

# Video under Linux

CLUG Talk

Stefano Rivera

10 May 2005



# Contents

- Very Quick Broadcast TV and Video History
- Digital Video
- DVDs
- Linux Software for Video:
  - Playing
  - Encoding
  - Ripping, utils, etc.
- Look at some *really* messed up DVDs ;-)



# Broadcast TV History

TVs timed from the electrical grid.



# Broadcast TV History

TVs timed from the electrical grid.

30's: All sorts of strange formats.

# Broadcast TV History

TVs timed from the electrical grid.

30's: All sorts of strange formats.

60's: Colour:

PAL: W. Europe (except for France), Africa, Asia

SECAM: France and E. Europe, Africa, Middle East

NTSC: N. America and parts of S. America



# Broadcast TV History

TVs timed from the electrical grid.

30's: All sorts of strange formats.

60's: Colour:

PAL: W. Europe (except for France), Africa, Asia

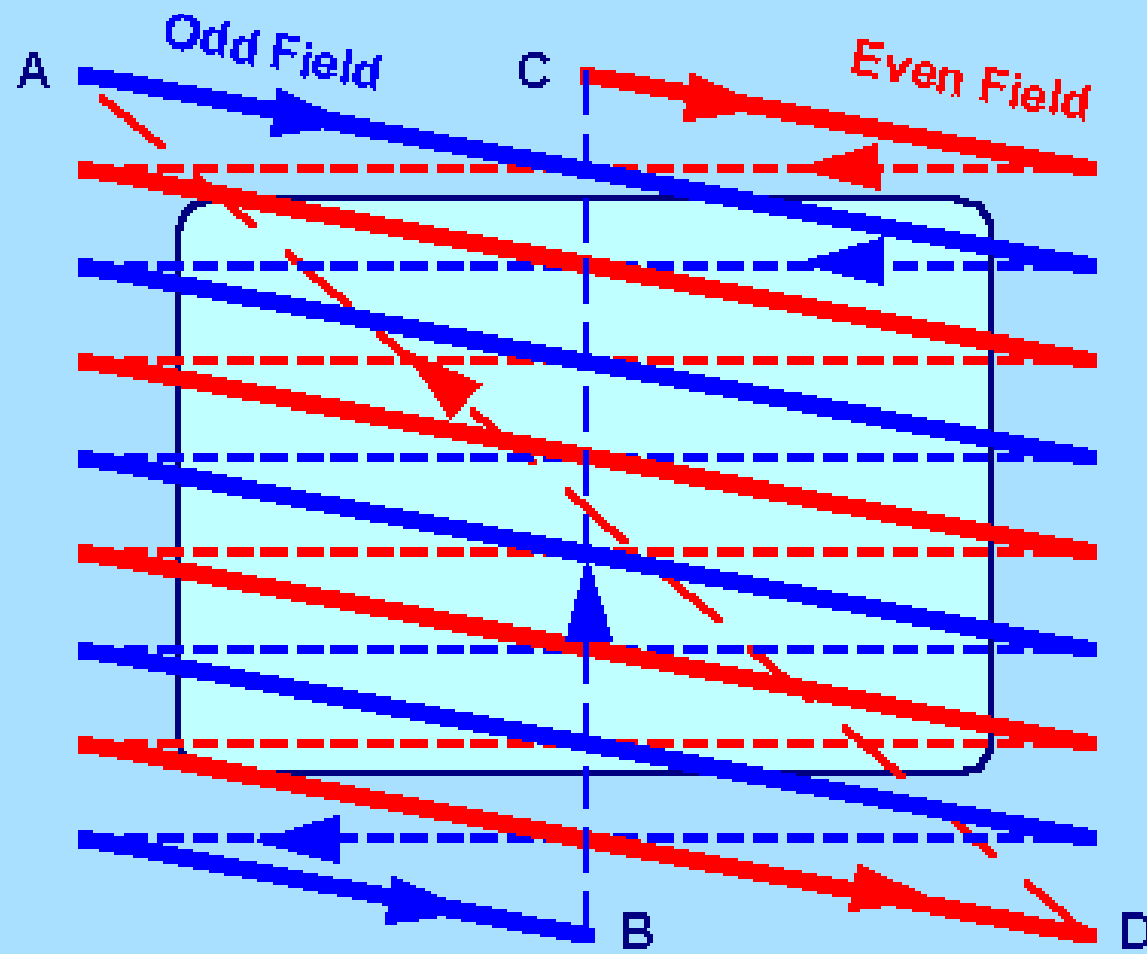
SECAM: France and E. Europe, Africa, Middle East

