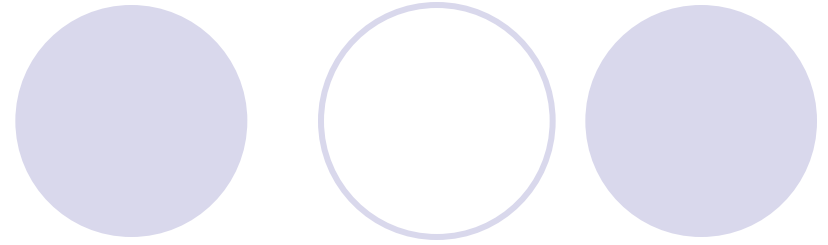
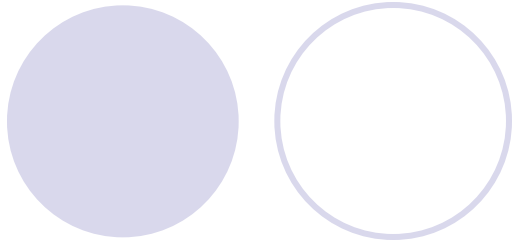




Stereoscopic video and GStreamer

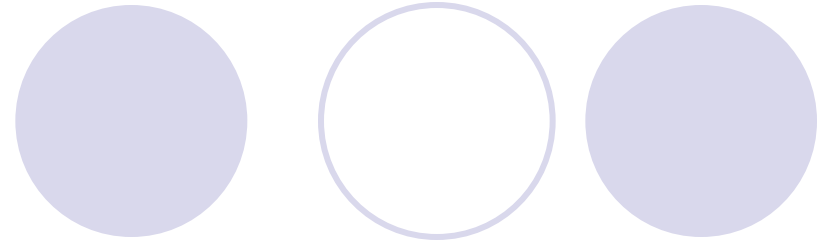
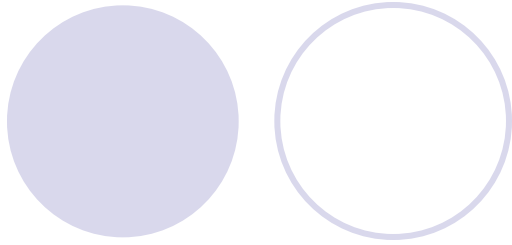
By Martin Bisson





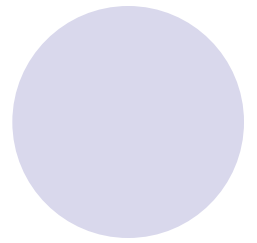
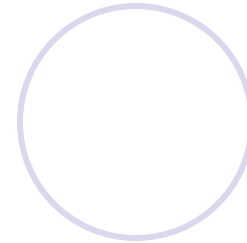
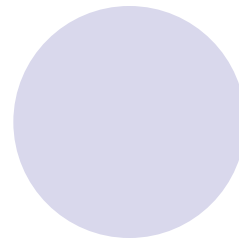
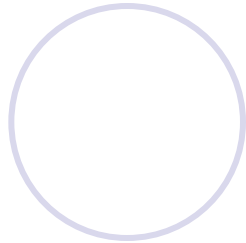
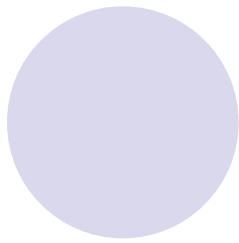
Presentation outline

