RMLL 2012 (2012-07-11)

OSS bricks for television head-ends

(Christophe Massiot)

OpenHeaden

Academic experiment: VideoLAN

- Broadcasting video over IP is the goal of the VideoLAN project founded at the École Centrale Paris in 1996
- First steps of the project included:
  - VLMS (TS file streaming)
  - VLS (satellite and file streaming)
  - VLC (IPTV network client)
- First TV broadcast on the campus: early 2000s
- Went GPL in 2001

VideoLAN ORGANIZATION

OpenHeaden

VideoLAN in the 2000s

- The project was continued by students, former students and other OSS contributors
- VLS and VLMS were abandoned in favour of factoring the code into VLC
  - VLC gained video acquisition interface: linux-dvb (satellite, cable, terrestrial), v4l (raw video and encoding devices)
  - VLC's “stream output” allowed to build a pipeline of video and audio processing, and streaming

OpenHeaden

First large-scale deployment: Free

- Free is a French ADSL (and now mobile) operator, invented the triple-play “Box” concept
- Started broadcasting TV channels nation-wide end of 2003
- TV head-end built with PCs and OSS bricks
  - For cost reasons at first (500 € vs. 15000 €/channel)
  - It then proved more reliable, more flexible, and easier to maintain and debug

OpenHeaden

Basic tasks in a head-end

- Satellite or terrestrial reception
  - Was made possible by the support of CAM modules (descrambling) in linux-dvb in 2004
  - Support for linux-dvb and EN 50 221 (common interface) was implemented in VLC
- MPEG-2 transcoding from VBR to 3.5 Mbits/s CBR (or capped VBR)
  - Satellite sources are statistically multiplexed and therefore inherently variable bit-rate
  - ADSL eligibility based on the highest bit-rate peaks

OpenHeaden

Performing MPEG-2 transrating

- FFmpeg featured MPEG-2 decoding and encoding, support for interlacing was added
- Mid-2000s PC hardware couldn't support transcoding 720x576 interlaced 50 fps
- VLC and FFmpeg were modified for transrating
  - Transrating = skip motion estimation and re-use motion vectors from the source
  - Didn't fit in nicely in VLC's stream output architecture, so was never merged upstream (and now the need is much lower)

