

Shading at NVIDIA

Kurt Akeley
Graphics Architect
NVIDIA Corporation

Outline



- Languages
- Workflow
- Programming Tips
- Coming Soon
- Demo



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Languages

Low-Level Languages

- DX8 and DX9
- OpenGL ARB
 - ARB_vertex_program
 - ARB_fragment_program
- NVIDIA OpenGL
 - NV_vertex_program
 - NV_fragment_program
- Powerful, but difficult to use

HLSL



- Direct3D only
- Windows only
- Strong support from GPU vendors
- Full NVIDIA support

Cg Language



- Graphics APIs
 - OpenGL
 - Java
- Operating Systems
 - Linux
 - Mac OS X
 - Windows
- Essentially all GPUs
- Full NVIDIA support

OpenGL Shading Language



- OpenGL specific
- Broad OS support expected
 - Should follow OpenGL
- Broad GPU support expected
- Full NVIDIA support

Recommendations

- Direct3D
 - Use HLSL
- OpenGL
 - Cg is usually the best answer
 - ARB profiles for compatibility
 - NV profiles for best NVIDIA performance
 - Use low-level when
 - Existing code (mix and match with Cg)
 - Hand tuning Cg output
 - Coding certain demanding algorithms



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Workflow

Separate Worlds



- DirectX – HLSL shading environment
 - HLSL language
 - FX metafile format
 - Industry-wide support coming
- OpenGL – Cg shading environment
 - Cg Language
 - CgFX metafile format
 - Industry-wide support now

Cg Shading Environment



- CgFX shader metafiles
- Cg enabled applications
- Cg development tools
- Documentation

CgFX - Shader Metafiles



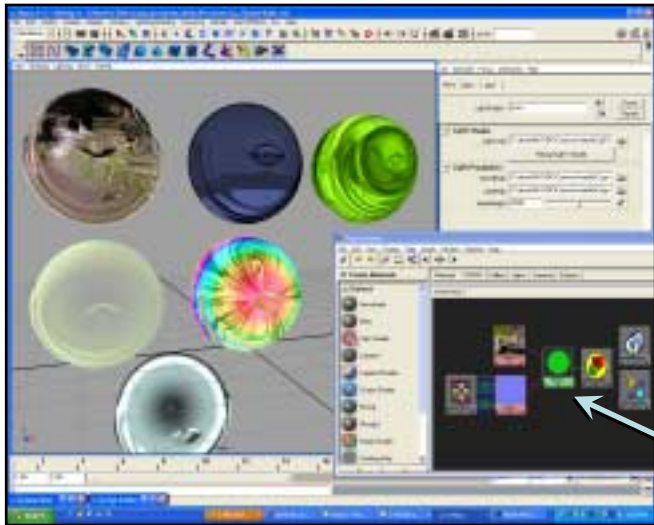
- Powerful shader interchange format
- Implements an effect with multiple
 - Cg shaders (or low-level shaders)
 - Techniques
 - Global parameters
- Separate techniques for
 - Different LODs / qualities
 - GPUs with different functionality
- Techniques include
 - Render state and texture state specification
 - Pointer to the desired shader
 - One or more rendering passes

Cg-Enabled Applications

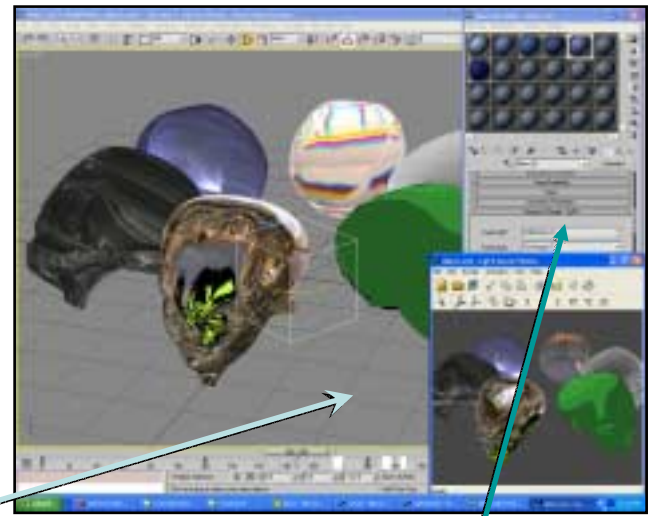
- discreet 3ds max 5/5.1
- Alias Maya 4.5/ 5.0
- SOFTIMAGE|XSI 3.0
- SolidWorks
- Dassault CATIA
- Digital Immersion
- Mental Images
- LightWork Design
- Others TBA



