The Linux CD−ROM HOWTO

Table of Contents

Table of Contents

The Linux CD−ROM HOWTO

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This document describes how to install, configure, and use CD−ROM drives under Linux. It lists the supported hardware and answers a number of frequently asked questions. The intent is to bring new users up to speed quickly and reduce the amount of traffic in the Usenet news groups and mailing lists.

1.Introduction

2.CD−ROM Technology

3.Supported Hardware

4.Installation

5.Applications

6.Answers to Frequently Asked Questions

7.References

1.Introduction

This is the Linux CD−ROM HOWTO. It is intended as a quick reference covering everything you need to know to install and configure CD−ROM hardware under Linux. Frequently asked questions related to CD−ROM are answered, and references are given to other sources of information related to CD−ROM applications and technology.

1.1 Acknowledgments

Much of this information came from the documentation and source files provided with the Linux kernel, the Internet alt.cdrom newsgroup FAQ, and input from Linux users.

Thanks to the SGML Tools package, this HOWTO is available in several formats, all generated from a common source file.

1.2 New Versions Of This Document

New versions of this document will be periodically posted to the comp.os.linux.answers newsgroup. They will also be uploaded to various anonymous ftp sites that archive such information including ftp://metalab.unc.edu/pub/Linux/docs/HOWTO/.

Hypertext versions of this and other Linux HOWTOs are available on many world−wide web sites, including http://metalab.unc.edu/LDP/HOWTO/. Most Linux CD−ROM distributions include the HOWTOs, often under the /usr/doc directory, and you can also buy printed copies from several vendors. Sometimes the HOWTOs available from CD−ROM vendors, ftp sites, and printed format are out of date. If the date on this HOWTO is more than six months in the past, then a newer copy is probably available on the Internet.

Please note that, due to the dynamic nature of the Internet, all web and ftp links listed in this document are subject to change.

Translations of this document are available in several languages:

Chinese: http://www.linux.org.tw/CLDP/CDROM−HOWTO.html

French: http://www.freenix.org/unix/linux/HOWTO/

Japanese: http://jf.linux.or.jp/JF/JF.html/

Polish: http://www.jtz.org.pl/Html/CDROM−HOWTO.pl.html

Spanish: ftp://ftp.insflug.org/es

Swedish: http://www.swe−doc.linux.nu/

Most translations of this and other Linux HOWTOs can also be found at http://metalab.unc.edu/pub/Linux/docs/HOWTO/translations/ and ftp://metalab.unc.edu/pub/Linux/docs/HOWTO/translations/. If you make a translation of this document into another language, let me know and I'll include a reference to it here.

1.3 Feedback

I rely on you, the reader, to make this HOWTO useful. If you have any suggestions, corrections, or comments, please send them to me, tranter@pobox.com, and I will try to incorporate them in the next revision.

I am also willing to answer general questions on CD−ROM under Linux, as best I can. Before doing so, please read all of the information in this HOWTO, and then send me detailed information about the problem. Please do not ask me about using CD−ROM drives under operating systems other than Linux.

If you publish this document on a CD−ROM or in hardcopy form, a complimentary copy would be appreciated; mail me for my postal address. Also consider making a donation to the Linux Documentation Project to help support free documentation for Linux. Contact the Linux HOWTO coordinator, Tim Bynum (linux−howto@metalab.unc.edu), for more information.

1.4 Distribution Policy

2.CD−ROM Technology

```
"CD-ROM is read-only memory, and audio compact disc system is
available as package-media of digital data for those purpose. For
playing audio CD, please insert Head-phone jack."
--- from a CD-ROM instruction manual
```

Don't Panic! The world of CD−ROM technology is not as confusing as your instruction manual.

CD−ROM stands for *Compact Disc Read−Only Memory*, a mass storage medium utilizing an optical laser to read microscopic pits on the aluminized layer of a polycarbonate disc. The same format is used for audio Compact Discs. Because of its high storage capacity, reliability, and low cost, CD−ROM has become an increasingly popular storage media.

The storage capacity of a CD−ROM disc is approximately 650 megabytes, equivalent to over 500 high density 3.5" floppy disks or roughly 250,000 typed pages.

First generation drives (known as *single speed*), provided a transfer rate of approximately 150 kilobytes per second. Hardware manufacturers then introduced double speed (300 kB/sec), quad speed (600 kB/sec), and higher. Current drives operate at up to 40 times speed, although the maximum rate is only achievable over certain portions of the disc surface.

Most CD−ROM drives use either the Small Computer Systems Interface (SCSI), ATAPI enhanced IDE interface, or a vendor proprietary interface. They also typically support playing audio CDs via an external headphone jack or line level output. Some CDs also allow reading the frames of data from audio CDs in digital form.

CD−ROMs are usually formatted with an ISO−9660 (formerly called *High Sierra*) file system. This format restricts filenames to the MS−DOS style (8+3 characters). The *Rock Ridge Extensions* use undefined fields in the ISO−9660 standard to support longer filenames and additional Unix style information (e.g. file ownership, symbolic links, etc.). Microsoft has defined a proprietary ISO file system extension called Joliet which supports long filenames using the 16−bit UNICODE character encoding.

PhotoCD is a standard developed by Kodak for storing photographic images as digital data on a CD−ROM. With appropriate software, you can view the images on a computer, manipulate them, or send them to a printer. Information can be added to a PhotoCD at a later date; this is known as *multi−session* capability.

CD recorders (CD−R) allow writing onto a special "gold" CD which can then be read by any CD−ROM drive. Data can only be written once, although using multi−session new data can be appended to a disc. These drives are now becoming increasingly affordable.

CD−RW (read/write) drives support multiple writing of data to CDs. They use special discs which cannot be read using standard CD−ROM drives, although the CD−RW drives themselves can read standard discs.

DVD−ROM expands the storage of a CD to as much as 17 gigabytes. They are commonly used as a medium for distributing full length motion pictures encoded using the MPEG−2 format. The MPEG video decoding is usually performed using specialized decoder hardware.

3.Supported Hardware

This section lists the CD−ROM drivers and interfaces that are currently supported under Linux. The information here is based on the latest stable Linux kernel, which at time of writing was version 2.2.4.

This information is only valid for Linux on the Intel platform. Much of it is applicable to Linux on other processor architectures as well.

3.1 ATAPI CD−ROM Drives

ATAPI (ATA Packet Interface) is a protocol for controlling mass storage devices. It builds on the ATA (AT Attachment) interface, the official ANSI standard name for the IDE interface developed for hard disk drives. ATAPI is commonly used for hard disks, CD−ROM drives, tape drives, and other devices. Currently the most popular type of interface, it offers most of the functionality of SCSI, without the need for an expensive controller or cables.

The Linux kernel has a device driver that should work with any ATAPI compliant CD−ROM drive. Vendors shipping compatible drives include Aztech, Mitsumi, NEC, Sony, Creative Labs, and Vertos. If you have recently purchased a CD−ROM drive, especially if it is quad speed or faster, it is almost guaranteed to be IDE/ATAPI.

Linux also has an IDE SCSI emulation kernel driver that makes an IDE/ATAPI device appear in software to be a SCSI device, allowing the use of a SCSI device driver instead of the native ATAPI driver. This is useful if you have an ATAPI device for which no native driver has been written (for example, an ATAPI PD−CD or CDR drive); you can then use this emulation together with an appropriate SCSI device driver.