OpenHeaden

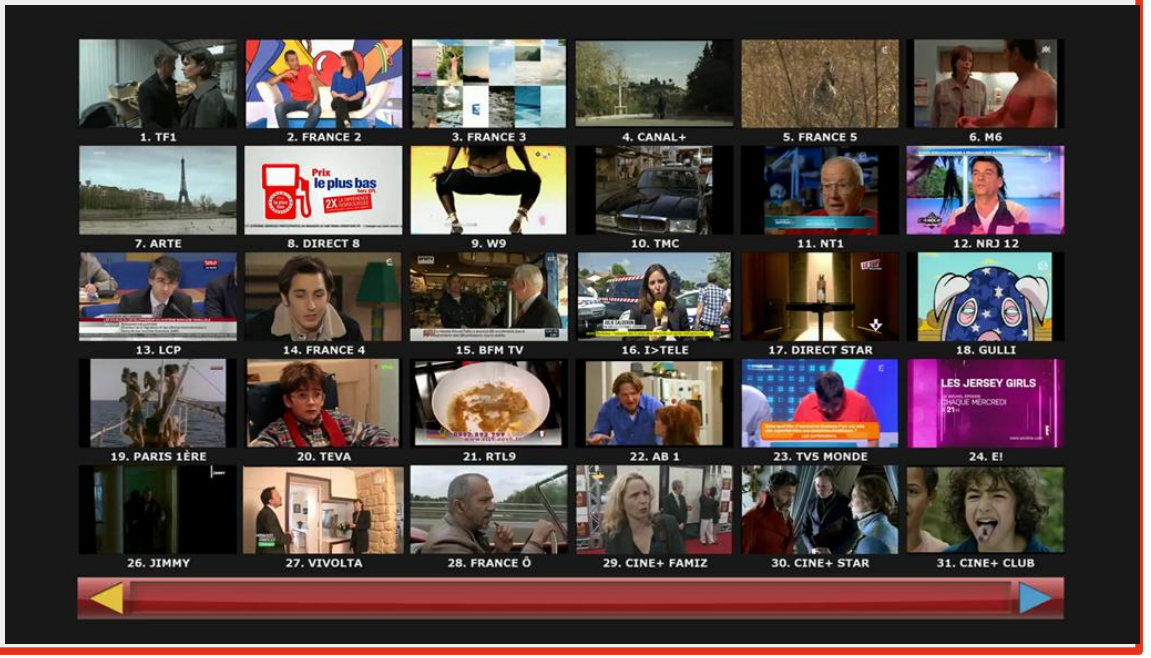
How needs and technologies evolved

- Industry moved to lower bit-rate H.264 and AAC, which implied transcoding
- Video moved towards high definition
- VideoLAN's x264 project is one of the best H.264 encoders (quality/performance-wise)
- Intel® Nehalem CPUs first allowed to transcode H.264 in real-time
- H.264 encoding is still based on VLC for reliability reasons

OpenHeaden

How services evolved

- VLC's stream output allows to build mosaics of TV channels
  - Number of channels only limited by CPU
  - Also allows to embed audio tracks as separate PIDs
  - 1440x1080p25 mosaics are in production with 30 channels, for a total of 5 Mbits/s



OpenHeaden

Later additions

- VLC's codebase is large and not flexible, so smaller projects have emerged on dedicated tasks:
  - DVBlast (demultiplexing of satellite/cable/terrestrial/IP source)
  - Multicat (TS streaming and recording)
  - AggregaRTP (aggregation of several network links for contribution)
- SDI and HD-SDI inputs (with Computer Modules and DeckLink cards) built into VLC

OpenHeaden

Some useful OSS projects

- Large multimedia frameworks: VLC, gstreamer
- Custom-built applications: DVBlast, Multicat, AggregaRTP, OBE, OpenCaster (TS mux with advanced PSI & carousel)
- Useful libraries:
  - FFmpeg/libav, x264
  - libdvbcsa (scrambling/descrambling)
  - libebur128 (R128 OSS implementation)
  - biTStream (transport stream structure parsing)

OpenHeaden

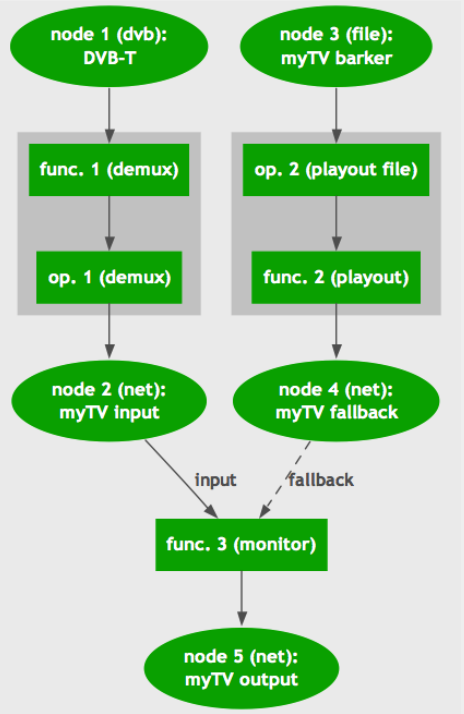
Limits of OSS for broadcast professionals

- Lots of projects mainly targeted at end-user, with broadcast extensions
  - Rare documentation
  - Not as maintained as other parts
- Tendency to become “bloated”
- Broadcast professionals generally aren't computer geeks
  - Complex command-line options
  - GNU/Linux skills are necessary

OpenHeaden

OpenHeadend

- French company created in 2011
- OSS/proprietary software symbiosis
  - Core features are and remain OSS
  - Delivers in addition an integrated GNU/Linux environment, with an SNMP server and an advanced Web interface
  - So that OSS reliability and features are accessible to non-technical people
- First products: demux, monitoring, catch-up



OpenHeaden