Computer Graphics

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(modified from Bing-Yu Chen's slides)

Introduction to OpenGL

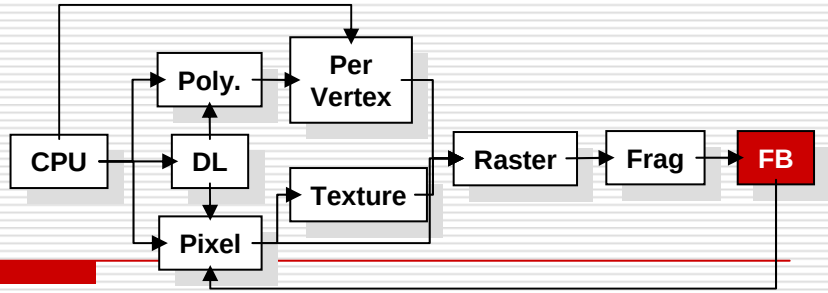
- General OpenGL Introduction
- An Example OpenGL Program
- Drawing with OpenGL
- Transformations
- Animation and Depth Buffering
- Lighting
- Evaluation and NURBS
- Texture Mapping
- Advanced OpenGL Topics
- Imaging

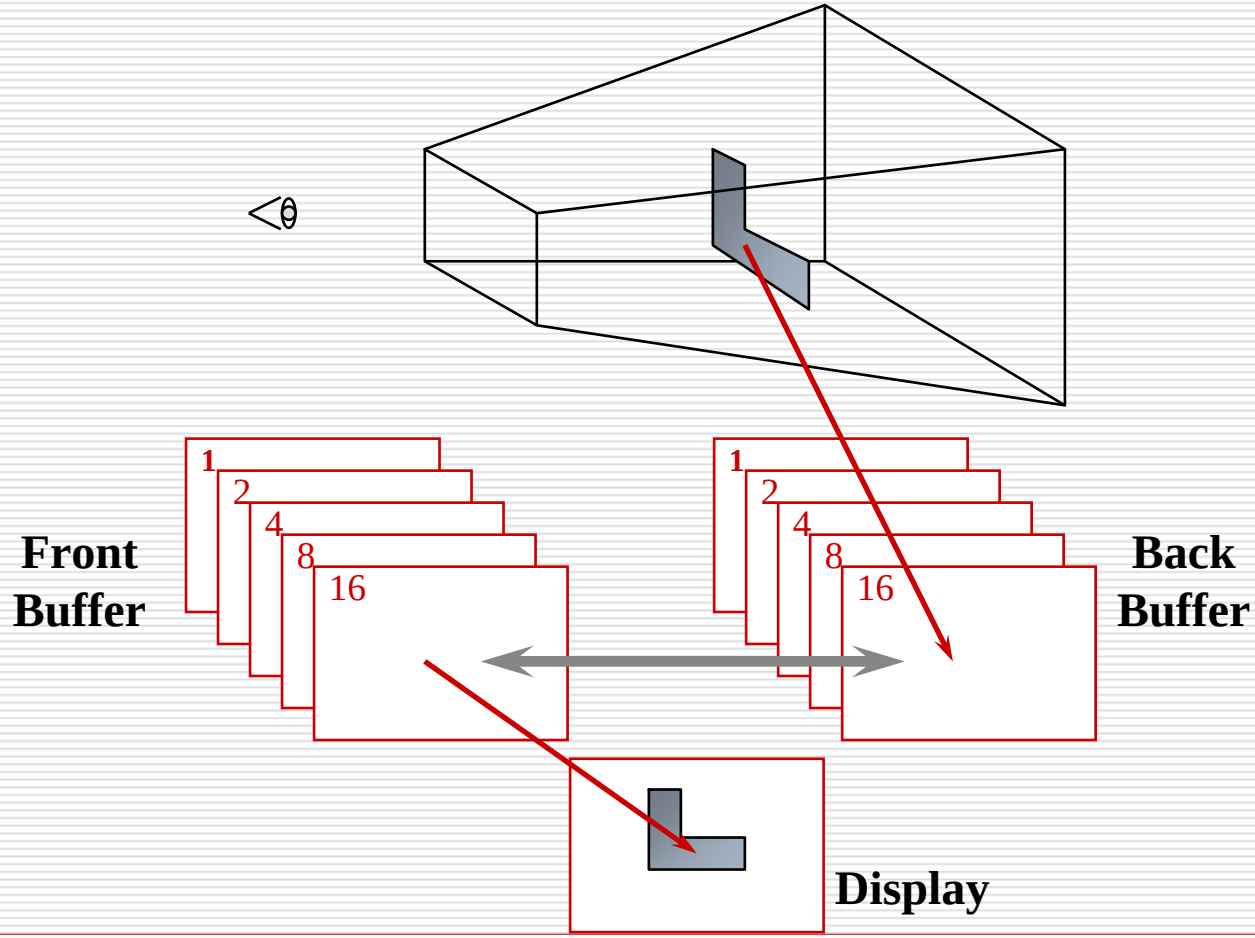
modified from
Dave Shreiner, Ed Angel, and Vicki Shreiner.
An Interactive Introduction to OpenGL Programming.
ACM SIGGRAPH 2001 Conference Course Notes #54.
& ACM SIGGRAPH 2004 Conference Course Notes #29.