3.2 SCSI CD−ROM Drives

SCSI (Small Computer Systems Interface) is a popular format for CD−ROM drives. Its chief advantages are a reasonably fast transfer rate, multi−device capability, and support on a variety of computer platforms. Some disadvantages of SCSI are the need for a relatively expensive controller card and cables.

Any SCSI CD−ROM drive with a block size of 512 or 2048 bytes should work under Linux; this includes the vast majority of CD−ROM drives on the market.

You will also need a supported SCSI controller card; see the SCSI HOWTO for more information on interface hardware.

Note that some CD−ROMs include a proprietary controller with a modified interface that is not fully SCSI compatible (e.g. it may not support adding other SCSI devices on the bus). These will most likely *not* work under Linux.

3.3 Proprietary CD−ROM Drives

Several CD−ROM drives using proprietary interfaces are available; the interface is often provided on a sound card. Simple interface cards equivalent to that provided on the sound card are also available. These drives generally tend to be lower in cost and smaller than SCSI drives. Their disadvantages are the lack of standardization and expandability.

Note that proprietary interfaces are sometimes erroneously referred to as IDE interfaces, because like IDE hard disks, they use a simple interface based on the PC/AT bus. To add to the confusion, some vendors, most notably Creative Labs, have shipped many different types of CD−ROM drives and have offered proprietary, SCSI, and ATAPI interfaces on their sound cards.

The table below lists the proprietary CD−ROM drives that are known to be supported under Linux. Drivers for additional devices may be available in the latest development kernels or as kernel patches. The latter can most often be found at ftp://metalab.unc.edu/pub/Linux/kernel/patches/cdrom/. Also check the documentation files included with the kernel distribution, usually installed in /usr/src/linux/Documentation/cdrom, for the latest information.

```
                Proprietary CD-ROM Drives

Vendor          Model           Kernel Driver   Notes
------          -----           -------------   --------
Panasonic       CR-521          sbpcd           Note 1
Panasonic       CR-522          sbpcd           Note 1
Panasonic       CR-523          sbpcd           Note 1
Panasonic       CR-562          sbpcd           Note 1
Panasonic       CR-563          sbpcd           Note 1
Creative Labs   CD-200          sbpcd
IBM             External ISA    sbpcd           Note 2
Longshine       LCS-7260        sbpcd
Teac            CD-55A          sbpcd
Sony            CDU-31A         cdu31a
Sony            CDU-33A         cdu31a
Sony            CDU-535         sonycd535       Note 3
Sony            CDU-531         sonycd535
Aztech          CDA268-01A      aztcd           Note 4
Orchid          CDS-3110        aztcd
Okano/Wearnes   CDD110          aztcd
Conrad          TXC             aztcd
CyCDROM         CR520ie         aztcd
CyCDROM         CR940ie         aztcd
GoldStar        R420            gscd            Note 5
Philips/LMS     CM206           cm206           Note 6
Mitsumi         CRMC LU005S     mcd/mcdx        Note 7, 8
Mitsumi         FX001           mcd/mcdx        Note 7, 8
Optics Storage  Dolphin 8000AT  optcd
Lasermate       CR328A          optcd
Sanyo           H94A            sjcd
various         various         isp16           Note 9
```

Notes:

1. These drives may be sold under the names Creative Labs, Panasonic, Matsushita, or Kotobuki.
2. This drive is the same as a Panasonic CR−562.
3. May also be sold under the Procomm name.
4. This driver is for the CDA268−01A only. Other models, including the CDA268−03I and CDA269−031SE are not proprietary and should use the IDECD (ATAPI) kernel driver.
5. May also be sold as part of a Reveal Multimedia Kit.
6. The Philips CM205 is not supported by this driver, but there is a separate alpha release driver available from ftp://metalab.unc.edu in /pub/Linux/kernel/patches/cdrom/lmscd0.4.tar.gz
7. May also be sold under the Radio Shack name.
8. There are two drivers available. "mcd" is the original one, and "mcdx" is a newer driver with more features (but possibly less stable).
9. This driver works with CD−ROM drives that are attached to the interface on an ISP16, MAD16 or Mozart sound card.

If a drive listed here is not supported by your kernel, you probably need to upgrade to a newer version.

If your drive is not one of the models listed here, particularly if it was bought recently and is quad speed or faster, it probably uses the IDE/ATAPI interface listed in a previous section. *The single most common error among Linux CD−ROM users is to assume that any drive connected to a SoundBlaster card should use the SBPCD driver*. Creative Labs and most other vendors are no longer selling proprietary interface drives, they are following the standard ATAPI/IDE interface.

3.4 Parallel Port Drives

There are external storage devices, including CD−ROM drives, that attach to the parallel port of personal computers. In many cases the devices internally use an IDE interface in conjunction with an adaptor which interfaces the internal IDE bus to the PC parallel port.

Linux has a parallel port IDE driver which supports most parallel port devices. At the time of writing it supported devices from the following vendors (as well as most no−name and clone drives compatible with these): ATEN, Avatar, DataStor, Fidelity International Technology, Freecom, Hewlett−Packard, Imation, KT Technology, KingByte Information Corp., Maxell, MicroSolutions, OnSpec, Shuttle Technology, SyQuest, and ValuStore.

Additional information can be found at http://www.torque.net/parport/.

3.5 Alternate Drivers

There is an alternate kernel driver available for Panasonic/Matsushita CR−56x drives written by Zoltan Vorosbaranyi. It can be found at ftp://ftp.honlap.net/pub/linux/pcd/pcd−0.30.tar.gz.

4.Installation

Installation of a CD−ROM under Linux consists of these steps:

1. Installing the hardware.
2. Configuring and building the Linux kernel.
3. Creating device files and setting boot time parameters
4. Booting the Linux kernel.
5. Mounting the media.

The next sections will cover each of these steps in detail.

4.1 Installing the Hardware

Follow the manufacturer's instructions for installing the hardware or have your dealer perform the installation. The details will vary depending on whether the drive is internal or external and on the type of interface used. There are no special installation requirements for Linux. You may need to set jumpers on the drive and/or interface card for correct operation; some of the kernel drivers include documentation files that include this information.

As explained in the file ide−cd, ATAPI CD−ROMS should be jumpered as "single" or "master", and not "slave" when only one IDE device is attached to an interface (although this restriction is no longer enforced with recent kernels).

4.2 Configuring and Building the Kernel

When initially installing Linux from CD−ROM you will likely be using a boot and/or root disk provided as part of a Linux distribution. If possible, you should choose a boot disk with the kernel driver for your CD−ROM device type. If you cannot find a boot disk with the necessary CD−ROM driver, you have several options:

1. Boot directly from CD−ROM (if supported by your computer and Linux CD)
2. Install over a network
3. Boot DOS, and install the Linux files onto your hard disk
4. Boot DOS, and create a set of floppies to install Linux
5. Find someone who can build you a boot disk with the needed CD−ROM driver

The Linux Installation HOWTO has more information on installing Linux. If you purchased Linux on CD−ROM, it likely also came with some installation instructions (that little booklet inside the jewel case, and/or files on the CD).

