

CD-Writing HOWTO

Table of Contents

<u>CD-Writing HOWTO</u>	1
Winfried Trümper <winni@xpilot.org>.....	1
1.Introduction.....	1
2.Setup the Linux-system for writing CD-ROMs.....	1
3.Burning CD-Rs.....	1
4.Dear Winfried.....	1
5.Troubleshooting.....	2
6.Credits.....	2
1.Introduction.....	2
1.1 Copyright, license and terms of usage.....	3
1.2 Availability.....	3
1.3 Suggested readings.....	3
1.4 Terminology ... lasers at maximum ... fire!.....	4
Adaptor vs. Adapter.....	4
1.5 Supported CD-writers.....	4
1.6 Supported "features".....	6
1.7 Mailing Lists.....	7
2.Setup the Linux-system for writing CD-ROMs.....	7
2.1 Quickstart.....	8
Compiling missing kernel modules.....	10
Special notes for kernel versions up to 2.2.9.....	12
Special notes about SCSI CD-writers.....	12
Special notes about CD-writers for the parallel port.....	12
2.2 Get the user software for burning CD-Rs.....	12
Command line utilities.....	13
Graphical user interfaces (optional).....	13
3.Burning CD-Rs.....	14
3.1 Writing CD-ROMs (pure data).....	14
Creating an image of the later CD-ROM.....	14
Test the CD-image.....	15
Write the CD-image to a CD.....	16
3.2 Writing audio CDs.....	17
DAQ.....	18
3.3 Mixed mode CD-ROMs.....	19
4.Dear Winfried.....	19
4.1 How sensitive is the burning process?.....	19
4.2 Has file fragmentation a bad impact on the throughput?.....	19
4.3 Is it possible to store the CD-image on an UMSDOS-filessystem?.....	20
4.4 Isn't there some way to get around the ISO-9660 limitations?.....	20
4.5 How to read the tracks from audio CDs?.....	21
4.6 How to probe for SCSI devices after boot?.....	21
4.7 Is it possible to make a 1:1 copy of a data CD?.....	22
4.8 Can Linux read Joliet CD-ROMs?.....	22
4.9 How do I read/mount CD-ROMs with the CD-writer?.....	23
4.10 How to put even more data on the CD-R?.....	23
4.11 How to make bootable CD-ROMs?.....	24
4.12 How to make CD-ROMs writable somehow?.....	24

Table of Contents

4.13 Is it possible to use several writers at once?	24
4.14 Which media is the best?	24
4.15 What about Solaris, *BSD, AIX, HP-UX, etc.?	25
4.16 Where to store the local configuration permanently?	25
4.17 How can the CD-info be retrieved?	26
4.18 What about re-writing?	27
4.19 How to create a multi-session CD?	27
4.20 Should I use the SCSI adapter shipped with the writer?	27
4.21 How to burn over the network?	27
4.22 I get a "crack" sound at the end of the each track.	28
4.23 How can this be set up so that a user can burn CDs instead of always being root?	28
4.24 Is my variant of Unix supported?	28
4.25 Where do I get the "Yellow Book" and "Orange Book" standards?	29
4.26 I've been searching for information on burning Video-CD under Linux.	29
4.27 Which is easier to set up IDE or SCSI.	29
4.28 How can I overburn a CD using {cdrecord.cdrdao}?	29
4.29 What will cdrecord do when it stops getting input from the pipe?	29
4.30 Is there an equivalent to ignore=hdX for the ide-scsi emulation?	29
4.31 How many times can you re-use CD-RW before they become faulty?	30
4.32 Which format to choose for a platform independant CD-ROM.	30
4.33 Is multi-session for audio tracks possible?	30
5.Troubleshooting	30
5.1 It doesn't work: under Linux	30
5.2 Error-message: No read access for 'dev=0,6,0'.	31
5.3 It doesn't work: under DOS and friends.	31
5.4 SCSI errors during the burning phase.	31
5.5 Newly written CDs are not readable on some players.	32
6.Credits	32

CD-Writing HOWTO

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v2.8.13, 5 March 2000

This document explains how to write CD-ROMs under Linux.

1. [Introduction](#)

- [1.1 Copyright, license and terms of usage](#)
- [1.2 Availability](#)
- [1.3 Suggested readings](#)
- [1.4 Terminology ... lasers at maximum ... fire!](#)
- [1.5 Supported CD-writers](#)
- [1.6 Supported "features"](#)
- [1.7 Mailing Lists](#)

2. [Setup the Linux-system for writing CD-ROMs](#)

- [2.1 Quickstart](#)
- [2.2 Get the user software for burning CD-Rs](#)

3. [Burning CD-Rs](#)

- [3.1 Writing CD-ROMs \(pure data\)](#)
- [3.2 Writing audio CDs](#)
- [3.3 Mixed mode CD-ROMs](#)

4. [Dear Winfried,...](#)

- [4.1 How sensitive is the burning process?](#)
- [4.2 Has file fragmentation a bad impact on the throughput?](#)
- [4.3 Is it possible to store the CD-image on an UMSDOS-filesystem?](#)
- [4.4 Isn't there some way to get around the ISO-9660 limitations?](#)
- [4.5 How to read the tracks from audio CDs?](#)
- [4.6 How to probe for SCSI devices after boot?](#)

- [4.7 Is it possible to make a 1:1 copy of a data CD?](#)
- [4.8 Can Linux read Joliet CD-ROMs?](#)
- [4.9 How do I read/mount CD-ROMs with the CD-writer?](#)
- [4.10 How to put even more data on the CD-R?](#)
- [4.11 How to make bootable CD-ROMs?](#)
- [4.12 How to make CD-ROMs writable somehow?](#)
- [4.13 Is it possible to use several writers at once?](#)
- [4.14 Which media is the best?](#)
- [4.15 What about Solaris, *BSD, AIX, HP-UX, etc.?](#)
- [4.16 Where to store the local configuration permanently?](#)
- [4.17 How can the CD-info be retrieved?](#)
- [4.18 What about re-writing](#)
- [4.19 How to create a multi-session CD?](#)
- [4.20 Should I use the SCSI adapter shipped with the writer?](#)
- [4.21 How to burn over the network?](#)
- [4.22 I get a "crack" sound at the end of the each track](#)
- [4.23 How can this be set up so that a user can burn CDs instead of always](#)
- [4.24 Is my variant of Unix supported?](#)
- [4.25 Where do I get the "Yellow Book" and "Orange Book" standards?](#)
- [4.26 I've been searching for information on burning Video-CD under Linux.](#)
- [4.27 Which is easier to set up IDE or SCSI.](#)
- [4.28 How can I overburn a CD using {cdrecord,cdrdao}?](#)
- [4.29 What will cdrecord do when it stops getting input from the pipe?](#)
- [4.30 Is there an equivalent to ignore=hdX for the ide-scsi emulation?](#)
- [4.31 How many times can you re-use CD-RW before they become faulty?](#)
- [4.32 Which format to choose for a platform independant CD-ROM.](#)
- [4.33 Is multi-session for audio tracks possible?](#)

5. Troubleshooting

- [5.1 It doesn't work: under Linux](#)
- [5.2 Error-message: No read access for 'dev=0,6,0'.](#)
- [5.3 It doesn't work: under DOS and friends](#)
- [5.4 SCSI errors during the burning phase](#)
- [5.5 Newly written CDs are not readable on some players.](#)

6. Credits

1. Introduction

Many people use Linux to burn CD-ROMs, because it is reliable and easy. No bluescreens while burning and no headaches about getting the right combination of hard- and software. It just works once properly set up. The CD-writing HOWTO explains the setup, how to put data on the media and gives some interesting applications kindly submitted by the readers.

1.1 Copyright, license and terms of usage

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Short: read and use at your own risk. No money-back guarantee.

1.2 Availability

As the editor of this document I mostly sum up what other people report to me. I'm not a software developer nor an expert in hardware, so for specific problems with hard- or software you may want to ask somebody else. What always makes sense is to report solutions for problems not already covered by the HOWTO to me.

