UFMA

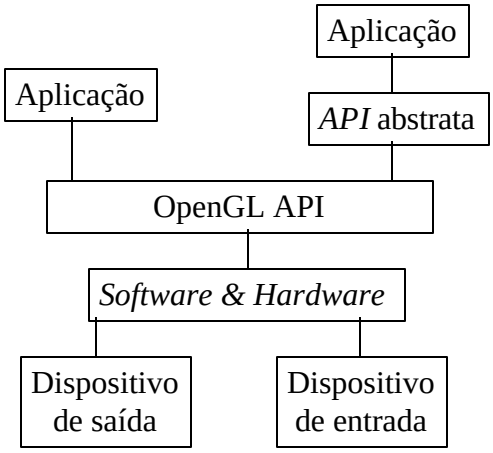
Departamento de Informática

Introdução à Computação Gráfica
DEINF-UFMA
Prof. Anselmo Paiva

OpenGL

OpenGL: o que é?

- API
  - Interface para programador de aplicação



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Por que OpenGL?

- primitivas geométricas e imagens
- arquitetura bem definida
- relativamente simples
- boa performance (sw & hw)
- bem documentado
- independente de sistemas de janelas
- padrão
  - disponível em diversas plataformas

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O que faz o OpenGL

- Desenhar objetos: desenha pontos, linhas and poligonos. Using these
- Controlar a visualizacao dos objetos: possui um conjunto de transformacoes para visualizacao e modelagem
- Aplicar iluminacao: permite a manipulacao de varios tipos de fontes luminosas
- Especificar modelos de iluminacao
- Melhoramentos na Imagem: antialias, *blend*, *fog*
- Mapeamento de texturas:
- Animacoes:
- Implementa *double buffering*

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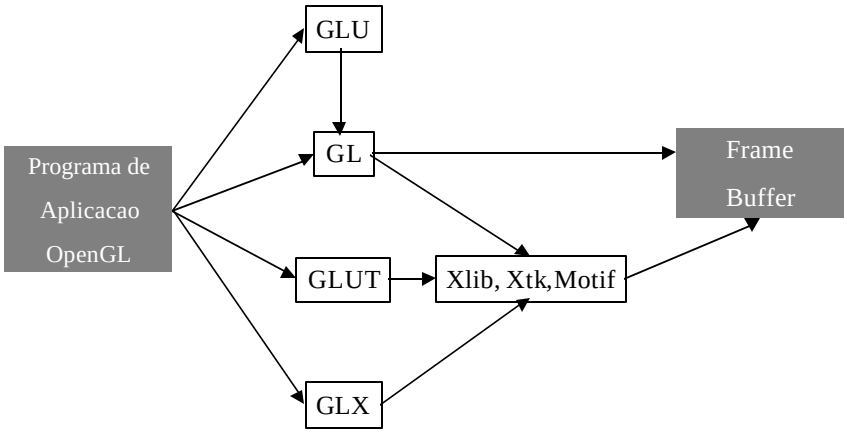
Organização da Biblioteca (XWindow)



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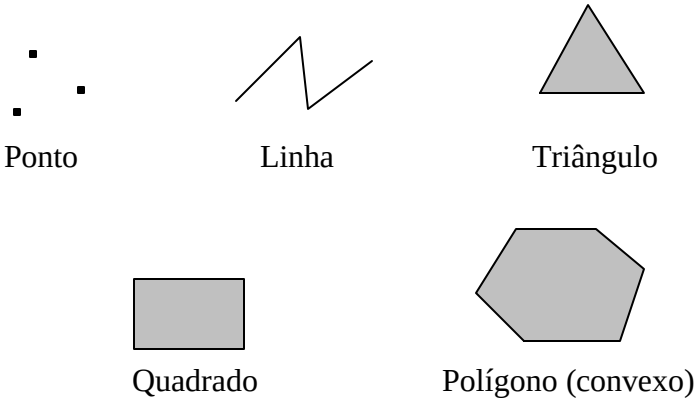
Primitivas geométricas básicas



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Objetos 3D

Polyhedra

Sphere

Bezier Surfaces

Quadric

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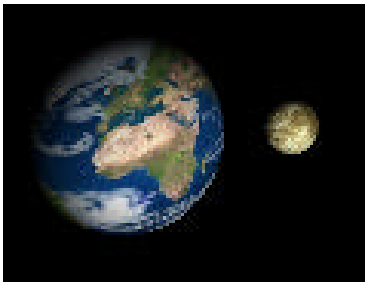
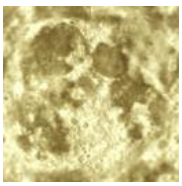
Imagem e Textura





