Seminario 1. Introducción a OpenGL

Sistemas Multimedia Interactivos e Inmersivos

Grado de Ingeniero en Informática

Escola Tècnica Superior de Enginyeria Informàtica

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2. Introducción a la práctica de OpenGL
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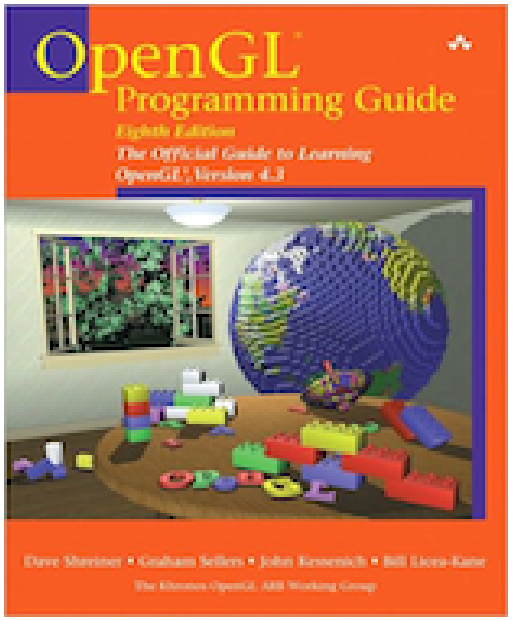
Introducción a OpenGL

- Tema 1. Introducción y conceptos básicos
  - Multimedia
  - Multiplataforma
  - Estándar
  - Abierto

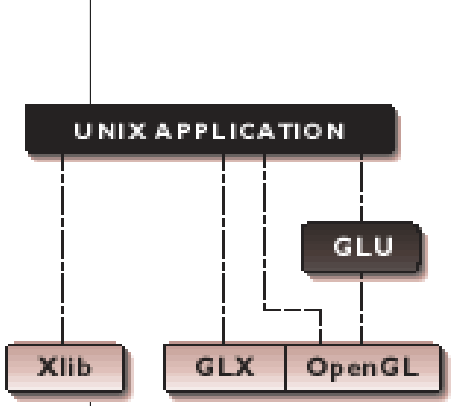
- OpenGL
  - "To create a single, vendor-independent API for the development of 2D and 3D graphics applications."
    - <http://www.sgi.com/tech/opengl/>