Once Linux has initially been installed, most users will want to compile their own kernel, usually for one of these reasons:

- to support a CD−ROM drive or other hardware
- to upgrade to a newer kernel release
- to free up memory resources by minimizing the size of the kernel

The Linux Kernel HOWTO should be consulted for the details of building a kernel. I will just mention here some issues that are specific to CD−ROM drives.

Obviously, you need to compile in support for your CD−ROM drive when you do a "make config".

If you have an ATAPI CD−ROM drive, you need to answer `yes` to the questions:

```
Enhanced IDE/MFM/RLL disk/cdrom/tape support (CONFIG_BLK_DEV_IDE) [Y/n/?]
Include IDE/ATAPI CDROM support (CONFIG_BLK_DEV_IDECD) [Y/n/?]
```

For SCSI CD−ROM drives, enable these options:

```
SCSI support (CONFIG_SCSI) [Y/n/m/?]
SCSI CDROM support (CONFIG_BLK_DEV_SR) [Y/n/m/?]
```

Also enable support for your SCSI host adapter when prompted, e.g.

```
Adaptec AHA152X/2825 support (CONFIG_SCSI_AHA152X) [Y/n/m/?]
```

For proprietary interface CD−ROM drives, enable the appropriate driver. You can use the table listed previously to determine the driver to use for your model.

Virtually all CD−ROMs use the ISO−9660 file system, so you must also enable:

```
ISO 9660 CDROM filesystem support (CONFIG_ISO9660_FS) [Y/n/m/?]
```

Although not needed for CD−ROM operation, if you have a sound card that is supported under Linux you might want to enable and configure the kernel sound driver at this time as well. The Sound HOWTO can be a useful reference here.

You should then follow the usual procedure for building the kernel and installing it. Don't boot with the new kernel until you create the device files and set up any boot time parameters as described in the next section.

The ISO−9660 filesystem and almost all of the CD−ROM drivers can be built as loadable kernel modules. This scheme allows the kernel drivers to be loaded and unloaded without rebooting the kernel, freeing up memory. I recommend you get your CD−ROM installation running using compiled−in drivers first. How to use modules is described in the modules documentation and the Kernel HOWTO.

If a drive type listed here is not supported by your kernel, you likely need to upgrade to a newer version.

It is possible that you need to use a driver that is distributed separately from the kernel source code. This usually involves patching the kernel. Again, the Kernel HOWTO explains how to do this.

Note that there is a menu−based kernel configuration program invoked by "make menuconfig" and an X11−based graphical configuration invoked as "make xconfig". All three configuration methods offer on−line help.

4.3 Creating Device Files and Setting Boot Time Parameters

The kernel uses device files to identify which device driver to use. If you are running a standard Linux distribution you may have created the necessary device files during installation. Under Slackware Linux, for example, there is a menu−based `setup` tool that includes CD−ROM setup, and most systems have a /dev/MAKEDEV script. If you don't use these methods, you can use the more manual procedure listed in this section. Even if you use either of these methods, it is recommended that you at least verify the device files against the information in this section.

You create the device file by running the shell commands indicated for your drive type. This should be done as user `root`. Note that some Linux distributions may use slightly different CD−ROM device names from those listed here.

It is recommended that you also create a symbolic link to the CD−ROM device to make it easier to remember. For example, for an IDE CD−ROM drive that is the second device on the secondary interface, the link would be created using

```
# ln -s /dev/hdd /dev/cdrom
```

If you want to play audio CDs, you will need to set the protection on the device file (the real file, not the symbolic link to it) to allow all users to read, e.g.

```
# chmod 664 /dev/hdd
# ls -l /dev/hdd
brw-rw-r--   1 root     disk      22,  64 Feb  4  1995 /dev/hdd
```

When booting Linux, the device drivers attempt to determine whether the appropriate devices are present, typically by probing specific addresses. Many of the drivers auto−probe at several addresses, but because of differences in configuration, possible device conflicts, and hardware limitations, the drivers sometimes need help identifying the addresses and other parameters. Most drivers support an option on the kernel command line to pass this information to the device driver. This can be done interactively, or more commonly, configured into your boot loader. With LILO, for example, you would add an `append` command such as the following to your /etc/lilo.conf file:

```
append = "sbpcd=0x230,SoundBlaster"
```

See the LILO documentation for more information.

In the next section I discuss issues specific to individual device drivers, including device files, boot parameters, and the capabilities of the different drivers. You probably only need to read the section relevant to your drive type. The documentation files are usually found in the directory /usr/src/linux/Documentation/cdrom.

Sbpcd Driver

```
      Principal author: Eberhard Moenkeberg (emoenke@gwdg.de)
  Multi-session support: yes (but not all drives)
 Multiple drive support: yes
Loadable module support: yes
   Reading audio frames: yes (CR-562, CR-563, CD-200 only)
           Auto-probing: yes
```

```
          Device file: /dev/sbpcd, major 25
   Configuration file: sbpcd.h
 Kernel config option: Matsushita/Panasonic CDROM support?
   Documentation file: sbpcd
```

This driver accepts a kernel command line of the form:

```
sbpcd=<io-address>,<interface-type>
```

where the first parameter is the base address of the device (e.g. 0x230), and <interface−type> is one of "SoundBlaster", "LaserMate", or "SPEA". See the file sbpcd.h for hints on what interface type to use. Using `sbpcd=0` disables auto−probing, disabling the driver.

The device file can be created using:

```
# mknod /dev/sbpcd b 25 0
```

Up to four drives per controller are supported. The next three drives on the first controller would use minor device numbers 1 through 3. If you have more than one controller, create devices with major numbers 26, 27, and 28, up to a maximum of 4 controllers (this is 16 CD−ROM drives in total; hopefully enough for most users :−).

See the file sbpcd for more information on this driver.

If you recently bought a CD−ROM drive, don't assume that if it connects to a SoundBlaster card it should use this kernel driver. Most CD−ROM drives being sold by Creative Labs are now EIDE/ATAPI drives.

Sonycdu535 Driver

```
     Principal author: Ken Pizzini (ken@halcyon.com)
  Multi−session support: no
 Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: no
            Device file: /dev/sonycd535, major 24
     Configuration file: sonycd535.h
   Kernel config option: Sony CDU535 CDROM support?
     Documentation file: sonycd535
```

This driver accepts a kernel command line of the form:

```
sonycd535=<io-address>
```

where <io−address> is the base address of the controller (e.g. 0x320). Alternatively you can set the address in the file sonycd535.h and compile it in.

The device file can be created using:

```
# mknod /dev/sonycd535 b 24 0
```

Some Linux distributions use /dev/sonycd for this device. Older versions of the driver used major device number 21; make sure your device file is correct.

This driver was previously distributed as a patch but is now part of the standard kernel. See the file sonycd535 for more information on this driver.

Cdu31a Driver

```
      Principal author: Corey Minyard (minyard@-rch.cirr.com)
  Multi−session support: yes
 Multiple drive support: no
Loadable module support: yes
   Reading audio frames: yes
           Auto−probing: no
            Device file: /dev/cdu31a, major 15
     Configuration file: cdu31a.h
   Kernel config option: Sony CDU31A/CDU33A CDROM support?
     Documentation file: cdu31a
```

This driver accepts a kernel command line of the form:

```
cdu31a=<io−address>,<interrupt>,PAS
```

The first number is the I/O base address of the card (e.g. 0x340). The second is the interrupt number to use (0 means to use polled i/o). The optional third parameter should be "PAS" if the drive is connected to a Pro−Audio Spectrum 16 sound card, otherwise left blank.