NTSC: N. America and parts of S. America

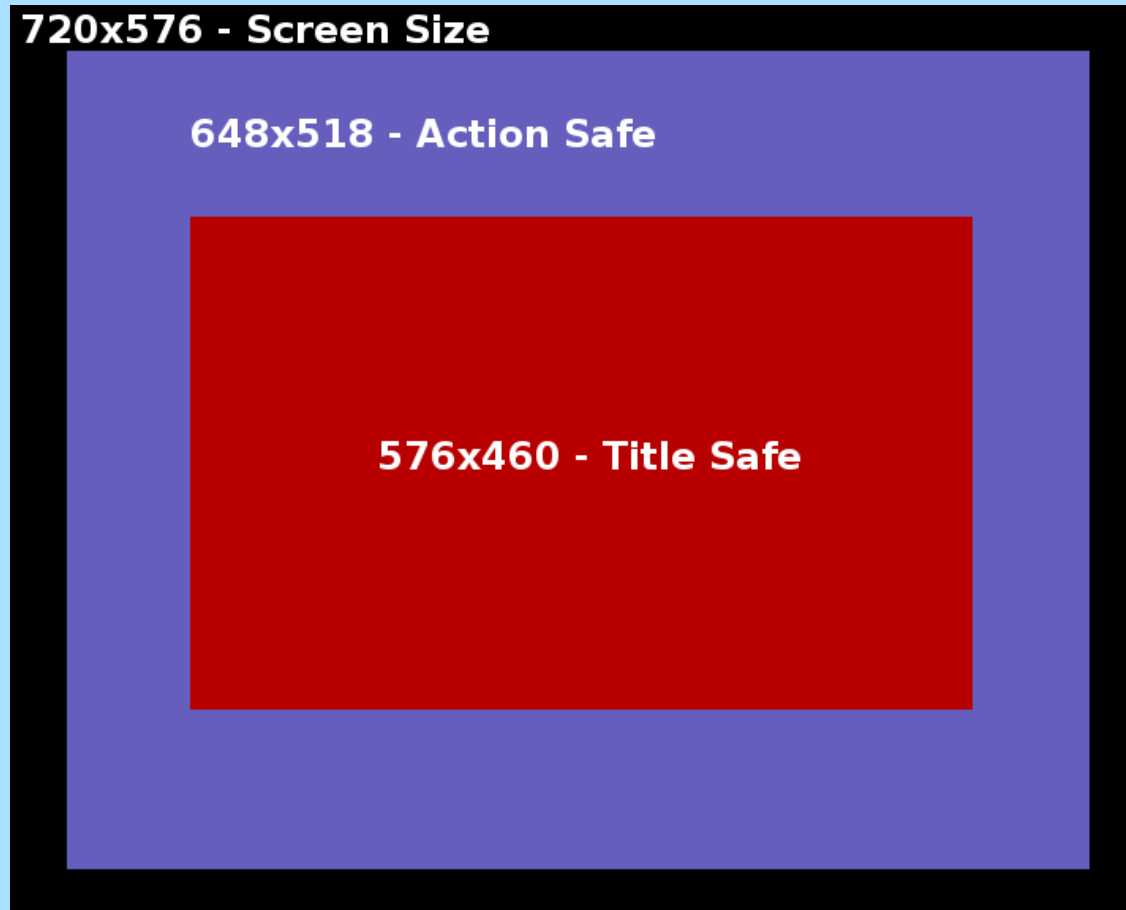
90's SECAM dying, Wide-screen, HDTV



# TV Minefields - Interlacing



# TV Minefields - Scanning area





# TV Minefields - Other

➤ Intensity Levels

## TV Minefields - Other

- Intensity Levels
- Analogue Copy Protection (Macrovision)

# Ways to Televisе Film: Interlacing

How do you convert 24fps film into 50fps TV?

