LINUXVOICE MASTERCLASS

Without music, life would be a mistake. Join us as we celebrate the new UK legal status of ripping your own CDs.

DVD-VIDEO: RIP AND BURN...

Now that you can legally copy DVDs, we show you how.

JOHN LANE

On 1 October, the UK's copyright law caught up with the real world. You can now legally make personal copies of your favourite ebooks, music and videos that you own. So, without further ado, this month's Masterclass will have you making backups of your favourite DVDs in no time. We'll explain the structure of a DVD and show you how to make your own so that you can now make that movie you've always wanted to.

There are two ways to copy a DVD. The first is to create an ISO image of the whole disc – an exact copy. Most media players will play images just like the real thing and you can burn them onto blank media to make an exact copy. The other way is to extract the contents of the DVD's filesystem by recursively copying its root directory. Again, most media players will play a directory tree copied from a DVD.

Before you start copying, make sure you have sufficient free storage. A typical DVD weighs in at around 7GB – you can see the actual size of a disc with the **isosize** command:

```
$ isosize /dev/sr0
6654584832
```

This outputs the raw size of the disc's filesystem in bytes (our optical drive is **/dev/sr0**).

If you just want to make an ISO image, you may be able do it with the **dd** or **cp** commands. This is the

Install the packages

Some of the tools that we will use are included in the base packages of most distros (for example, things like **dd** and **isosize**, which we use to make ISO images). You'll need some other tools to go beyond, however.
- **lsdvd** displays the contents of a DVD; it's a quick way to identify the main title on a disc, because this is usually the longest track.
- **vobcopy** copies the contents of a DVD as files and directories.
- **libdvdcss** decrypts titles that use the Content Scramble System (CSS).
- **ffmpeg** is used to transcode video files into the format required by DVD-Video.
- **cdrtools** provides the tools we need to write ISO images to disc.

The UK Government now communicates changes in the law of the land via the proprietary medium of Twitter. If it is Tweeted, it must be official.

most basic method – it copies the raw data from the disc's block device into an image file.

The following commands are equivalent, as they copy the entire disc:

```
$ dd if=/dev/sr0 of=mydvd.iso
$ cp /dev/sr0 mydvd.iso
```

It's possible for these methods to receive a few null blocks at the end of the stream. They won't affect the image but, for an exact block-perfect copy, you can try these instead:

```
$ dd if=/dev/sr0 of=mydvd.iso bs=2048 count=$(isosize -d 2048 /dev/sr0)
$ head -c $(isosize /dev/sr0) </dev/sr0 >mydvd.iso
```

These use **isosize** to obtain the exact size of the original and then copy that amount of space (the block size of a DVD is 2048 bytes). A **md5sum** hash of the original disc and images produced this way should match.

Authoring

If you encounter errors then you might be able to overcome them by adding **conv=noerror,sync** to the end of the **dd** command. These arguments make the **dd** command continue after errors (**noerror**) and NUL-pad the error blocks (**sync**) to preserve the image size. Both these methods of using the **dd** command provide a disc image suitable for playback on many players, such as *VLC*; they provide a true backup of the whole disc, complete with any encryption and copy protection they may have.

If you want to modify your copy, perhaps by extracting only the main title to save space or by
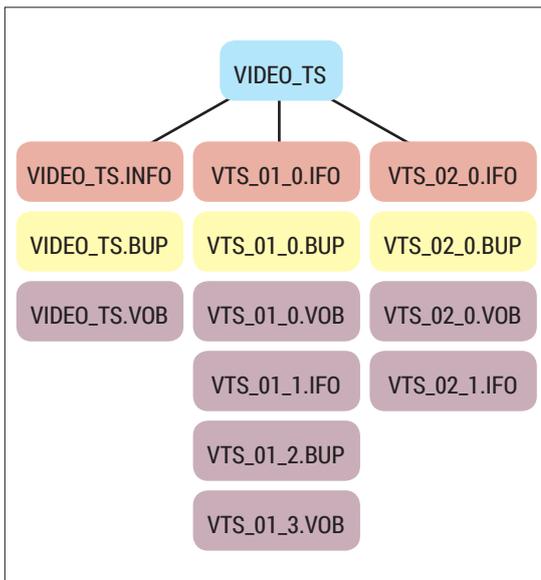
Each title on a DVD has files collectively called a Title Set; there can be up to 99 title sets on one disc. This example has two; the first is divided into four VOB files and the second one is divided into two.

