Gst-plugins-gl / The gl elements

Saturday, June 28, 2008

Requirements:

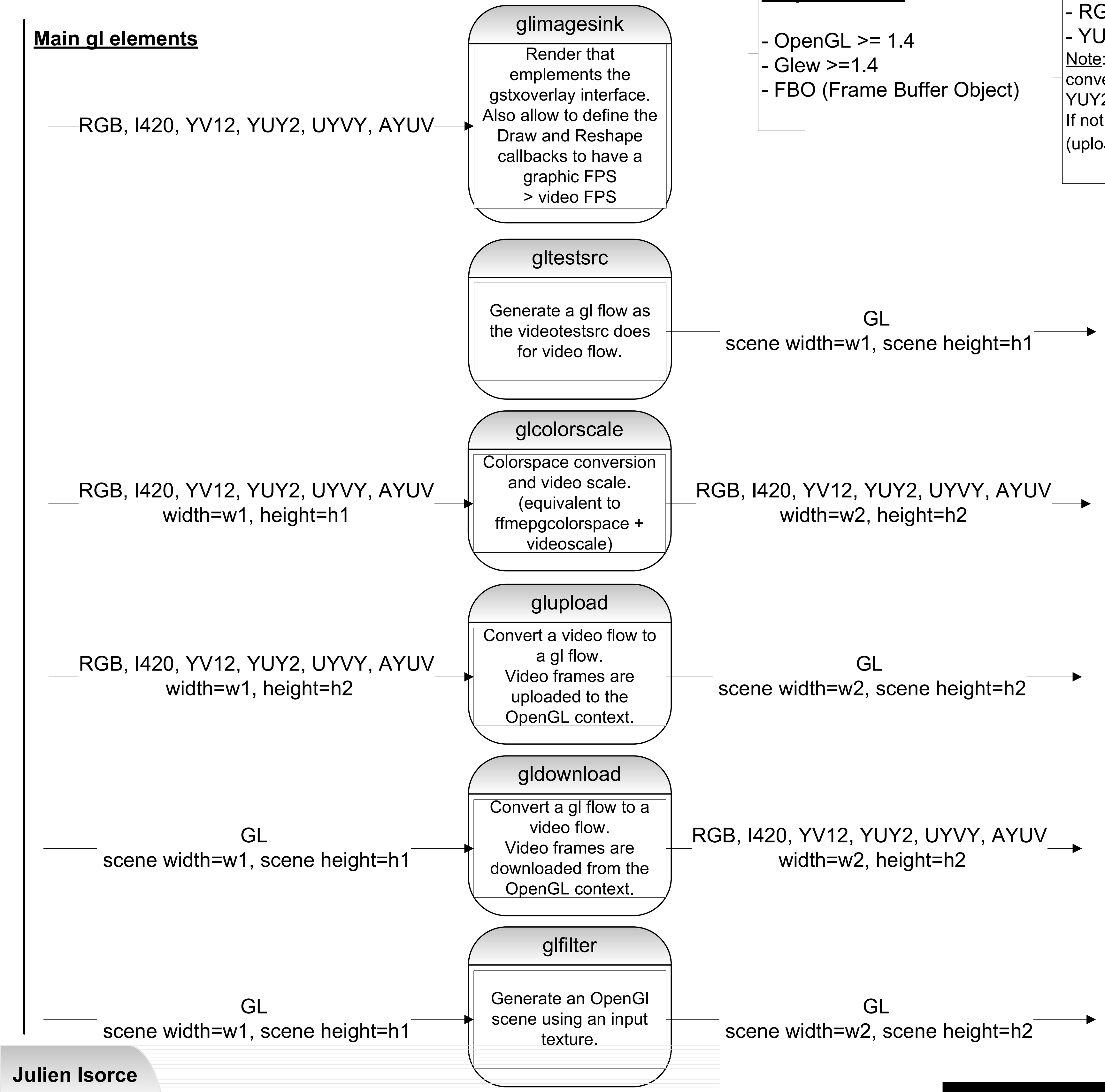
- OpenGL >= 1.4
- Glew >=1.4
- FBO (Frame Buffer Object)