# Ways to Televisе Film: Interlacing

How do you convert 24fps film into 50fps TV?

1. Interlace every frame into 2 fields.

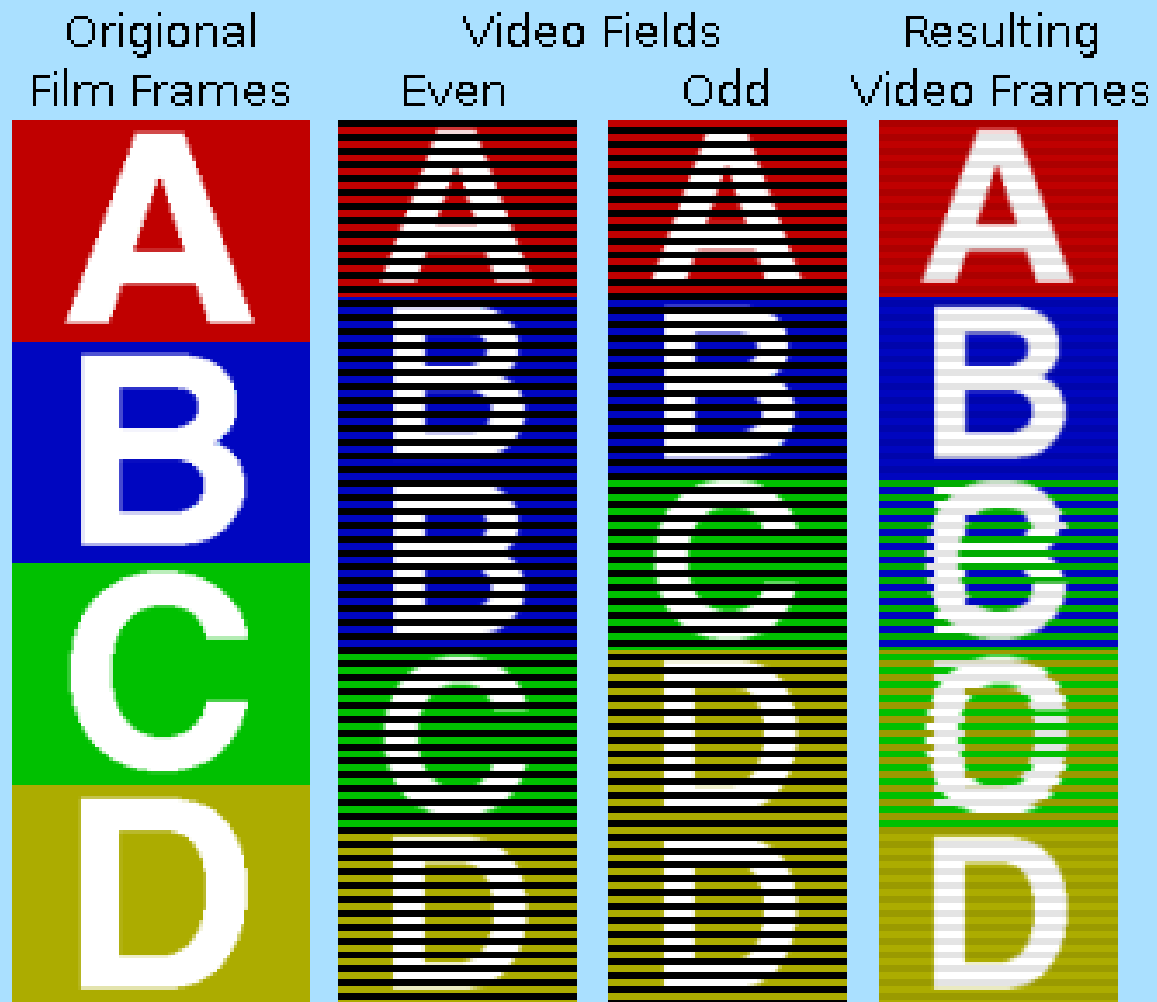
## Ways to Televisе Film: Interlacing

How do you convert 24fps film into 50fps TV?

