The Linux CD-ROM HOWTO

Jeff Tranter, jeff_tranter@mitel.com v1.8, 10 June 1996

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.

Contents

1 Introduction

This is the Linux CD-ROM HOWTO document. 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 `README` files provided with the Linux kernel source code, the internet alt.cdrom newsgroup FAQ, and input from Linux users.

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

1.2 Revision History

Version 1.0

First version made publicly available

Version 1.1

CDU33A is explicitly supported as of 1.1.20 kernel; notes on Reveal FX; info on reading audio tracks; info on some alpha drivers; added troubleshooting section; a few other minor additions

Version 1.2

ISO-9660 file systems must be mounted read-only starting with 1.1.33 kernel; clarified that SB16 SCSI is supported and newer Aztech drives are not supported; references to photocd and xpcd programs; note on new sbpcd auto eject feature

Version 1.3

Minor change to the way SBPCD eject feature is disabled starting with the 1.1.49 kernel; added info on XA discs and how to identify them

Version 1.4

HOWTO now available in other languages; IBM and Longshine drives now supported by SBPCD; alpha driver for Aztech drives; CDU-33 driver no longer auto-probes, supports PhotoCD and audio; more than 2 SCSI drives are supported; new driver for IDE; reminder to check drive jumpers; can now set SBPCD auto-eject with IOCTL; list drivers with multisession support; question on flashing light on CDU-33

Version 1.5

A long overdue update (I've been busy); document placed under GPL; info on many new kernel drivers; more info on configuration and troubleshooting; lots of HTML links added; many other minor changes

Version 1.6

Added link to eject program; question on file permission patch; link to Creative Labs Web site; reference to ATA/EIDE FAQ and FTP site; note that many Creative Labs and Mitsumi drives are now EIDE; mention Supermount; drives listed as supporting digital data are obsolete, refer to cdda2wav; more info on writing CDs; multi-disc EIDE drive info; a few typos fixed

Version 1.7

new kernel version; most README files moved to /usr/src/linux/Documentation; some drivers are no longer experimental; a few more supported drives; emphasize that most drives are now IDE/ATAPI; added questions on Plug and Play support and identifying drive speed; vger mailing lists being shut down; other miscellaneous minor changes

Version 1.8

question on why CD-ROM stops working after install; aztcd driver now supports two CyCDROM drives; more pleading not to use SBPCD driver with IDE drives; some ATAPI multi-disc changer support; note on (lack of) support for parallel port drives; latest stable kernel is 2.0; other miscellaneous minor changes

1.3 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://sunsite.unc.edu/pub/Linux/docs/HOWTO/>`.

Hypertext versions of this and other Linux HOWTOs are available on many World-Wide-Web sites, including `<http://sunsite.unc.edu/mdw/mdw.html>`. Most Linux CD-ROM distributions include the HOWTOs, often under the `</usr/doc/>` directory, and you can also buy printed copies from several vendors.

A French translation of this document, by Bruno Cornec (cornec@stna7.stna.dgac.fr) is available at `<ftp://ftp.ibp.fr/pub2/linux/french/docs/HOWTO/>`.

A Japanese translation by Itsushi Minoura (minoura@uni.zool.s.u-tokyo.ac.jp) is available from `<http://yebisu.ics.es.osaka-u.ac.jp/linux/>`.

If you make a translation of this document into another language, let me know and I'll include a reference to it here.

1.4 Feedback

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

I am also willing to answer general questions on CD-ROM and Linux, as best I can. Before doing so, please read all of the information in this HOWTO, and send me detailed information about the problem.

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, Greg Hankins (gregh@sunsite.unc.edu), for more information.

1.5 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*), provide a transfer rate of approximately 150 kilobytes per second; these are now generally considered obsolete. Double speed drives (300 kilobytes per second) are widely available, and many users are now opting for quad speed (600 kilobytes per second) or higher.

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.).

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) have recently become available. They use a different media and specialized equipment for recording, but the resulting disc can be read by any CD-ROM drive.

In the future CD-ROM drive vendors are expected to offer technology that will increase storage capacity by an order of magnitude.

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 2.0.

This information is only valid for Linux on the Intel platform. Some information may be applicable to other processor architectures, but I have no first hand experience or information.

3.1 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 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.