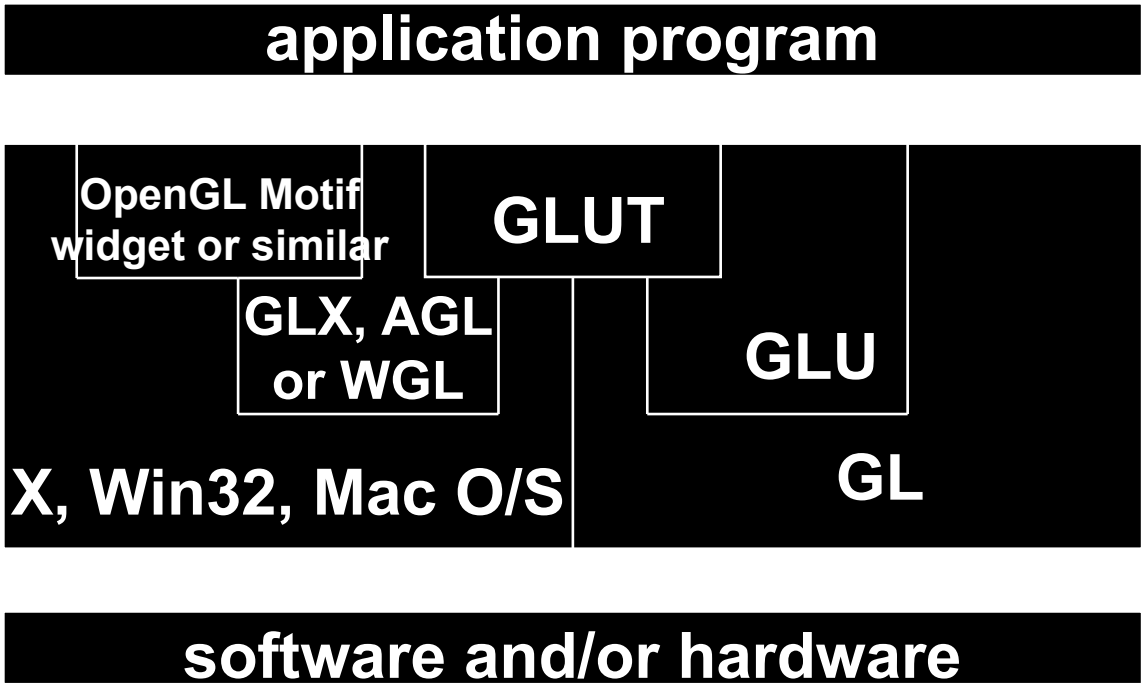


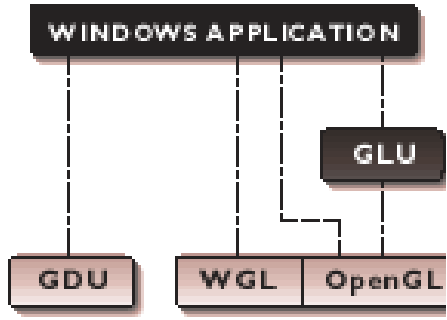
Imágenes de logotipo de OpenGL <http://www.opengl.com/>
y de *OpenGL Programming Guide, Version 1.1* (*Red Book*) <http://www.opengl-redbook.com/>

Introducción a OpenGL (II)

- *Jerarquía de librerías*







  - *Ejemplos sobre UNIX y MS/Windows*
  - *Alternativas y por encima: OpenInventor, OpenSceneGraph, Iris Performer, ...*

Imágenes de <https://www.opengl.org/about/> y <http://www.vis.uky.edu/~ryang/teaching/cs535-2012spr/lectures/opengl.pptx>

Introducción a OpenGL (III)

- *The OpenGL API (Application Programming Interface)* → iniciativa de SGI
- *OpenGL Architecture Review Board* (ARB)
  - <http://www.opengl.org>
- Licencias
  - Software developers do not need to license OpenGL to use it in their applications.
    - They can simply link to a library provided by a hardware vendor.
  - Hardware vendors do need to have a license to create an OpenGL implementation for their hardware.

Introducción a la práctica de OpenGL

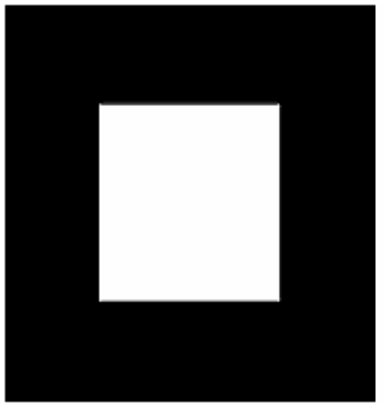
- Escenas de contenido estático: Hello, World!