- **Introduction**
- **Use cases**
- **Implementation**
- **Road ahead**

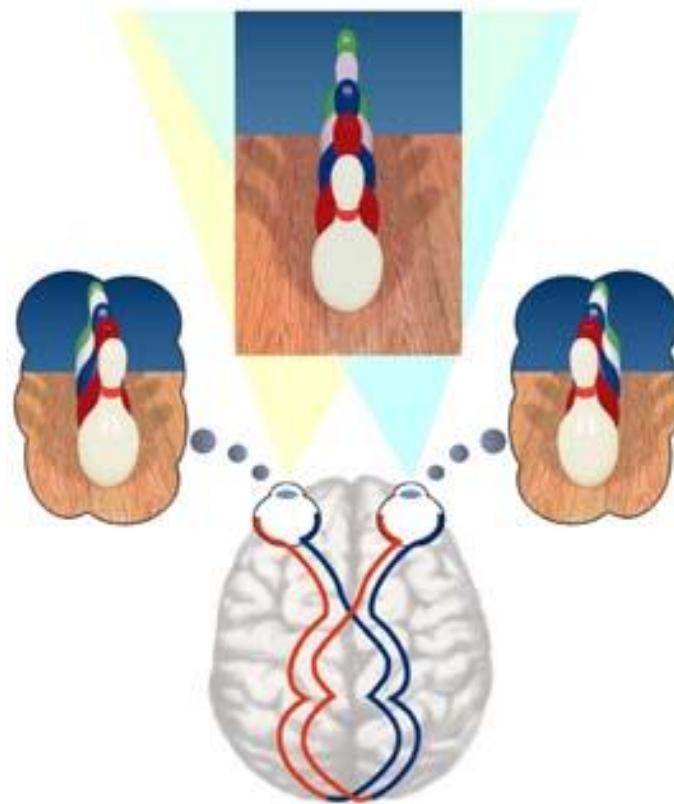


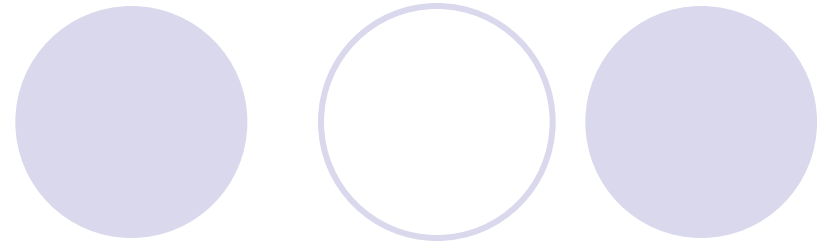
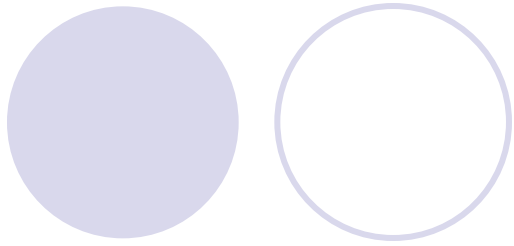
Presentation outline

- **Introduction**
- Use cases
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Stereoscopy





Recent popularity

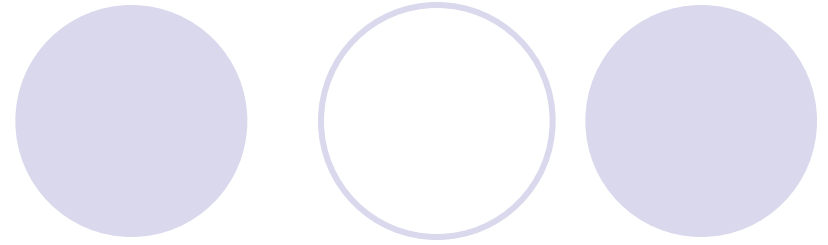
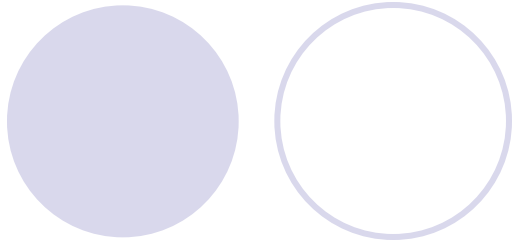
- **3D-ready hardware**



- **3D movies**

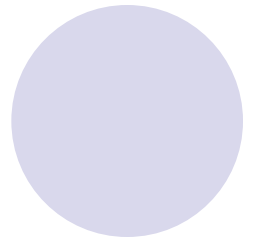
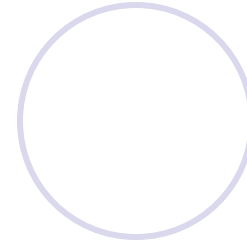
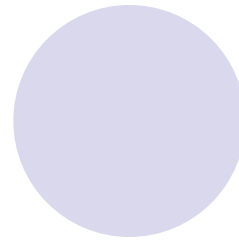
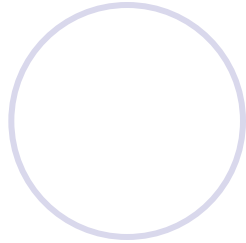
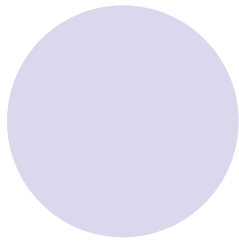
 - **Avatar => ~2.8 billion USD**





Presentation outline

- Introduction
- **Use cases**
- Implementation
- Road ahead



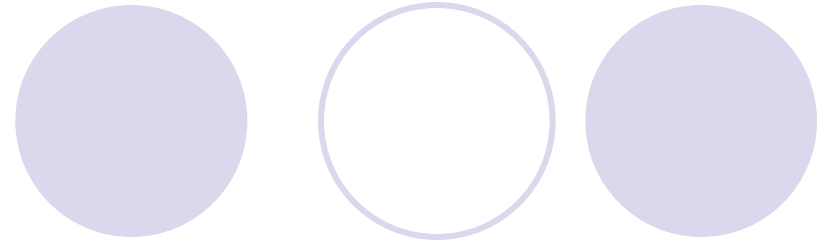
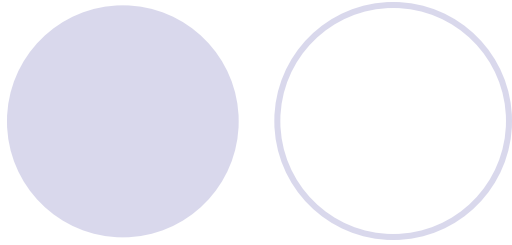
Use cases