3.2 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://sunsite.unc.edu/pub/Linux/kernel/patches/cdrom/>. Also check the README files included with the kernel distribution, usually installed /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	
Orchid	CDS-3110	aztcd	
Okano/Wearnes	CDD110	aztcd	
Conrad	TXC	aztcd	
CyCDROM	CR520ie	aztcd	
CyCDROM	CR940ie	aztcd	
GoldStar	R420	gscd	Note 4
Philips/LMS	CM206	cm206	Note 5
Mitsumi	CRMC LU005S	mcd/mcdx	Note 6, 7
Mitsumi	FX001	mcd/mcdx	Note 6, 7
Optics Storage	Dolphin 8000AT	optcd	
Lasermate	CR328A	optcd	
Sanyo	H94A	sjcd	
various	various	isp16	Note 8

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. May also be sold as part of a Reveal Multimedia Kit.
5. The Philips CM205 is not supported by this driver, but there is a separate alpha release driver available from ftp://sunsite.unc.edu in /pub/Linux/kernel/patches/cdrom/lmscd0.4.tar.gz
6. May also be sold under the Radio Shack name.
7. There are two drivers available. "mcd" is the original one, and "mcdx" is a new experimental driver with more features (but possibly less stable).
8. 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 the next section. *The 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.

3.3 ATAPI CD-ROM Drives

ATAPI (ATA Packet Interface) is a protocol for controlling mass storage devices, similar to SCSI. It builds on the ATA (AT Attachment) interface, the official ANSI standard name for 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.

3.4 Parallel Port Drives

Some vendors sell CD-ROM drives that attach to the PC parallel port. The standard Linux kernel does not support these drives, and I am not aware of anyone working on drivers.

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 README 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 (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. install over a network
2. boot DOS, and install the Linux files onto your hard disk
3. boot DOS, and create a set of floppies to install Linux
4. find someone who can build you a boot disk with the needed CD-ROM driver

The *Linux Installation HOWTO* `<http://sunsite.unc.edu/mdw/HOWTO/Installation-HOWTO.html>` 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* `<http://sunsite.unc.edu/mdw/HOWTO/Kernel-HOWTO.html>` 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 CD-ROM support (CONFIG_BLK_DEV_SR) [Y/n/m/?]
```

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

```
Adaptec AHA152X 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:

```
ISO9660 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* `<http://sunsite.unc.edu/mdw/HOWTO/Sound-HOWTO.html>` 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 do use modules is described in the modules documentation and the *Kernel HOWTO* `<http://sunsite.unc.edu/mdw/HOWTO/Kernel-HOWTO.html>`.

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* `<http://sunsite.unc.edu/mdw/HOWTO/Kernel-HOWTO.html>` 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 a Panasonic CD-ROM drive, the link would be created using

```
% ln -s /dev/sbpcd /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 and write, e.g.

```
% chmod 666 /dev/sbpcd
% ls -l /dev/sbpcd
brw-rw-rw-   1 root     disk      25,   0 Jul 18  1994 /dev/sbpcd
```

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.

4.3.1 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?
            README file: ide-cd
```

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, rendering the driver useless.

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. Please don't bug the author with questions about using this driver with IDE drives. I quote from the README file:

```
sbpcd really, really is NOT for ANY IDE/ATAPI drive!
Not even if you have an "original" SoundBlaster card with an IDE interface!
So, you better have a look into README.ide if your port address is 0x1F0,
0x170, 0x1E8, 0x168 or similar.
I get tons of mails from IDE/ATAPI drive users - I really can't continue
any more to answer them all. So, if your drive/interface information sheets
mention "IDE" (primary, secondary, tertiary, quaternary) and the DOS driver
invoking line within your CONFIG.SYS is using an address below 0x230:
DON'T ROB MY LAST NERVE - jumper your interface to address 0x170 and IRQ 15
(that is the "secondary IDE" configuration), set your drive to "master" and
use ide-cd as your driver. If you do not have a second IDE hard disk, use the
LILO commands
   hdb=noprobe hdc=cdrom
and get lucky.
To make it fully clear to you: if you mail me about IDE/ATAPI drive problems,
my answer is above, and I simply will discard your mail, hoping to stop the
flood and to find time to lead my 12-years old son towards happy computing.
```

4.3.2 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?
            README 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.

4.3.3 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?
            README 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.

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://www.infinet.com/ zureal/cdu31a.html>`.

4.3.4 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?
            README 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
```

See the file aztcd for more information on this driver.