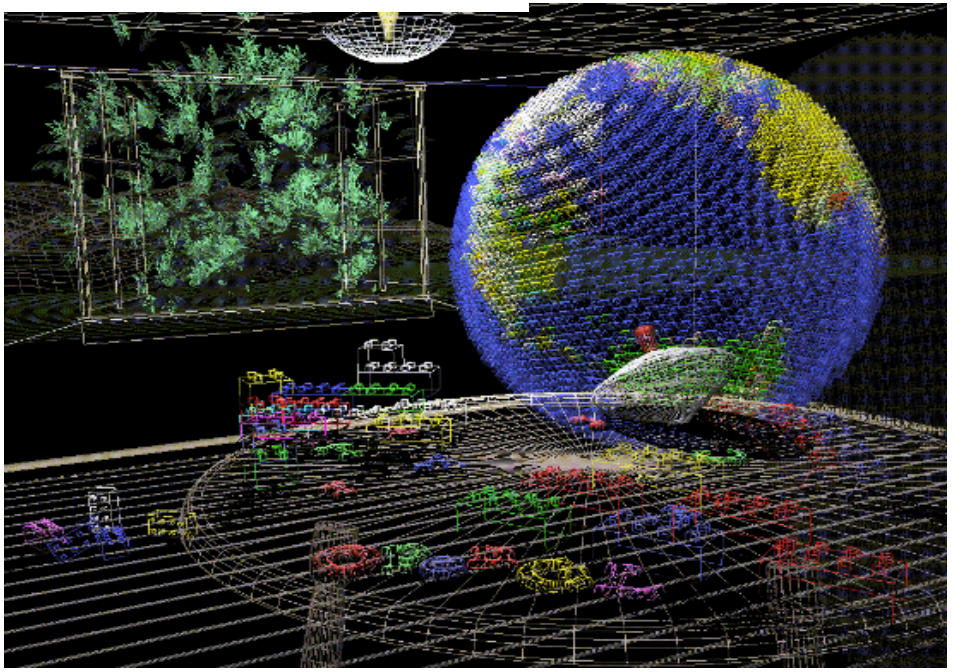
```
#include <GL/gl.h>
#include <GL/glut.h>

void display(void)
{
   glClear (GL_COLOR_BUFFER_BIT);
   glColor3f (1.0, 1.0, 1.0);
   glBegin(GL_POLYGON);
      glVertex3f (0.25, 0.25, 0.0);
      glVertex3f (0.75, 0.25, 0.0);
      glVertex3f (0.75, 0.75, 0.0);
      glVertex3f (0.25, 0.75, 0.0);
   glEnd();
   glFlush ();
}

void init (void)
{
   glClearColor (0.0, 0.0, 0.0, 0.0);
   glMatrixMode(GL_PROJECTION);
   glLoadIdentity();
   glOrtho(0.0, 1.0, 0.0, 1.0, -1.0, 1.0);
}


int main(int argc, char** argv)
{
   glutInit(&argc, argv);
   glutInitDisplayMode (GLUT_SINGLE | GLUT_RGB);
   glutInitWindowSize (250, 250);
   glutInitWindowPosition (100, 100);
   glutCreateWindow ("hello");
   init ();
   glutDisplayFunc(display);
   glutMainLoop();
   return 0;
}
```





Imágenes de http://www.glprogramming.com/red/chapter01.html
y de http://www.glprogramming.com/red/appendixi.html#plate1

Introducción a la práctica de OpenGL

- Escenas de contenido dinámico: animación

```
#include <GL/gl.h>
#include <GL/glu.h>
#include <GL/glut.h>
#include <stdlib.h>

static GLfloat spin = 0.0;

void init(void)
{
   glClearColor (0.0, 0.0, 0.0, 0.0);
   glShadeModel (GL_FLAT);
}

void display(void)
{
   glClear(GL_COLOR_BUFFER_BIT);
   glPushMatrix();
   glRotatef(spin, 0.0, 0.0, 1.0);
   glColor3f(1.0, 1.0, 1.0);
   glRectf(-25.0, -25.0, 25.0, 25.0);
   glPopMatrix();
   glutSwapBuffers();
}

void spinDisplay(void)
{
   spin = spin + 2.0;
   if (spin > 360.0)
      spin = spin - 360.0;
   glutPostRedisplay();
}
```

```
void reshape(int w, int h)
{
   glViewport (0, 0, (GLsizei) w, (GLsizei) h);
   glMatrixMode(GL_PROJECTION);
   glLoadIdentity();
   glOrtho(-50.0, 50.0, -50.0, 50.0, -1.0, 1.0);
   glMatrixMode(GL_MODELVIEW);
   glLoadIdentity();
}

void mouse(int button, int state, int x, int y)
{
   switch (button) {
      case GLUT_LEFT_BUTTON:
         if (state == GLUT_DOWN)
            glutIdleFunc(spinDisplay);
         break;
      case GLUT_MIDDLE_BUTTON:
         if (state == GLUT_DOWN)
            glutIdleFunc(NULL);
         break;
      default:
         break;
   }
}
```

```
int main(int argc, char** argv)
{
   glutInit(&argc, argv);
   glutInitDisplayMode (GLUT_DOUBLE | GLUT_RGB);
   glutInitWindowSize (250, 250);
   glutInitWindowPosition (100, 100);
   glutCreateWindow (argv[0]);
   init ();
   glutDisplayFunc(display);
   glutReshapeFunc(reshape);
   glutMouseFunc(mouse);
   glutMainLoop();
   return 0;
}
```