transcoding for playback on other devices, then you'll need to read the data files from the disk and work with those instead. The long-standing tool of choice for this is the **vobcopy** command, which requires that you mount the DVD first:

```
$ sudo mount /dev/sr0 /mnt
$ vobcopy --mirror /mnt
```

The DVD will be extracted to a new directory created inside the current directory, whose name will be determined by the titling on the DVD (usually the name of the programme on the disc). If the files are encrypted and the appropriate libraries are installed then **vobcopy** will decrypt them first so that it can copy them and the resulting copies will be free from encryption.

A look inside

If you look at an extracted DVD-Video disc you will see that there is a directory named **VIDEO_TS** at its root (there may also be an **AUDIO_TS** directory, which is for DVD-Audio discs and is normally empty on a DVD-Video disc).

The **VIDEO_TS** directory contains three kinds of files: IFO (information) files tell the player how to navigate the disc and have BUP backups (**x.ifo** and

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tccat: another way to extract a title

You can use **cat** to extract a DVD title, but the resulting MPEG header will have incorrect duration data, which can cause confusion in some players. The **transcode** package includes a utility called **tccat** that offers another way to achieve a similar result direct from a disc or image:

```
$ tccat -i /dev/sr0 -T1,-1 > output.mpg
```

The **-T** option specifies the track to extract. The format is **-T<track>,<chapters>** and specifying a chapter value of **-1** selects the whole track.

Intentionally bad sectors

The DVD copier's nemesis is the intentional bad sector. These are sectors that have incorrect CRC checksums, and they are used as a crude copy protection on some commercially produced discs. Most standalone players don't encounter the errors because they are avoided by the disc indexes (the **IFO** files) they follow but they are hit by attempts to image the disc.

There are several such schemes, with names like ARccOS, XProtect and RipGuard. If you encounter such a disc, you should be able to make an ISO from it with the GNU **ddrescue** tool, like this:

```
$ ddrescue -n -b 2048 /dev/sr0 mydvd.iso
```

The **-n** parameter causes bad blocks to be ignored; they're intentional and contain no data so we don't care about them. The block size of a DVD is 2048 bytes.

If the image is still unplayable, extract it with **vobcopy** or **dvdbackup** and play that instead. If you still want an ISO, perhaps to write to another disc, you could use **mkisofs** to make one from the extracted directories.

An alternative method is to locate the main title and stream it into a file:

```
$ lsdvd /dev/sr0
longest track is 4
$ mplayer dvdnav://4 -dvd-device //dev/sr0
-dumpstream -dumpfile main_title.mpg
```

ddrescue may also help you rip a scratched disc.

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x.bup are identical). The third kind of file is the VOB (Video Object), and these contain the actual media: video, audio and subtitles. They're basically MPEG-2 Program Stream files with DVD-specific limitations. Any player that can play MPEG can play unmodified VOB files. Because they can't be larger than 1GB, longer titles are split into multiple files. You can, however, use **cat** to join them:

```
$ cat mydvd/VIDEO_TS/VTS_01_*.VOB > title.mpg
```

The files follow a strict naming convention: the **VIDEO_TS** files are for the Video Manager and contain the control and playback information for the disc, referring to title sets which are the **VTS_nn_n** files on the disc. Once you understand the format, you can make your own DVDs by creating the appropriate files.