I get several hundred e-mails concerning the CD-Writing HOWTO each year. So please be patient with me, as I cannot always answer within hours. However, I read everything immediately and put you on my CDR-queue. Before you ask a question, please make sure you are aware of the newest version of this document; it is always available from <http://www.guug.de/~winni/linux/>.

1.3 Suggested readings

You may need the handbook for your Linux-distribution to learn about installing a new kernel. I'm really clueless about this issue when it comes to any

The [CD-R FAQ](#) is a general FAQ about compact-disk recordables (CD-R), CD-writers and the required software. As most CD-writers can be used to read CD-ROMs, too, you may want to read the *Linux CD-ROM HOWTO*, the *Linux SCSI HOWTO* and the *Linux Kernel HOWTO*.

1.4 Terminology ... lasers at maximum ... fire!

CD-ROM stands for *Compact Disc Read Only Memory*, a storage medium utilizing an optical laser to sense microscopic pits on a colorful shimmering disk. The pits represent the bits of the information and are so petite that some billions of them fit on the disc. Thus a CD is a mass-storage medium.

The term *CD-R* is a short form of *CD-ROM recordable* and refers to a CD that doesn't have those "microscopic pits" on its surface. Thus it is empty. The CD-R has a special chemical film inside into which pits can be burned. This is done by giving the laser which normally just senses the pits a little bit more power so it burns the pits. This action can only be taken **once** on a CD-R. Although you can leave out some areas for later writing, creating a so called *multi-session CD*.

The *CD-ROM rewritable* (short: *CD-RW*) was developed to work around the limitation of CD-R media. With a CD-RW burner the laser can do both, burn pits into the media and also melt the media back into its original state. This is possible, because the laser does not really burn holes into the media, which would get lost in a puff of smoke. A decent analogy for the technique is an ice-hockey game: by driving over the ice, a players (laser) leave scratches in it. The pattern in the ice (media) is a recording of what happened on the ice during one round. In between the periods of the game, the Zamboni cleaning car drives over the ice and fills the scratches by melting the very top layer of the ice. (Zamboni is *the* brand name for cleaning cars in ice-hockey stadiums). This way the pattern on the ice is cleared and a new round can begin. The scientific term for evaporating, condensing, melting and freezing is "phase change", thus the name "phase change devices" for CD-RW-writers.

This HOWTO deals with the task of writing CD-Rs and CD-RWs. Welcome on board, captain.

Adaptor vs. Adapter

The the most frequent spelling within the kernel sources is adapter (adapter: 4283, adaptor: 154). Even more important, the module options and aliases are naturally affected, like in "scsi_hostadapter". So in order to achieve a consistent spelling throughout configuration examples and text, I follow that convention regardless of the official spelling.

1.5 Supported CD-writers

USB CD-writers are currently not supported at all. Apart from that you can safely assume that most newer IDE/ATAPI- and SCSI-writers work under Linux. Newer drives are mostly MMC-compliant and therefore supported. If the SCSI-version of a particular writer works, the IDE/ATAPI-version will most likely work and vice versa. However, some people want to get a warm and fuzzy feeling by reading the exact model of their writer in some sort of compatibility list. That is the reason why I didn't throw the following list out of the HOWTO:

Here is a comprehensive summary of drives reported to work with cdrecord:

CD-Writing HOWTO

Acer: CDRW 4432A, CDRW 6206A, CD-R/RW 6X4X32
BTC: BCE 621E (IDE)
Compro: CW-7502, CW-7502B
Creative: MK 4211, RW 4224E,
Delta: OME-W 141
Dysan: CRW-1622
Elite: Elite b444.41
Goldstar: CED-8041B
Grundig: CDR 100 IPW
Guillemot: Maxi CD-R 4X/8X
HP: SureStore 4020i, SureStore 6020i,
C4324, C4325
CD-writer+ 7100, 7200i, 7500e, 8100i, 8110i, 8200i Plus,
8250i, 9100i, 9110i, 9200e, 9210
Hi-Val: CDD 2242, CDD-3610,
Iomega: ZIPCD 4x650
JVC: XR-W 2001, XR-W 2010, XR-W 2040, XR-W 2042, XR-RW 2224,
YR 2626
Kiss: CDRW (no model given)
Kodak: PCD 200, PCD 225, PCD 260, PCD 600
Matsushita: matsushita is the japanese name for panasonic, please see there
Memorex: CRW-620, CDR-622, CRW-1622, CRW-2224, CDRW-4420
Microboards: PlayWrite 2000, PlayWrite 4000 RW, PlayWrite 4001 RW
MicroNet: MasterCD Plus 4x4, MasterCD Plus 4x6
Mitsubishi: CDRW-226
Mitsumi: CR-2401-TS, CR-2600 TE, CR-2801 TE,
CR-4801 TE, CR-4802 TE, CR-4804 TE
Nomai: 680.RW
Olympus: CDS 615E, CDS 620E
Optima: DisKovery 650 CD-R
OTI: CDRW 965, CDRW 975 (Socrates 1.0)
Panasonic: CW-7502, CW-7503, CW-7582
Philips: CDD-521/10, CDD-522
CDD-2000, CDD-2600, CDD-3600, CDD-3610, CDD 4201
PCA 267cr, PCA 460 RW, PCRW 404,
Omniwriter 26, Omniwriter 26A
Pinnacle: RCD-100, RCD-1000, RCD-5020, RCD-5040
Pioneer: DW-S114X
Plasmon: CDR 480, CDR 4220, RF-4100, RF-4102, CDR 4400
Plextor: CDR PX-24 CS, PX-412 C, PX-R412 C
PX-R 810Ti, PX-R 820T, PX-W 4220Ti, PX-W 8220T, PX-W 8432T
Plexwriter RW 4/2/20
Procom: PCDR 4
REC: 820s
Ricoh: RO-1420C+, MP 1420C, MP 6200S, MP 6201S, MP 7040A, MP-7060A
Samsung: SW-204
Sanyo: CRD-R24S
Smart and
Friendly: CD-RW 226, CD-R 1002, CD-R 1002/PRO, CD-R 1004,
CD-R 2004, CD-R 2006 PLUS, CD-R 2006 PRO, CD-RW 2224,
CD-R 4000, CD-R 4006, CD-R 4012, CD-RW 4424A
CD-R 8020, CD-R 8220
Sony: CDRX 100E, CDRX 120E, CDRX 140S-RP,
CDU 920S, CDU 924, CDU 926S, CDU 928E, CDU 948S
Taiyo Yuden: EW-50
TEAC: CD-R50S, CD-R55S, CDR-55S, CDR-55K,
CDR-56S-400, CD-R56S-600, R56S-614
Traxdata: CRW 2260,
CDR 4120, CDR 4120 Pro, CDRW 4260, CDRW 4424, CDR 4800
Turtle Beach: 2040R
Waitec: wt 2036, wt 2444ei
WPI (Wearnes): CDRW-622, CDR-632P

CD-Writing HOWTO

Yamaha: CDR-100, CDR 102, CDR-200, CDR-200t, CDR-200tx
CDR-400, CDR-400c, CDR-400t, CDR-400tx, CDR-400Atx
CDW-2216E, CRW-2260, CRW-2260t,
CRW-4250tx, CRW-4260t, CRW-4260tx, CRW-4261, CRW-4416S,
CRW-6416S, CRW-8424E

Table: CD-writers supported under Linux

The detailed list of models which have been reported to work or not to work under various Unix-like operating systems is available online from <http://www.guug.de:8080/cgi-bin/winni/lsc.pl>.

If your hardware isn't supported you can still use Linux to create an image of the CD. You may wish to do so because most burning software for DOS does not deal with RockRidge-extensions. In a second step, you can use DOS or Macintosh software to write the image to the CD-R.