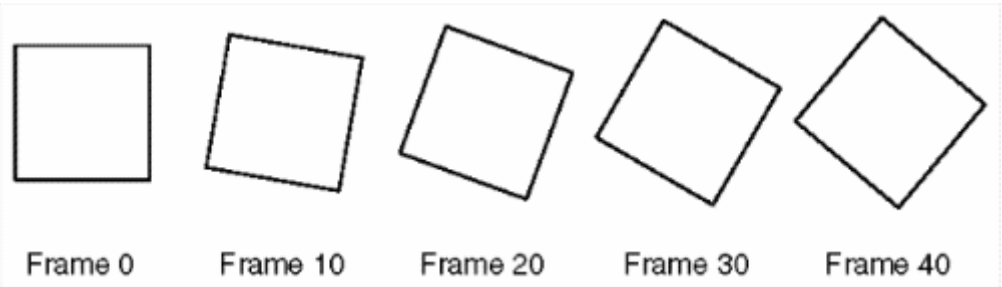
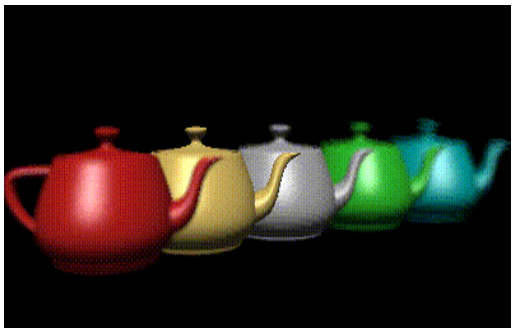
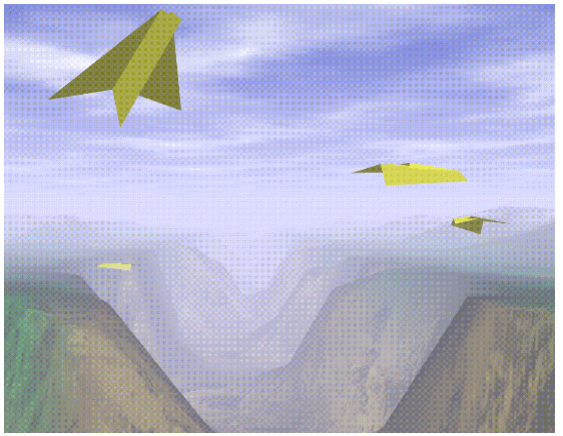


