



by Katja and Guido Socher  
<katja/at/linuxfocusorg  
guido/at/linuxfocus.org>

*About the authors:*

Katja is the German editor of LinuxFocus. She likes Tux, film & photography and the sea. Her homepage can be found [here](#).

Guido is a long time Linux fan and he likes Linux because it is designed by honest and open people. This is one of the reasons why we call it open source. His homepage is at [linuxfocus.org/~guido](http://linuxfocus.org/~guido)

Perhaps you have read Katja's article A whole new world in our last issue and went on the tour with Tux. And now you have a lot of "sights" and "sounds" that you want to bring home and wonder how you can do this. Burning everything on a CD is a good solution and in this article we are going to tell you how you can do just that.

## What you need

Hardware setup:

Of course Linux must be up and running on your computer and you need a CD burner to do the job. If you have a SCSI CD burner chances are very good that your burner is immediately recognized by the kernel. You only have to check whether your SCSI hostadapter is supported by Linux (see the hardware database for this). All SCSI CD writers will work under Linux.

For an ATAPI/IDE burner you have to configure SCSI emulation to make your burner look like a SCSI

## Writing CDs with Linux



*Abstract:*

In this article we describe how you can write CDs under Linux.

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device even though the hardware is physically connected via the IDE bus. How to do this is e.g. described in the README.atapi file from xcdroast and we also recommend you to read the CD Writing HOWTO at linuxdoc.org

For USB burners see the USB-CD Writer HOWTO at mobilix.org/linux\_usb\_cd.html.

As we both only have experience with SCSI burners we could only repeat what we have read there.

Software to burn CDs:

For burning CDs you need the following programs:

1. cdrecord: this is the program that actually communicates with your CD writer.
2. mkisofs: you need it for making data CDs. It is used to generate a file system image for the CD called ISO image.
3. cdda2wav: this is needed to read digital audio data from audio CDs.

All three are included in the cdrtools package you can download from [www.xcdroast.org](http://www.xcdroast.org) or <ftp.fokus.gmd/pub/unix/cdrecord/>

With these tools you can already burn your CDs using the command line. But if you want a nicer and friendlier graphical user interface you need one of the frontends in addition. There are a lot of frontends available but in this article we will only talk about xcdroast (<http://www.xcdroast.org>) and koncd (<http://www.koncd.org/>). xcdroast seems to be the frontend with the most possibilities and we like koncd because it is really very easy to use.

## Installation

In many cases xcdroast will already be installed on your computer but at least with the RedHat distribution it is compiled with the pam-library which means it will always ask you for the root password if you want to burn CDs and you probably don't want to give the root password to all users who want to burn CDs. A second drawback is that it will not allow you to start the program remote over a network. Therefore it is better to download the latest version from <http://www.xcdroast.org>. This should be straight forward as there are pre-compiled packages for most of the common distributions available.

koncd can be downloaded from [www.koncd.org](http://www.koncd.org). Recent versions of koncd rely on new QT/KDE features. If you don't want to spend time updating your QT and KDE libraries you can use an older version of koncd. For this article we have used koncd-0.7.5 running under redhat 7.1.

## Burning CDs as a normal (non-root) user

To burn CDs you first of all must have write permissions to the /dev/sg\* devices which are used for the communication with the hardware. But cdrecord also uses some realtime extensions to avoid buffer underruns during the writing process that require root permissions as well. The best solution is therefore to use SUID on cdrecord and cdda2wav. Uhh? SUID? Don't worry. You can read Guido's article on file permissions if you want to know exactly what it is but for the moment it is sufficient if you type in the following two commands and then forget about it again :-)

```
chmod 4111 /usr/bin/cdrecord
chmod 4111 /usr/bin/cdda2wav
```

Be aware that this could be a potential security risk but it is definitively less of a security risk than telling everybody who wants to burn a CD what the root password is.  
Now you can test if your CD writer is recognized correctly. Just run:

```
cdrecord -scanbus
```

If everything is alright then you should see something like:

```
0,6,0 6) 'PLEXTOR ' 'CD-ROM PX-W8220T ' '1.03' Removable CD-ROM
```

The numbers and the description may be different dependent on your hardware setup.  
Alternatively you can also click on the SETUP button of xcdroast or koncd and check there if your burner is recognized correctly.  
So let's now finally start burning a CD.