1.6 Supported "features"

There are two classes of utilities for writing CD-Rs: the hardware drivers and the data-formatters. The hardware drivers support the following features:

Supported Feature	cdwrite-2.1	cdrecord-1.6	cdrdao
IDE/ATAPI	no	yes	yes
Parallel Port	no	yes	yes
CD-RW	no	yes	yes
Audio CD	yes	yes	yes
Data CD-ROM	yes	yes	partial
Multisession	partial	yes	no
TAO (Track at once)	yes	yes	yes
DAO (Disk at once)	no	no	yes

Table:

`cdwrite` is unmaintained software referenced only for completeness. Please use `cdrecord` instead, as it supports a wider range of hardware and has significantly more features. The main benefit of `cdrdao` is the ability to create audio CDs without two seconds of silence between the tracks (writing in disk-at-once mode).

The tools classified as "data-formatters" organize the data on the media ("put a filesystem on it").

Feature	mkisofs	mkhybrid
ISO 9660	yes	yes
RockRidge	yes	yes
El Torito	yes	yes
HFS	no	yes

CD-Writing HOWTO

Joliet	yes	yes
Multisession	yes	yes
<i>Table:</i>		

The most obvious difference between the ISO 9660 filesystem compared to the Extended-2 filesystem is: you can't modify files once they are written. Other limitations of the ISO-9660-filesystem include:

- only 8 levels of sub-directories allowed (counted from the top-level directory of the CD)
- maximum length for filenames: 32 characters
- 650 MB capacity

RockRidge is an extension to allow longer filenames and a deeper directory hierarchy for the ISO-9660 filesystem. When reading a CD-ROM with RockRidge extensions under Linux, all the known properties of files like owner, group, permissions, symbolic links appear (feels like a Unix filesystem). These extensions are not available when reading the CD-ROM under DOS or the Windows-family of operating systems.

El Torito can be used to produce bootable CD-ROMs. In order to use this feature, the BIOS of your PC must support it. Roughly speaking, the first 1.44 (or 2.88 if supported) Mbytes of the CD-ROM contains a floppy-disk image supplied by you. This image is treated like a floppy by the BIOS and booted from. (As a consequence, while booting from this virtual floppy, your original drive A: (/dev/fd0) may not be accessible.)

HFS lets a Macintosh read the CD-ROM as if it were an HFS volume (the native filesystem for MacOS).

Joliet brings long filenames (among other things) to newer variants of Windows (95, 98, NT). However, the author knows of no tool that allows long filenames under plain DOS or Windows 3.11.

Section 2.8 lists the availability of the mentioned software.

1.7 Mailing Lists

If you want to join the development team (with the intention to actively *help* them), send e-mail to cdwrite-request@other.debian.org and put the word `subscribe` in body of the message.

2. [Setup the Linux-system for writing CD-ROMs](#)

This section applies to the following types of CD-writers: SCSI, IDE/ATAPI and the devices for the parallel port. USB CD-writers are not supported as of March 2000. Non-SCSI writers require compatibility drivers, which make them appear as if they were real SCSI devices. On the one side such a unifying strategy is easy ("everything is SCSI"), because on the application level you can share your knowledge with other users regardless of their kind of CD-writer. On the other side, you have to reconfigure applications like audio CD players or the mount utility to reflect the change of the driver name. For example, if you accessed your

CD-Writing HOWTO

ATAPI CD-writer through the device file `/dev/hdc` before, you will have to access it through `/dev/scd0` after activating the SCSI compatibility drivers.

Once you succeed setting up your hardware and the rest of your Linux-system, the command `cdrecord -scanbus` shows you a list of devices on your SCSI busses. The goal of this section is to guide you in setting up your Linux-system, so that you finally end up seeing something like:

```
shell> cdrecord -scanbus
Cdrecord release 1.7a1 Copyright (C) 1995-1998 Jörg Schilling
scsibus0:
 0,0,0) 'Quantum ' 'XP34300          ' 'F76D' Disk
 0,1,0) 'SEAGATE ' 'ST11200N          ' '8334' Disk
 0,2,0) *
 0,3,0) 'TOSHIBA ' 'MK537FB/          ' '6258' Disk
 0,4,0) 'WANGTEK ' '5150ES SCSI 36    ' 'ESB6' Removable Tape
 0,5,0) 'EXABYTE ' 'EXB-8500-85QUE    ' '0428' Removable Tape
 0,6,0) 'TOSHIBA ' 'XM-3401TASUNSLCD' '3593' Removable CD-ROM
 0,7,0) *
scsibus1:
 1,0,0) 'Quantum ' 'XP31070W          ' 'L912' Disk
 1,1,0) *
 1,2,0) *
 1,3,0) 'TEAC    ' 'CD-R55S           ' '1.0H' Removable CD-ROM
 1,4,0) 'MATSHITA' 'CD-R    CW-7502    ' '4.02' Removable CD-ROM
 1,5,0) *
 1,6,0) 'YAMAHA  ' 'CDR400t          ' '1.0d' Removable CD-ROM
 1,7,0) *
```

Listing: Detecting devices on your SCSI bus

The example was provided by Jörg Schilling and shows a total of four CD-writers. Please note that `-scanbus` also reports other devices, e.g. regular CD-ROMs and hard disk drives. The last column gives the SCSI description of the device, from which you cannot clearly distinguish ordinary CD-ROM drives from those with burning capability. But the product identification (middle column) often has hints about the feature in form of a R, -R or -RW.

2.1 Quickstart

This section is an attempt to provide an fast and easy description of the configuration. Not all possible setups are covered, but please go and figure yourself. First of all, check the version number printed by the command `uname`. It should be something like 2.0.X or 2.2.Y, where X is higher than 36 and Y is higher than 11. If you run older things or 2.1.* or 1.*.*, you are on your own. The listing below shows a set of commands you could start with. The commands create device file entries under `/dev` and attempt to load some modules.

```
test `whoami` = 'root' || echo "You must be root to execute the commands."
cd /dev/
umask -S u=rwx,g=rwx,o=rwx
./MAKEDEV loop || for i in 0 1 2 3 4 5 6 7; do mknod loop$i c 7 $i; done
./MAKEDEV sg    || for i in 0 1 2 3 4 5 6 7; do mknod sg$i c 21 $i; done
```

CD-Writing HOWTO

```
for i in ide-scsi scsi_mod sg sr_mod loop
do
    modprobe $i || grep loop /proc/modules || echo "Module $i missing."
done
cdrecord -scanbus
```

Listing: creating of devicefiles and loading of modules

Hardware access is usually implemented through device files under Linux. So before any other thing you make sure the necessary entries do exist in the directory /dev. Still nobody could give me a compelling reason why this has not been automated through techniques like the device filesystem (devfs). The devfs is available for years now, brings safer (!) and far clearer naming of devices and makes the device entries appear automatically under /dev. Some people argue devfs is not the perfect solution, but they do not come up with anything better, not even something comparable and last but not least nothing available and tested now. Let's start to use devfs!

Please read the next chapter if modules are reported to be missing on your system or consult the documentation of your Linux-distribution. If you are in text mode (console), the loading of modules may cause some messages to be printed on your screen. If you are in graphics mode (X11, KDE, Gnome), you can print these messages with the command `dmesg`. To have the modules loaded, you should either list them in a configuration file like /etc/modules or run the daemons `kerneld` or `kmod`, which both load the required modules automatically for you when the kernel sees a need for them.

People with a SCSI-writer can skip the rest of this section, because `cdrecord` will most likely already detect their hardware. If not, then please send me an email with some information about your setup, so I can improve the section about SCSI-writers.

