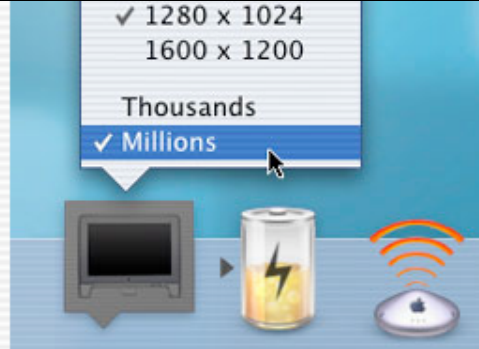




Apple OpenGL and Quartz Extreme



Peter Graffagnino
Apple

Apple OpenGL Update

- Mac OS X “Jaguar” Release
- Quartz Extreme
- Demo
- Jaguar Open GL



Mac OS X “Jaguar”

- Mac OS X version 10.2
- Available August 24th
- Announced last week at MacWorld NY
- 3rd major update to Mac OS X in 18 months
- Lots of new graphics features



Aqua

Frameworks

Graphics

Darwin



Aqua

Frameworks

Quartz

OpenGL

QuickTime

Darwin



Quartz

OpenGL

QuickTime

Quartz Compositor



Window System as a Digital Image Compositor

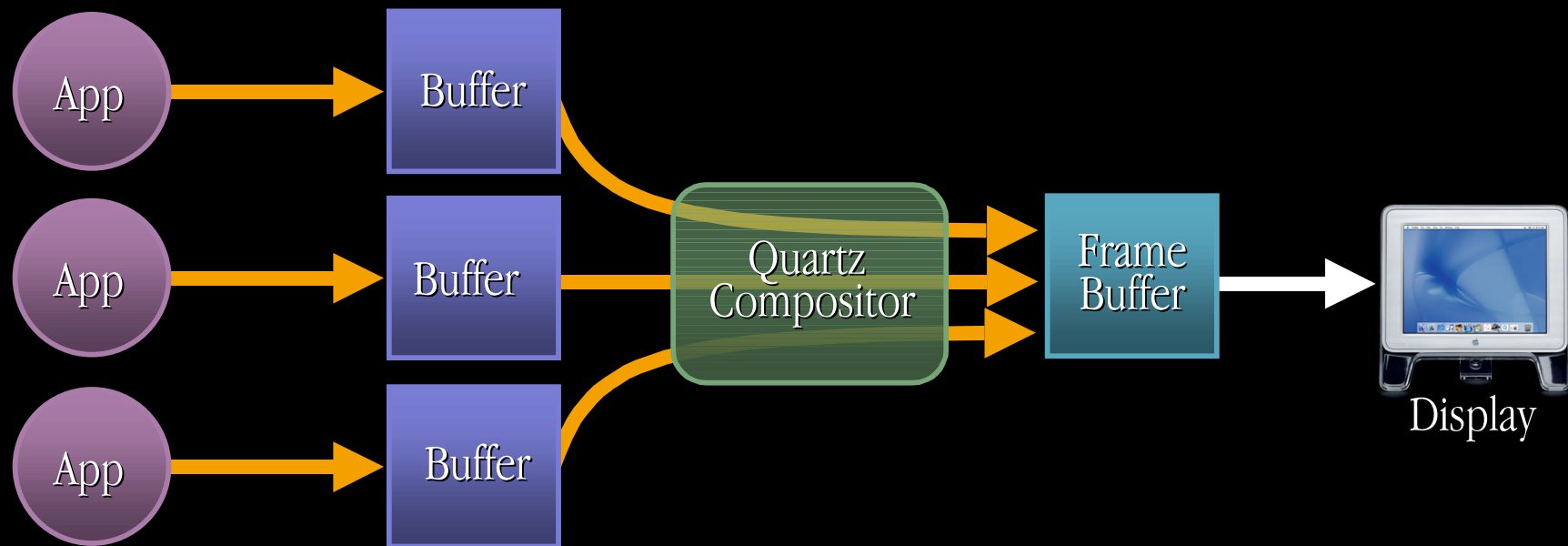


Quartz Compositor

- Double buffered windows
- Per-pixel alpha channel
- Per-window fade control
- Per-window transform and warp
- Integrates 2D, 3D, and Video