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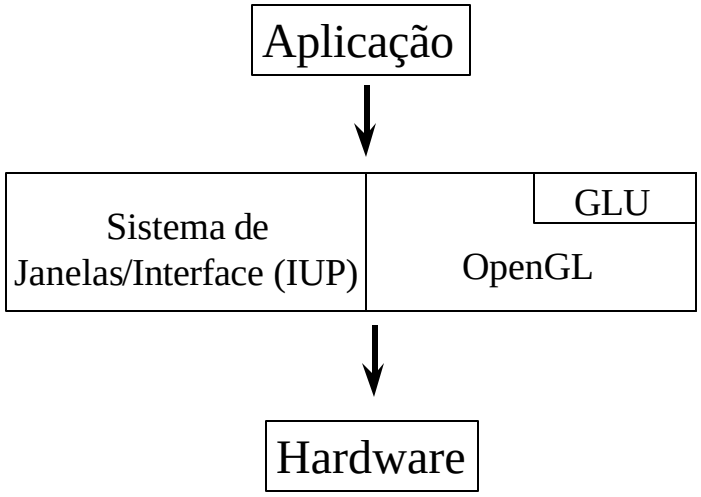
Aplicação típica



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Programa simples (usando GLUT)

```
#ifdef _WIN32
#include <windows.h>
#endif
#include "GL/gl.h"
#include "GL/glu.h"
#include “GL/glut.h”
```

```
int main (int argc, char* argv[])
{
 /* openg GLUT */
 glutInit(&argc, argv);
 glutInitDisplayMode (GLUT_SINGLE | GLUT_RGB);
 glutInitWindowSize (250, 250);

 /* create window */
 glutCreateWindow (”simple");
 glutDisplayFunc(display);

 /* interact … */
 glutMainLoop();
 return 0;
}
```

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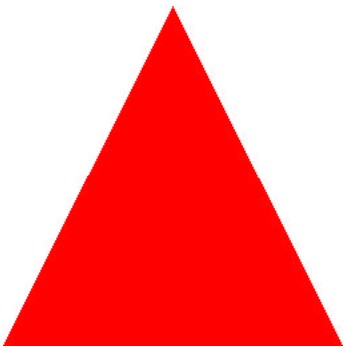
Programa simples (usando GLUT) - cont.

```
void display (void)
{
 /* clear window */
 glClearColor(1,1,1,1);
 glClear(GL_COLOR_BUFFER_BIT);

 /* draw red triangle */
 glColor3d(1,0,0);
 glBegin(GL_TRIANGLES);
  glVertex2d(-1,-1);
  glVertex2d(1,-1);
  glVertex2d(0,1);
 glEnd();

 /* update screen */
 glFlush();
}
```



OpenGL: máquina de estado

- Trabalha com o conceito de valor corrente
  - Iluminação
  - Shading
  - Textura
  - etc.

glEnable/glDisable

Primitivas geométricas

glBegin(*tipo_de_prim);*

…define attributo de vértice
…define vértice

glEnd();

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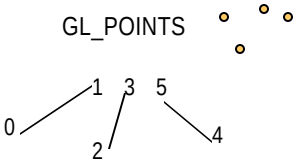
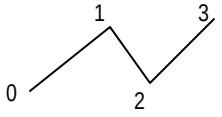
Tipos de primitivas

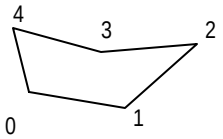
GL_POINTS



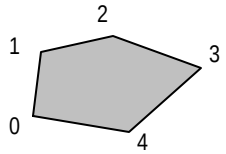
GL_LINES



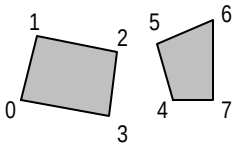
GL_LINE_STRIP



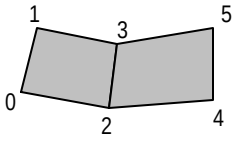
GL_LINE_LOOP



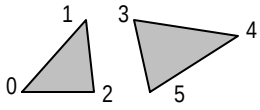
GL_POLYGON



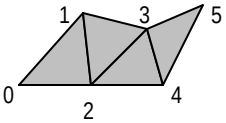
GL_QUADS



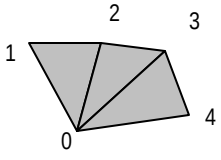
GL_QUAD_STRIP



GL_TRIANGLES



GL_TRIANGLE_STRIP



GL_TRIANGLE_FAN

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Especificação de vértice

glVertex{tam}{tipo}{vetor} (…);

exemplo:

```
GLdouble pos[ ] = {0.4,9.0,2.0};
glVertex3dv(pos);
```

ou

```
glVertex3d(0.4,9.0,2.0);
```

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Especificação de atributos: Cor

- Modelo de cor
  - RGB

    ```
    glColor3d(red,green,blue);
    ```

  - *Color index*
    - Paleta previamente definida

      ```
      IupGLPalette (handle, index, red, green, blue);
      ...
      glIndexi(index);
      ```

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Projeção

- 2D
  - retângulo de clipping
  - Exemplo:

```
glMatrixMode(GL_PROJECTION)
glLoadIdentity();
gluOrtho2D(left, right, bottom, top)
glmatrixMode(GL_MODELVIEW)
```

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Referências

- "The Red Book"

  OpenGL: Programming Guide

  Release 1.1

  M. Woo, J. Neider, T. Davis
- Web sites

  The official OpenGL web page

  http://www.opengl.org

  SGI's OpenGL WWW Center

  http://www.sgi.com/Technology/openGL

  Gateway to OpenGL

  http://reality.sgi.com/mjk_asd/opengl-links.html

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