Animation and Depth Buffering

- Discuss double buffering and animation
- Discuss hidden surface removal using the depth buffer

Double Buffering





Animation Using Double Buffering

- Request a double buffered color buffer

```
glutInitDisplayMode( GLUT_RGB | GLUT_DOUBLE );
```

- Clear color buffer

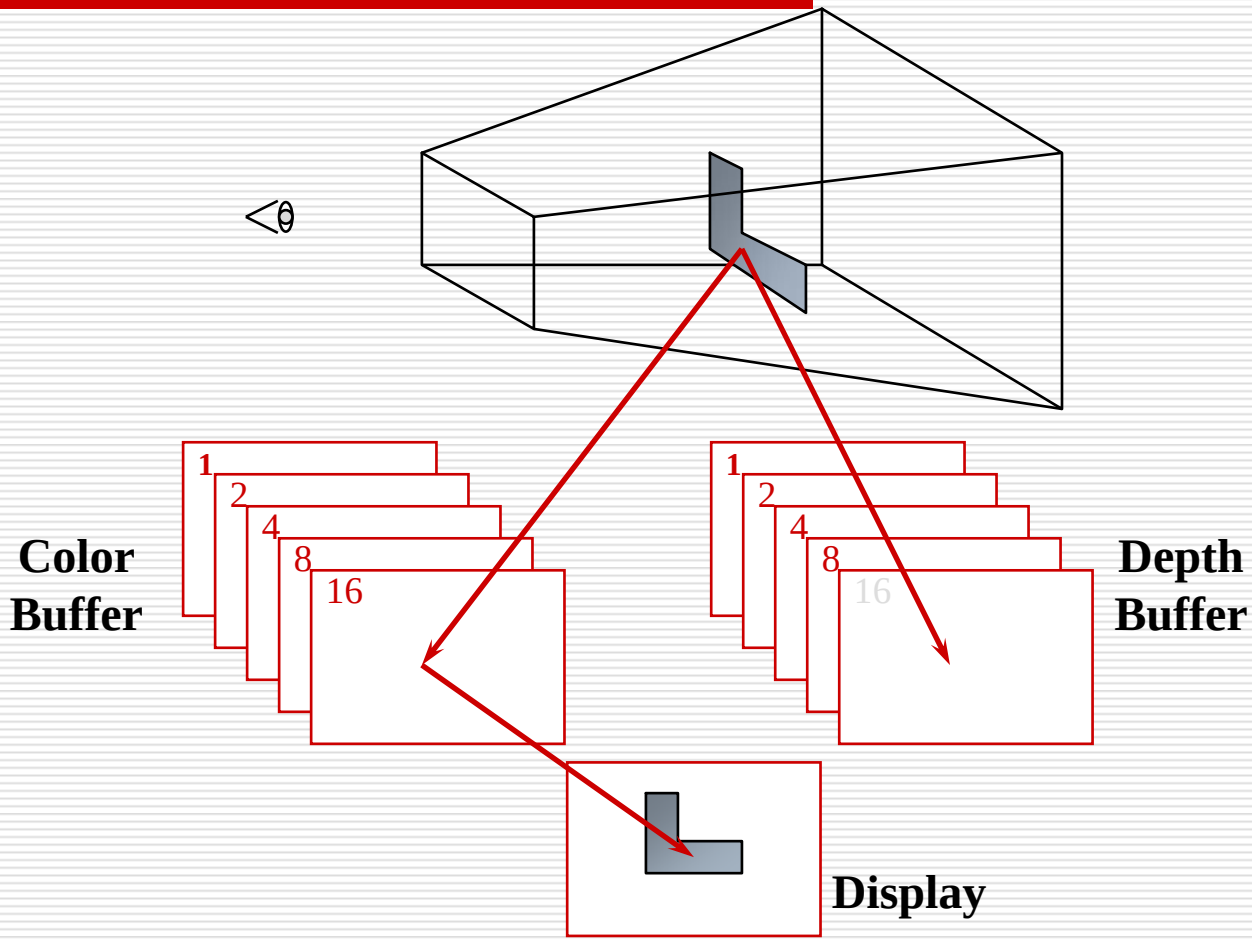
```
glClear( GL_COLOR_BUFFER_BIT );
```

- Render scene
- Request swap of front and back buffers

```
glutSwapBuffers();
```

- Repeat steps 2 - 4 for animation

Depth Buffering and Hidden Surface Removal



Depth Buffering Using OpenGL

- Request a depth buffer

```
glutInitDisplayMode( GLUT_RGB |
                     GLUT_DOUBLE |
                     GLUT_DEPTH );
```

- Enable depth buffering

```
glEnable( GL_DEPTH_TEST );
```

- Clear color and depth buffers

```
glClear( GL_COLOR_BUFFER_BIT |
         GL_DEPTH_BUFFER_BIT );
```

- Render scene
- Swap color buffers

An Updated Program Template

```
void main( int argc, char** argv )
{
  glutInit( &argc, argv );
  glutInitDisplayMode( GLUT_RGB |
                       GLUT_DOUBLE |
                       GLUT_DEPTH );
  glutCreateWindow( “Tetrahedron” );
  init();
  glutIdleFunc( idle );
  glutDisplayFunc( display );
  glutMainLoop();
}
```

An Updated Program Template

```
void init( void )
{
   glClearColor( 0.0, 0.0, 1.0, 1.0 );
}

void idle( void )
{
   glutPostRedisplay();
}
```

An Updated Program Template

```
void drawScene( void )
{
  GLfloat vertices[] = { … };
  GLfloat colors[] = { … };
  glClear( GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT );
  glBegin( GL_TRIANGLE_STRIP );
  /* calls to glColor*() and glVertex*() */
  glEnd();
  glutSwapBuffers();
}
```