4.3.5 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?
            README 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.

4.3.6 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?
            README 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 still considered experimental.

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.

4.3.7 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?
            README file: mcdx
```

This is a new and currently experimental 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. Some Mitsumi models are now EIDE/ATAPI drives and should use the idecd kernel driver.

See the file `mcdx` for more information on this driver.

4.3.8 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?
            README 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.

4.3.9 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?
            README 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.

4.3.10 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?
            README 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.

4.3.11 SCSI Driver

```
       Principal author: David Giller
  Multi-session support: yes (depending on drive)
 Multiple drive support: yes
Loadable module support: yes
   Reading audio frames: yes (depending on drive)
           Auto-probing: yes
            Device file: /dev/scd0, major 11
     Configuration file: cdrom.h
   Kernel config option: SCSI CDROM support?
            README file: none
```

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
```

4.3.12 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{b,c},  major 22
     Configuration file: cdrom.h
   Kernel config option: Include support for IDE/ATAPI CDROMs?
            README 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/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.

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):

```
SBPCD: Trying to detect a SoundBlaster CD-ROM drive at 0x230.
SBPCD: - Drive 0: CR-562-x (0.76)
SBPCD: 1 SoundBlaster CD-ROM drive(s) at 0x0230.
SBPCD: init done.
```

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

```
% mount -t iso9660 -r /dev/cdrom /mnt
```

The CD can now be accessed under the directory `/mnt`. Note that `/mnt` is commonly used as a temporary mount point; a more suitable name for a permanent installation might be something like `/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
```

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). The sbpcd driver 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.

Stephen Tweedie (sct@dcs.ed.ac.uk) has written the `Supermount` package which provides transparent mounting of removable media including CD-ROM. You can find it at `<ftp://sunsite.unc.edu/pub/linux/patches/diskdrives/>`.

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.

4.6.1 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 2.0.0 #1 Fri May 17 17:35:40 EDT 1996 i386
```

or by displaying the file `/proc/version`:

```
% cat /proc/version
Linux version 2.0.0 (root@fizzbin) (gcc version 2.7.0) #1 Fri May 17 17:35:40 EDT 1996
```

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

4.6.2 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
 4 tty
 5 cua
 6 lp
14 sound
```

```
15 Joystick

Block devices:
 2 fd
 3 hd
25 sbpcd
```

First look for your CD-ROM device driver. These are all block devices, in this case we can see that the `sbpcd` driver was present.

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

```
% cat /proc/filesystems
        ext2
        msdos
nodev   proc
        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.

4.6.3 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/adm/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.

4.6.4 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 DOS, if possible, to determine if this could be the case.

4.6.5 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 CD-ROM (not Audio CD) is inserted in the drive. You normally must mount drives as user `root`.

With ATAPI CD-ROM drives you may need to mount specifying a block size of 2048 bytes. Add the option "-o block=2048" to the mount parameters.

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/adm`, depending on how your system is configured.

4.6.6 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 few of the CD-ROM drivers do not support playing Audio CDs. Check the README 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. Mask 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).

4.6.7 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 README 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 author of the relevant kernel driver
- send mail to me
- fire up emacs and type `Esc-x doctor`

5 Applications

This section briefly lists some of the key 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 Inheriting File System

The Inheriting File System (IFS) is a kernel driver that allows mounting multiple file systems at the same point. It is similar to the Translucent File System provided under SunOS. By mounting a hard disk directory over a CD-ROM file system, you can effectively obtain a writable CD-ROM file system.

The current version is experimental and was written for the 0.99pl11 and pl12 kernels; it may or may not work with more recent revisions. The author is Werner Almesberger (almesber@bernina.ethz.ch).

A package called the user file system is another possible method of implementing similar functionality.

5.3 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/>`.

5.4 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.

5.5 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/cdrom/ptf/>`. 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?

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

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

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

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

The disc will be mounted with some options that ensure security (e.g. programs cannot executed, device files are ignored); in some cases this may be too restrictive.

