

Standard Definition Stereoscopic Video

Miloš Liška, Petr Holub

`xliska@fi.muni.cz`, `hopet@ics.muni.cz`

CESNET and Masaryk University, Czech Republic

Immersive Medical Telepresence Meeting

Phoenix, AZ, 2006-09-06



Talk Overview

- Digital Video
- DV over IP
- `xdvshow`
- Stereoscopic Video
- Synchronization



Digital Video (DV)

- MPEG-2 like system, best quality for standard definition video in consumer sector, high level of details
- Standards: PAL (720×576 , 25 fps) a NTSC (720×480 , 29,97 fps)
- Intra-frame compression, compression rate 5:1
- Target bitrate 25 Mbps



DV Transmission

- RTP protocol is used for video transmission
- The transmission is defined by RFC3189 a RFC3190
- DVTS project (<http://www.sfc.wide.ad.jp/DVTS>)
 - `dvsend`, `dvrecv` and `dvplay` tools
 - (`xdvshow`)



xdvshow reimplementation

- Multiple threads architecture
 - DV video receiving
 - DV video decoding
 - Video rendering
- Robust architecture, lower CPU consumption
- DV video inputs
 - RTP stream
 - Local file
 - IEEE-1394 interface



xdvshow reimplementation

- RTP stream
 - Unicast
 - Multicast
 - Packet reflector
- DV video decoding
 - Quasar DV codec, libdv



xdvshow reimplementation

- SDL display
 - Fast displaying method
 - Fullscreen mode, several scaling modes
 - Support for Xinerama
- X Windows
 - Backup, compatible display method
 - Too slow



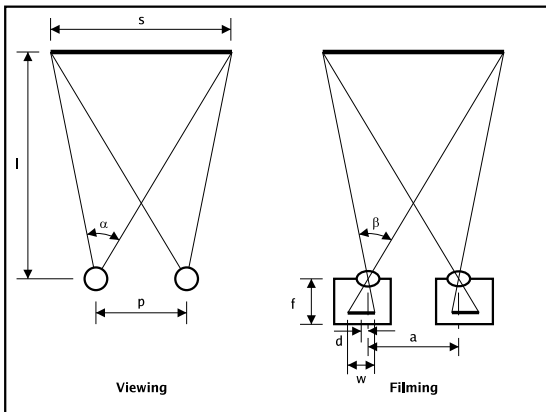
Stereoscopic Video Capturing

- Simulates real human view
- Two DV video streams each for one eye
- Camera tripod head
- Two capturing/sending computers
 - IEEE-1394 interface, Linux or FreeBSD OS, dvsend



Stereoscopic Video Capturing

- Theoretical background



$$a = b$$

$$\alpha = \beta$$

$$\frac{f}{l} = \frac{w}{s} = \frac{2d}{p}$$

- However the whole setting may be done by hand

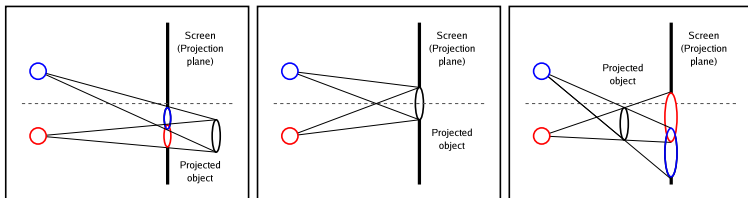


Stereoscopic Video Capturing

- Camera tripod head (Parallax Setting Device by APEC)



- Parallax setting

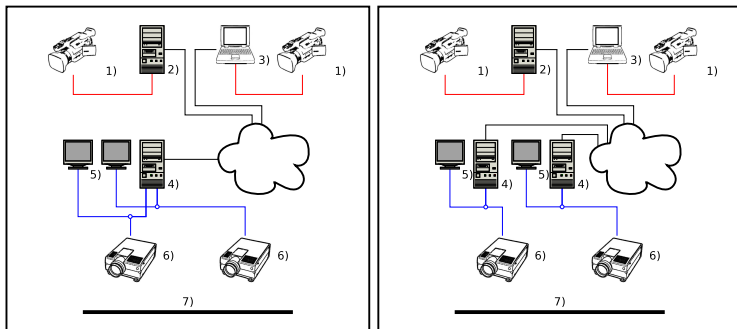


Stereoscopic Video Projection

- Receiving/displaying computer, graphics card with two heads
 - FreeBSD or Linux OS, X Windows with Xinerama extension
 - Enhanced `xdvshow`
- Two projectors with polarising filters
- Projection screen with non-depolarising surface
- Polarising glasses



Setup Possibilities Overview



- 1) cameras, 2) sending computer, 3) sending computer,
4) displaying computer, 5) monitors, 6) projectors

Actual Setup Overview



DV streams synchronization

- Synchronizing packet reflector (rum)
- Source PCs must be synchronized (e.g. using NTP protocol)
- Synchronization via RTP and RTCP timestamps
 - Out-of-order packets reordering (discarding)
 - Time information matching
- Practically absolute synchronization



Synchronization Traps

- Increased overall latency penalty
 - Packet reflector delay around 68 ms
 - Increases with inter-stream delay
 - Final penalty around 10% of inter-stream delay
 - Unusable for real-time transmissions
- Slightly unsuitable for DV over IP transmission
 - No actual timestamps used in RFC3189
 - Real timestamping used
 - Transmission is not complying with RFC3189



Conclusions

- Stable and easy to set up system
- Resolved stereoscopic video capturing and displaying
- Synchronization of both video streams
 - Synchronization done by the network
 - Practically absolute synchronization



Thank you for your attention!

Q?/A!

`xliska@fi.muni.cz`

`https://sitola.fi.muni.cz/~xliska/`