- **1) Merge 2 video streams into a stereo stream**
- **2) Convert a (double) video stream into a stereo stream**



Use cases

- **3) Convert a stereo stream into a « regular » video stream**
 - Can be displayed or encoded by normal plugins
- **4) Generate an anaglyph video stream from a stereo stream**
- **5) Output a stereo stream on various 3D display hardware**



Presentation outline

- Introduction
- Use cases
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- Road ahead



Implementation

- **What is a « stereo stream »?**

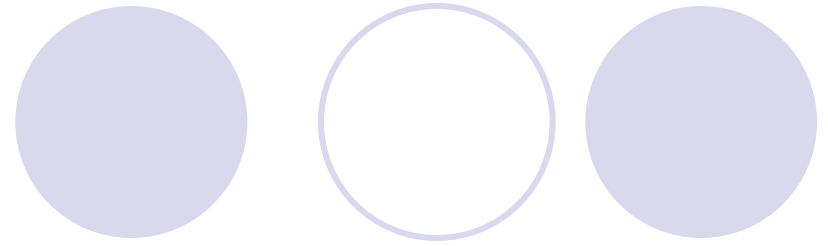
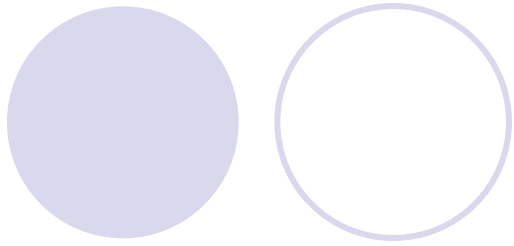
- **Buffer flags?**

- **New caps**

- `video/x-raw-{rgb,yuv,gray}-stereo`

- `layout = { 1122 , 1212 }`

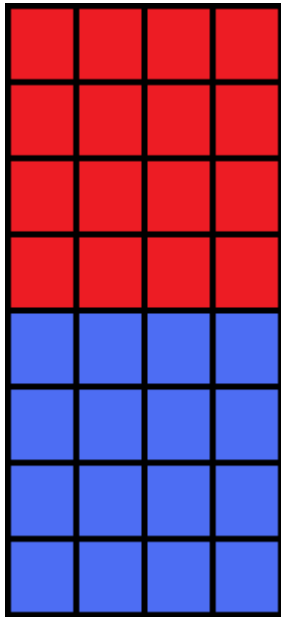
- `fourcc = { YUY2 , YVYU , UYVY , Y800 ,
GREY , Y8 , Y16 }`



Memory layout

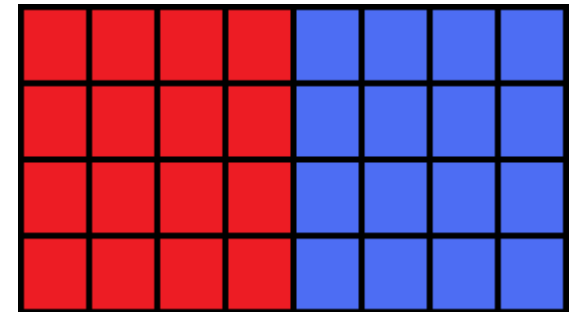
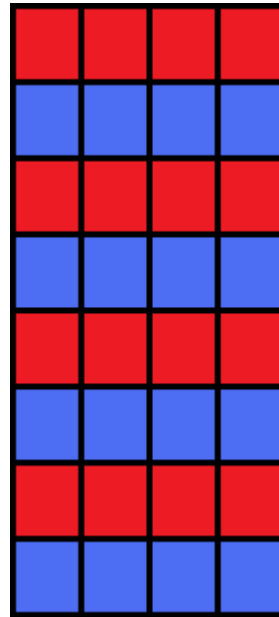
1122

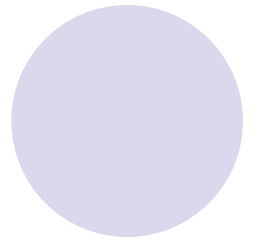
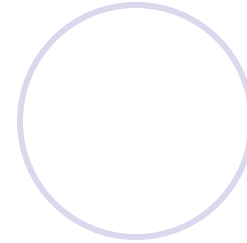
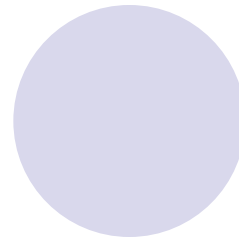
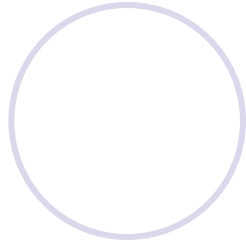
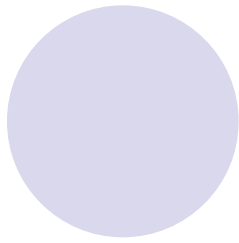
Memory-consecutive