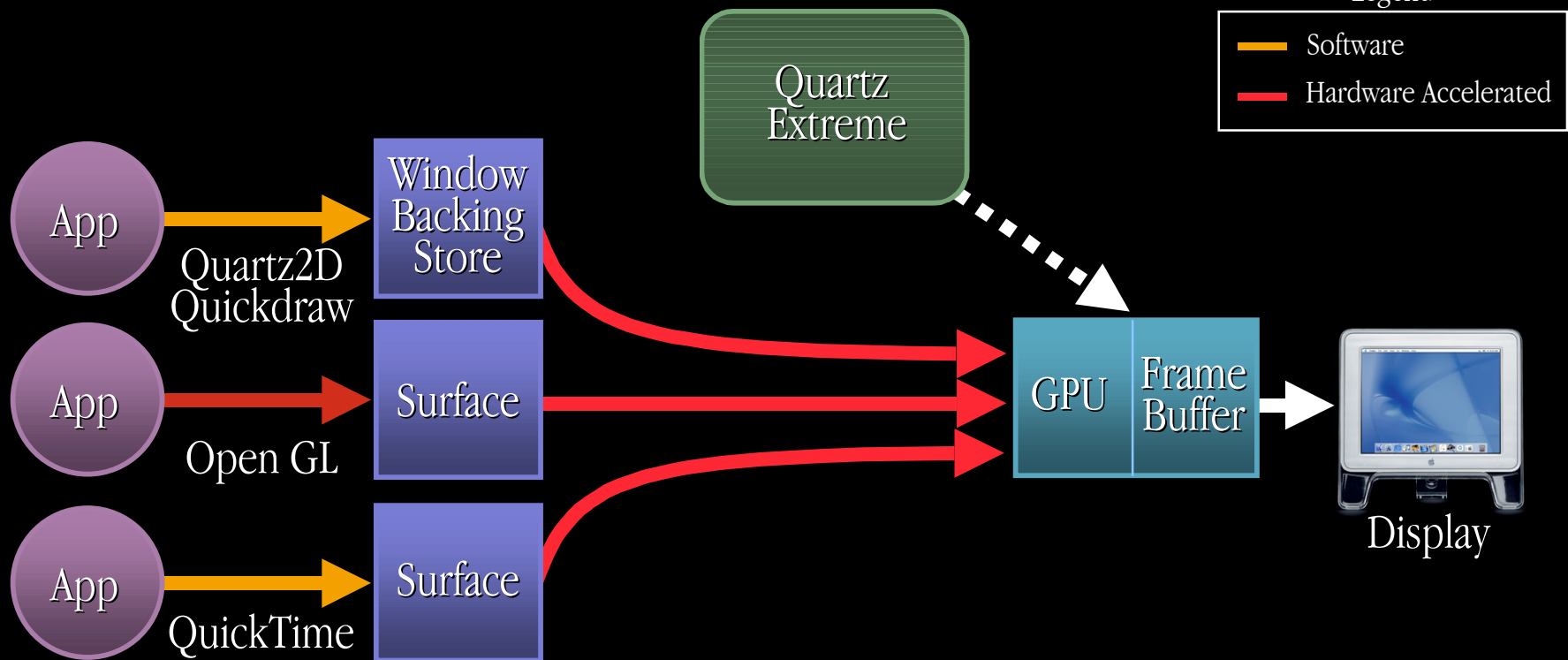
Quartz Compositor



Quartz Extreme

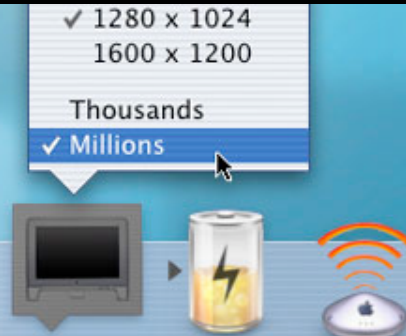
Legend

— Software
— Hardware Accelerated

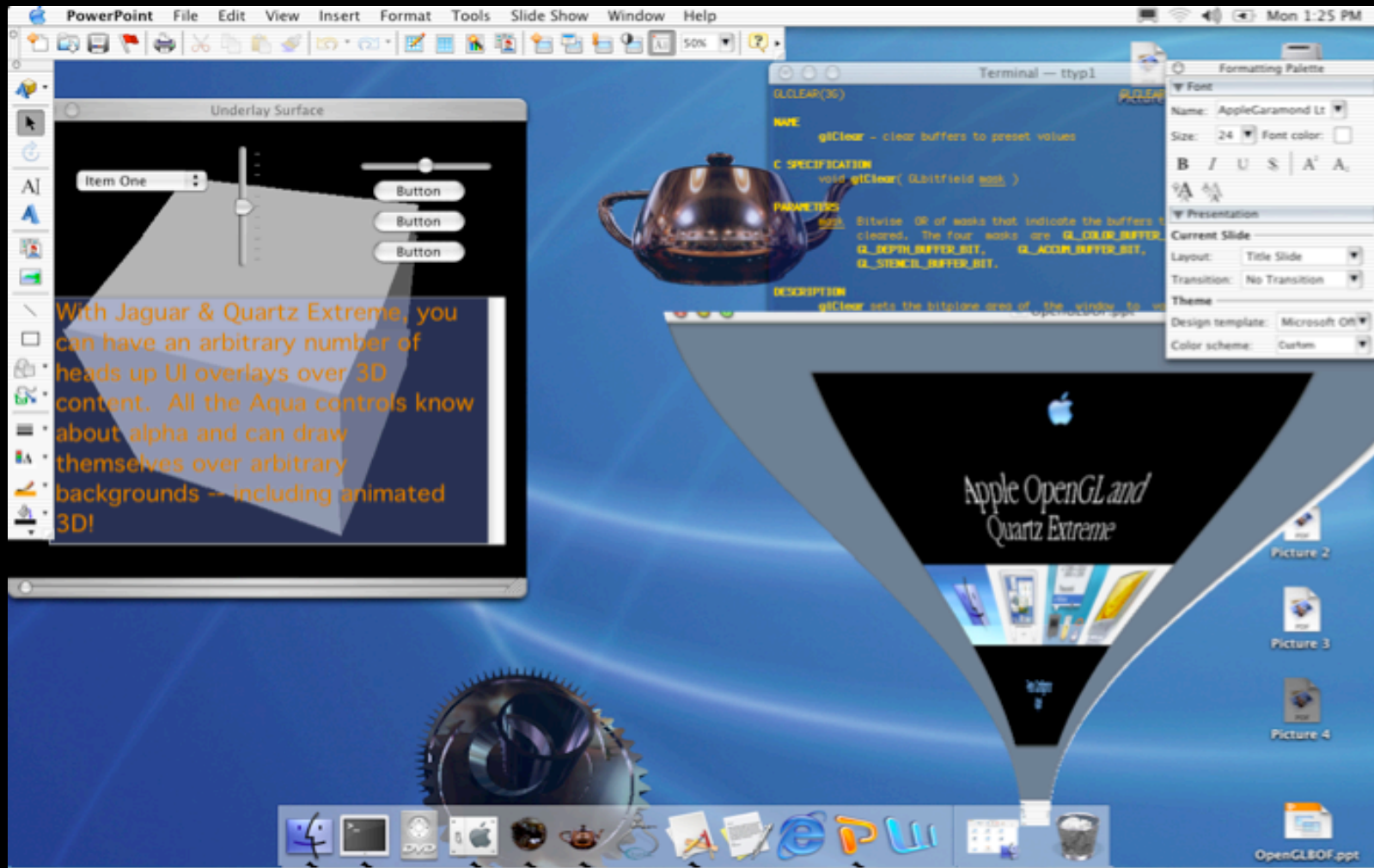




DEMO: Quartz Extreme



Quartz Extreme Screenshot



Just another OpenGL application

- Quartz Extreme uses OpenGL like any other application
- The desktop is a 3D scene
- Everything is a textured polygon
- Compositing via blending and multitexture



GPU Requirements

- 16MB of video memory required (32 recommended)
- AGP 2X required (4x recommended)
- Direct support for Quartz data formats via DMA
 - ARGB8888, ARGB1555, A8, 2vuy, yuvs
- Non-power of two textures
- Multitexture



Mac OS X OpenGL

- State of the art architecture
 - Resource virtualization
 - Textures, surfaces, gpu contexts
 - Data flow optimizations
- Apple co-develops drivers
 - Work closely with vendors
 - Maintain consistence across product line
 - Consistent and stable drivers



New in Jaguar OpenGL

- System Integration
- Texture upload performance
- Programmable Shaders
- Lots of extensions
- Amazing new Tools



System Integration

- Quartz2D on a texture
 - High quality 2D antialiased content on ARGB textures
- Video on a texture
 - Non power of 2 textures
 - YUV texture formats
- Window Compositor integration
 - Arbitrary number of alpha blended overlays
 - “Heads up” UI for 3d apps



Texture Upload Performance

- Direct DMA from native texture formats
- No per pixel CPU involvement
- Flexible synchronization model