Imagen de http://www.glprogramming.com/red/chapter01.html

Otras posibilidades de OpenGL

- Ejemplos
- Demos
- Otras

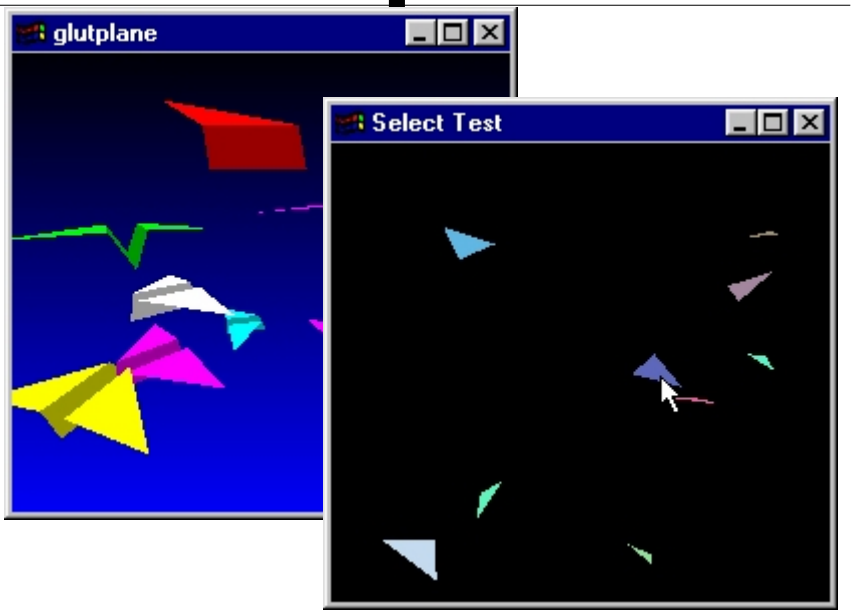


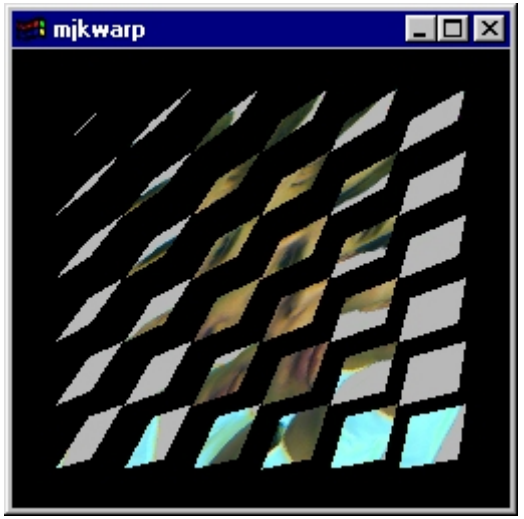


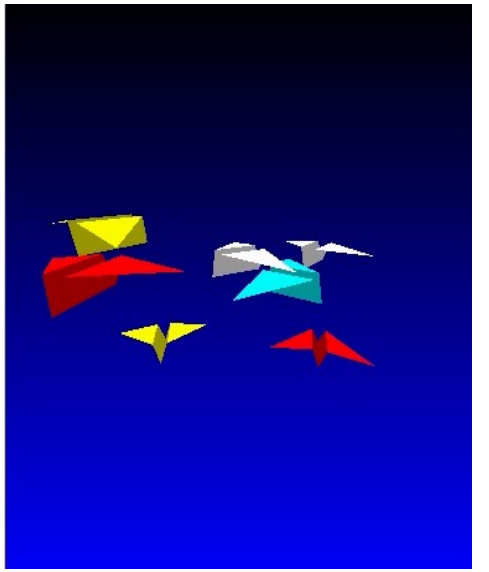
Imágenes de http://www.glprogramming.com/red/appendixi.html

Otras posibilidades de OpenGL

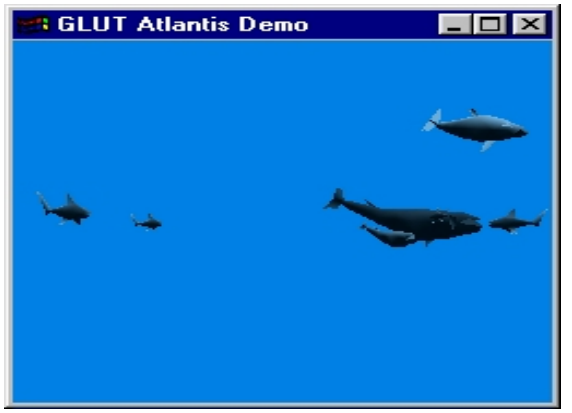
- Ejemplos
  - “glutplane” y “triselec”
  - “mjkwarp”.
  - dinoshade