1212

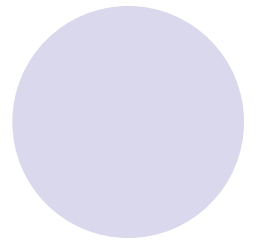
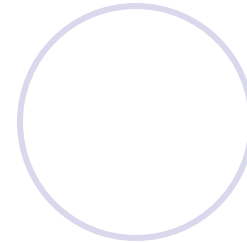
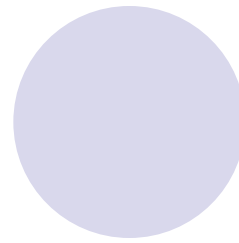
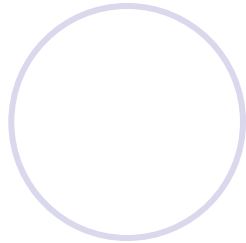
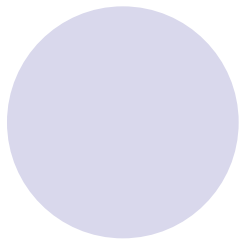
Row-interleaved





Supported formats

- **Only packed, no planar**
- **RGB : RGBx, xRGB, BGRx, xBGR, RGB, BGR, RGB_16, RGB_15**
- **YUV : YUY2, YVYU, UYVY, Y800, GREY, Y8, Y16**
- **GRAY : GRAY8, GRAY16**

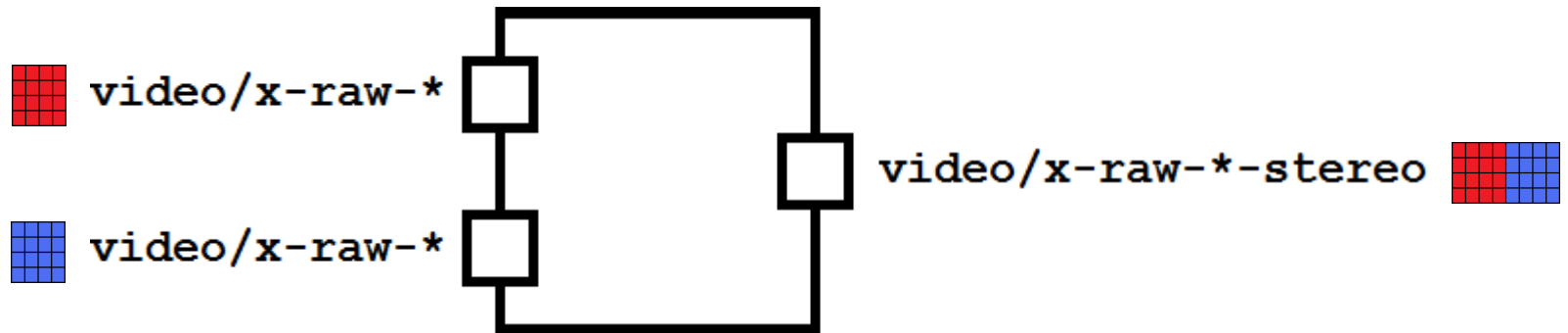


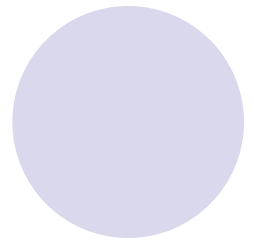
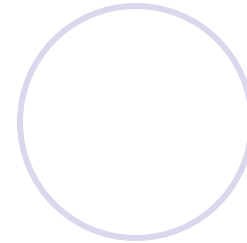
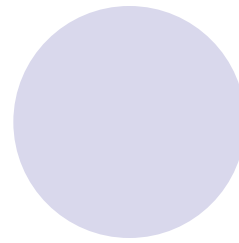
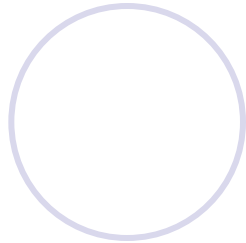
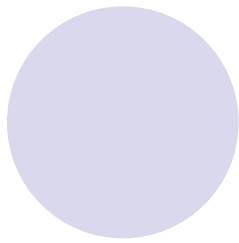
Plugins