## General notes on burning CDs

There are four necessary steps to write CDs:

1. You have to select the data/music you want to burn on CD
2. You have to set some options for the CD that is going to be burned. For example when you want to burn an audio CD you have to choose between TAO and DAO mode or for a data CD you have to set some options for the filesystem.
3. You must create an image directory with the files you want to burn on CD. If you only want to duplicate another CD completely you will "write on the fly" otherwise you have to create an image on harddisk first.  
An image directory is a temporary storage place for the data that will be written to the CD. For audio CDs these are index files and the wav files containing the music and for data CDs this is a big file called ISO image.
4. You actually burn the CD.

CDs generally need to be written in "one go" and the data flow needn't be disturbed during the writing process. Thanks to the realtime extensions buffer underruns who lead to faulty CDs are only a problem of windows users. With Linux you don't really need "burn proof". There is a special buffer called FIFO inside the CD writer to compensate for small disturbances which is usually enough to avoid burn failures under Linux. Nevertheless you should be cautious and don't do things that need too much CPU power. You can browse the web, compile software, ... but deleting a large file can be a problem and maybe is enough to disturb the process which then results in a faulty CD.

If you are concerned about buffer underruns you can use the simulation write (dummy write) option to first test if the CD writing would work before actually burning it. There the burning process is tested with real data but the laser inside the CD writer is turned off. It is always better to run a test first than to have to do it all over again.

The fact that you usually have to burn in "one go" which means that if you have forgotten something, even if it is only a single small file you have to burn the CD again. There is the possibility of multisession where you can add something later but we won't talk about it here because with multisession you can't read the CD on many CD writers as long as it is not ready and as the prize of one

CD is so low we never had a reason to use it.

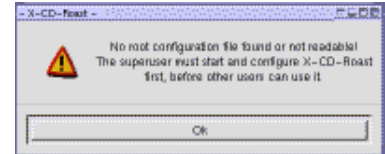
## Setup

When you start koncd or xcdroast you will recognize that both of them have a setup button. Here you can find out if your burner is recognized correctly and set general options.

Let's look at the setup of xcdroast and koncd:

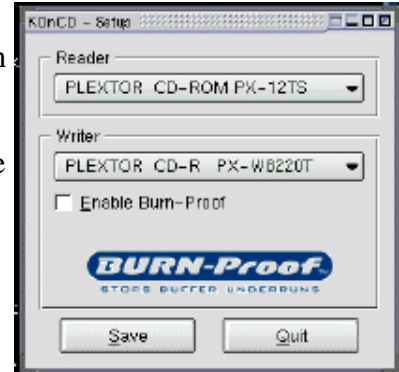
- xcdroast:

The first time you will get a pop up window saying that root should start the program first and configure it so that not every single user has to do it all over again.



- Device Scan: here you will see all devices connected to your SCSI bus.
- CD settings: here you can select your CD burner and the device where the data/music should be read from.  
For "CD writer mode" you have to give the right driver but usually "autodetect" should be okay. CD Writer FIFO Buffer size: this depends on your hardware. You have to look at the manual of your writer for its size. Common values for that buffer are 4MB or 8MB.  
As a CD must be written without an interruption in the data flow (due to the design of CD burners) there is a buffer (=FIFO) which avoids that just because of small disturbances the burning process will fail.
- HD settings: Here you need to specify a temporary storage directory for the ISO image. There should be more than 800MB of free space available (you can check your free space with the shell command `df -k /the/directory` or by using a file manager).
- Miscellaneous:
  - Audio: this is only of interest if you want xcdroast to play the songs, it doesn't have any influence on the burning process. DSP stands for digital signal processor and it is the part that will send sound to the loudspeaker.
  - Network: for a lot of CDs there are information about their titles available from a database in the internet. When burning your CD you can ask for this information which can save you a lot of typing work if you want.
  - Logging: to create a log file
  - Internationalization: here you can choose your language and everything will be in your chosen language then.
- Options: here you can e.g. set if you will get tips on the options buttons when you go over them with your mouse pointer. Especially if you don't know the program very well we recommend to have these tips.
- Users: This panel appears only if you are logged in as root. Here you can define what normal users are allowed to do.