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/sbpcd: device is busy
% fuser -v /cdrom
/cdrom:              USER       PID ACCESS COMMAND
                     tranter     50 ..c..  bash
```

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; see the `exports(5)` man page for details.

6.4 Can I boot Linux from a CD-ROM?

The easiest way to boot from CD-ROM is to use a boot floppy. Several of the Linux CD-ROM distributions (e.g. Yggdrasil) include one, or you can use the boot disk(s) from one of the Linux distributions (e.g. Slackware) that includes the necessary CD-ROM drivers for your system.

In the future it may be possible to boot from ATAPI CD-ROM drives which have the appropriate ROM BIOS functions.

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 `sunsite.unc.edu`.

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` package and read the documentation.

For more information on this subject, also see 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.

The reason for this is that the number of links for each directory file is not easily obtainable, so it is set to 2. The default behavior for the `find` program is to look for (i_links - 2) subdirectories in each directory, and it then assumes that the rest are regular files. The `-noleaf` switch disables this optimization.

6.7 Is the Reveal Multimedia Effects kit CD-ROM supported?

(The following was provided by Steve Horne Horne@cmod2.pfc.mit.edu. This only applies to certain Reveal drives; apparently newer ones are made by Panasonic and work fine with the sbpcd driver.)

About a year ago I bought a Reveal CD/soundcard kit, and managed to get my particular configuration to work under Linux. I posted the tricks I used to make the thing work; that note got into the CD-ROM HOWTO. Recently I've been receiving a couple of requests a week for help on making Reveal kits work under Linux.

I'm no expert. All I did was hammer away at Reveal Tech Support until they gave me the address of the appropriate port, then added the two SOUND-FX lines to the cdu31a driver. I don't know how to help most of the people who e-mail me. This is the note I plan to send them. It would be a good idea for you to condense it to the appropriate level for the HOWTO. In particular, I don't want anyone to get the impression that this is a good card to buy for a linux system. It's not.

REVEAL cards - under Linux

Summary:

- Don't buy one.
- If you already have one, and have a Sony drive, you can make the CD work.
- If you don't have a Sony drive, you can probably make the drive work, but I'm not certain, since I don't have that hardware.
- Sound support is poor. If Aztech would release programming information, there would be some hope.

Fine print:

If your kit has a Sony, the cdu31a driver will work for you. You need a kernel with cdu31a support compiled in. The following is from the comments in the cdu31a source code:

```
* WARNING -    All autoprobes have been removed from the driver.
*             You MUST configure the CDU31A via a LILO config
*             at boot time or in lilo.conf.  I have the
*             following in my lilo.conf:
*
*               append="cdu31a=0x1f88,0,PAS"
*
*             The first number is the I/O base address of the
*             card.  The second is the interrupt (0 means none).
*             The third should be "PAS" if on a Pro-Audio
*             spectrum, or nothing if on something else.
```

I expect the appropriate line for a Reveal card to be

```
append="cdu31a=0x654,0"
```

Since I don't consistently use LILO, I have just put the autoprobing back in by deleting the conditional stuff, and put my address first. (The file is `</usr/src/linux/drivers/cdrom/cdu31a.c>`; search for the string "cdu31a_addresses" to find the spot.)

THIS WILL NOT WORK IF YOUR KIT DOESN'T HAVE A SONY DRIVE! (I don't know that for sure, but I'd be very surprised if it did.)

By analogy to the Sony case, I expect that if you have a Panasonic or Mitsumi drive, you need to obtain from Reveal Tech Support the base register for your CD-ROM type, then use the appropriate driver. (I don't know if the sbpcd driver will work; it might. No matter what, you need those addresses.) I don't know if the "append=..." will work with the other drivers.

You can't patch the driver or lilo.conf until you have some sort of system up. If you are starting from scratch (DOS only, no Linux) here are a few things to try –

1. Copy the installation files to a DOS partition and install from there. This is foolproof but will require up to 90 MB of space in your DOS partition. Once the system is up you can use the above tricks. It's possible to bootstrap yourself up by installing only the A, AP, and D series (if you are using Slackware) plus a kernel source tree (Q ?). This will give you the tools to patch and build a kernel.

2. If you either have a Sony CD or are otherwise confident, have a friend make you a patched kernel – (autoprobes on, your address first.) Rdev it in the usual way:

   ```
   rdev  /dev/fd0 /dev/fd0              ; root=floppy
   rdev -r /dev/fd0 1440                ; ramdisk
   rdev -t /dev/fd0 -3                  ; prompt for screen mode
   ```

   Then use it to boot the installation root-disk. Make a mount point for the CD that won't interfere with the installation procedure:

