) to clear out any remaining settings that are hung, then remove the module with **rmmod CDCEther**, reinsert the CDCEther module and then **ifup ethX** . A reboot may be necessary if this doesn't fix the problem. If none of these work you probably have a real service interruption.

Q: I get the following messages on boot−up; are they errors?

```
 Can't use
SetEthernetMulticastFilters request Mar 2 11:00:52 K7 kernel: CDCEther.c: Ethernet
information found at device configuration.  Trying to use it anyway.  Mar 2 11:00:52
K7 kernel: CDCEther.c: Imperfect filtering support - need sw hashing
```

A: No. The multicast message is pertaining to Multicast support in the kernel, which is optional and not necessary for the proper functioning of this modem. The message about 'Ethernet Information' is a design bug in the modem and can be ignored. As for the 'Imperfect filtering support, to quote Brad Hards:

"This is a bit difficult to explain − I assume that you know what multicasting is − when you join a multicast group, this can be handled by the networking device so that other multicast traffic doesn't cause interrupts. That is called 'perfect filtering.' However sometimes the number of multicast addresses exceeds the number of filters that you have. This leads to 'imperfect filtering,' which can cut down the number of interrupts, but you still need to do some work in the networking stack. Then you get to the typical cable modem implementation, and there is not filtering at all. Every multicast packet goes to the host to be filtered. This doesn't normally matter though, because the cable modem is a point to point link."

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