- koncd:  
 You see the devices that koncd automatically detected in a selection box. You can tell the program to which writer it should write when burning (this should be your CD burner) and from where it should read CDs. This could be your CD ROM or if you only have this one CD burner then this can be used for reading and writing CDs. You can also select "burn proof" here if it is supported by your CD burner. Burn proof slows down the speed of your writer when the FIFO (see above) is almost empty.



## (Pure) music (audio) CDs

Here you should think about the format a little bit first. If the song is from another CD there is no problem. You can just go on and copy it. But otherwise you should notice that cdrecord recognizes au and wav files and converts them automatically to the right format to play it on your CD player but for other formats you need to convert them to wav first if you later don't want to hear only noise on your CD. To convert a file from mp3 to wav you can do the following on the command line:

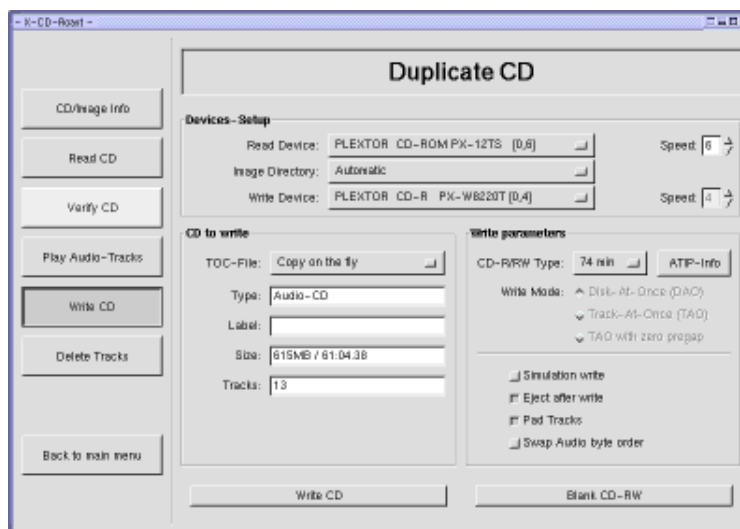
```
mpg123 -w /tmp/song.wav song.mp3
```

This allows you to make normal audio CDs from mp3 music. It takes more space but can be played in almost every CD player.

When finally burning the CD you can choose whether you want the copy to be in TAO or DAO mode. In TAO mode you will have 2 seconds of a pause between each song while you don't have that in DAO mode which makes it the mode of choice for live music recordings. TAO= Track at Once and DAO= Disk at Once.

You can copy a CD completely or mix songs from different CDs, or other sound files e.g. downloaded from the internet.

Let's first see how you can copy a CD without changes:



- xcdroast:

Select "Duplicate CD".

You get a menu on the left side where you can see:

CD/Image Info, Read Tracks, Verify CD, Play Audio-Tracks:

We don't know why these menu entries are available. They don't make sense if you just want to duplicate a CD. At least in the version used for this article (xcdroast-0.98alpha9) xcdroast only allows you to do a "write on the fly" for which you only need the "Write CD" menu. Therefore go directly to "Write CD".

Write CD:

- On top you again have to specify the device to read from and its speed. Next select the CD burner and its speed. The speed of the reader should be a bit higher than the writing speed (to avoid buffer underruns).