SolidWorks 2004 using CgFX



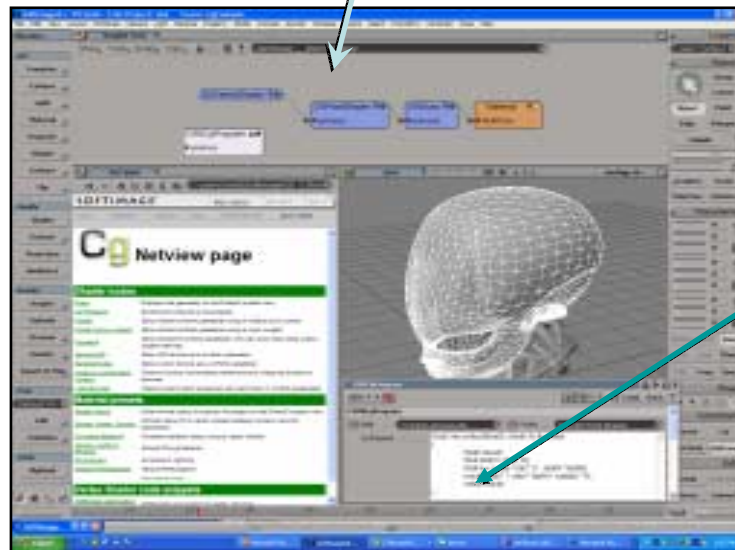
Maya®



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Cg Integration in
DCC Rendering
Pipelines

Direct Cg
Code Editing
and
Compilation



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Images courtesy Alias|Wavefront,
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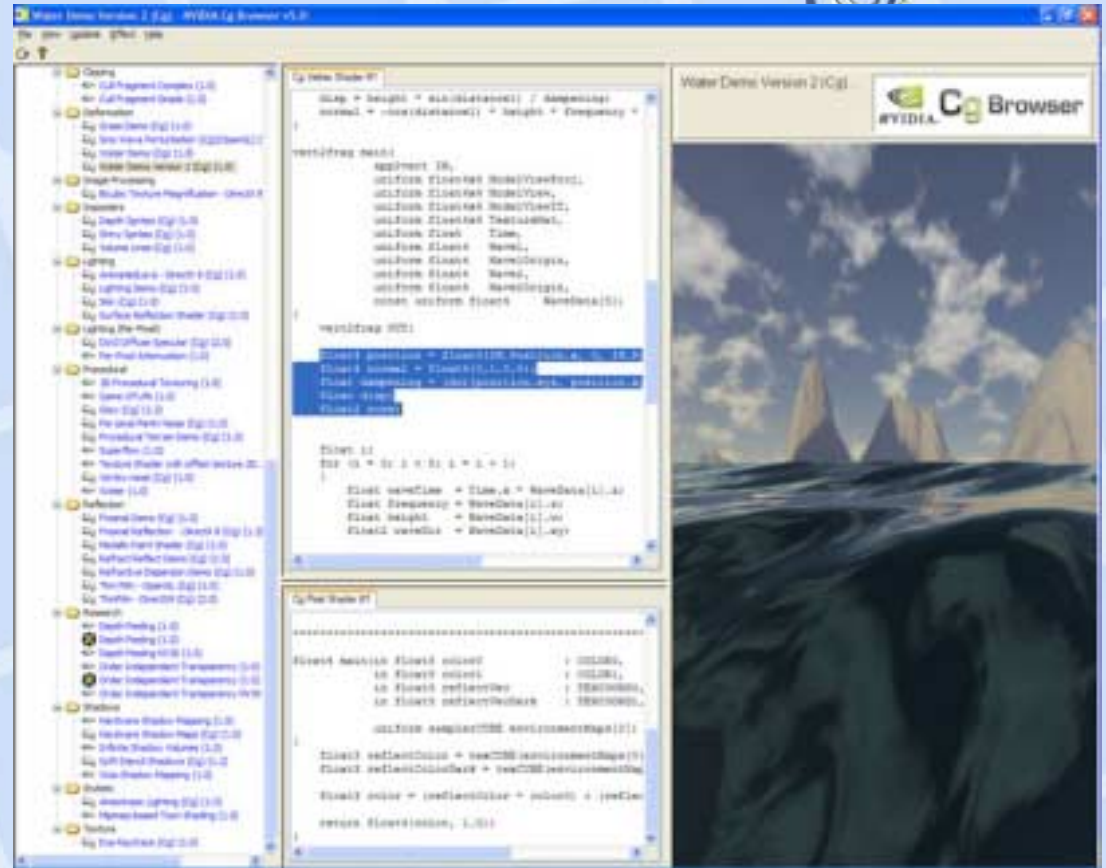
CgFX Viewer