Now to the people with CD-writers for IDE/ATAPI. As written in the previous chapter, you have to load the compatibility driver `ide-scsi`. But this driver can only access your CD-Writer, if no other driver has already done so. In other words, you have to tell the regular IDE driver to leave your CD-writer unrecognized, so the `ide-scsi` driver can grab it.

```
hda = IDE bus/connector 0 master device
hdb = IDE bus/connector 0 slave device
hdc = IDE bus/connector 1 master device
hdd = IDE bus/connector 1 slave device
```

Table: device file names of IDE/ATAPI devices

The table above shows the relation of device file names and the placing of devices on the IDE busses. The device file name representing your CD-Writer has to be passed to the driver in the Linux kernel. Example: `hdb=ide-scsi`. This setting should be placed into `lilo.conf` or `chos.conf` if the driver is statically compiled into your kernel, which is the most common setup. The next two listings show example configurations. All other variants like `hdb=ignore` or `hdb=none` will not do what you need. "Ignore" just means "no autoprobing" and "none" will even block access to the device for `ide-scsi`.

```
image=/boot/zImage-2.2.14
label=Linux
read-only
```

CD-Writing HOWTO

```
append="hdb=ide-scsi"
```

Listing: Example configuration for lilo (/etc/lilo.conf)

```
linux "Linux 2.1.14" {  
    image=/boot/zImage-2.0.37  
    cmdline= root=/dev/hda5 readonly hdb=ide-scsi  
}
```

Listing: Example configuration for chos (/etc/chos.conf)

If the driver for IDE/ATAPI CD-ROMs is loaded as a module, then the above won't make any difference to you, but make sure you include the options-line from the next listing. The last three lines of that listing are generally suggested to further automate the loading of the required modules. If you do not run the kernel daemon to trigger module loading automatically, then add the names of the modules to the files /etc/modules (or whatever strategy your Linux distribution uses).

```
options ide-cd ignore=hdb          # tell the ide-cd module to ignore hdb  
alias scd0 sr_mod                  # load sr_mod upon access of scd0  
pre-install sg modprobe ide-scsi # before sg, load ide-scsi  
pre-install sr_mod modprobe ide-scsi # before sr_mod, load ide-scsi
```

Listing: Example configuration for /etc/modules.conf

Remember you have to access your CD-writer through the device file /dev/scd \times where $\times=0,\dots,8$. You may want to change the symbolic name cdrom to point to your actual device file name. The listing below shows the command to achieve this with the example scd0.

```
cd /dev && rm cdrom && ln -s scd0 cdrom
```

Listing: Making cdrom a symbolic name for scd0

Compiling missing kernel modules

The Linux kernel can be equipped with drivers for various features. You can compile the drivers into the kernel image statically or you can compile them as a module for on-demand loading. The last method is preferred for drivers not essential for bringing your Linux-system into life, because your kernel will be smaller and faster then. However, some drivers are essential for the system to come up and you shouldn't compile them as a module. Example: if your system lives on an IDE hard disk, you must have the driver for IDE hard disks in the kernel -- not as a module.

There are three different types of CD-writers: SCSI, IDE/ATAPI and external writers that work through the parallel port. The table shows how to configure the Linux kernel for those hardware types. The first column of the table is the section of the kernel configuration menu, where you can find the setting. The second

CD-Writing HOWTO

column is the description of the feature (taken from the kernel configuration menu, too). The third column gives the name of the resulting module. The columns named SCSI, IDE and PP contain the necessary options for the associated hardware (PP = parallel port).

Sect.	Description	Module	SCSI	IDE	PP
BLOCK	Enhanced IDE/MFM/RLL...			Y	
BLOCK	IDE/ATAPI CDROM	ide-cd		M	
BLOCK	SCSI emulation support	ide-scsi		M	
BLOCK	Loopback device	loop	M	M	M
PARIDE	Parallel port IDE device	paride			Y/M
PARIDE	Parallel port ATAPI CD-ROMs				M
PARIDE	Parallel port generic ATAPI				M
PARIDE	(select a low-level driver)				Y
SCSI	SCSI support	scsi_mod	Y/M	Y/M	
SCSI	SCSI CD-ROM support	sr_mod	Y/M	Y/M	
SCSI	Enable vendor-specific		Y	Y	
SCSI	SCSI generic support	sg	Y/M	Y/M	
SCSI	(select a low-level driver)		Y		
FS	ISO 9660 CDROM filesystem	iso9660	Y/M	Y/M	Y/M
FS	Microsoft Joliet cdrom...	joliet	Y	Y	Y

Table: driver selection for different writer types

Y stands for yes and means you should put the beast into the kernel. M stands for module and means you should or must compile this feature as a module. Y/M gives you the option to decide between either (order indicates choices with less potential problems). Empty settings don't need to be modified and not changing them increases the chance that the resulting kernel will work for you (if it did before...). Especially in environments where SCSI and ATAPI devices are mixed, you better build most things as modules.

Compiling loopback device is optional. It allows you to test the image before writing it to the media. If you want to be able to read CD-ROMs, you need support for the ISO 9660 filesystem. This driver automatically includes RockRidge Extensions. The Microsoft Joliet CD-ROM extensions have to be explicitly added to the ISO 9660 filesystem. In any case, you need a low-level driver for your hardware. Low-level refers to the driver, which interacts directly with the hardware. For SCSI and the parallel port, there are a lot of low-level drivers available.

Installing the resulting Linux-kernel is beyond the scope of this HOWTO. Please consult the documentation of your Linux-distribution.

Users of RedHat Linux be aware that you have to compile in the features "Ramdisk support" and "Initial ramdisk". Furthermore, you have to generate a new ramdisk with the new modules by issuing a command like "mkinitrd --preload ide-cd initrd-2.2.14.img 2.2.14".

Special notes for kernel versions up to 2.2.9

Up to kernel version 2.2.9, don't enable CONFIG SCSI_MULTI_LUN ('probe for multiple luns') and ide-scsi support at the same time, there is an ide-scsi bug that prevents this.

Some users reported conflicts with pre-compiled binaries and the 2.2-release. This is a problem with the Linux kernel. Possible solutions:

- It may go away if you recompile cdrecord so that it adopts to the actual values in linux/include/scsi/sg.h. These values must be the values of the running kernel due to the dumb sg user interface.
- It may be caused by a loadable sg driver which cannot get enough memory that is suitable for DMA (Kernel releases up to 2.2.5).

Special notes about SCSI CD-writers

Please make sure that your writer is recognized by the BIOS of your computer. It makes no sense to proceed if your computer does not accept the hardware (the fact that it doesn't spit it out should not be interpreted as a sign of confirmation; a message on the screen is required).

If you plan to connect your SCSI through the parallel port (not to confuse with the IDE drives for the parallel port), you need a special active cable and a special kernel driver. Read <http://www.torque.net/parport/parscsi.html> to learn more about this option.

Special notes about CD-writers for the parallel port

I have no clue about this, sorry. Please read <http://www.torque.net/parport/paride.html> or your local file /usr/src/linux/Documentation/paride.txt.

2.2 Get the user software for burning CD-Rs

A more detailed survey of tools related to produce CD-ROMs is available from <http://www.fokus.gmd.de/research/cc/gclone/employees/joerg.schilling/private/cdb.html>.

Command line utilities

One of the following packages are required to generate images of CD-Rs (only required for data CD-ROMs):

<ftp://tsx-11.mit.edu/pub/linux/packages/mkisofs/> (mkisofs)

<ftp://ftp.ge.ucl.ac.uk/pub/mkhfs> (mkhybrid)

To write images to the CD-R, you need one of the following software packages:

<ftp://ftp.fokus.gmd.de/pub/unix/cdrecord/> (cdrecord)

<http://www.ping.de/sites/daneb/cdrdao.html> (cdrdao)

Don't trust the man page of (old) `mkisofs` which states you need version 1.5 of `cdwrite`. Just use `cdrecord` and you are fine. Please note that newer versions of `cdrecord` ship with an enhanced version of `mkisofs` and some extra tools in the subdirectory `misc/` (`readcd`, `isosize`) not found elsewhere.

Graphical user interfaces (optional)

Front-ends are really front-ends under Linux. That means, you still have to install the command-line utilities, but you access them in a better looking manner.