- **video3dmerge**

- **GstCollectPads**

- **mode : memory-consecutive or row-interleaved**



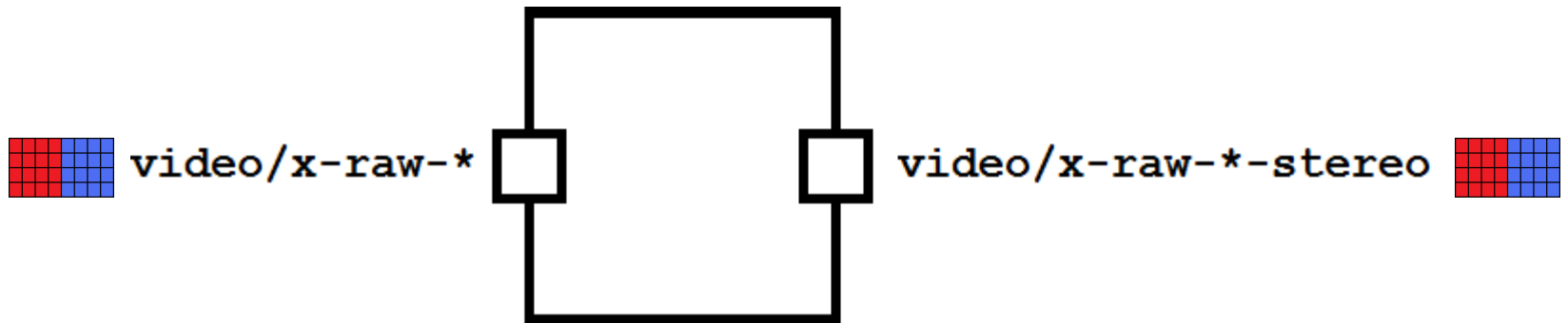


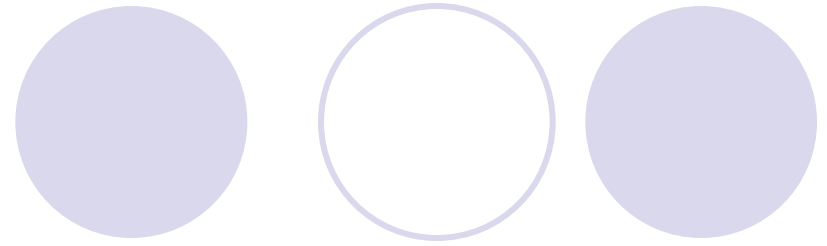
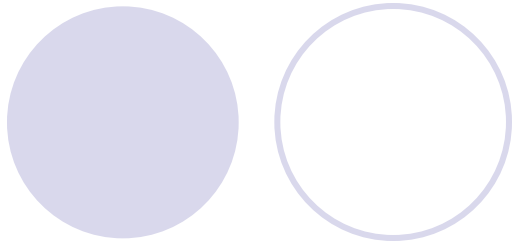
Plugins

- **video3dconvert**

- **GstVideoFilter**

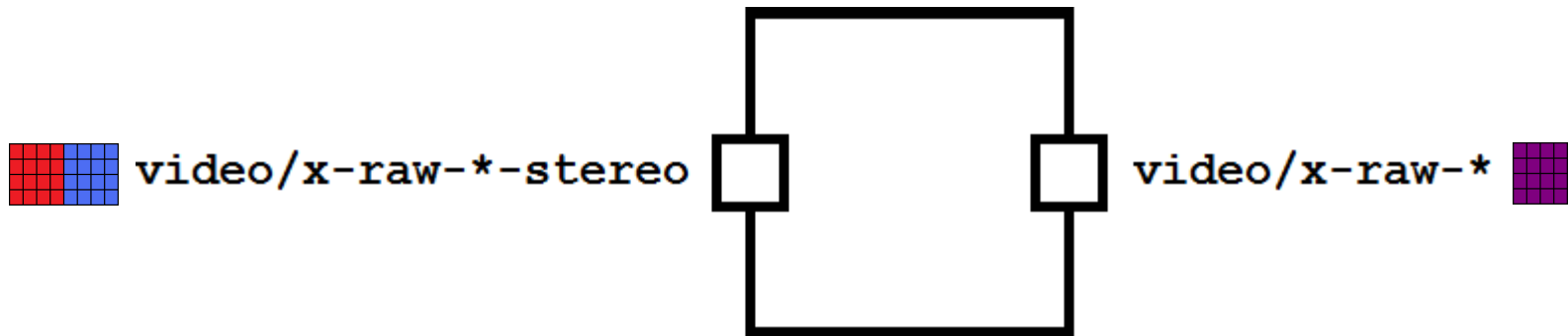
- **mode : left-right or top-bottom**

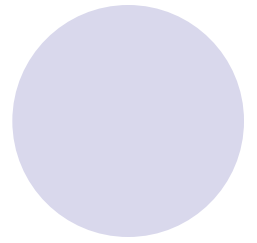
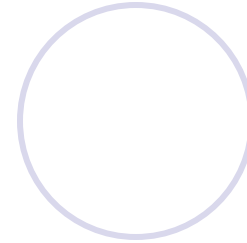
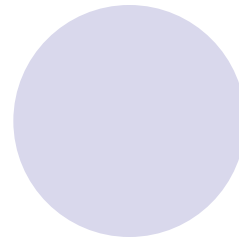
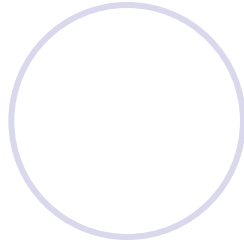
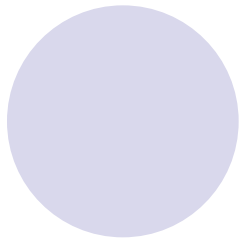