If the driver is loaded as a module, it uses a slightly different format. When loading the driver using the modprobe or insmod command, the parameters take the form:

```
cdu31a_port=<io−address> cdu31a_irq=<interrupt>
```

The base io−address is required while the interrupt number is optional.

The device file can be created using:

```
# mknod /dev/cdu31a b 15 0
```

See the file cdu31a for more information on this driver.

Also see the web page put together by Jeffrey Oxenreider (zureal@infinet.com) that covers a lot of common problems with these drives. It can be found at http://lemures.shinma.symix.com/~zureal/cdu31a.html.

Aztcd Driver

```
       Principal author: Werner Zimmermann (zimmerma@rz.fht-esslingen.de)
  Multi-session support: yes
 Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto-probing: no
            Device file: /dev/aztcd0, major 29
     Configuration file: aztcd.h
   Kernel config option: Aztech/Orchid/Okano/Wearnes (non IDE) CDROM support?
     Documentation file: aztcd
```

This driver accepts a kernel command line of the form:

```
aztcd=<io-address>
```

where the parameter is the I/O base address of the card (e.g. 0x340).

The device file can be created using:

```
# mknod /dev/aztcd0 b 29 0
```

Note that this driver is for the CDA268−01A only. Other models, including the CDA268−03I and CDA269−031SE are not proprietary and should use the IDECD (ATAPI) kernel driver.

See the file aztcd for more information on this driver.

Gscd Driver

```
       Principal author: Oliver Raupach (raupach@nwfs1.rz.fh−hannover.de)
   Multi−session support: no
  Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: no
            Device file: /dev/gscd0, major 16
     Configuration file: gscd.h
   Kernel config option: Goldstar R420 CDROM support?
     Documentation file: gscd
```

This driver accepts a kernel command line of the form:

```
gscd=<io−address>
```

specifying the I/O base address of the card (e.g. 0x340).

The device file can be created using:

```
# mknod /dev/gscd0 b 16 0
```

See the file gscd and the world−wide web site http://linux.rz.fh−hannover.de/~raupach/ for more information on this driver.

Mcd Driver

```
       Principal author: Martin  (martin@bdsi.com)
    Multi−session support: no
  Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: no
            Device file: /dev/mcd, major 23
     Configuration file: mcd.h
   Kernel config option: Standard Mitsumi CDROM support?
     Documentation file: mcd
```

This is the older driver for Mitsumi drivers that has been available for some time. You might want to try the newer `mcdx` driver, which has some new features but is possibly less stable.

This driver accepts a kernel command line of the form:

```
mcd=<io-address>,<irq>
```

specifying the I/O base address of the card (e.g. 0x340) and the IRQ request number used.

The device file can be created using:

```
# mknod /dev/mcd b 23 0
```

See the file mcd for more information on this driver.

Mcdx Driver

```
       Principal author: Heiko Schlittermann
  Multi−session support: yes
 Multiple drive support: yes
Loadable module support: yes
   Reading audio frames: no (not supported by hardware)
           Auto−probing: no
            Device file: /dev/mcdx0, major 20
     Configuration file: mcdx.h
   Kernel config option: Experimental Mitsumi support?
     Documentation file: mcdx
```

This is a newer driver for Mitsumi drivers. The older and possibly more stable `mcd` driver is still available.

This driver accepts a kernel command line of the form:

```
mcdx=<io-address>,<irq>
```

specifying the I/O base address of the card (e.g. 0x340) and the IRQ request number used.

The device file can be created using:

```
# mknod /dev/mcdx0 b 20 0
```

If you recently bought a Mitsumi CD−ROM drive, don't assume that it should use this kernel driver. New Mitsumi drives are now EIDE/ATAPI compatible and should use the idecd kernel driver instead.

See the file mcdx for more information on this driver.

Cm206 Driver

```
       Principal author: David A. van Leeuwen (david@tm.tno.)
  Multi−session support: yes
 Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: yes
            Device file: /dev/cm206cd, major 32
     Configuration file: cm206.h
   Kernel config option: Philips/LMS CM206 CDROM support?
     Documentation file: cm206
```

The driver accepts a kernel command line of the form:

```
cm206=<io−address>,<interrupt>
```

where the first number is the I/O base address of the card (e.g. 0x340). The second is the interrupt channel.

The device file can be created using:

```
# mknod /dev/cm206cd b 32 0
```

See the file cm206 for more information on this driver.

Optcd Driver

```
       Principal author: Leo Spiekman (spiekman@dutette.et.tudelft.nl)
  Multi−session support: yes
 Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: no
            Device file: /dev/optcd0, major 17
     Configuration file: optcd.h
   Kernel config option: Experimental Optics Storage ... CDROM support?
     Documentation file: optcd
```

The driver accepts a kernel command line of the form

```
optcd=<io−address>
```

to specify the I/O base address of the card (e.g. 0x340).

The device file can be created using:

```
# mknod /dev/optcd0 b 17 0
```

See the file optcd for more information on this driver.

Sjcd Driver

```
       Principal author: Vadim V. Model (vadim@rbrf.msk.su)
  Multi−session support: no
 Multiple drive support: no
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: no
            Device file: /dev/sjcd, major 18
     Configuration file: sjcd.h
   Kernel config option: Experimental Sanyo H94A CDROM support?
     Documentation file: sjcd
```

The driver accepts a kernel command line of the form:

```
sjcd=<io−address>,<interrupt>,<dma>
```

indicating the base address, interrupt, and DMA channel to be used (e.g. sjcd=0x340,10,5).

The device file can be created using:

```
# mknod /dev/sjcd b 18 0
```

See the file sjcd for more information on this driver.

Paride Driver

```
       Principal author: Grant R. Guenther (grant@torque.net)
  Multi−session support: no
 Multiple drive support: yes
Loadable module support: yes
```

```
   Reading audio frames: no
           Auto−probing: yes
            Device file: /dev/pcd0, major 46
     Configuration file: bpcd.h
   Kernel config option: Parallel port IDE device support?
     Documentation file: paride.txt
```

This is the driver for various types of storage devices that attach to a parallel port. Normally the driver will auto−detect the parallel port device. The documentation describes parameters that can be used to specify the device parameters if auto−detection does not work.

The device file for the first drive can be created using:

```
       # mknod /dev/pcd0 b 46 0
```

See the file /usr/src/linux/Documentation/paride.xt for more information on this driver. Note that this replaces the bpcd driver that was present in older kernels.

SCSI Driver

```
       Principal author: David Giller
  Multi−session support: yes (depending on drive)
 Multiple drive support: yes
Loadable module support: yes
   Reading audio frames: no
           Auto−probing: yes
            Device file: /dev/scd0, major 11
     Configuration file: cdrom.h
   Kernel config option: SCSI CDROM support?
     Documentation file: scsi.txt
```

There are kernel command line option specific to each type of SCSI controller. See the SCSI HOWTO for more information.