X-CD-Roast is a program package dedicated to easy CD creation under Linux. It combines command line tools like `cdrecord` and `mkisofs` into a nice graphical user interface.

http://www.fh-muenchen.de/home/ze/rz/services/projects/xcdroast/e_overview.html

BurnIT is a JAVA front-end to `cdrecord`, `mkisofs` and `cdada2wav-0.95` making it a complete package for burning CDs on the Unix platform. It is available from

<http://sunsite.auc.dk/BurnIT/>

CD-Tux is a character based frontend for the programs `mkisofs` and `cdrecord`. "It creates an easy to use environment for doing almost anything to a CD in full color through the use of the (in)famous NCURSES Library. And it does all this with an executable of under 75K."

<http://www.datadictator.co.za/cdtux/>

3. Burning CD-Rs

"If to smoke you turn I shall not cease to fiddle while you burn." (Roman emperor Nero about burning his own classic-CDs, AD64. He misunderstood it completely and burned Rome down.)

Writing CD-ROMs consists of two steps under Linux:

- packaging the desired data (files, music or both) into files with special formats
- writing the data from the files to the CD-R with the utility `cdrecord`

This chapter describes the steps for data and audio CDs in greater detail.

3.1 Writing CD-ROMs (pure data)

Note that collecting the data to put onto a CD usually takes longer than one expects. Consider that missing files cannot be added once the CD is written and fixated. Also keep in mind that a certain amount of the free space of a CD is used for storing the information of the ISO-9660-filesystem (usually a few MB). 620 MB data will always fit on a 650 MB CD-R.

Creating an image of the later CD-ROM

Before any storage medium (e.g. floppy disk, hard disk or CD) can be used, it must get a filesystem (DOS speak: get formatted). The filesystem is responsible for organizing and incorporating the files that should be stored on the medium.

The usual utilities for creating filesystems on hard disk partitions write an empty filesystem onto them, which is then mounted and filled with files by the user as they need it. A writable CD is only writable once so if we wrote an empty filesystem to it, it would get formatted and remain completely empty forever. This is also true for rewritable media as you cannot change arbitrary sectors; you must erase their whole content.

So what we need is a tool that creates the filesystem while copying the files to the CD. This tool is called `mkisofs`. A sample usage looks as follows:

applies to audio CDs only and the option `-pad` for `mkisofs` requires a patch, which is as much work to apply than to upgrade to a bug-free Linux kernel.)

Note:

Some ancient versions of `mount` are not able to deal with loopback devices. If you have such an old version of `mount`, then upgrade your Linux-system. Several people have already suggested putting information about how to get the newest `mount` utilities into this HOWTO. I always refuse this. If your Linux distribution ships with an ancient `mount`, report it as a bug. If your Linux distribution is not easily upgradable, report it as a bug.

If I include all the information that is necessary to work around bugs in badly designed Linux distributions, this HOWTO would be a lot bigger and harder to read.

Write the CD-image to a CD

Not much more left to do. If you haven't already tried, it's a good time for the command

```
cdrecord -scanbus
```

This will tell you to which SCSI device your CD-writer is attached to. All other methods of guessing the information printed so nicely by `cdrecord` have been removed from the HOWTO (especially the somewhat dangerous naming scheme for generic SCSI devices).

Before showing you the last command, let me warn you that CD-writers want to be fed with a constant stream of data because they only have small data buffers. So the process of writing the CD image to the CD must not be interrupted or a corrupt CD will result. It's easy to interrupt the data stream by deleting a very large file. Example: if you delete a previous image of 650 Mbytes size, the kernel must update information about 650,000 blocks on the hard disk (assuming you have a block size of 1 Kbyte for your filesystem). That takes some time and is very likely to slow down disk activity long enough for the data stream to pause for a few seconds. However, reading mail, browsing the web, or even compiling a kernel generally will not affect the writing process (on modern machines).

Please note that no writer can re-position its laser and continue at the original spot on the CD when it gets disturbed. Therefore any strong vibrations or other mechanical shocks will probably destroy the CD you are writing.

When you are mentally prepared, dress up in a black robe, multiply the SCSI-id of the CD-writer with its SCSI-revision and light as many candles, speak two verses of the ASR-FAQ (newsgroup `alt.sysadmin.recovery`) and finally type:

```
shell> SCSI_BUS=0      # taken from listing 1 "scsibus0:"
shell> SCSI_ID=6       # taken from listing 1 "TOSHIBA XM-3401"
```

CD-Writing HOWTO

```
shell> SCSI_LUN=0
shell> cdrecord -v speed=2 dev=${SCSI_BUS},${SCSI_ID},${SCSI_LUN} \
              -data cd_image

# same as above, but shorter:
shell> cdrecord -v speed=2 dev=0,6,0 -data cd_image
```

For better readability, the coordinates of the writer are stored in three environment variables with natural names: `SCSI_BUS`, `SCSI_ID`, `SCSI_LUN`. The option `-data` is not mandatory but is given to make the command line comparable to the one used for writing audio CDs.

If you use `cdrecord` to overwrite a CD-RW, you must add the option `"blank=..."` to erase the old content. Please read the man page to learn more about the various methods to blank the CD-RW.

In times where everybody except me owns a 400 Mhz machine, people feed the output of `mkisofs` directly into `cdrecord`:

```
shell> IMG_SIZE=`mkisofs -R -q -print-size private_collection/ 2>&1 \
| sed -e "s/.*/ = //"`
shell> echo $IMG_SIZE
shell> [ "0$IMG_SIZE" -ne 0 ] && mkisofs -r private_collection/ \
|cdrecord speed=2 dev=0,6,0
      tsize=${IMG_SIZE}s -data -
#      don't forget the s --^      ^-- read data from STDIN
```

The first command is an empty run to determine the size of the image (you need the `mkisofs` from the `cdrecord` distribution for this to work). Maybe your writer does not need to know the size of the image to be written, so you can leave this out. The printed size must be passed as a `tsize`-parameter to `cdrecord` (it is stored in the environment variable `IMG_SIZE`). The second command is a sequence of `mkisofs` and `cdrecord`, coupled via a pipe.

3.2 Writing audio CDs

Writing audio CDs is very similar to the steps described above for data CDs. There are two main differences. One, the audio CD consists of audio tracks, which are organized as separate images. So if you want to have ten tracks on your CD, you have to make ten images. The other difference is that the format of the images is not ISO-9660 (or whatever filesystem you prefer), but it is "16 bit stereo samples in PCM coding at 44100 samples/second (44.1 kHz)".

One utility to convert your sound files into the required format is `sox`. Its usage is straightforward:

```
shell> sox killing-my-software.wav killing-my-software.cdr
```

CD-Writing HOWTO

This command would convert the song `kill-my-software` from the WAV-format into the CDR audio-format. See the man page for `sox` for more details about formats and filename-extensions `sox` recognizes. Because the output of the conversion takes up much disk space, it was made a built-in feature of `cdrecord` for the formats WAV and AU. So as long as your sound files have the extensions `.wav` or `.au` (and the sample rate "stereo, 16 bit, 44.1 kHz"), you can use them as images without manual conversion.

`Cdrecord` writes CD images as audio tracks if the option `-audio` is specified. The other options are identical to those used for writing data-CDs (unless you have very special requirements). These three examples all do the same thing, but read the tracks from different sound file formats:

```
shell> cdrecord -v speed=2 dev=0,6,0 -audio track1.cdr track2.cdr...
shell> cdrecord -v speed=2 dev=0,6,0 -audio track1.wav track2.wav...
shell> cdrecord -v speed=2 dev=0,6,0 -audio track1.au track2.au...
```

One notable exception are MPEG Layer 3 files, which can be converted to the CD format with the command `"mpg123 --cdr -s track1.mp3 > track1.cdr"`. The option `--cdr` ensures the track is encoded in the required format (see above). Converting from WAV to MPEG can be done with `LAME` for WAV-files (extract the track with `cdda2wav` from the audio CD and encode it into MP3 with the help of `LAME`). To create a CD-R from a whole bunch of MP3-files, you can use the following command sequence:

```
for I in *.mp3
do
    mpg123 --cdr -s "$I" | cdrecord -audio -pad -swab -nofix -
done
cdrecord -fix
```

Depending on the speed of your machine, you may want to slow down writing to `"speed=1"` (`cdrecord`-Option). If you use `"speed=4"`, your machine must be able to play the MP3-file at quadruple speed. `mpg123` consumes much CPU-time! If you are in doubt, try an empty run with `-dummy` (keeps the laser switched off). By doing this, you will produce an audio CD which has a 2 seconds of pause between audio tracks.