Plugins

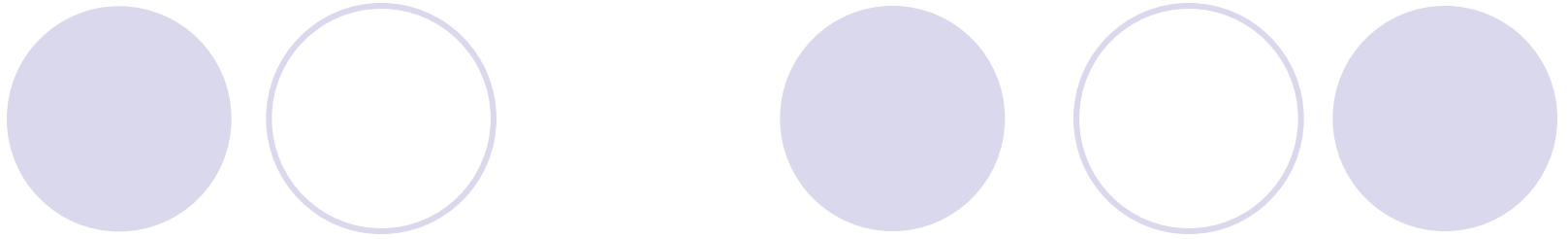
- **video3dpresent**
 - **GstVideoFilter**
 - **mode : a lot of them...**





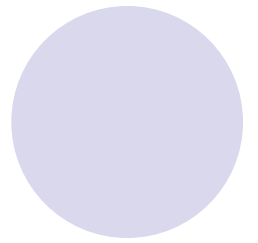
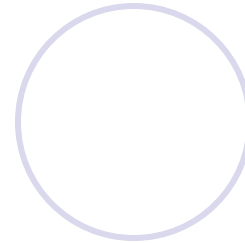
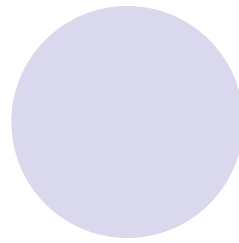
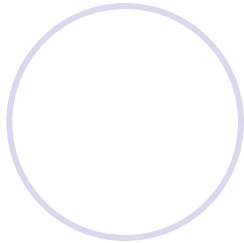
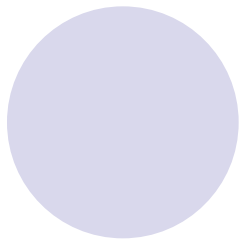
video3dpresent modes

- **Left, Right**
- **Left/Right, Right/Left, Top/Bottom, Bottom/Top**
- **Anaglyph**
 - **Gray/Gray, Gray/Color, Color/Gray, Color/Color**
 - **Red/Cyan, Green/Magenta, Blue/Yellow, and vice-versa**



Anaglyph implementation

- « C templates »
 - Inspired by `ffmpegcolorspace (imgconvert.c)`
- **Orc optimization**
 - Only **RGBx/BGRx/xRGB/xBGR** output formats
 - **YUY2/YVYU/UYVY/Y800/GREY/Y8/Y16** input formats for gray-gray anaglyph
 - **RGBx/BGRx/xRGB/xBGR** input formats for all anaglyph types



Example application

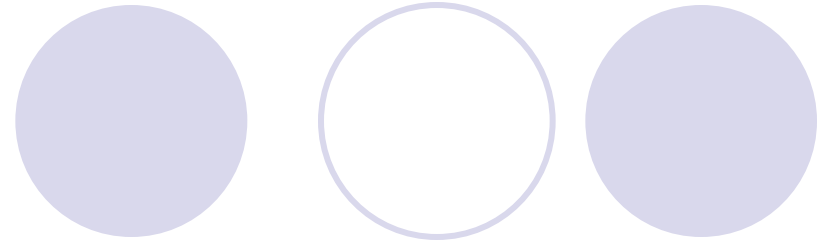
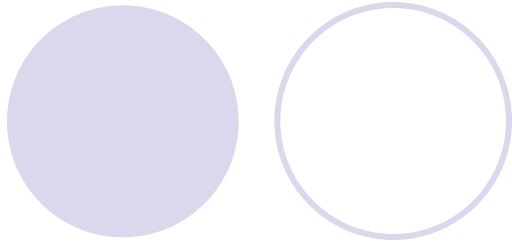
video3dplayer

Play Pause Stop Left/Right Anaglyph Gray/Gray Red/Cyan

00:09:76

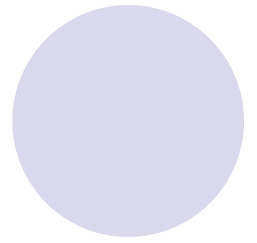
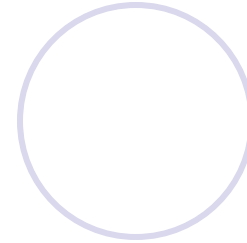
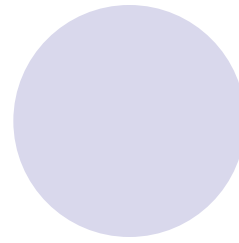
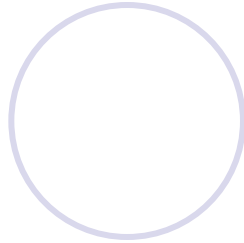
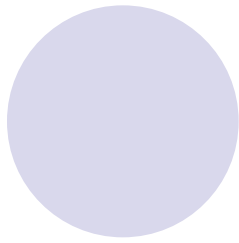
Playing