Authoring

Taking regular video files and making a DVD from them is called authoring. Your source material may be in various formats and will probably need to be transcoded first; one suitable tool is **ffmpeg**:

```
$ ffmpeg -i my_video.mp4 -target pal-dvd my_dvd_video.mpg
```

The simplest authoring just takes your video file and packages it into a DVD-Video directory structure suitable for the PAL video system used in the UK:

```
$ export VIDEO_FORMAT=PAL
$ dvdauthor -d my_dvd -t my_dvd_video.mpg
$ dvdauthor -d my_dvd -T
```

The last command writes the DVD table of contents and completes a basic example that will play a single title when the disc is inserted. You can create an XML configuration file to define chapter marks and multiple titles or add menu systems - read the documentation at **http://dvdauthor.sourceforge.net** to learn more. Before you can give that holiday video to your gran, you need to make an ISO image and put it onto a disc:

```
$ mkisofs -dvd-video -o my_dvd.iso my_dvd
$ cdrecord -dao dev=/dev/sr0 my_dvd.iso
$ cdrecord -fix dev=/dev/sr0
```

Fixating the disc is the final step and makes it ready for use in standalone players. If it doesn't happen automatically the last command will do it.

LV PRO TIP
You can use **cp** on its own to copy unencrypted files from a mounted DVD.

LV PRO TIP
dvd+rw-mediainfo /dev/sr0 shows useful information about the disc.

DVD-VIDEO: RIP AND BURN

The GUI way to read and write your video DVDs.

JOHN LANE

You are somewhat spoilt for choice if you prefer to use a desktop application to read and write DVD-Video media. If you're looking for ease of use the current favourite is *Handbrake*, an open-source, GPL-licensed but Apple-flavoured video transcoder. If all you want to do is extract content from a DVD to watch on your phone, tablet, desktop or smart television then look no further than your distro's repository.

Handbrake comes in command line and *GTK* desktop versions; the executable for the latter is called **ghb**. When you start it, the main screen is displayed and is where you select source material, desired encodings and other settings.

You can choose from almost any video file format supported by **libavformat and libavcodec**. The output file formats are limited to MKV and MP4, but these can contain various video encodings including H.264, MPEG-4 and MPEG-2 along with the usual audio encodings that go with them. For use with most modern devices, it probably has your needs covered.

To make it even easier for you, the right-hand side of the main window displays presets, mostly for Apple and Android phones and tablets, but there is also the default preset (Normal) and a general-purpose preset for H.264 video (High Profile), with all the bells and whistles. You can also add, modify and remove presets, whether they're built-in or your own.

Copying a DVD is easy: place it in your drive and press the Source button to select it (this is also how you'd choose material on your hard drive). Once selected, the disc is scanned and the title list is populated. *Handbrake* attempts to select the main title for you, and you can use the Title drop-down menu to select any title. You can select part of the title by chapter numbers, time in seconds or frames. Choose your desired preset, set the destination and press

> **LV PRO TIP**
>
> *Handbrake* writes MP4 files with a **.m4v** extension so *QuickTime* and *Qt 4* applications can play them properly. There is no internal difference.