DAO

If you want to get rid of the pauses between the audio tracks, you have to use disk-at-once (DAO) recording versus the (individual) track-at-once (TAO) recording described above. Support for DAO is currently most advanced in `cdrdao`. Please see its homepage for details.

Using the parameter `read-cd`, you are even able to produce 1:1 copies of audio CDs.

3.3 Mixed mode CD-ROMs

There is not much to say about this topic. Just indicate the type of the (subsequent) images with the options `-data` and `-audio`. Example:

```
cdrecord -v dev=0,6,0 -data cd_image -audio track*.cdr
```

4. [Dear Winfried,...](#)

This is the section usually known as "frequently asked questions with answers". If you have a problem with your partner, kids or dog, just send it in, as long as it is related to writing CD-Rs or is otherwise entertaining.

4.1 How sensitive is the burning process?

Test it. Use the option `-dummy` to do an empty run of `cdrecord`. Do everything you would do otherwise and watch if the burning process survives.

If you feed `cdrecord` directly from `mkisofs`, then disk intensive processes such as updating the *locate* database lower the maximum flow rate and may corrupt the CD. You better check such processes are not started via `cron`, `at` or `anacron` while you burn CD-Rs.

4.2 Has file fragmentation a bad impact on the throughput?

Fragmentation of files is usually so low that its impact isn't noticed. However, you can easily construct pathological cases of fragmentation, which lower the throughput of your hard disks under 100 kbytes/second. So don't do that. :-) Yes, files on a hard disk get fragmented over the years. The faster, the fuller the filesystem is. Always leave 10% or 20% free space, and you should run fine with respect to writing CD-Rs.

If you're uncertain then look at the messages printed while booting. The percentage of fragmentation is reported while checking the filesystems. You can check for this value with the very dangerous command

```
shell> e2fsck -n /dev/sda5          # '-n' is important!
[stuff deleted -- ignore any errors]
/dev/sda5: 73/12288 files (12.3% non-contiguous)
```

In this example the fragmentation seems to be very high — but there are only 73 very small files on the filesystem. So the value is *not* alarming.

There is an experimental utility called `e2defrag` to defragment extended-2 filesystems. The current version does not work reliable enough to use it even for private environments. If you really want to defragment your filesystem, make a backup copy (better: two copies), practice restoring the data, then create a new filesystem (that will destroy the old) and restore the data. This sketch is currently the safest technique.

4.3 Is it possible to store the CD-image on an UMSDOS-filesystem?

Yes. The only filesystem that isn't reliable and fast enough for writing CD-ROMs from is the *network filesystem (NFS)*. I used UMSDOS myself to share the disk-space between Linux and DOS/Win on a PC (486/66) dedicated for writing CD-ROMs.

4.4 Isn't there some way to get around the ISO-9660 limitations?

Yes. You can put any filesystem you like on the CD. But other operating systems than Linux won't be able to deal with this CD. Here goes the recipe:

- Create an empty file of 650MB size.

```
dd if=/dev/zero of="empty_file" bs=1024k count=650
```

- Create an extended-2 filesystem on this file

```
shell> /sbin/mke2fs -b 2048 empty_file
empty_file is not a block special device.
Proceed anyway? (y,n) y
```

- Mount this empty file through the loopback devices (you need a reasonable new mount for this; read above).

```
mount -t ext2 -o loop=/dev/loop1 empty_file /mnt
```

- Copy files to /mnt and umount it afterwards.
- Use `cdrecord` on `empty_file` (which is no longer empty) as if it were an ISO-9660-image.

If you want to make an entry in `/etc/fstab` for such a CD, then disable the checking of the device file on system startup. For example:

```
/dev/cdrom /cdrom ext2 defaults,ro 0 0
```

The first 0 means "don't include in dumps", the second (=important) one means "don't check for errors on startup" (fsck will fail to check the CD for errors).

4.5 How to read the tracks from audio CDs?

There are several software packages available. The newest one is "cdpranoia" and can be downloaded from

<http://www.xiph.org/paranoia/>

Or you want to try the combination of "cdda2wav" and "sox", available from sunsite and its mirrors:

<ftp://sunsite.unc.edu/pub/Linux/apps/sound/cdrom/cdda2wav0.71.src.tar.gz>

<ftp://sunsite.unc.edu/pub/Linux/apps/sound/convert/sox-11gamma-cb3.tar.gz>

cdda2wav enables you to get a specific interval (or a whole track) from your audio CD and converts it into a .wav-file. sox converts the WAV files back into the (audio CD) cdda-format so it can be written to the CD-R using cdrecord. You don't necessarily need sox if you use a recent version of cdrecord, because it has built-in support for .au and .wav files.

4.6 How to probe for SCSI devices after boot?

The file `drivers/scsi/scsi.c` contains the information

```
/*
 * Usage: echo "scsi add-single-device 0 1 2 3" >/proc/scsi/scsi
 * with "0 1 2 3" replaced by your "Host Channel Id Lun".
 * Consider this feature BETA.
 * CAUTION: This is not for hot plugging your peripherals. As
 * SCSI was not designed for this you could damage your
 * hardware !
 * However perhaps it is legal to switch on an
 * already connected device. It is perhaps not
 * guaranteed this device doesn't corrupt an ongoing data transfer.
 */
```

Please note that this should only be used if you add SCSI devices to the end of the chain. Inserting new SCSI devices into an existing chain disturbs the naming of devices (directory /dev) and may destroy the complete content of your hard disk.

4.7 Is it possible to make a 1:1 copy of a data CD?

Yes. But you should be aware of the fact that any errors while reading the original (due to dust or scratches) will result in a defective copy. Please note that both methods will fail on audio CDs! You have to use `cdrdao` or `cdda2wav` on audio CDs.

First case: you have a CD-writer and a separate CD-ROM drive. By issuing the command

```
cdrecord -v dev=0,6,0 speed=2 -isosize /dev/scd0
```

you read the data stream from the CD-ROM drive attached as `/dev/scd0` and write it directly to the CD-writer.

Second case: you don't have a separate CD-ROM drive. In this case you have to use the CD-writer to read out the CD-ROM first:

```
dd if=/dev/scd0 of=cddimage
```

This command reads the content of the CD-ROM from the device `/dev/scd0` and writes it into the file "cddimage". The contents of this file are equivalent to what `mkisofs` produces, so you can proceed as described earlier in this document (which is to take the file `cddimage` as input for `cdrecord`). If you want to see a progress-meter and other fancy stuff, then you can also use Jörg Schillings `sdd`.

In case you run into errors, then install a recent version of `cdrecord`, which ships a tool called "readcd" (found under `misc/`). It gives you the same result as `dd`, but reads sectors on the CD-ROM several times in case of errors.

4.8 Can Linux read Joliet CD-ROMs?

Yes. Newer Kernels (2.0.36 and the upcoming 2.2) have built-in support for the joliet format. Remember you have to use both options in your `/etc/fstab`: the keywords `iso9660` and `joliet` (later is really an extension). For more details, see <http://www-plateau.cs.berkeley.edu/people/chaffee/joliet.html>.