Color space conversion:

- RGB: no conversion needed
- YUV: GLSL (OpenGL Shading Language)

Note: if GLSL is not available on your driver or OpenGL version, color space conversion is made through the GL_MESA_ycbcr_texture extension for upload YUY2 and UYVY only.
If not avaible too and for the other yuv formats, we plan to made the conversion (upload and download) through ColorMatrix (if ARB_imaging extension available)

Main gl elements



RGB, I420, YV12, YUY2, UYVY, AYUV → **glimagesink**: Render that emplements the gstxoverlay interface. Also allow to define the Draw and Reshape callbacks to have a graphic FPS > video FPS

gltestsrc: Generate a gl flow as the videotestsrc does for video flow. → GL scene width=w1, scene height=h1

RGB, I420, YV12, YUY2, UYVY, AYUV width=w1, height=h1 → **glcolorscale**: Colorspace conversion and video scale. (equivalent to ffmepgcolorspace + videoscale) → RGB, I420, YV12, YUY2, UYVY, AYUV width=w2, height=h2

RGB, I420, YV12, YUY2, UYVY, AYUV width=w1, height=h2 → **glupload**: Convert a video flow to a gl flow. Video frames are uploaded to the OpenGL context. → GL scene width=w2, scene height=h2

GL scene width=w1, scene height=h1 → **gldownload**: Convert a gl flow to a video flow. Video frames are downloaded from the OpenGL context. → RGB, I420, YV12, YUY2, UYVY, AYUV width=w2, height=h2

GL scene width=w1, scene height=h1 → **glfilter**: Generate an OpenGl scene using an input texture. → GL scene width=w2, scene height=h2

Some glfilters

glfilterapp

Allow to define the Draw and Reshape callbacks from a Gstreamer client code. It avoids to compile a new filter. (FPS cannot be modified unlike glimagesink)

glfiltercube

The input texture is map on a 6 cube faces. This is a basic filter example.

glfilteredge

Edge detection. The method can be selected trough a property (Sobel, Laplace, …) This filter shows how to use GLSL in the glfilters.