Multiple drives are supported (up to the limit of the maximum number of devices on the SCSI bus). Create device files with major number 11 and minor numbers starting at zero:

```
       # mknod /dev/scd0 b 11 0
       # mknod /dev/scd1 b 11 1
```

While the kernel driver itself does not support reading digital audio frames, some SCSI drives have the capability and will work with the cdda2wav program (which uses the generic SCSI kernel interface).

Also see the discussion of the IDE SCSI emulation driver earlier in this document.

IDECD Driver

```
       Principal author: Scott Snyder (snyder@fnald0.fnal.gov)
   Multi−session support: yes
  Multiple drive support: yes
 Loadable module support: no
    Reading audio frames: yes (on supported drives)
            Auto−probing: yes
             Device file: /dev/hd{a,b,c,d},  major 22
      Configuration file: cdrom.h
    Kernel config option: Include support for IDE/ATAPI CDROMs?
      Documentation file: ide−cd
```

This is the driver for ATAPI CD−ROMS. The driver accepts a kernel command line of the form

```
       hdx=cyls,heads,sects,wpcom,irq
         or
       hdx=cdrom
```

where `hdx` can be any of {hda,hdb,hdc,hdd}, or simply hd, for the "next" drive in sequence. Only the first three parameters are required (cyls,heads,sects). For example `hdc=1050,32,64 hdd=cdrom`.

Getting the IDE driver to recognize your CD−ROM drive can be tricky, especially if you have more than 2 devices or more than one IDE controller. Usually all that is required is to pass the right command line options from LILO. The file /usr/src/linux/Documentation/cdrom/ide−cd explains how to do this. Read it carefully.

Recent Linux kernels have better support for multiple IDE devices. If you have problems with an older kernel, upgrading may help.

Some IDE controllers have hardware problems which the kernel driver can work around. You may need to pass additional parameters to the driver to enable this. See the documentation for details.

4.4 Booting the Linux Kernel

You can now reboot with the new kernel. Watch for a message such as the following indicating that the CD−ROM has been found by the device driver (the message will vary depending on the drive type):

```
       hdd: NEC CD−ROM DRIVE:282, ATAPI CDROM drive
```

If the bootup messages scroll by too quickly to read, you should be able to retrieve them using `dmesg` or `tail /var/log/messages`.

If the drive is not found, then a problem has occurred, See the section on troubleshooting.

4.5 Mounting, Unmounting, and Ejecting Devices

To mount a CD−ROM, insert a disc in the drive, and run the `mount` command as `root` (this assumes you created a symbolic link to your device file as recommended above and that an empty directory /mnt/cdrom exists):

```
# mount −t iso9660 −r /dev/cdrom /mnt/cdrom
```

The CD can now be accessed under the directory /mnt/cdrom.

There are other options to the mount command that you may wish to use; see the `mount(8)` man page for details.

You can add an entry to /etc/fstab to automatically mount a CD−ROM when Linux boots or to specify parameters to use when it is mounted; see the `fstab(5)` man page.

Note that to play audio CDs you should *not* try to mount them.

To unmount a CD−ROM, use the `umount` command as `root`:

```
# umount /mnt/cdrom
```

The disc can only be unmounted if no processes are currently accessing the drive (including having their default directory set to the mounted drive). You can then eject the disc. Most drives have an eject button; there is also a standalone eject program that allows ejecting CD−ROMs under software control.

Note that you should not eject a disc while it is mounted (this may or may not be possible depending on the type of drive). Some CD−ROM drivers can automatically eject a CD−ROM when it is unmounted and insert the CD tray when a disc is mounted (you can turn this feature off when compiling the kernel or by using a software command).

Its possible that after playing an audio CD you may not be able to mount a CD−ROM. You need to send a CD audio "stop" command (using a CD player program) before trying the mount. This problem only appears to occur with the SBPCD driver.

Recent kernels support a kernel−based automounter which provides transparent mounting of removable media including CD−ROM. You can find the tools needed to use it at ftp://ftp.kernel.org/pub/linux/daemons/autofs/.

4.6 Troubleshooting

If you still encounter problems after following the instructions in the HOWTO, here are some things to check. The checks are listed in increasing order of complexity. If a check fails, solve the problem before moving to the next stage.

Step 1: Make sure you are really running the kernel you compiled

You can check the date stamp on the kernel to see if you are running the one that you compiled with CD−ROM support. You can do this with the `uname` command:

```
% uname −a
Linux fizzbin 2.2.4 #1 Tue Mar 232 11:23:21 EST 1999 i586 unknown
```

or by displaying the file /proc/version:

```
% cat /proc/version
Linux version 2.2.4 (root@fizzbin) (gcc version 2.7.2.3) #1 Tue Mar 23 11:23:21 EST 1999
```

If the date stamp doesn't match when you compiled the kernel, then you are running an old kernel. Did you remember to reboot? If you use LILO, did you re−install it (typically by running /sbin/lilo)? If booting from floppy, did you create a new boot floppy and use it when booting?

Step 2: Make sure the proper kernel drivers are compiled in

You can see what drivers are compiled in by looking at /proc/devices:

```
% cat /proc/devices
Character devices:
 1 mem
 2 pty
 3 ttyp
 4 ttyS
 5 cua
 7 vcs

Block devices:
 3 ide0
22 ide1
```

First look for your CD−ROM device driver. These are all block devices, in this case we can see that the `idecd` driver with major number 22 was present.

Also make sure that ISO−9660 filesystem support was compiled in, by looking at /proc/filesystems:

```
% cat /proc/filesystems
        ext2
nodev   proc
nodev   devpts
        vfat
        iso9660
```

You can also see what i/o port addresses are being used by a driver with the file /proc/ioports:

```
howto % cat /proc/ioports
 ...
0230−0233 : sbpcd
 ...
```

If any of the drivers you thought you compiled in are not displayed, then something went wrong with the kernel configuration or build. Start the installation process again, beginning with configuration and building of the kernel.

Step 3: Did the kernel detect your drive during booting?

Make sure that the CD−ROM device was detected when the kernel booted. You should have seen a message on bootup. If the messages scrolled off the screen, you can usually recall them using the `dmesg` command:

```
% dmesg
```

or

```
% tail /var/log/messages
```

If your drive was not found then something is wrong. Make sure it is powered on and all cables are connected. If your drive has hardware jumpers for addressing, check that they are set correctly (e.g. drive 0 if you have only one drive). ATAPI CD−ROMS must be jumpered as "single" or "master", and not "slave" when only one IDE device is attached to an interface. If the drive works under DOS then you can be reasonably confident that the hardware is working.

Many kernel drivers using auto−probing, but some do not, and in any case the probing is not always reliable. Use the kernel command line option listed for your kernel driver type. You may want to try several different values if you are not sure of the i/o address or other parameters. LILO can be (and usually is) configured to allow you to enter the parameters manually when booting.

Another possibility is that you used the wrong kernel driver for your CD−ROM driver. Some documentation may refer to proprietary interfaces as IDE, leading some to mistakenly believe they are ATAPI drives.

Another possibility is that your drive (or interface card) is one of the "compatible" type that requires initialization by the DOS driver. Try booting DOS and loading the vendor supplied DOS device driver. Then soft boot Linux using `Control−Alt−Delete`.

If your drive is not listed in this document, it is possible that there are no drivers for it available under Linux. You can check with some of the references listed at the end of this document for assistance.