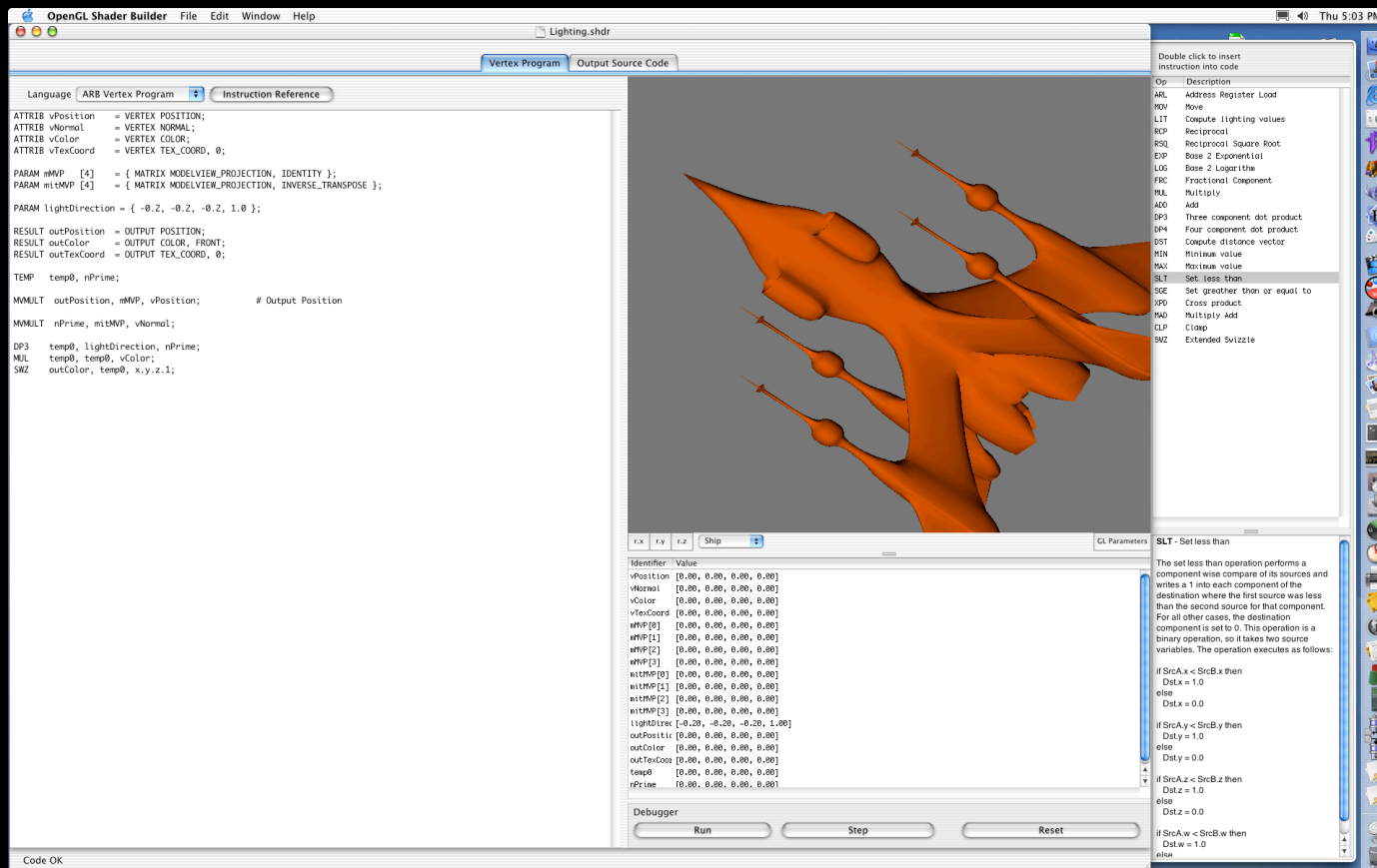


Programmable Shaders

- Vertex Shading based on:
 - `GL_ARB_vertex_program`
- Pixel and Texture shading based on vendor-specific extensions:
 - `GL_NV_texture_shader[123]`
 - `GL_NV_register_combiners[12]`
 - `GL_ATIX_fragment_program`