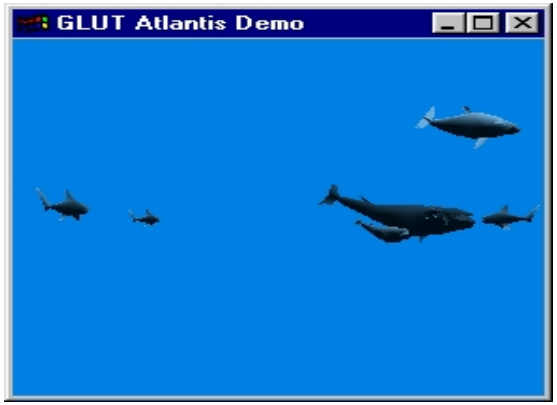


Otras posibilidades de OpenGL

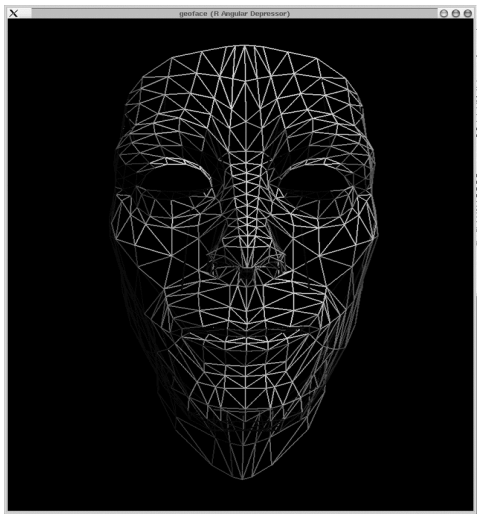


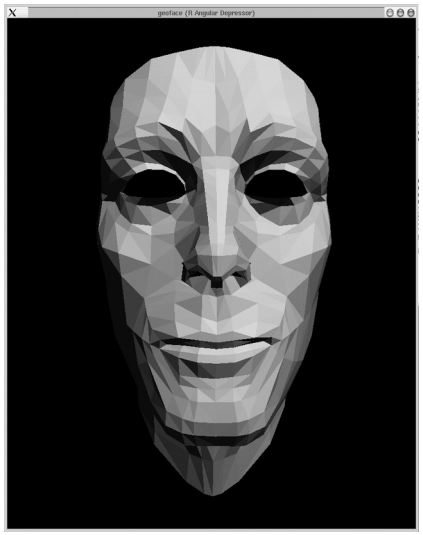
- Demos:
  - "atlantis" y "geoface".
    - *Swimming around with sharks, dolphins and whales.*

Otras posibilidades de OpenGL



- Demos:
  - "atlantis" y "geoface".
    - *Swimming around with sharks, dolphins and whales.*
    - *Contort this face as much as you want.*





Otras posibilidades de OpenGL

- Ampliar la descripción
  - glut_SpecialFunc(), …
  - Animación:: mover la cámara
  - Renderizar a disco
  - Cargar modelos complejos (OBJ, 3DS, Blender, ...)
  - Estereoscopia

Bibliografía

- OpenGL <http://www.opengl.com/>
  - Ejemplos clásicos
    <https://www.opengl.org/archives/resources/code/samples/glut_examples/examples/examples.html>
  - Demos <https://www.opengl.org/archives/resources/code/samples/glut_examples/demos.html>
- OpenGL Programming Guide, Version 1.1 (Red Book)
  <http://www.opengl-redbook.com/>
- Wiki. Getting Started <https://www.opengl.org/wiki/Getting_Started>
- OpenGL Reference Manual (“Blue Book”) <http://www.glprogramming.com/blue/>
- Edward Angel. OpenGL : a primer
- Wikibooks. “OpenGL Programming”
  <http://en.wikibooks.org/wiki/OpenGL_Programming>
- NeHe Productions – Everything OpengGL <http://nehe.gamedev.net/>
- Mesa 3D Graphics Library <http://www.mesa3d.org/>
- GLUT: Mark Kilgard <https://github.com/markkilgard/glut/> y
  Nate Robins <http://user.xmission.com/~nate/opengl>
- freeglut <http://freeglut.sourceforge.net/>