> **LV PRO TIP**
>
> Advanced users can tweak *Handbrake*'s x264 encoder parameters; they are documented at **https://trac.handbrake.fr/wiki/x264Options**.
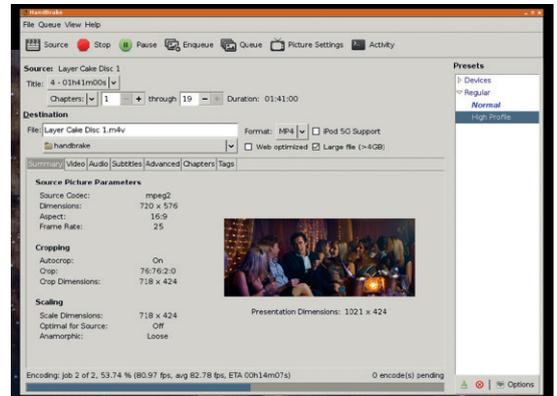
Handbrake at work: the Start button changes to Stop while it's working. It takes around 30 minutes to transcode a feature film.
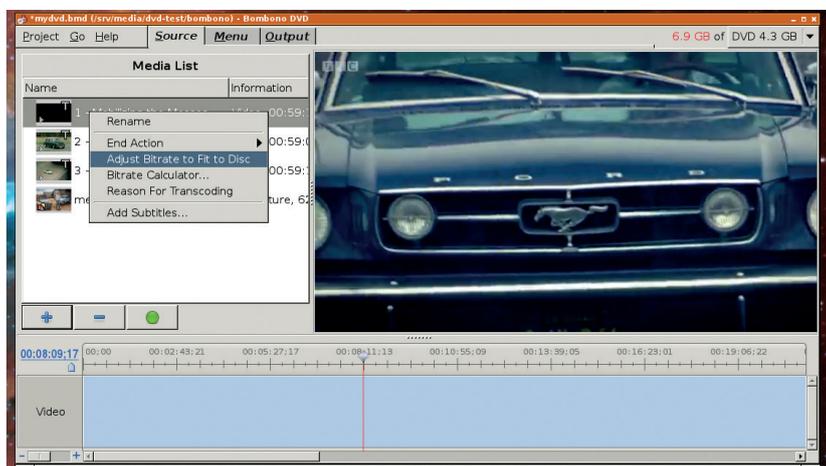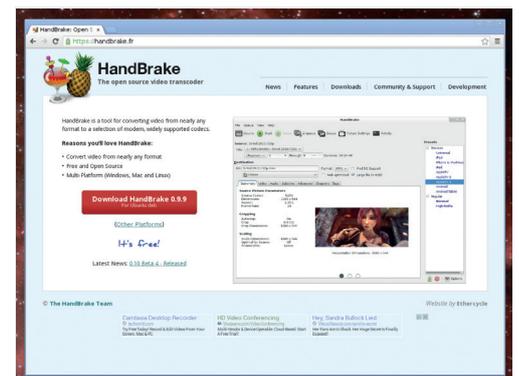
Start. That's all there is to it. Because *Handbrake* copies and also transcodes, or converts from one format to another, it takes longer than a simple copy would, but it works and gets the job done without a great deal of fuss.

Make your own DVD

One thing that *Handbrake* doesn't do is DVD authoring – this is the preparation of video in the required format and creating the menu system used to navigate the disc. There are quite a few tools that purport to offer these capabilities. One of them is called *Bombono DVD* and should be in your distro's repository. Its *GTK* user interface is straightforward, having three main tabs that are used to select the source material, build a menu system and, finally, write the disc. The writing stage can include writing

Bombono's video timeline lets you move through a title and set chapter marks.

Support options

Handbrake benefits from decent documentation and support resources. There's a user guide, forums and you can head over to **#handbrake** on Freenode IRC and **https://handbrake.fr**.

the DVD directory tree, creating the disc image (ISO file) and burning the image to a disc.

The first stage is where you choose your content; you don't need to worry about its format because it will be transcoded into the required MPEG-2 Program Stream format that DVD-Video needs. You also don't need to worry about its size, because you can adjust its bitrate to fit on the destination media. To add media, you can either drag it on to the left-hand Media List panel or use its Add Media Files button to select them from a pop-up list. You can re-order selected titles by dragging and renaming them (although this has nothing to do with the DVD-specific names used on the disc).