OpenGL Shader Builder



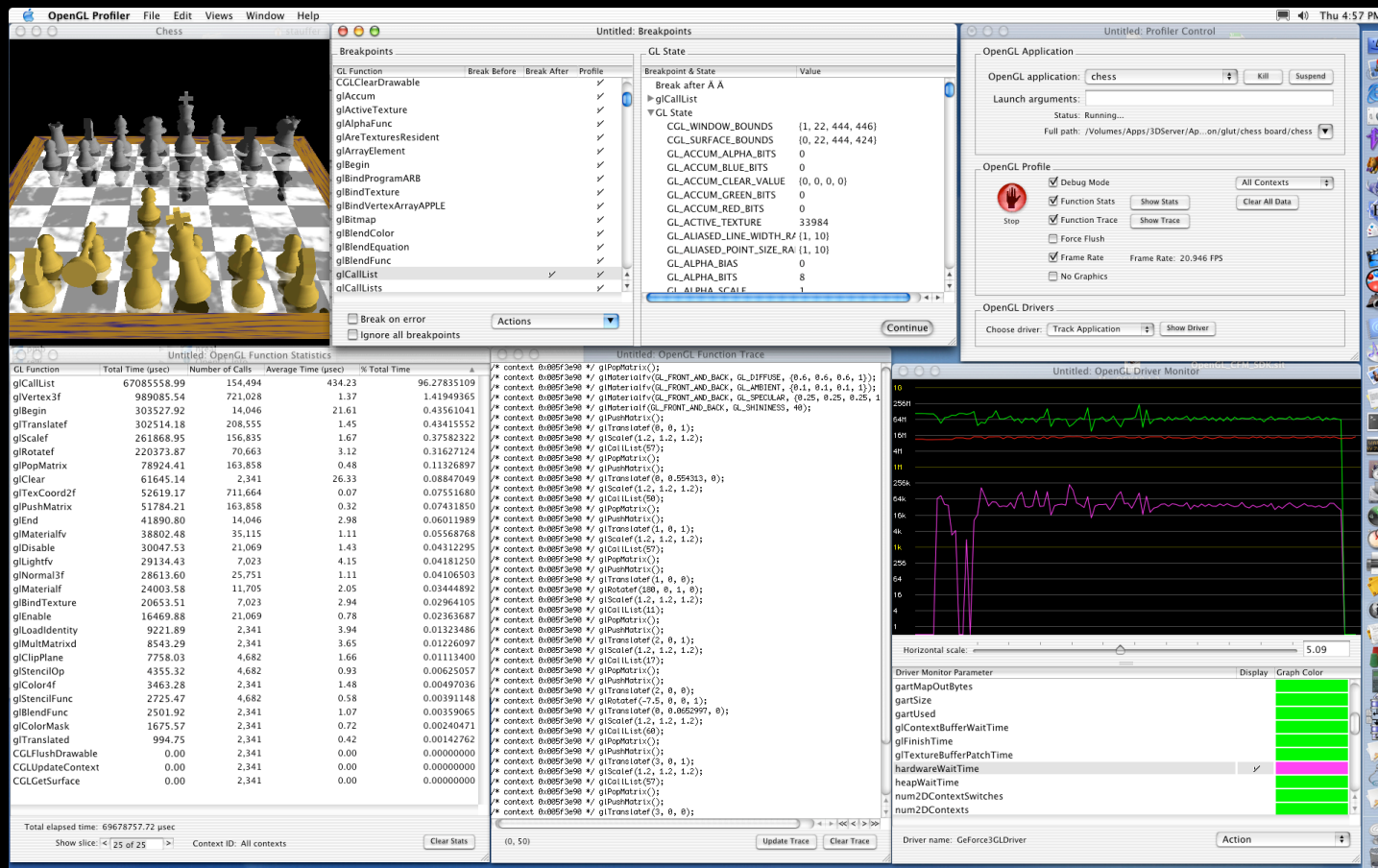
New Extensions in Jaguar

GL_APPLE_ycbcr_422
GL_APPLE_texture_range
GL_APPLE_fence(e)
GL_APPLE_vertex_array_range
GL_APPLE_vertex_array_object
GL_ARB_imaging
GL_ARB_texture_env_crossbar
GL_ARB_multisample
GL_ARB_point_parameters
GL_ARB_pipeline_program
GL_ARB_vertex_program
GL_ARB_texture_mirrored_repeat
GL_EXT_secondary_color
GL_EXT_fog_coord
GL_EXT_draw_range_elements
GL_EXT_stencil_wrap
GL_EXT_blend_func_separate

GL_SGIX_depth_texture
GL_SGIX_shadow
GL_ATI_texture_mirror_once
GL_ATIX_fragment_program
GL_ATI_blend_equation_separate
GL_ATI_blend_weighted_minmax
GL_NV_blend_square
GL_NV_fog_distance
GL_NV_multisample_filter_hint
GL_NV_point_sprite
GL_NV_texture_shader
GL_NV_texture_shader2
GL_NV_texture_shader3
GL_NV_depth_clamp



OpenGL Profiler



Mac OS X “Jaguar”

- Available August 24th.
- First OpenGL-based windowing system
- Lots of headroom for future innovation
- OpenGL is a key technology for Apple



For more info:

- www.apple.com/developer
- Apple developer conference sessions available on DVD or online.
- Become an online ADC member -- it's free!





Think different.