The image shows a 3D-rendered scroll floating in a dark, brick-walled environment. The scroll is unrolled, revealing text. At the top, it says 'ORIC BODKIN' in a serif font. Below that, in a larger, stylized font, it says 'DIVIDED WE FALL'. There are small star-like symbols above and below the main text. The scroll is rendered with a slight red and cyan offset, characteristic of an anaglyph 3D effect. The player interface below the video shows standard controls: Play, Pause, Stop, Left/Right, and a dropdown menu currently set to 'Anaglyph Gray/Gray Red/Cyan'. A progress bar is visible with a time of 00:09:76. The status bar at the bottom indicates 'Playing'.



Presentation outline

- Introduction
- Use cases
- Implementation
- **Road ahead**



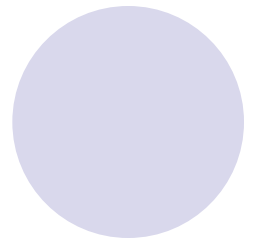
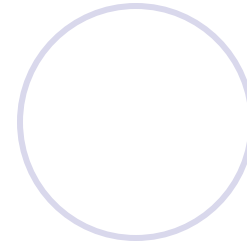
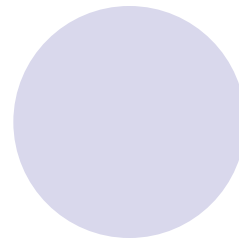
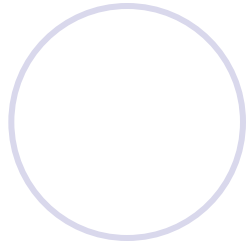
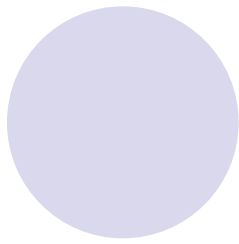
Integration

- **Not in main GStreamer tree (in a branch at <http://www.gitorious.org/video3d/video3d/>)**
- **Talks about how to handle stereo video:**
 - **Buffer flags**
 - **Metadata**
 - **New caps**