Step 4: Can you read data from the drive?

Try reading from the CD−ROM drive. Typing the following command should cause the drive activity light (if present) to come on and no errors should be reported. Use whatever device file is appropriate for your drive and make sure a CD−ROM is inserted; use Control−C to exit.

```
# dd if=/dev/cdrom of=/dev/null bs=2048
^C
124+0 records in
124+0 records out
```

If this works, then the kernel is communicating with the drive and you can move on to step 5.

If not, then a possible cause is the device file. Make sure than the device file in the /dev directory has the correct major and minor numbers as listed previously for your drive type. Check that the permissions on the device file allow reading and writing.

A remote possibility is a hardware problem. Try testing the drive under another operating system, if possible, to determine if this could be the case.

Step 5: Can you mount the drive?

If you can read from the drive but cannot mount it, first verify that you compiled in ISO−9660 file system support by reading /proc/filesystems, as described previously.

Make sure you are mounting the drive with the "−t iso9660" and "−r" options and that a known good ISO−9660 CD−ROM (not Audio CD) is inserted in the drive. You normally must mount drives as user `root`.

Make sure that the mount point exists and is an empty directory.

If you are automatically mounting the CD−ROM on bootup, make sure that you have correct entries in the /etc/fstab file.

If you are running the syslog daemon, there may be error messages from the kernel that you are not seeing. Try using the "dmesg" command:

```
% dmesg
SBPCD: sbpcd_open: no disk in drive
```

There may also be errors logged to files in /var/log, depending on how your system is configured.

Debugging Audio Problems

If the drive works with CD−ROMs, but not for playing audio CDs, here are some possible solutions.

You need an application program to play audio CDs. Some applications may be broken or may not be compatible with your drive. Try other applications and/or try recompiling them yourself. A good place to look for software is ftp://metalab.unc.edu/pub/Linux/apps/sound/cdrom/.

A few of the CD−ROM drivers do not support playing Audio CDs. Check the documentation file or source code to see if that is the case.

Check if the audio can be played through the headphone jack. If so, then the problem is likely related to your sound card. Use a mixer program to set the input device and volume levels. Make sure you have installed an audio cable from the CD−ROM drive to the sound card. Make sure that the kernel sound card driver is installed and working (see the Sound HOWTO).

When All Else Fails

If you still have problems, here are some final suggestions for things to try:

- carefully re−read this HOWTO document
- read the references listed at the end of this document, especially the relevant kernel source files
- post a question to one of the `comp.os.linux` or other usenet newsgroups
- send a question to the Linux mailing list
- try using the latest Linux kernel
- contact your computer dealer
- contact the CD−ROM manufacturer
- send mail to the maintainer of the relevant kernel driver (look in the file /usr/src/linux/MAINTAINERS)

- send mail to me
- fire up emacs and type `Esc−x doctor` :−)

5.Applications

This section briefly lists a few of the many applications related to CD−ROM that are available under Linux. Check the Linux Software Map for the latest versions and archive sites.

5.1 Audio CD Players

Several programs are available for playing audio CDs, either through a headphone jack or an attached sound card.

Workman

a graphical player running under X11 and supporting a CD database and many other features

WorkBone

an interactive text−mode player

xcdplayer

a simple X11 based player

cdplayer

a very simple command line based player

Xmcd

an X11/Motif based player

xmitsumi

another X11 based player for Mitsumi drives

xplaycd

another X11 based player, bundled with sound mixer and VU meter programs

cdtool

command line tools for playing audio CDs

Some of these programs are coded to use a specific device file for the CD−ROM (e.g. /dev/cdrom). You may be able to pass the correct device name as a parameter, or you can create a symbolic link in the /dev directory. If sending the CD output to a sound card, you may wish to use a mixer program to set volume settings or select the CD−ROM input for recording.

5.2 PhotoCD

PhotoCDs use an ISO−9660 file system containing image files in a proprietary format. Not all CD−ROM drives support reading PhotoCDs.

The `hpcdtoppm` program by Hadmut Danisch converts PhotoCD files to the portable pixmap format. It can be obtained from ftp://ftp.gwdg.de/pub/linux/hpcdtoppm or as part of the PBM (portable bit map) utilities, available on many archive sites (look for "pbm" or "netpbm").

The `photocd` program by Gerd Knorr (kraxel@cs.tu−berlin.de) can convert PhotoCD images into Targa or Windows and OS/2 bitmap files.

The same author has written the program `xpcd`, an X11−based program for handling PhotoCD images. You can select the images with a mouse, preview the image in a small window, and load the image with any of the five possible resolutions. You can also mark a part of the Image and load only the selected part. Look for these packages at ftp://ftp.cs.tu−berlin.de/pub/linux/Local/misc/.

The ImageMagick image file manipulation program also supports PhotoCD files. It is available from ftp://ftp.x.org/contrib/applications/ImageMagick/.

5.3 Mkisofs

Eric Youngdale's `mkisofs` package allows creating an ISO−9660 file system on a hard disk partition. This can then be used to assist in creating and testing CD−ROM file systems before mastering discs.

The tools for actually writing data to writable CD−ROM drives tend to be vendor specific. They also require writing the data with no interruptions, so a multitasking operating system like Linux is not particularly well suited.

5.4 ISO−9660 Utilities

These are some utilities for verifying the format of ISO−9660 formatted discs; you may find them useful for testing suspect CDs. The package can be found at ftp://ftp.cdrom.com/pub/unixfreeware/archive/. They were written by Bill Siegmund and Rich Morin.

6.Answers to Frequently Asked Questions

6.1 How can a non−root user mount and unmount discs?

Most `mount` commands support the *user* option. If you make an entry such as the following in /etc/fstab:

```
/dev/sbpcd  /mnt/cdrom   iso9660     user,noauto,ro
```

then an ordinary user will be allowed to mount and unmount the drive using these commands:

```
% mount /mnt/cdrom
% umount /mnt/cdrom
```

By default the disc will be mounted with some options that help enforce security (e.g. programs cannot executed, device files are ignored). If this is too restrictive you can use additional options (e.g. the "exec" option will enable execution or programs). See the mount(8) man page for details.

Another method is to get the `usermount` package which allows non−root users to mount and unmount removable devices such as floppies and CD−ROMs, but restricts access to other devices (such as hard disk partitions). It is available on major archive sites.

The archive site `ftp.cdrom.com` has the source file `mount.c` which allows mounting an unmounting of CD−ROMs (only) by normal users. It runs as a setuid executable.

6.2 Why do I get device is busy when unmounting a CD−ROM?

The disc cannot be unmounted if any processes are accessing the drive, including having their default directory set to the mounted filesystem. If you cannot identify the processes using the disc, you can use the `fuser` command, as shown in the following example.

```
% umount /cdrom
umount: /dev/hdd: device is busy
```

```
% fuser -v /cdrom
                     USER       PID ACCESS COMMAND
/mnt/cdrom           tranter    133 ..c..  bash
```

On some systems you may need to be root when running the `fuser` command in order to see the processes of other users.

6.3 How do I export a CD−ROM to other hosts over NFS?

You need to add an entry to the /etc/exports file. Users on other machines will then be able to mount the device. See the `exports(5)` man page for details.