You can right-click on a title to choose what should happen when it ends; the default action is to return to the menu. You also right-click and use 'Adjust Bitrate To Fit To Disc' to make sure your content will fit.
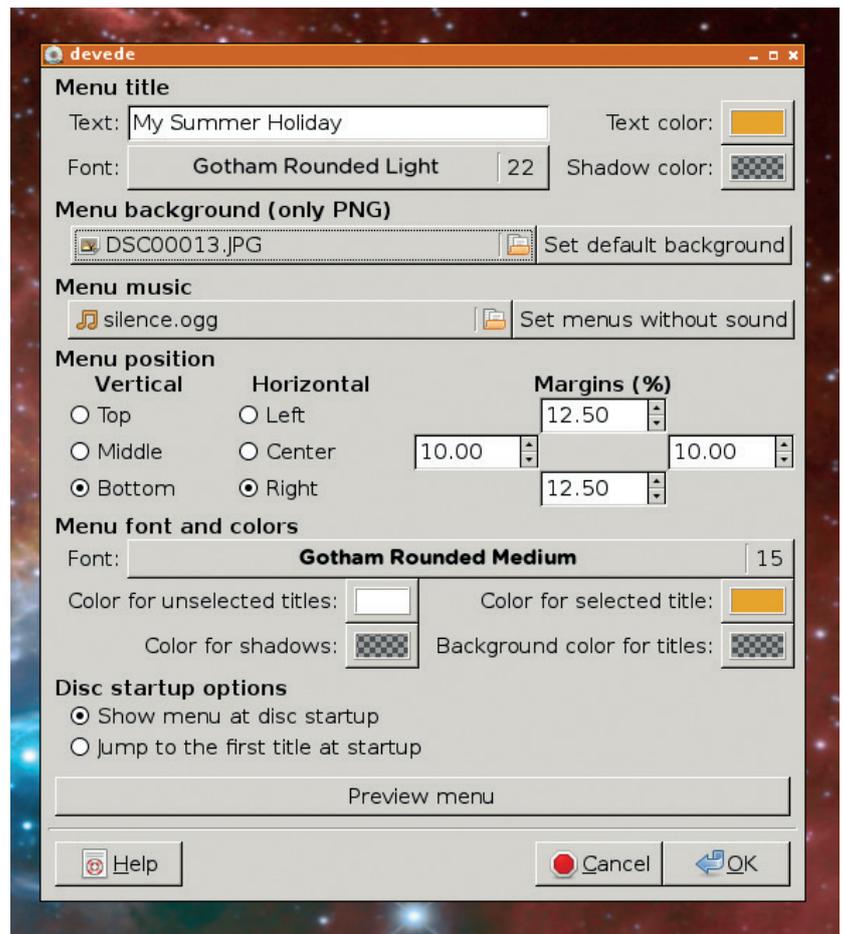
Menus

The next stage is to prepare menus. You can set a background image and write text labels or drag and drop chapters to produce a set of thumbnails that play from those points in the title, and there are basic align and distribute tools to help you lay them out neatly. Menu creation is something you could quite easily get carried away with, but can yield good results to give your disc a polished look and feel.

Writing is the final stage and uses the command-line **dvdauthor** utility underneath. You have to select a working directory and it's a good idea to create a new, empty, one for this. You can choose whether to only create the DVD folder – the directories and files that will go on the disc – to create an image or burn onto a disc. If your content needs to be transcoded, the process will take longer.

Another popular tool that performs similar tasks is *DeVeDe*: you select your content, create menus and launch it. A little while later, your choice of a disc structure or ISO pops out. There's no option to burn that to a disc, so you'll need to use something else for that task.

The menu options are more limited than *Bombono*'s: you can only have one menu and the layout options are much more primitive. It displays each title as text

You can create menus with *DeVeDe* but the options are limited – there are no dragging elements here and no submenus, but it is quick and easy.

(no thumbnails here) and you can choose where they appear: at the top, middle or bottom and either on the left, right or in the centre. You can also place an overall title across the top of the menu screen and select a soundtrack and a background image (this needs to be prepared to the correct aspect ratio beforehand or will appear distorted). A preview window shows you what your menu will look like.

Once your disc image is written, you can preview it in a player such as *VLC* to make sure it's OK before using a separate burning tool to write it to a disc.

Spoilt for choice; spoiled by cruft

If you search your repositories for graphical GUI tools, you'll find options of varying quality, many of which are either abandonware that will present problems as soon as you try to install them, or feature-poor, knocked-together efforts that fail to meet their objectives. This is one area of open source software where there is a significant amount of cruft.

That said, the ones that we've used here work well and do what they were designed to do. Have faith – the package manager will provide. ◼

John Lane provides technical solutions to business problems. He has yet to find something that Linux can't solve.

A few alternatives

- **MakeMKV** is dedicated to ripping DVD-Video to Matroska MKV containers.
- **PGCEdit** is a DVD IFO and menu editor designed to allow the modification of the navigation commands and parameters of an already authored DVD structure.
- **AcidRip**, a *GTK* wrapper for the **mencoder** command, is feature-rich but one for the more advanced user.
- **Brasero** is a beginner-level tool that is a standard part of the Gnome desktop.
- **K3b** is the KDE application for ripping and burning media. And then there's *VLC*, which can do just about anything. But that flexibility cost is met by complexity that may be too much for the casual user taking a backup of the occasional DVD.

ᴸV PRO TIP
Handbrake's preset parameters are described at **https://trac.handbrake. fr/wiki/BuiltInPresets**.