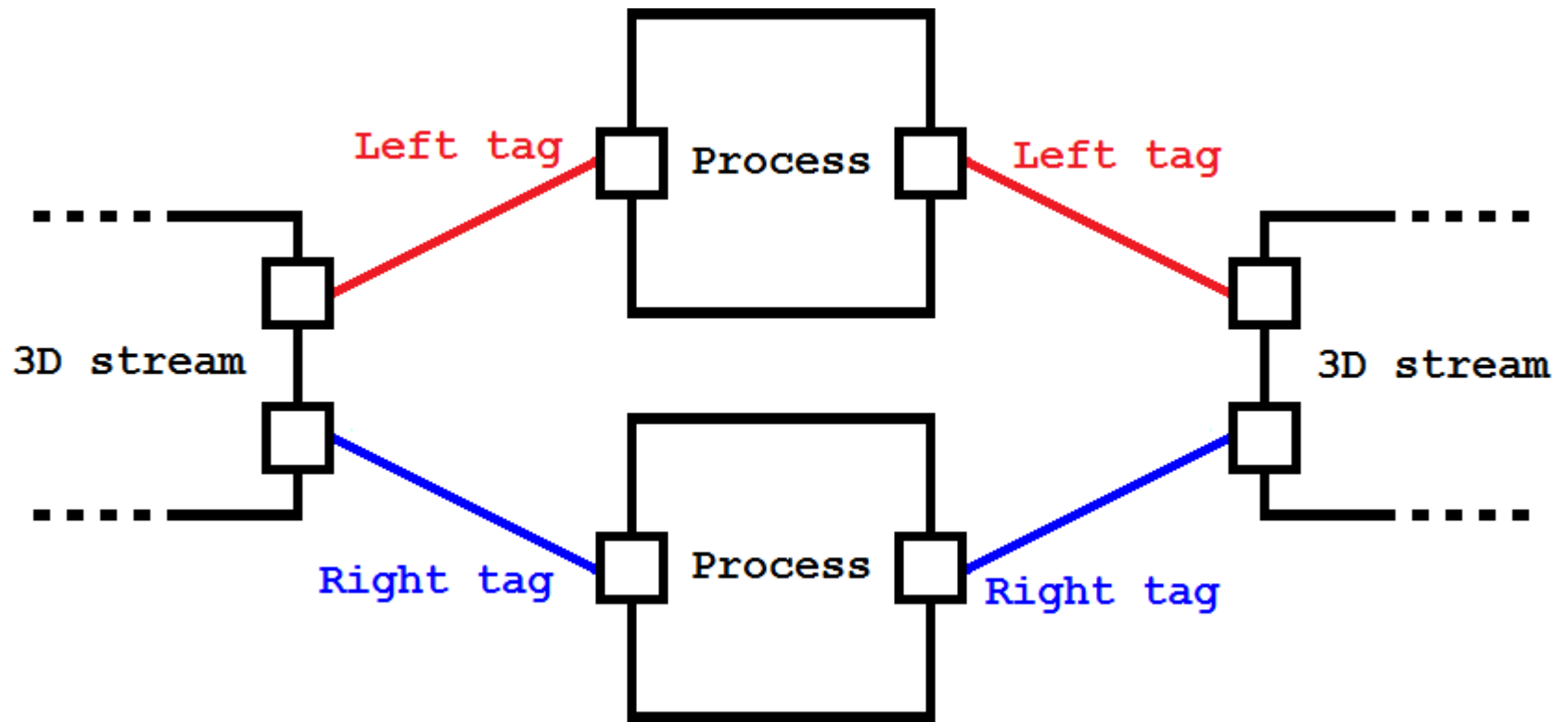


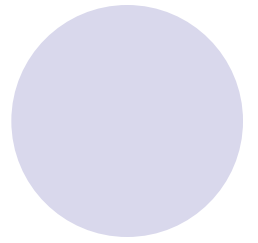
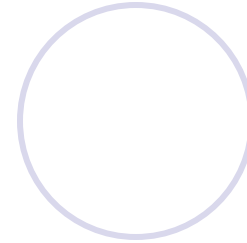
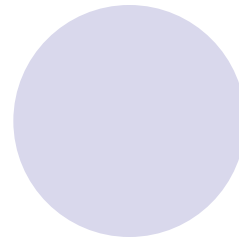
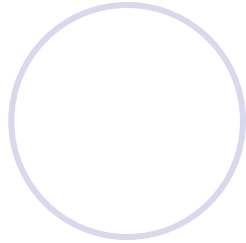
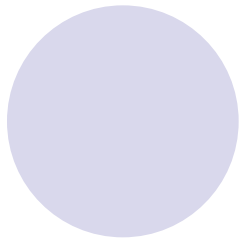
Integration

- **New caps (video/x-raw-*-stereo)**
 - Caps negotiation and all that jazz...
- **Buffer flags/metadata**
 - Buffers can be used in existing plugins



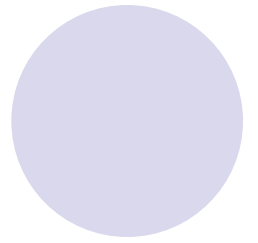
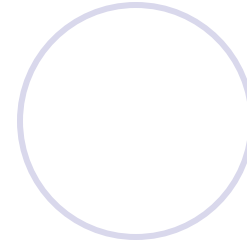
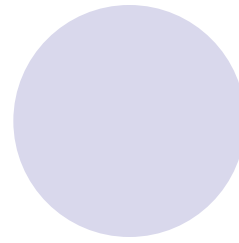
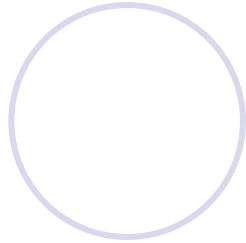
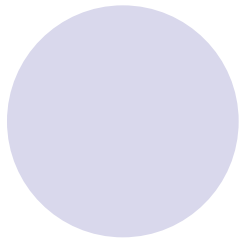
Integration





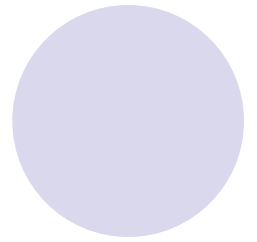
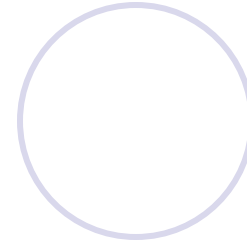
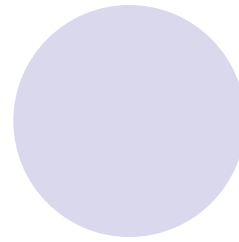
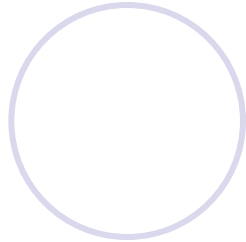
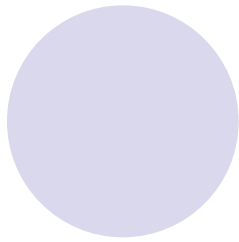
3D hardware

- **Implement stereo sinks**
 - **NVIDIA 3D Vision**
 - **Quad Buffered OpenGL**
 - **iZ3D**
 - **Etc...**
- **See Stereoscopic Player**
(<http://www.3dtv.at/>)



Stereo codecs

- **Multiview Video Coding (H.264/MPEG-4 AVC)**
 - **Uses temporal AND inter-view prediction**
 - **Existing implementation by Nokia**
 - **<http://research.nokia.com/page/4988>**



Questions?