4.9 How do I read/mount CD-ROMs with the CD-writer?

Just as you do with regular CD-ROM drives. No tricks at all. Note that you have to use the `scd` devices (SCSI CD-ROM) to mount CD-ROMs for reading, even if you have an ATAPI CD-ROM (remember you configured your ATAPI devices to act like SCSI). Example entry for `/etc/fstab`:

```
/dev/scd0 /cdrom iso9660 ro,user,noauto 0 0
```

4.10 How to put even more data on the CD-R?

Use `bzip2` instead of any other compressor like `gzip` or `pkzip`. It will save you up to 30% of disk-space for larger (>100kb) files. You can download it from

<http://www.muraroa.demon.co.uk/>

Instead of writing a true audio CD, you can optionally convert your WAV audio files into MP3 audio files and store them on a ISO-9660 filesystem as regular files. Usually MPEG III give you a compression of 1:10. Of course, most CD-players are not able to read files... this is the drawback. On the other hand, why not running the music for your next party from hard disk? 18 Gbytes are enough for 3000-4000 titles. :-)

A software MPEG III-encoder is available from

<http://www.sulaco.org/mp3/>

A MPEG III-player is available from

<http://www.mpg123.org/>

For recorded speech, you may want to try to reduce its size using `shorten` or "GSM lossy speech compression":

<ftp://svr-ftp.eng.cam.ac.uk/pub/comp.speech/>

<http://kbs.cs.tu-berlin.de/~jutta/toast.html>

4.11 How to make bootable CD-ROMs?

You must have an 1.44 MB bootable floppy-disk. Create an exact image of this floppy-disk by issuing the command

```
dd if=/dev/fd0 of=boot.img bs=18k
```

Place this floppy image into the directory holding the collection of your files (or into a subdirectory of it, just as you like). Tell mkisofs about this file with the option '-b' and also use '-c'. For details read the file README.eltorito in the mkisofs-distribution.

An interesting application for a custom bootable CD is as a virus safe DOS- or Windows-system. It saves you the money for the hard disks (if you have a network and use samba to put the user-data on a file server). The German computer magazine c't has a article about this issue in the issue 11/99, page 206 (<http://www.heise.de/>).

Some details about the bootable RedHat CD-ROM is available from <http://members.bellatlantic.net/~smithrod/rhjol-technical.html>.

4.12 How to make CD-ROMs writable somehow?

There is an *overlay filesystem* available for Linux, which is mounted over the CD-ROM and intercepts all writing operations. New and modified files are stored elsewhere, but for the user it looks like the CD-ROM is modified. For more information, see <http://home.att.net/~artnaseef/ovlfs/ovlfs.html>.

If that is not enough for your needs: wait for the UDF-filesystem to be supported by Linux or help developing it (see <http://trylinux.com/projects/udf/>).

4.13 Is it possible to use several writers at once?

Yes. However, it has been only tested with two writers yet. You need either a recent version of the Linux kernel (2.2.10 as of writing) or a kernel patch for more buffers in the SCSI generic driver (<ftp://ftp.fokus.gmd.de/pub/unix/cdrecord/alpha>; works up to 2.2.5).

4.14 Which media is the best?

The German computer magazine "c't" had a list of tips regarding the blank CD-Rs in their November 1996 issue:

- "No name" discs are generally not of highest quality and should better not be used.
- If a recordable CD is defective, this is likely to apply to the whole batch (if you bought more than one at a time); maybe you are lucky and can at least use the first 500MB of such CD-Rs ...
- Don't touch the CD-Rs at their shimmering side before writing.

4.15 What about Solaris, *BSD, AIX, HP-UX, etc.?

Only chapter 2 is Linux-specific. You can apply chapter 3 and 4 even if you run another family of operating systems than Linux. Please see the files README.NetBSD, README.aix, README.hpux, README.next, README.solaris, README.sunos, README.vms or README.xxxBSD from the cdrecord-distribution.

4.16 Where to store the local configuration permanently?

You have two options. Either you use the built-in configuration file for cdrecord, or you use a shell wrapper like the one shown below. This shell script reads a configuration file, which lists the options and parameters for cdrecord line by line. The names are exactly the same as on the command line, but without the leading dash. Comments are allowed. Example:

```
# be verbose
v
# set the speed of the writer
speed=2
# the device-coordinates in the form BUS,ID,LUN
dev=0,6,0
```

The configuration files for the wrapper belong into /etc/cdrecord/ and must be referenced on the command line. Example: if you want to refer to the configuration /etc/cdrecord/mywriter.cfg, then you can issue the command "cdrecord.sh mywriter.cfg -audio track1...". Everything after mywrite.cfg is passed to cdrecord.

```
#!/bin/bash

CFGDIR="/etc/cdrecord"

CFG="$1"
shift
ARGS_LEFT="$@"

if [ ! -f "$CFGDIR/$CFG" ]
then
    echo "Configuration file $CFGDIR/$CFG not found. Exiting."
    exit 1
```

```

fi

while read LINE
do
    case $LINE in
        \#*|") continue;;
    esac
    old_IFS="$IFS"
    IFS="$IFS"
    set -- $LINE
    IFS="$old_IFS"
    O_NAME="$1"
    O_VALUE=""
    while shift
    do
        case $1 in
            ") continue;;
        esac
        O_VALUE="$1"
    done

    if [ -z "$O_VALUE" ]
    then
        O_CDRECORD="$O_CDRECORD -$O_NAME "
        continue
    fi
    O_CDRECORD="$O_CDRECORD $O_NAME=$O_VALUE "

done < "$CFGDIR/$CFG"

set -x    #DEBUG
exec cdrecord $O_CDRECORD $ARGS_LEFT
echo "Execution of cdrecord failed."

```

4.17 How can the CD-info be retrieved?

Somewhere behind the first 32 k on the CD, a block with information about the CD is located. You can extract the information with the following shell script:

```

#!/bin/bash

RD=/dev/cdrom
for i in 32768,7 32776,32 32808,32 32958,128 33086,128 33214,128 \
        33342,128 33470,32 33581,16 33598,16 33615,16 33632,16
do
    old_IFS="$IFS"
    IFS=","
    set -- $i
    IFS="$old_IFS"
    OFFSET=$1
    LENGTH=$2
    echo "`dd if=$RD bs=1 skip=$OFFSET count=$LENGTH 2> /dev/null`#"
done

```

4.18 What about re-writing

When overwriting CD-RW media, specify the parameter `blank=fast` to `cdrecord`. That's all. See the man page of `cdrecord` for details about this parameter.

4.19 How to create a multi-session CD?

First of all, the image for a multi-session CD must be formatted using the ISO-9660 filesystem using RockRidge-extensions. And you must use the option `-multi` for `cdrecord` as long as you want to add further sessions. So at least for the first session, you must use `-multi`.

The images for the second and subsequent sessions are a little bit more complicated to generate. `Mkisofs` must know where the free space on the CD-R begins. That information can be gathered by using the option `-msinfo` on `cdrecord` (see example below).

```
shell> NEXT_TRACK=`cdrecord -msinfo dev=0,6,0`
shell> echo $NEXT_TRACK
shell> mkisofs -R -o cd_image2 -C $NEXT_TRACK -M /dev/scd5
        private_collection/ \
```

For more information, please read the file `README.multi`, which is distributed with `cdrecord`.

4.20 Should I use the SCSI adapter shipped with the writer?

Most CD-writer docs say to use a separate SCSI bus if going from a CD-ROM to a CD-writer and i have seen this myself in the following scenario:

Adaptec 2940UW SCSI card, a 24x SCSI CD-ROM and a 4x4 SCSI CD-writer. When I got the CD-writer, it came with its own ISA SCSI card which could only handle one device. I figured I'd toss this and use my better adaptec card for all the stuff. I noticed it was quite prone to buffer under-runs when recording at the 4x speed, but as soon as I tried hooking up the ISA SCSI card, it had no problems. I know 2 other people (both using adaptec 2940 cards), who have experienced exactly the same symptoms, usually when writing from a CD-ROM to a CD-recorder. Though I've never experienced the problem when going from a hard drive to a CD-writer on the same bus.