- Left you see "CD to write":

This is just for your information. You have no other choice than "write on the fly".

- Right you see "write parameters":

CD R/RW type: here you have to specify how many minutes will fit on the CD you are burning the music onto

and then you have to choose between TAO or DAO mode (see above).

You can then decide to make a simulation write first (see above) and if you want the CD to be ejected after the burning is finished. "Pad tracks" is not important when duplicating CDs.

With "Blank CD-RW" you can delete rewritable CDs and finally with "WRITE CD" you can burn your CD. That's it.

- koncd:

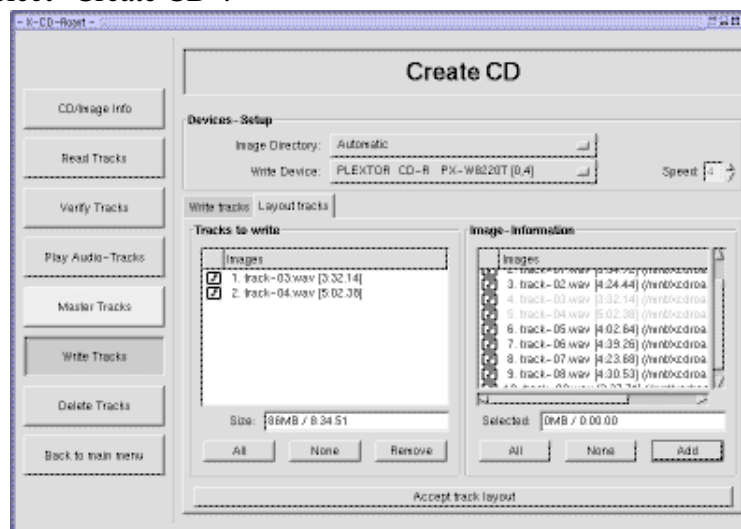
Choose "Copy CD".

On top you can delete the content of a rewritable CD and set the burning speed. Under "options" you don't need to select anything. Press "START" and the burning begins.

Let's now look what you have to do if you want to burn a CD with music from various places:

- xcdroast

Now you have to select "Create CD".



Let's look at the menu:

- CD/Image info:  
On the left side you see the content of the CD that is read from. On the right side you see the content of the image directory if you have anything in there. There is nothing to do here. Go straight to "Read Tracks"
- Read Tracks:  
On top you have to choose the device where the music should be read from and the image directory. Now in this case the tracks will be written as individual wav files and not as a single big image file. For music CDs you should not go too high in speed because audio CDs are only specified to be read at "1 x" speed and a higher speed increases the occurrence of bit errors which reduces the quality. However a speed of "4 x" or "8 x" should be ok.  
To read the music tracks to the image directory select the tracks you want to copy and then press READ SELECTED TRACKS.
- Verify CD:  
If you press the VERIFY button it is verified that the reading of the music tracks was done without bit errors.
- Play Audio-Tracks:  
With this you can play the songs as they are in the image directory. To select a song to be played you need to double click on it.
- Master tracks:  
This is only for data CDs. Ignore it for the moment.
- Delete Tracks:  
Here you can see how much space you have already used and how much is still left. And you can delete all or some tracks from the image directory according to your wishes.
- Write Tracks:  
Here you first need to go to the second panel "Layout tracks". On the right you will see the content of the image directory. Select the tracks and press "add" to copy them over to the left panel for writing tracks. Go back to the "write tracks" panel. Here you find the same options that were already explained under "Duplicate CD". But now you have to select the option "PAD tracks". This is to ensure that all .wav's are properly terminated on sector boundaries. The Audio CD format requires that all wav files are a multiple of 2352 Bytes long. "PAD tracks" adds some zero-bytes to ensure the correct length. Press "WRITE CD" to burn the CD.
- koncd:  
Choose "audio CD". The version used for this article (0.7.5) does not yet have the possibility to read individual audio tracks from another audio CD. But you can select a number of wav files somewhere on your harddisk and write them as audio tracks to the CD. Click on "Add track" and add several wav files to the list of selected tracks. Under "options" select "Use padding" and then click on "start" to burn your CD.