1. Interlace every frame into 2 fields.
2. Then speed it up from 48fps to 50fps. Adjust the audio up by one semitone.

This Interlacing can be removed.

## Ways to Televise Film: Telecine (3:2 pull-up)



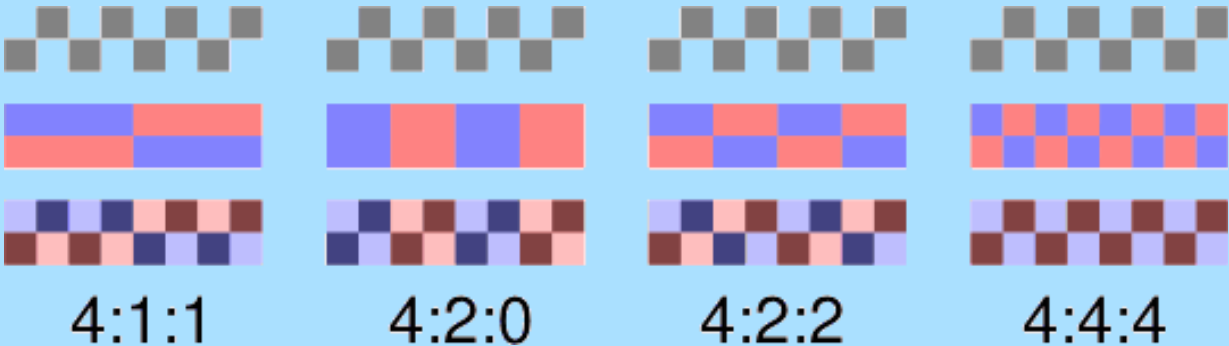
## Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750

# Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750

Colour Sub-sampling:

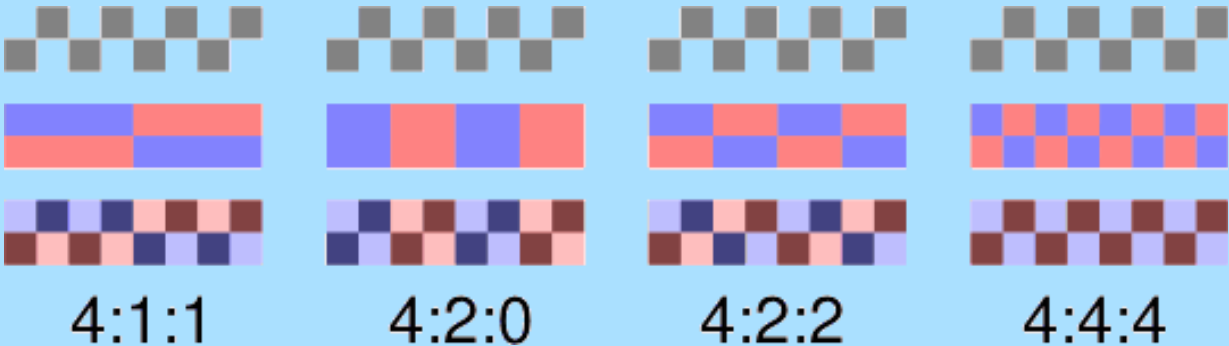




# Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750
D1	10b 4:2:2	720 × 625	270	120

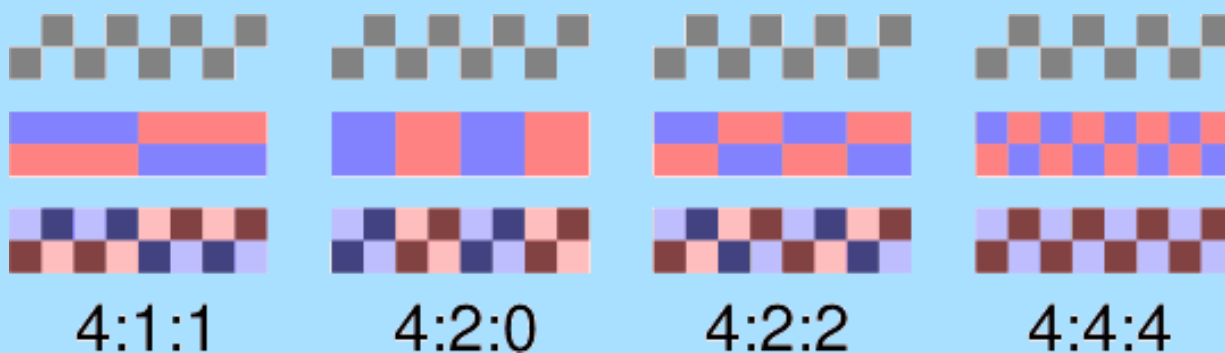
Colour Sub-sampling:



## Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750
D1	10b 4:2:2	720 × 625	270	120
Digibeta	10b 4:2:2	720 × 625	90	40

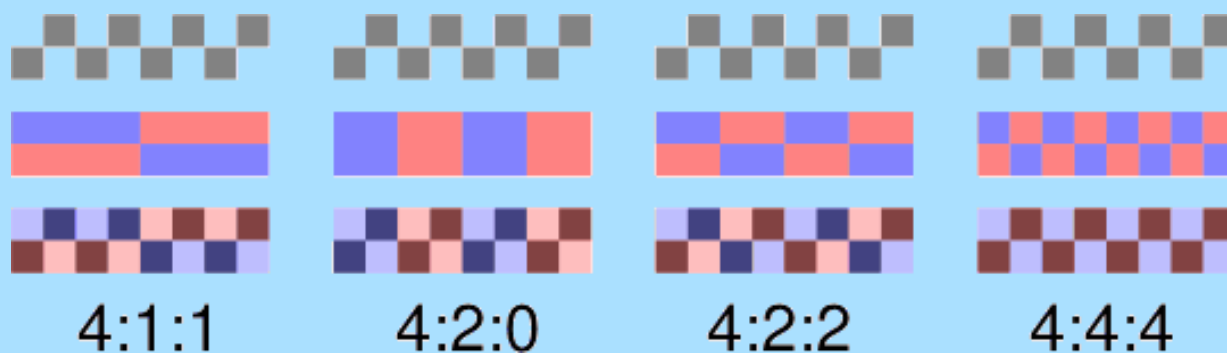
Colour Sub-sampling:



## Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750
D1	10b 4:2:2	720 × 625	270	120
Digibeta	10b 4:2:2	720 × 625	90	40
DV	4:2:0	720 × 576	25	13

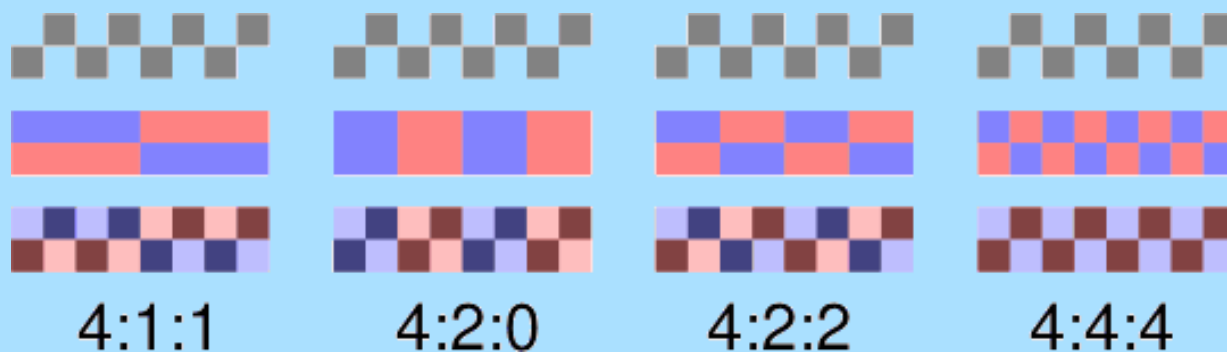
Colour Sub-sampling:



## Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750
D1	10b 4:2:2	720 × 625	270	120
Digibeta	10b 4:2:2	720 × 625	90	40
DV	4:2:0	720 × 576	25	13
DVD	4:2:0 <sup>2</sup>	720 × 576	3 – 10	1, 3 – 4, 5