6.4 Can I boot Linux from a CD−ROM?

When initially installing Linux the most common method is to use a boot floppy. Some distributions allow booting a Linux kernel on CD directly from DOS.

With the right CD−ROM, ROM BIOS, and ATAPI CD−ROM drive it is possible to boot directly from CD. The latest version of `mkisofs` supports creating such disks using the El Torito standard for bootable CDs.

6.5 How can I read digital data from audio CDs?

Heiko Eissfeldt (heiko@colossus.escape.de) and Olaf Kindel have written a utility that reads audio data and saves it as `.wav` format sound files. The package is called `cdda2wav.tar.gz` and can be found on `metalab.unc.edu`.

Another utility to extract digital audio is `cdparanoia` available from http://www.mit.edu/afs/sipb/user/xiphmont/cdparanoia.

Because CD−ROM drives are changing very quickly, it is difficult to list which models support reading digital data. You best bet is to get the latest `cdda2wav` or `cdparanoia` package and read the documentation.

For more information on this subject, see the web site http://www.tardis.ed.ac.uk/~psyche/cdda/ and the alt.cd−rom FAQ listed in the references section.

6.6 Why doesn't the find command work properly?

On ISO−9660 formatted discs without the Rock Ridge Extensions, you need to add the `−noleaf` option to the `find` command. See the find(1) man page for details.

(In my experience virtually all recent Linux CDs use the Rock Ridge extensions, so this problem should occur very rarely.)

6.7 Does Linux support any recordable CD−ROM drives?

The X−CD−Roast package for Linux is a graphical front−end for using CD writers. The package can be found at metalab.unc.edu in /pub/Linux/utils/disk−management/xcdroast−0.95.tar.gz

Also see the Linux CD−Writing HOWTO document, found at ftp://metalab.unc.edu/pub/Linux/docs/HOWTO/CD−Writing−HOWTO or http://metalab.unc.edu/LDP/HOWTO/CD−Writing−HOWTO.html.

6.8 Why do I get mount: Read−only file system when mounting a CD−ROM?

CD−ROM is a read−only media. With some early kernels you could mount a CD−ROM for read/write; attempts to write data to the CD would simple be ignored. As of kernel version 1.1.33 this was corrected so that CD−ROMs must be mounted read only (e.g. using the −r option to mount).

6.9 Why does the disc tray open when I shut down the system?

The sbpcd driver supports automatically ejecting the CD when it is unmounted. In some older kernel versions this was the default behaviour. If you shut down the system, a mounted CD will be unmounted, causing it to eject.

This feature is for convenience when changing discs. If the tray is open when you mount or read a CD, it will also automatically be closed.

I found that this caused problems with a few programs (e.g. cdplay and workbone). As of the 1.1.60 kernel you can control this feature under software control. A sample program is included in the sbpcd documentation file (or use the eject program). You can also control the default behaviour by editing the kernel source file sbpcd.h.

6.10 I have a "special" CD that can't be mounted

The "special" CD is likely an XA disc (like all Photo CDs or "one−offs" created using CD−R drives). Most of the Linux kernel CD−ROM drivers do not support XA discs, although you may be able to find a patch to add support on one of the archive sites.

The sbpcd driver *does* support XA. If you are using this driver you can determine if the disc is XA using the following procedure: go into the file sbpcd.c and enable the display of the "Table of Contents" (DBG_TOC). Build and install the new kernel and boot from it. During each mount the TOC info will be written (either to the console or to a log file). If the first displayed value in the TOC header line is "20", then it is an XA disc. That byte is "00" with normal disks. If the TOC display shows different tracks, that is also a sign that it is an XA disc.

(thanks to Eberhard Moenkeberg for the above information)

Other possibilities for unreadable CDs are:

1. The disc doesn't use an ISO−9660 file system (e.g. some use SunOS or HFS)
2. It is an audio CD
3. The CD is damaged or defective
4. You put it in the drive upside down :−)

6.11 Do multi−platter CD−ROM drives work with Linux?

Several users have reported success with SCSI multi−disc CD−ROM changers. You probably need to enable the "Probe all LUNs on each SCSI device" kernel configuration option (this is not necessary if your CD changer is already known to the SCSI−driver. Have a look at /usr/src/linux/drivers/scsi.c).

At least one user also had to increase a SCSI timeout value in the kernel driver. A symptom of this is an error message like "wrong fs type, bad option, bad superblock on /dev/sr5, or too many mounted file systems" when trying to mount a CD for the first time, but a second mount immediately afterwards succeeds. To increase the timeout increase the value of IOCTL_TIMEOUT at the beginning of /usr/src/linux/drivers/scsi/sr_ioctl.c and recompile the kernel. A value of 10000 instead of the default 3000 is reported to work with a NEC Multispin 4Xc.

It might be necessary to create additional block special files, so that all LUNs can be accessed. A device file is needed for every LUN. So for a 7 disc changer `/dev/sr0` to `/dev/sr6` are needed (more if you have additional SCSI CD−ROM drives). To create the block special file execute `mknod /dev/sr? b 11 ?` as root with ? being the required number.

The Nakamichi MBR−7 7 disc changer, NEC Multispin 4Xc and Pioneer 12 disc changer have been reported to work.

EIDE/ATAPI multi−disc changers are also available. The kernel has support for some drives using the CDROM_SELECT_DISC ioctl function. The IDE−CD kernel driver documentation file includes source code for a program to select changer slots, or you can use various utilities such as the `eject` program described earlier.

6.12 I get "/cdrom: Permission denied" errors

Some CDs have root directory file permissions that only allow user `root` to read them. This is an error on the part of the CD−ROM vendor and is a real inconvenience. A more common occurrence is for certain files or directories not to be world readable. Some people have patched their kernels to work around the problem.

Also see the related question on hidden files later in this document.

6.13 How do I interpret IDE CD kernel error messages?

What does it mean when I get a kernel message from the IDE CD−ROM driver like "hdxx: code: xx key: x asc: xx ascq: x"?

This is an status/error message from the IDE CD−ROM drive. By default the IDECD driver prints out the raw information instead of wasting kernel space with error messages. You can change the default to display the actual error messages by going into /usr/src/linux/drivers/block/ide−cd.c, changing the value of VERBOSE_IDE_CD_ERRORS to 1, and recompiling the kernel.

6.14 How can I tell what speed CD−ROM I have?

Here's one way. This command measures how long is takes to read 1500K of data from CD:

```
% time -p dd if=/dev/cdrom of=/dev/null bs=1k count=1500
1500+0 records in
1500+0 records out
real 5.24
user 0.03
sys 5.07
```

The transfer rate of single speed drives is 150 kilobytes per second, which should take about 10 seconds. At double speed it would take five seconds, quad speed would take 2.5, etc.

The "real" time above is probably the best number to look at −− in this case it indicates a double speed drive. You can increase the amount of data transferred to get a more accurate value (in case you were wondering, the data does not get cached). You should probably run the command a few times and take the average.

I've also written a small C program that measures and reports CD−ROM data transfer rate; I can send it to you on request.

6.15 My CD−ROM stopped working after Linux was installed

The usual symptom is that the boot disk used to initially install Linux recognized your CD−ROM drive, but after Linux was installed on the hard drive or floppy and rebooted it no longer recognizes the CD−ROM.