## **(Pure) Data CDs**

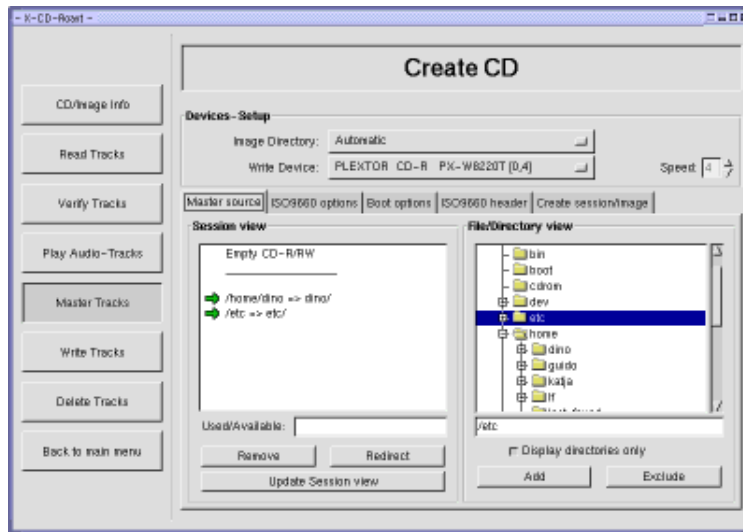
For data CDs you need a filesystem or as is often said the CD must be formatted. You have to choose which filesystem you want. This choice will depend on which operating system(s) you want to be able to read the data. The ISO-9660 standard which describes the CD filesystem for example does not allow long file names. Therefore extensions have been made for this standard. For Linux and Unix RockRidge

extensions are used, Microsoft uses Joliet extensions. With the RockRidge format you can also have permissions etc. as you already know it from your system.

The recommended solution is to use RockRidge and Joliet extensions on the same CD.

If you just want to copy a CD from another existing CD you don't have to worry about that because then the CD already has a filesystem and this is copied as well.

- xcdroast:  
Choose "Duplicate CD"  
and then do everything as described above. Just go to "WRITE CD".
- koncd:  
Choose "Copy CD" ( see above).



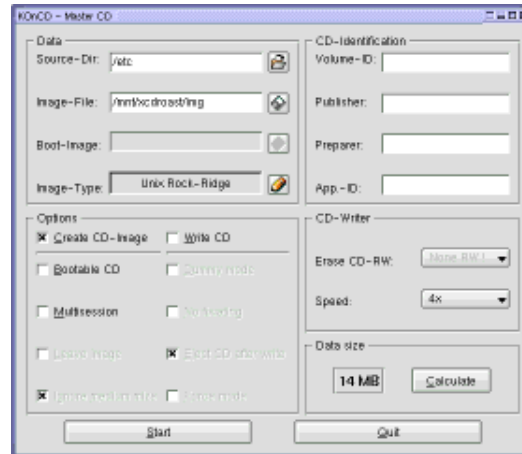
If you want to copy data from your hard disk :

- xcdroast:  
Choose "Create CD" and then "Master Tracks" from the menu on the left.
  - Under "Master source" you select the directories that you want to write to your CD. You can also choose the paths and names these directories should have on CD (use the "redirect" button on the left side to do this).
  - ISO 9660 options:  
You can choose one of the predefined image types:  
just use RockRidge + Joliet if you want your CD to be readable for Linux and Window computers
  - Under boot options you can create bootable CDs but this is beyond the scope of this article. If you want a bootable CD then we recommend you to use one of the pre-build ISO images (see the references at the end of the article)
  - Create session/image: This is the most important panel. Here you can now create an ISO image of the files selected in the first panel. Press the button "master image to file" for that. Always choose "fixation" (or better: don't choose "Do not fixate after write") unless you want to do mulitsession, otherwise if you don't choose fixation no Toc (= Table of Contents) is made and your CD won't be readable for many CD players.