Julien Isorce

Gst-plugins-gl / Internal functioning

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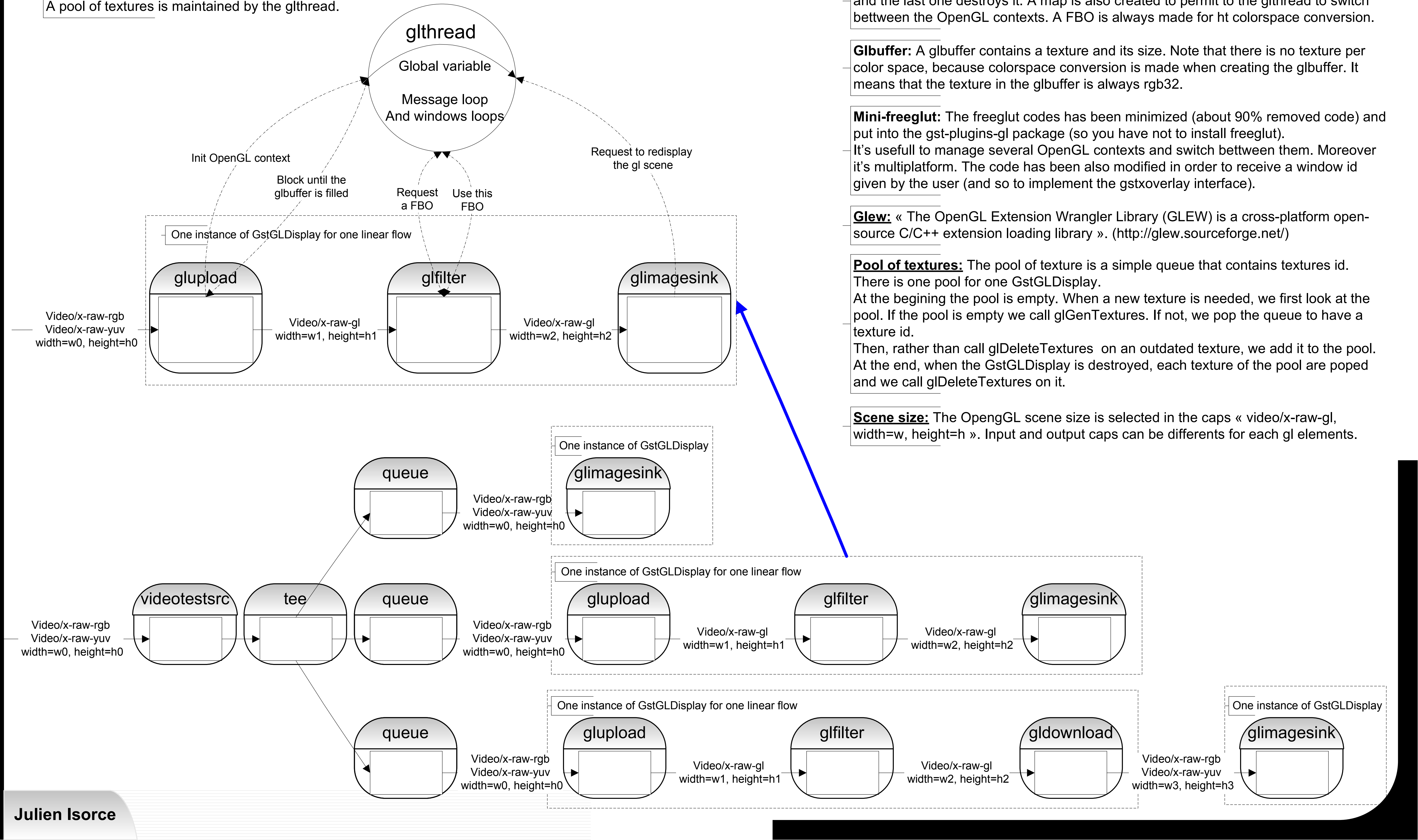
A GstGLDisplay represents an OpenGL context. A single glthread executes the OpenGL code from all the GstGLDisplays.
The gl elements communicate with the glthread through a synchronised message loop system.
So they need to post a message for their needs.
A pool of textures is maintained by the glthread.



Init: A unique GstGLDisplay is made for one gl flow. The first one creates the glthread, and the last one destroys it. A map is also created to permit to the glthread to switch betwween the OpenGL contexts. A FBO is always made for ht colorspace conversion.

Glbuffer: A glbuffer contains a texture and its size. Note that there is no texture per color space, because colorspace conversion is made when creating the glbuffer. It means that the texture in the glbuffer is always rgb32.

Mini-freeglut: The freeglut codes has been minimized (about 90% removed code) and put into the gst-plugins-gl package (so you have not to install freeglut).
It's usefull to manage several OpenGL contexts and switch betwween them. Moreover it's multiplatform. The code has been also modified in order to receive a window id given by the user (and so to implement the gstxoverlay interface).

Glew: « The OpenGL Extension Wrangler Library (GLEW) is a cross-platform open-source C/C++ extension loading library ». (http://glew.sourceforge.net/)

Pool of textures: The pool of texture is a simple queue that contains textures id.
There is one pool for one GstGLDisplay.
At the begining the pool is empty. When a new texture is needed, we first look at the pool. If the pool is empty we call glGenTextures. If not, we pop the queue to have a texture id.
Then, rather than call glDeleteTextures on an outdated texture, we add it to the pool.
At the end, when the GstGLDisplay is destroyed, each texture of the pool are poped and we call glDeleteTextures on it.

Scene size: The OpengGL scene size is selected in the caps « video/x-raw-gl, width=w, height=h ». Input and output caps can be differents for each gl elements.

Julien Isorce