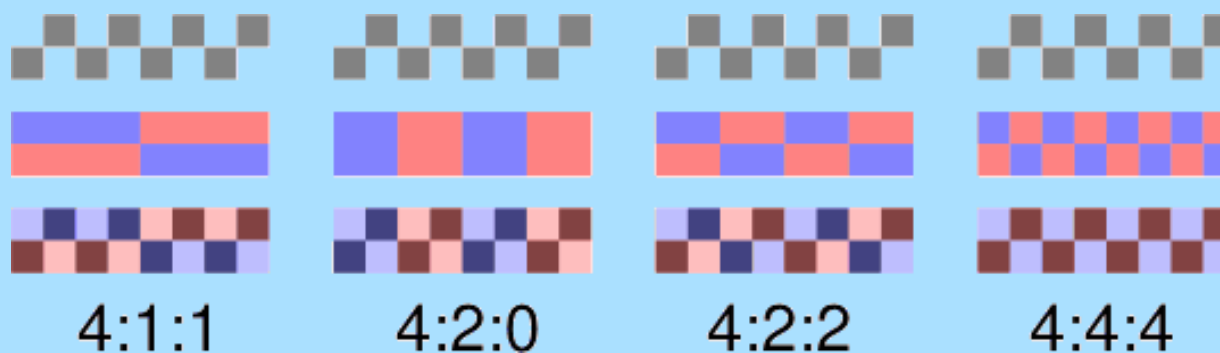
Colour Sub-sampling:



## Digital Video

	Colour	Resolution	Mbps	GB/hr
4k Film	10b 4:4:4	4096 × 3072 <sup>1</sup>	7 500	3 750
D1	10b 4:2:2	720 × 625	270	120
Digibeta	10b 4:2:2	720 × 625	90	40
DV	4:2:0	720 × 576	25	13
DVD	4:2:0 <sup>2</sup>	720 × 576	3 – 10	1, 3 – 4, 5
<i>DVD-rip</i>	?	480 × 360	≤ 1	< 1

Colour Sub-sampling:



# Digital Video Formats

Many different ways of encoding and storing video:

Video Codecs: MPEG-1, MPEG-2, MPEG-4 (DivX, XviD, WM7/8, H.264, etc), Ogg Theora, WM9, Sorenson, Cinepak, MJPEG, DV, Real, etc.

# Digital Video Formats

Many different ways of encoding and storing video:

Video Codecs: MPEG-1, MPEG-2, MPEG-4 (DivX, XviD, WM7/8, H.264, etc), Ogg Theora, WM9, Sorenson, Cinepak, MJPEG, DV, Real, etc.

Audio Codecs: MPEG layer 1/2/3, WM7/8/9, AC3, AAC, Ogg Vorbis, Real, GSM, A-Law, U-Law, PCM, DTS, etc.

# Digital Video Formats

Many different ways of encoding and storing video:

Video Codecs: MPEG-1, MPEG-2, MPEG-4 (DivX, XviD, WM7/8, H.264, etc), Ogg Theora, WM9, Sorenson, Cinepak, MJPEG, DV, Real, etc.

Audio Codecs: MPEG layer 1/2/3, WM7/8/9, AC3, AAC, Ogg Vorbis, Real, GSM, A-Law, U-Law, PCM, DTS, etc.

Other: Subtitles, Timecode



# Digital Video Formats

Many different ways of encoding and storing video:

Video Codecs: MPEG-1, MPEG-2, MPEG-4 (DivX, XviD, WM7/8, H.264, etc), Ogg Theora, WM9, Sorenson, Cinepak, MJPEG, DV, Real, etc.

Audio Codecs: MPEG layer 1/2/3, WM7/8/9, AC3, AAC, Ogg Vorbis, Real, GSM, A-Law, U-Law, PCM, DTS, etc.

Other: Subtitles, Timecode

Containers: AVI (OpenDML), MPEG-PS, ASF, QT, RM, OGG/OGM, MKV, etc.

# Digital Video Formats

Many different ways of encoding and storing video:

Video Codecs: MPEG-1, MPEG-2, MPEG-4 (DivX, XviD, WM7/8, H.264, etc), Ogg Theora, WM9, Sorenson, Cinepak, MJPEG, DV, Real, etc.