Now go to "Write Tracks":

Here you use the image that you created under the panel "Master tracks". Go to the panel "Layout tracks", select your image and press "add". Then go back to the panel "Write tracks" and press the button "write tracks" at the bottom. Now your CD is burned.



- koncd:

Copy all the files that you want to write to CD into one directory (using either the shell command cp or a file manager).

Open koncd and choose "Master CD".

Under "data" you give the source directory to where you copied the files. Now you have several possibilities to create the CD. We suggest to create an ISO image first and then write the image to your CD. Under Data -> "image file" enter the name for the image file that will be created. The version used for this article required that the file would already exist. Therefore create an empty file called "image" with the shell command "touch image".

Go to "options" and click on "Create CD image", press "calculate size" on the right and then "start".

Once the image is created you click on the option "Write CD" and unselect "Create CD-image". Now the CD writer will burn the CD for you.

## Backup of your home directory

Basically you can backup everything on CD with the method described under "pure data CDs". If the data in your home directory is too big to fit onto one CD then you need to select individual sub-directories and write them to a different CD.

## Tips and Tricks:

It can be useful to check if the ISO image is correct before finally burning it. To do this you can mount the ISO image as if it was a real CD:

Change to root: su -

Create an empty directory (known as mount point): mkdir /tmp/mycd

Mount the ISO image (connect the ISO image to the directory):

```
mount -o loop -t iso9660 Image.iso /tmp/mycd
```

Now you can use the command "ls" to inspect the CD image: ls /tmp/mycd

If it looks ok then unmount it: umount /tmp/mycd

... and burn the image to your CD.

## Command line tools

Above we have discussed two graphical frontends to burn CDs but you can also burn CDs using only the command line. If you look at the man page of cdrecord you will see that there are hundreds of options, uuuuhh... don't be scared. It's much easier than it looks at first. Download the two perl scripts cdrecordeasy and mkisofseasy.

They are included in the package easycdscripts (download page)

Unpack them with the command

```
tar zxvf easycdscripts-0.1.tar.gz
```

Now run the command cdrecord -scanbus. Look at the line where you see your CD burner and remember the numbers that you see at the beginning. It should be something like 0,4,0 or 0,6,0 ....

Edit the file cdrecordeasy by entering this number behind the line that says \$dev=... You will find it somewhere at the beginning.

Now the installation of our two little scripts is finished. Creating a data CD is now very easy:

1. Copy all the files that you want to have on the CD into one directory (e.g ~/cdrom). Harddisks are very big and cheap these days and it should be no problem to copy a few hundred MB.
2. Run the command: mkisofseasy ~/image.iso ~/cdrom  
This will create an ISO image of all the files in the directory ~/cdrom.
3. Burn the CD by running the command: cdrecordeasy ~/image.iso

That's it. Much easier than it looked at the beginning, isn't it!? :-)

Have fun with your CDs!

## References

- CD Writing Howto: [linuxdoc.org](http://linuxdoc.org)
- Linux MP3 CD Burning mini-HOWTO: [linuxdoc.org](http://linuxdoc.org)( How to make normal audio CDs from mp3 files )
- USB CD howto: [mobilix.org/linux\\_usb\\_cd.html](http://mobilix.org/linux_usb_cd.html)
- A big bootable CD image: <http://rescuecd.sourceforge.net/>
- Various boot CDs and linux on one floppy systems

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<http://www.LinuxFocus.org>

Translation information:

en --> -- : Katja and Guido Socher <[katja@linuxfocus.org](mailto:katja@linuxfocus.org)  
[guido@linuxfocus.org](mailto:guido@linuxfocus.org)>