```
# mkdir /cd
# mount -r -t iso9660 /dev/fd0 /cd
```

Then use the "install from mounted directory" option. Of course, the kernels in the distribution won't work for you; copy your custom kernel instead.

3. It's just barely possible (I haven't checked) that the new LOADLIN routine, which boots Linux from DOS, might save you. I believe it's possible to use it like LILO to pass data to the kernel, so it might work to boot DOS, then boot Linux, passing the hardware addresses to the driver via LOADLIN. I've never tried this.

Sound support:

This card (isc-400) isn't well supported by Linux, which is a shame because it seems to be a nice piece of hardware. The card will produce output in the 8-bit SB mode. I haven't made the mixer work, so recording doesn't work properly either. The MSS mode doesn't have an IRQ; I don't know how to tell the driver that, so that doesn't work. I haven't seen the AdLib compatibility work.

I have tried, and at least one other person has tried, to obtain programming information for the native mode(s) of the card. After many hours on the phone I was referred to Singapore. I passed at that point. When I get serious about sound again, I'll buy a genuine SoundBlaster card.

6.8 Does Linux support any recordable CD-ROM drives?

According to Adam J. Richter, adam@yggdrasil.com:

The Yggdrasil distribution can drive a Philips CD writer with an Adaptec 154x SCSI controller. I'm not sure which other SCSI controllers, if any, will work. You can use `mkisofs` to make an ISO-9660 filesystem and `cdwrite` to write it to the CD. If you want us to help you set this up, you can call us on our 900 technical support number: 1-900-446-6075 extension 835 (US$2.95/minute, U.S. only).

George Moody, george@hstbme.mit.edu reports:

I use 'mkisofs' (from tsx-11.mit.edu and other standard sources) and 'cdwrite' (from ftp.yggdrasil.com) to write CDs using the following configuration:

- Philips CDD522 CD recorder
- Seagate ST15150N hard disk (4.1 GB 'Barracuda' drive, not an AV drive)
- NCR B355 PCI SCSI controller (uses 53C810, praised as cheap and fast in the PCI-HOWTO)

The hard disk and the CD recorder are on the same SCSI bus. My system is a 100 MHz Pentium running Linux 1.2.12. I'm using the standard NCR PCI-SCSI driver, not one of the new alpha versions that are said to support disconnect/reconnect. I've been able to make CDs at 2x speed from image files in both ext2fs and MSDOS file systems (I haven't tried copying from a raw disk device, since I don't have a partition to spare). The only problem is that occasionally the system gets wedged *after* 'fixating' the CD; when this happens, I reboot the system and everything's OK, including the CD I've just written. I run 'cdwrite' as root, sometimes while running X11 and a few low-load X11 clients, but I try not to do anything else with the system while writing a CD.

Also see the Linux CD-Writer mini-HOWTO document, found at `<ftp://sunsite.unc.edu/pub/Linux/docs/HOWTO/mini/CD-Writer>` or `<http://sunsite.unc.edu/mdw/HOWTO/CD-Writer.html>`.

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

CD-ROM is a read-only media. With older kernels you could mount a CD-ROM for read/write; attempts to write data to the CD would not generate any errors. 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).

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

As of the 1.1.38 kernel, the sbpcd driver ejects the CD when it is unmounted. 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 README.sbpcd file (or use the eject program).

6.11 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)
2. It is an audio CD
3. The CD is damaged or defective

4. You put it in the drive upside down :-)

6.12 Why does the drive light flash on my CDU-33 drive?

This is normal and was added in a recent revision of the driver. It flashes the drive light when a CD is mounted (it's not a bug, it's a feature...).

6.13 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. At least one user also had to increase a SCSI timeout value in the kernel driver. The Nakamichi MBR-7 7 disc changer and Pioneer 12 disc changer have been reported to work.

EIDE/ATAPI multi-disc changers are also available. The 2.0 kernel has rudimentary support for some drives using the CDROMLOADFROMSLOT ioctl function. The IDE-CD kernel driver documentation file includes source code for a program to select changer slots.

6.14 I get "/cdrom: Permission denied" errors

Some CDs have file permissions that only allow user `root` to read them. The March 1995 InfoMagic CD set is one example.

The following patch, courtesy of Christoph Lameter (clameter@waterf.org) patches the kernel to get around this problem.