Audio Codecs: MPEG layer 1/2/3, WM7/8/9, AC3, AAC, Ogg Vorbis, Real, GSM, A-Law, U-Law, PCM, DTS, etc.

Other: Subtitles, Timecode

Containers: AVI (OpenDML), MPEG-PS, ASF, QT, RM, OGG/OGM, MKV, etc.

Features: Streaming (Interleaving), Seeking, Robustness



## DVDs

- UDF File-system. VIDEO\_TS, AUDIO\_TS

## DVDs

- UDF File-system. VIDEO\_TS, AUDIO\_TS
- Virtual Machine

## DVDs

- UDF File-system. VIDEO\_TS, AUDIO\_TS
- Virtual Machine
- MPEG-PS Streams containing:
  - MPEG-1 / MPEG-2 Video (including menus and subtitles)

## DVDs

- UDF File-system. VIDEO\_TS, AUDIO\_TS
- Virtual Machine
- MPEG-PS Streams containing:
  - MPEG-1 / MPEG-2 Video (including menus and subtitles)
  - LPCM Audio (optionally AC3, DTS, MP3, etc.)

## DVDs

- UDF File-system. VIDEO\_TS, AUDIO\_TS
- Virtual Machine
- MPEG-PS Streams containing:
  - MPEG-1 / MPEG-2 Video (including menus and subtitles)
  - LPCM Audio (optionally AC3, DTS, MP3, etc.)
  - Timecode

## DVDs

- UDF File-system. VIDEO\_TS, AUDIO\_TS
- Virtual Machine
- MPEG-PS Streams containing:
  - MPEG-1 / MPEG-2 Video (including menus and subtitles)
  - LPCM Audio (optionally AC3, DTS, MP3, etc.)
  - Timecode
- Protection: CSS Encryption, Regions, Macrovision Protection (Player)



## DVDs on Linux

- Nothing. . . (well, only un-encrypted DVDs)

## DVDs on Linux

- Nothing. . . (well, only un-encrypted DVDs)
- DVD John: decss

## DVDs on Linux

- Nothing. . . (well, only un-encrypted DVDs)
- DVD John: decss
- libdvdcss (Videolan) libdvdread (Ogle) libdvdnav (dvd.sf.net)

## DVDs on Linux

- Nothing. . . (well, only un-encrypted DVDs)
- DVD John: decss
- libdvdcss (Videolan) libdvdread (Ogle) libdvdnav (dvd.sf.net)
  - Region Coding (RPC-I/II firmware — 1999)

**NB:** deborphan



## Players — XV

All decent players support XV:

The XFree86 video overlay extension is a very poorly documented standard feature of XFree86 4.x and is absolutely essential for high quality video playback under Linux. It is the only type of hardware playback acceleration that is widely supported in Linux, and it is by far the single most important configuration element for DVD playback on a Linux system.

— DVD Playback Howto

## Players — XV

All decent players support XV:

The XFree86 video overlay extension is a very poorly documented standard feature of XFree86 4.x and is absolutely essential for high quality video playback under Linux. It is the only type of hardware playback acceleration that is widely supported in Linux, and it is by far the single most important configuration element for DVD playback on a Linux system.

— DVD Playback Howto

MPlayer: `-vo xv`



# Players

➤ MPlayer



# Players

- MPlayer
- Xine
- Gstreamer
- Wrappers:
  - i.e. totem - based on either Gstreamer or Xine
- VLC



# Encoders

- Transcode
- Mencoder
- Gstreamer
- Mjpegtools, etc.

# Utils

- dvdbackup
- ogmtools
- transcode
- gocr
- growisofs
- thoggen, dvd::rip
- CloneDVD (wine)



# Ripping DVDs - By Hand

➤ Do it ;-)



## Ripping DVDs - dvd::rip

- Based on transcode
- Fully automatic but lots of control — designed for pirates
- Written in perl :-)
- Doesn't ocr subtitles
- Clustering

## Things to look at

Les Triplettes De Belleville	1 00:03:00	Animation. . .
Kgotla Clip 20/69	00:00:00	Interlacing
Meaning of life	2 00:17:00	“Missing” Scene
The Wall	1 01:20:00	Frame rate switching
The Wall	3 00:08:00	Pulldown