History of Video in Linux

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In the beginning (1995)

- Windows 95 with early DirectShow
  - Hardware scaling
  - Different pluggable codecs (INDEO popular)
- QuickTime 2.1 available for Windows and MacOS
- MPEG too CPU intensive for common PC’s.
Xanim

- OpenSource animation and video player for Linux/UNIX
  - Supports codecs like INDEO through licensed binaries.
  - Uses shared memory to speed up drawing

Xanim problems

- X11 is a slow protocol.
- No hardware support.
- Development was slow for a long while and died in 1999.
- Missing support for new codecs
  - MPEG support really bad.
  - Sorenson QuickTime unavailable
MpegTV

- Commercial MPEG Player for Linux
- Good MPEG support.
- Support for VCD.
- Easy to use GUI with advanced controls.
  - For example dropping of B or B and P frames for better performance
- Synchronized audio and video

MpegTV problems

- X11 still a slow protocol.
- Closed source.
  - Not possible to make alterations.
  - Slow development. Died in 1999.
- CPU intensive
Windows in early 2000

- Most drivers support DirectShow with hardware scaling, color space conversion and in some cases HW IDCT and Motion Compensation
- VCD and MPEG playback is common
- DVD playback possible with some HW support
- DivX ;-) appearing and popularity is increasing rapidly

The problem in Linux so far

- Don’t use video-features of graphics boards
  - Common video boards in 1999 had video scalers and hardware color space conversion
- X11 graphics is slow(er than windows)
  - Network transparency
- XFree86 3.x server is outdated
- Popular codecs remain unsupported for various reasons
  - Complexity, secrecy, patents etc.
- DVD playback is difficult at best
The solution: XFree86 4.0 (March 2000)

- Hardware accelerated 3D through DRI/glx extension (OpenGL)
- Hardware accelerated video through XVideo extension
- Video drivers as modules
  - Hardware producers can write binary modules

XVideo extension (XV)

- An API that enables use of hardware for color space conversion, filtering and scaling
- A lot of time is saved by doing color space conversion and scaling in hardware
  - Smoother playback
  - Removes tearing artifact
  - Often results in better picture quality
- Software needs to be rewritten to use XV
SDL MPEG Player Library (SMPEG)

- Mpeg Player and library made by Loki Software.
  - LGPL
  - Based on UC Berkley's mpeg_play and splay, and MPEG-audio player by Woo-jae Jung
  - One of the first Linux-players to support XV.
  - Uses SDL to address audio and video hardware
- Loki Software filed for Ch.11 in 2001
  - Development stopped
  - Player was never finished as an end-user product
  - Library used in XMMS to support MPEG playback

X Movie Player System (XMPS)

- Promised to be for Video what XMMS was for audio under X11
- The idea was to have plugins do everything.
- XMPS can currently play mpeg2 video and some other codecs, but the project seems to be dead.
Avi File Library (Avifile)

- OpenSource (GPL) Avi player/encoder/library for Linux x86.
- Original goal was to create a video capture and recompression applications that would work with most popular AVI file format and newest data compression methods
  - Indeo Video and variations of MPEG-4 for image compression and MPEG Layer-3/Windows Media Audio for sound.
- Became the first DivX ;-) player for Linux. Later used in other players to provide DivX ;-) support.
- The core idea of the project was in using Win32 dynamic-link libraries in Linux environment.
  - No need to implement codec, only a DLL loader which loads the windows codec.
  - Idea has later been used to implement other Win32 codecs in other players.

Gstreamer

- LGPL Multimedia Framework primarily for Gnome
- “GStreamer allows the construction of graphs of media-handling components, ranging from simple mp3 playback to complex audio (mixing) and video (non-linear editing) processing. Applications can take advantage of advances in codec and filter technology transparently. Developers can add new codecs and filters by writing a simple plugging with a clean, generic interface.”
- Very complex system, not yet mature enough to be used by end-users. But a very cool idea :)

Gstreamer example MPEG player

MPlayer

- OpenSource (GPL) media-player
- Plays: MPEG, VOB, AVI, OGG/OGM, VIVO, ASF/WMA/WMV, QT/MOV/MP4, FLI, RM, NupelVideo, YUV4MPEG, FILM, RoQ, PVA files, supported by many native, XAnim, and Win32 DLL codecs.
  - You can watch VideoCD, SVCD, DVD, 3ivx, DivX 3/4/5 and even WMV movies, too (without the avifile library).
- The philosophy is to let every hacker do as he wants and hope something useful emerges as a result.
- The result is ugly code, but a fast and rapidly evolving media player.
- Usually the first to support new codecs (like Sorenson QuickTime)
XINE – A Free Video Player

- OpenSource GPL Video player/library
- Supports most of the same codecs as MPlayer
- The philosophy here is to use readily available software instead of creating everything from scratch
  - Result is cleaner, more stable code than MPlayer, but they lag behind
  - Easier to use than MPlayer
- In the beginning it was one of the best DVD-players under Linux
  - It still is

XINE - Architecture
DVD playback under Linux

- What do you need?
  - MPEG2 video decoder
  - MPEG-audio or AC3-audio decoder
  - A demuxer
  - A way of descrambling the stream
  - A virtual machine to enable menus

Darwinistic development

- Several projects were started to get DVD playback under Linux. Most of them are dead now, but a lot of code survives.
- libMPEG2 is used to decode MPEG2 video
- libA52 is used to decode AC3 audio
- DeCSS was used to descramble the stream, but was later abandoned for brute-force methods which worked on more streams. Libcss is popular today.
- The earliest DVD players did not support menus, and CSS support was poor.
Ogle

- The first DVD-player for Linux with menu-support.
- Menu-support added by reverse engineering. Only some menus worked at first.
- Menu support was later released as a library
  - Xine implemented it through a plugin at first and is now officially a part of xine
  - Development of Ogle stopped shortly after this
    - The last month seems to have brought new life to Ogle
- Menu support now handles most DVDs, but some still cause problems

What’s still missing?

- Hardware IDCT and Motion compensation
- Good deinterlacers
- OpenSource codecs for Sorenson, Real codecs, Microsoft codecs etc. to get better portability
XV Motion Compensation (XvMC)

- New extension to X
- Enables motion compensation and IDCT in hardware
- Supported (in part) by NVIDIA and Intel i810
- Little or no support by software producers