

Welcome

To Advance through Presentation  
Use Page Up and Page Down Keys



99 | Worldwide  
Developers  
Conference



99 | Worldwide  
Developers  
Conference

# OpenGL Acceleration

John Stauffer

OpenGL Engineering Manager

# OpenGL Introduction

- GL stands for Graphics Library
- Low-level 3D graphics library
- Procedural rather than descriptive
- Supports points, lines, polygons, bitmaps and images



# System Support

- Supports multiple monitors
- Supports fullscreen mode through DrawSpocket
- Reverts to software when hardware resources run out
- Plug and play driver model



# Hardware Buffer Formats

- Color buffer: (16, 32) bit
- Depth buffer: (16, 32\*) bit

\* ATI Rage 128 only



# Software Buffer Formats

- Color buffer: (8, 16, 32) bit
- Depth buffer: (16, 32) bit
- Stencil buffer: (8) bit
- Accumulation buffer: (32, 64) bit



# Buffer Dimensions

- Tracks size of window
- Can be changed with AGL\_BUFFER\_RECT





99 | Worldwide  
Developers  
Conference

# Demo

## Moth





99 | Worldwide  
Developers  
Conference

# OpenGL Example

# Command Syntax

- Commands use the prefix `gl`
  - Example: `glVertex3f()`
- Defined constants begin with `GL_`
  - Example: `GL_POINTS`



# Context Initialization

- AGLContext Initialize(AGLDrawable win)  
{  
    GLint attrib[] = { AGL\_RGBA,  
                      AGL\_DOUBLEBUFFER, AGL\_NONE };  
    AGLPixelFormat fmt =  
        **aglChoosePixelFormat**(NULL, 0, att);  
    AGLContext ctx = **aglCreateContext**(fmt,  
                                      NULL);  
    **aglSetDrawable**(ctx, win);  
    **aglSetCurrentContext**(ctx);  
    **aglDestroyPixelFormat**(fmt);  
  
    return ctx;  
}



# Rendering

- `void render(AGLContext ctx)`  
`{`  
    `glClear(GL_COLOR_BUFFER_BIT);`  
  
    `glBegin(GL_TRIANGLES);`  
        `glVertex3d( 0.8, 0.8, 0.0);`  
        `glVertex3d( 0.8, -0.8, 0.0);`  
        `glVertex3d(-0.8, -0.8, 0.0);`  
    `glEnd();`  
  
    `aglSwapBuffers(ctx);`  
`}`



# Destroying a Context

- `void CleanUp(AGLContext ctx)`  
`{`  
    **`aglSetCurrentContext(NULL);`**  
    **`aglSetDrawable(ctx, NULL);`**  
    **`aglDestroyContext(ctx);`**  
`}`





99 | Worldwide  
Developers  
Conference

# Demo

## Sky Fly

# Primitives

- Points
- Lines, Line Strip, Line Loop
- Polygons, Quads, Quad Strip, Triangles, Triangle Strip, Triangle Fan
- Bitmaps (1 bit)
- Images (Color Index, Red, Green, Blue, Alpha, RGB, RGBA, Luminance, Luminance Alpha)



# Viewport Control

- `glViewport(x, y, width, height)`
- Size limits (-2048 to 2048)





# Model Transformations

- `glMatrixMode(GL_MODELVIEW)`
- `glLoadIdentity()`
- `glTranslate(x, y, z)`
- `glRotate(angle, x, y, z)`
- `glScale(x, y, z)`



# Perspective Projection

- `glMatrixMode(GL_PROJECTION)`
- `glLoadIdentity()`
- `glFrustum(left,right,bottom,top,near,far)`



# Ortho Projection

- `glMatrixMode(GL_PROJECTION)`
- `glLoadIdentity()`
- `glOrtho(left, right, bottom, top, near, far)`



# Changing State

- “On” and “Off” State Variables
  - Example: `glEnable()`
- Mode State Variables
  - Example: `glShadeModel()`
- Value State Variables
  - Example: `glGetDoublev()`



# Lighting

- `glLightfv()`
- `glNormal()`
- `glMaterialfv()`
- `glColorMaterial()`
- `glEnable(GL_LIGHTING)`
- `glEnable(GL_LIGHT0)`



# Display Lists

- Creating List
  - glNewList(name, GL\_COMPILE)
    - OpenGL Commands ...
  - glEndList()
- Calling the list
  - glCallList(name)





99 | Worldwide  
Developers  
Conference

# Demo

## Under Water

# Performance Tips

- Use high level primitives
  - GL\_TRIANGLE\_STRIP
  - GL\_QUAD\_STRIP
- Maximize vertices between glBegin/glEnd
- Limit state changes
- Limit changing the current texture
- Size textures to match hardware
- Keep current state as simple as possible





# OpenGL Extensions

- Compiled vertex array
  - Avoids redundant transformations
  - Direct DMA buffer packing
  - Reduces CPU memory traffic
- Multi-Texture
  - Apply two textures in a single pass





99 | Worldwide  
Developers  
Conference

# Demo

## Quake III



99 | Worldwide  
Developers  
Conference

Q&A



Think different.<sup>TM</sup>



Welcome

To Advance through Presentation  
Use Page Up and Page Down Keys



99 | Worldwide  
Developers  
Conference