```
From: clameter@waterf.org (Christoph Lameter)
Newsgroups: comp.os.linux.setup
Subject: Infomagic Developers Set: Fix for CD-Rom permissions
Date: 12 Apr 1995 20:32:03 -0700
Organization: The Water Fountain - Mining for streams of Living Water
NNTP-Posting-Host: waterf.org
X-Newsreader: TIN [version 1.2 PL2]

The March 1995 Edition of the Infomagic Developers CD-ROM Set has
problems because the information stored in the root directory
permissions is causing the following problems with using the CDs

1. Disc1 will always have the owner/group of 5101/51 and has write
access allowed (?)

2. Disc2 and 3 have rwx set for root and no rights at all for any
other group/user. These discs cannot be accessed from any user other
than root! I run a BBS and I need to make them accessible for download
```

```
by others.

I have seen several fixes to this problem already floating
around. Trouble is that these fixes usually change the rights for ALL
directories on the CD. This fix here changes ONLY the rights for the
root directory of the CD-Rom. If you want to run parts of Linux
directly off the CD you might run into trouble if all directories are
readable for everyone and if they are all owned by root.

This fix will set the rights for the root directory to r-xr-xr-x and
the owner/group to the values indicated in the uid and gid options to
the mount command.

To apply:
 cd /usr/src/linux/fs/isofs
 patch <**THIS MESSAGE**

and recompile kernel (you may have to fix up the patch by hand
depending on your kernel version).

This fix should probably be incorporated into the kernel. What business
does data on a CD have to mess around with the permissions/owners of the
mount-point anyways?

--- inode.c.ORIG        Wed Apr 12 17:24:36 1995
+++ inode.c     Wed Apr 12 17:59:12 1995
@@ -552,7 +552,15 @@
    these numbers in the inode structure. */

        if (!high_sierra)
-         parse_rock_ridge_inode(raw_inode, inode);
+       {  parse_rock_ridge_inode(raw_inode, inode);
+           /* check for access to the root directory rights/owner CL */
+          if((inode->i_sb->u.isofs_sb.s_firstdatazone) == inode->i_ino)
+           { /* Change owner/rights to the ones demanded by the mount command */
+             inode->i_uid = inode->i_sb->u.isofs_sb.s_uid;
+             inode->i_gid = inode->i_sb->u.isofs_sb.s_gid;
+            inode->i_mode = S_IRUGO | S_IXUGO | S_IFDIR;
+           }
+        }

 #ifdef DEBUG
        printk("Inode: %x extent: %x\n",inode->i_ino, inode->u.isofs_i.i_first_extent);
@@ -805,4 +813,3 @@
```

```
}

#endif
```
-

6.15 How do you pronounce "Matsushita" ?

I'm told that the correct pronunciation it something like MAT-SOOSH-TA.

6.16 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>` and changing the value of VERBOSE_IDE_CD_ERRORS to 1.

6.17 Does Linux support Plug and Play devices?

Linux does not yet fully support Plug and Play devices, but it is being worked on. In the mean time some users have reported success by either disabling the Plug and Play options in their BIOS, or by initializing the devices under Windows 95 before soft booting Linux.

6.18 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 "sys" 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).

6.19 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 most 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* `<http://sunsite.unc.edu/mdw/HOWTO/Kernel-HOWTO.html>` 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).

7 References

I have already mentioned the README 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* `<http://sunsite.unc.edu/mdw/HOWTO/SCSI-HOWTO.html>`
- *Hardware Compatibility HOWTO* `<http://sunsite.unc.edu/mdw/HOWTO/Hardware-HOWTO.html>`
- *Sound HOWTO* `<http://sunsite.unc.edu/mdw/HOWTO/Sound-HOWTO.html>`
- *Kernel HOWTO* `<http://sunsite.unc.edu/mdw/HOWTO/Kernel-HOWTO.html>`
- *Distribution HOWTO* `<http://sunsite.unc.edu/mdw/HOWTO/Distribution-HOWTO.html>`

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 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.

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://sunsite.unc.edu/pub/Linux/docs/LSM.gz/>`.

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 (Note: at time of writing these mailing lists were severely overloaded and a replacement was being sought).

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 new my book *Multimedia on Linux* published by O'Reilly and Associates (`<http://www.ora.com/>`). It should be available in the September 1996 time frame.