The most common reason for this problem is that with some Linux distributions the kernel that is installed on your hard drive (or floppy) is not necessarily the same one that was on your boot disk. You selected a boot disk that matched your CD−ROM hardware, while the kernel you installed is a "generic" kernel that is lacking CD−ROM support. You can verify this by following the troubleshooting guidelines discussed previously in this document (e.g. start by checking /proc/devices).

The solution is to recompile the kernel, ensuring that the drivers for your CD−ROM drive and any others that are needed (e.g. SCSI controller, ISO−9660 file system) are included. See the Kernel HOWTO if you don't know how to do this.

If you passed any command line options to the boot disk (e.g. "hdc=cdrom") you need to add these to your boot program configuration file (typically /etc/lilo.conf).

6.16 There are "hidden" files on a CD which I can't read

Some CDs have files with the "hidden" bit set on them. Normally these files are not visible. If you mount the CD with the "unhide" option then the files should be accessible (this doesn't seem to be documented anywhere).

6.17 Where is the CD−ROM API documented?

If you want to write your own application, such as an audio CD player program, you will need to understand the application programming interface (API) provided by Linux.

Originally the CD−ROM kernel drivers used their own ioctl() functions to support features specific to each drive. Header files such as /usr/include/linux/sbpcd.h describe these. Because many of the drivers were based on other drivers, the interfaces, while not identical, have a lot in common.

More recently there has been an initiative headed by David van Leeuwen (david@tm.tno.nl) to standardize the API for CD−ROM drives, putting common code in one place and ensuring that all drivers exhibit the same behaviour. This is documented in the file /usr/src/linux/Documentation/cdrom/cdrom−standard.tex. Several kernel drivers support this. As of the 2.0 kernel all CD−ROM drivers conform to this API.

My book, *Linux Multimedia Guide*, goes into quite a bit of detail on how to program CD−ROM drives, especially for audio functions. See the end of the References section.

6.18 Why don't I see long filenames on this Windows CD−ROM?

If you have a CD−ROM which has long filenames under Windows but not under Linux, it may be formatted using Microsoft's proprietary Joliet filesystem. See the next question for a solution.

6.19 Is Microsoft's Joliet filesystem supported?

Microsoft has created an extension to the ISO CD−ROM format called Joliet. It allows for long filenames encoded using the 16−bit UNICODE format.

Starting with version 2.0.34 the Linux kernel has support for the Microsoft Joliet file system extensions. You need to enable support for it in the kernel.

If you want to display filenames with native language characters from Joliet CD−ROMs correctly on the screen, you need to enable support in the kernel for the appropriate NLS ISO8859 character sets.

6.20 Does Linux support "enhanced" CDs?

Some audio CDs are "enhanced" with additional data. Typically you will find that these CDs have the usual audio CD tracks as well as a data track which can be mounted as an ISO−9660 file system.

An enhanced CD I examined had Microsoft Windows and Apple Macintosh applications on it (which won't run directly under Linux of course, although I had partial success running the Windows application under the WINE Windows emulator). There were some GIF images which could be viewed using a standard viewer such as `xv` and some animations in Apple QuickTime format which could be viewed using the `xanim` program. It was a multisession disk which some very old CD−ROM drives do not support reading. On the disc was a `readme.txt` file containing an Enhanced CD FAQ.

6.21 Does Linux support DVD−ROM?

SCSI and ATAPI compliant DVD−ROM drives should work under Linux for reading discs formatted with an ISO−9660 file system. In other words they will work as a (possibly large) CD−ROM drive.

Many DVD−ROM discs use the UDF file system. At the time of writing this was still in development. Kernel patches were available from http://trylinux.com/projects/udf/.

However, I am not aware of any support for playing MPEG−2 encoded DVD videos either in software or in conjunction with DVD decoder hardware. Apparently the standard document for the encoding format can only be obtained at a high cost and under a non−disclosure agreement. Another issue is that MPEG decoding typically uses proprietary hardware for which the vendor may not be willing to release programming information. These factors may preclude any freely available DVD video software being developed for Linux.

6.22 Does Linux support CD−RW?

SCSI and ATAPI compliant CD−RW drives should work under Linux for discs formatted with an ISO−9660 file system. This includes the ability to write to the disc.

Many CD−RW discs use the UDF file system. At the time of writing this was still in development. Kernel patches were available from http://trylinux.com/projects/udf/.

7.References

I have already mentioned the documentation files, typically installed in /usr/src/linux/Documentation/cdrom. These can be a gold mine of useful information.

The following Usenet FAQs are posted periodically to news.answers and archived at Internet FTP sites such as ftp://rtfm.mit.edu/:

- alt.cd−rom FAQ
- comp.periphs.scsi FAQ
- Enhanced IDE/Fast−ATA/ATA−2 FAQ

Several other Linux HOWTOs have useful information relevant to CD−ROM:

- SCSI HOWTO
- Hardware Compatibility HOWTO
- Sound HOWTO
- Kernel HOWTO
- Distribution HOWTO
- CD Writing HOWTO

At least a dozen companies sell Linux distributions on CD−ROM; most of them are listed in the Distribution HOWTO.

The following Usenet news groups cover CD−ROM related topics:

- comp.publish.cdrom.hardware
- comp.publish.cdrom.multimedia
- comp.publish.cdrom.software
- comp.sys.ibm.pc.hardware.cd−rom
- alt.cd−rom
- alt.cd−rom.reviews

The `comp.os.linux` newsgroups are also good sources of Linux specific information.

There is a large archive of CD−ROM information and software at ftp://ftp.cdrom.com/pub/cdrom/.

A FAQ document on IDE and ATA devices can be found at ftp://rtfm.mit.edu/pub/usenet/news.answers/pc−hardware−faq/enhanced−IDE/ and at http://www.seagate.com/techsuppt/faq/faqlist.html.

Western Digital, the company that started the IDE protocol, has information available on the IDE protocol available on their FTP site at ftp://fission.dt.wdc.com/pub/standards/atapi.

A web site dedicated to multimedia can be found at http://viswiz.gmd.de/MultimediaInfo/. Creative Labs has a web site at http://www.creaf.com/.

The *Linux Software Map* (LSM) is an invaluable reference for locating Linux software. The LSM can be found on various anonymous FTP sites, including ftp://metalab.unc.edu/pub/Linux/docs/LSM/ (formerly known as sunsite). There are also various web sites that maintain databases of Linux applications. One such site is http://www.freshmeat.net.

The Linux mailing list has a number of "channels" dedicated to different topics. To find out how to join, send a mail message with the word "help" as the message body to majordomo@vger.rutgers.edu

The Linux Documentation Project has produced several books on Linux, including *Linux Installation and Getting Started*. These are freely available by anonymous FTP from major Linux archive sites or can be purchased in hardcopy format.

Finally, a shameless plug: If you want to learn a lot more about multimedia under Linux (especially CD−ROM and sound card applications and programming), check out my book *Linux Multimedia Guide*, ISBN 1−56592−219−0, published by O'Reilly and Associates. As well as the original English version, French and Japanese translations are now in print. For details, call 800−998−9938 in North America or check the web page http://www.ora.com/catalog/multilinux/noframes.html or my home page http://www.pobox.com/~tranter/.