4.21 How to burn over the network?

Usually a file transfer with FTP is fast enough to feed a CD-recorder at quadruple (4x) speed even over a 10 Mbit ethernet. You can couple the ftp-client and `cdrecord` via a fifo. First create a fifo named `cdimage`:

```
mkfifo cdimage
ftp other.host.org
get cdimg cdimage
```

Then treat cdimage like a regular file, i.e. issue the following command:

```
cdrecord dev=0,1,0 speed=2 cdimage
```

Your ftp-client will notice when cdrecord wants to read from the file and will start transferring data from the ftp-host.

4.22 I get a "crack" sound at the end of the each track

You have to use disk-at-once mode (DAO) to get rid of the cracks.

4.23 How can this be set up so that a user can burn CDs instead of always being root?

You can add the setuid-bit to the cdrecord-executable. However, this might be a security risk. Just setting the permissions on the device files does not help as cdrecord issues privileged commands via the SCSI generic interfaces.

```
which cdrecord
chown root.root /usr/bin/cdrecord
chmod 4111 /usr/bin/cdrecord
```

4.24 Is my variant of Unix supported?

Probably yes. Compile cdrecord for your platform and issue the command "cdrecord -scanbus". Read the README.* file for your Unix distributed with the sources of cdrecord. However, not all variants of Unix can read the RockRidge, Joliet or HFS extensions on your newly written CD-R.

4.25 Where do I get the "Yellow Book" and "Orange Book" standards?

You get the printed specifications from Philips and they are expensive.

4.26 I've been searching for information on burning Video-CD under Linux.

Me, too.

4.27 Which is easier to set up IDE or SCSI.

SCSI CD-writers are slightly easier to set up with regard to CD-writing under Linux. And they are reported to have better error recovery. If that outweighs the higher price cannot be answered generally.

4.28 How can I overburn a CD using {cdrecord,cdrdao}?

Overburning a CD-R is nothing special. It is at your own risk that the data fits on the CD-ROM, but thats all. There are no 650 Mbytes-limits in the software under Linux.

4.29 What will cdrecord do when it stops getting input from the pipe?

It will finish writing. So you can just couple your favourite backup tool with cdrecord using a pipe, like in "bru -size=640m -f - | cdrecord dev=0,1,0 speed=2 -". You have to take special care within the backup utility.

4.30 Is there an equivalent to ignore=hdX for the ide-scsi emulation?

I know of no way, but anybody is welcome to add this feature to the Linux kernel sources.

4.31 How many times can you re-use CD-RW before they become faulty?

Good question.

4.32 Which format to choose for a platform independant CD-ROM.

A CD-ROM to be read by all systems can only use the plain ISO 9660 format. That means stupid 8+3 filenames from old MS-DOS and without any HFS (Macintosh), Joliet (Microsoft) or RockRidge (newer Unices) extensions. There is no extension for longer filenames, which could be read by all operating systems.

4.33 Is multi-session for audio tracks possible?

I doubt usal CD-players are able to deal with that.

5. [Troubleshooting](#)

Always remember, that you can still use corrupt CD-ROMs as coasters. :-)

5.1 It doesn't work: under Linux

Please check first, that the writer works under the software it is shipped with (=under another operating system). Concretely:

- Does the controller recognize the writer as a SCSI device?
- Does the driver software recognize the writer?
- Is it possible to make a CD using the accompanied software?

If "it doesn't even work" with the accompanied software you have a hardware conflict or defective hardware. If it works and you use loadlin to boot Linux, then that is your problem. Loadlin makes a warm-boot with most of the hardware already initialized and that can confuse the Linux kernel.

5.2 Error-message: No read access for 'dev=0,6,0'.

Under Linux, some versions of the C-library are incompatible (buggy), so that an application linked against one version will not work with another. An example for an error triggered by pre-compiled binaries is the following:

```
[root@Blue /dev]# cdrecord -eject dev=0,6,0
cdrecord: No such file or directory. No read access for 'dev=0,6,0'.
```

5.3 It doesn't work: under DOS and friends

Try to use Linux. Installation and configuration of SCSI drivers for DOS is the hell. Linux is too complicated? Ha!

5.4 SCSI errors during the burning phase

Most likely those errors are caused by

- missing dis-/reconnect feature on the SCSI bus
- insufficiently cooled hardware
- defective hardware (should be detected by 5.1.)

Under various circumstances SCSI devices dis- and reconnect themselves (electronically) from the SCSI bus. If this feature is not available (check controller and kernel parameters) some writers run into trouble during burning or fixating the CD-R.

Especially the NCR 53c7,8xx SCSI driver has the feature disabled by default, so you might want to check it first:

```
NCR53c7,8xx SCSI support          [N/y/m/?] y
  always negotiate synchronous transfers [N/y/?] (NEW) n
  allow FAST-SCSI [10MHz]          [N/y/?] (NEW) y
  allow DISCONNECT                  [N/y/?] (NEW) y
```

5.5 Newly written CDs are not readable on some players.

Some people reported problems with playing their self-written CDs. Very old audio players or car devices can have problems with CD-Rs, although this is extremely rare. Quite frequent are problems with CD-RWs, because they don't reflect the laserlight as good as CD-Rs and factory-pressed "silver" discs.

6. Credits

Many thanks go to the readers of this HOWTO, who contributed actively to its contents. As I don't had access to a CD-writer myself for several years, reports about real live setups and experience have always been of great value to me.

Doug Alcorn <doug@lathi.net>

helped to improve the handling of newer kernels

Kalle Andersson <kalle@sslug.dk>

How to write audio CDs directly from MP3.

Alan Brown <alan@manawatu.net.nz>

Rick Cochran <rick@msc.cornell.edu>

hint about dis-/reconnect disabled by default in the ncr driver

Robert Doolittle <bob.doolittle@sun.com>

good arguments for dropping cdwrite from the HOWTO

Markus Dickebohm <m.dickebohm@uni-koeln.de>

Thomas Duffy <tduffy@sgi.com>

major cleanup of syntax and spelling

Dave Forrest <dforrest@virginia.edu>

fixed adapter spelling problems

Jos van Geffen <jos@tnj.phys.tue.nl>

noted the problem in 4.9.

Bernhard Gubanka <beg@ipp-garching.mpg.de>

noticed the need of a recent version of mount to utilize the loopback device

Stephen Harris <sweh@mpn.com>

contributed hint about writing audio CDs

Janne Himanka <shem@oyt.oulu.fi>

pointer to kernel patch to read Joliet CD-ROMs

Stephan Noy <stnoy@mi.uni-koeln.de>

information and experience about writing audio CDs

Don H. Olive <don@andromeda.campbellsvil.edu>

URL of the mkhybrid tool

Jesper Pedersen <jews@imada.ou.dk>

Pierre Pfister <pp@uplift.fr>

helped to develop the recipe on 1:1 copies.

Daniel A. Quist <dquist@cs.nmt.edu>

information about IDE CD-R and newer kernel versions

Martti.Rahkila@hut.fi

Reported problem with pre-initialized writers when booting via loadlin.

Dale Scheetz <dwarf@polaris.net>

Joerg Schilling <schilling@fokus.gmd.de>

information about cdrecord

Martin Schulze <joey@Infodrom.North.DE>

gave information about the cdwrite-mailinglist

Gerald C Snyder <gcsnyd@loop.com>

tested writing of an ext2 CD-ROM (see 4.4)

CD-Writing HOWTO

Art Stone <stone@math.ubc.ca>

had the idea to put non-ISO-9660 filesystems on a CD

The Sheepy One <ker0@escape.com>

suggested using defective CD-ROMs as coasters for drinks

Erwin Zoer <ezoer@wxs.nl>

Futhermore, I would like to thank the following people for reporting spelling mistakes: Bartosz Maruszewski <B.Maruszewski@zsmeie.torun.pl>, Alessandro Rubini <rubini@prosa.it>, Ian Stirling <ian@opus131.com>, Brian H. Toby.

End of the Linux CD-Writing HOWTO. (You can stop reading here.)