- Parameters editor
- Error reporting
- Available at developer.nvidia.com
- Source code provided



Cg Browser

- Huge shader and effect repository
- Auto-updating keeps NVSDK in sync
- Copy & paste source from hundreds of effects



Cg Documentation

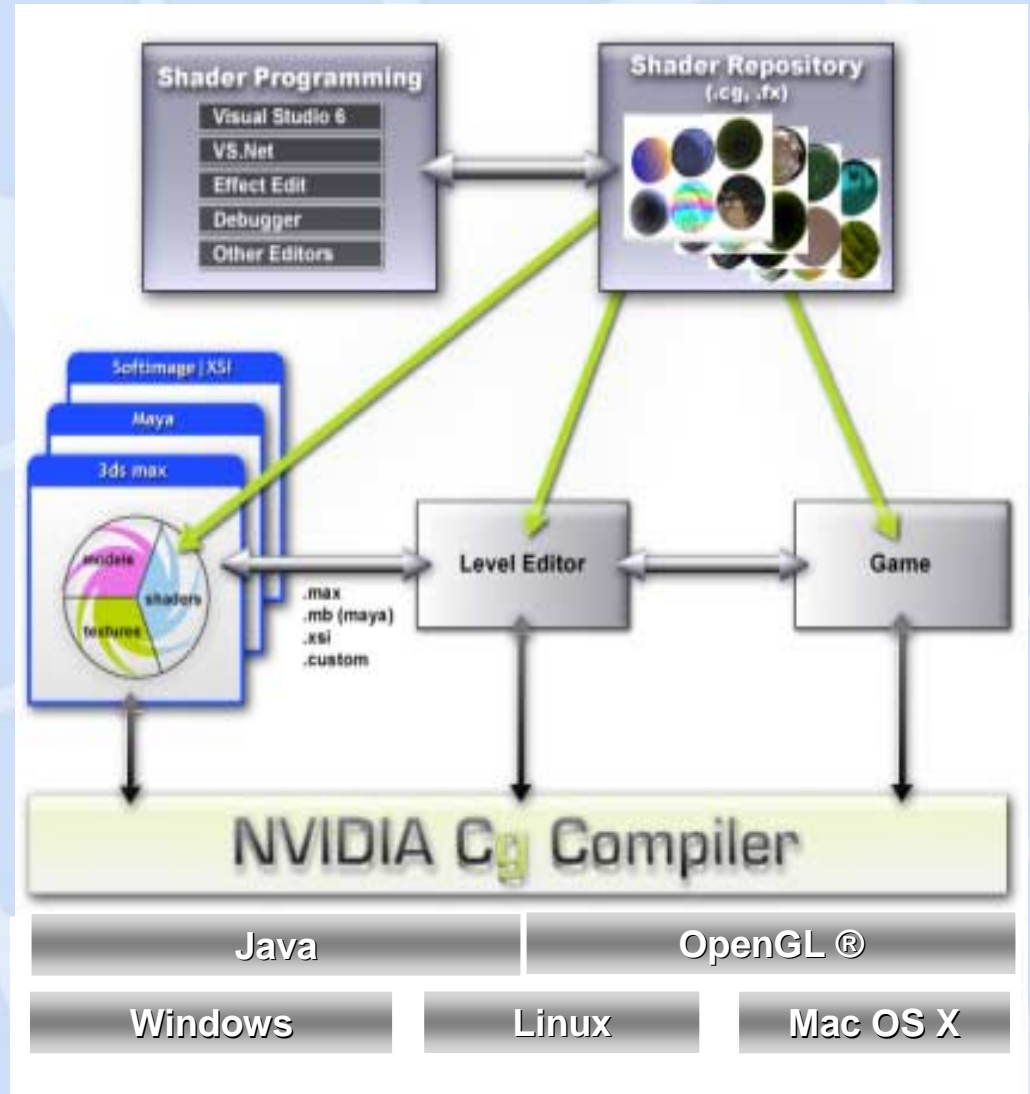


- Cg Toolkit Users Manual
 - English and Japanese editions
- Cg Language Spec
- *The Cg Tutorial* book



Cg Game Workflow

- CgFX-based
- Bidirectional
- Runtime /
hardwired





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Programming Tips

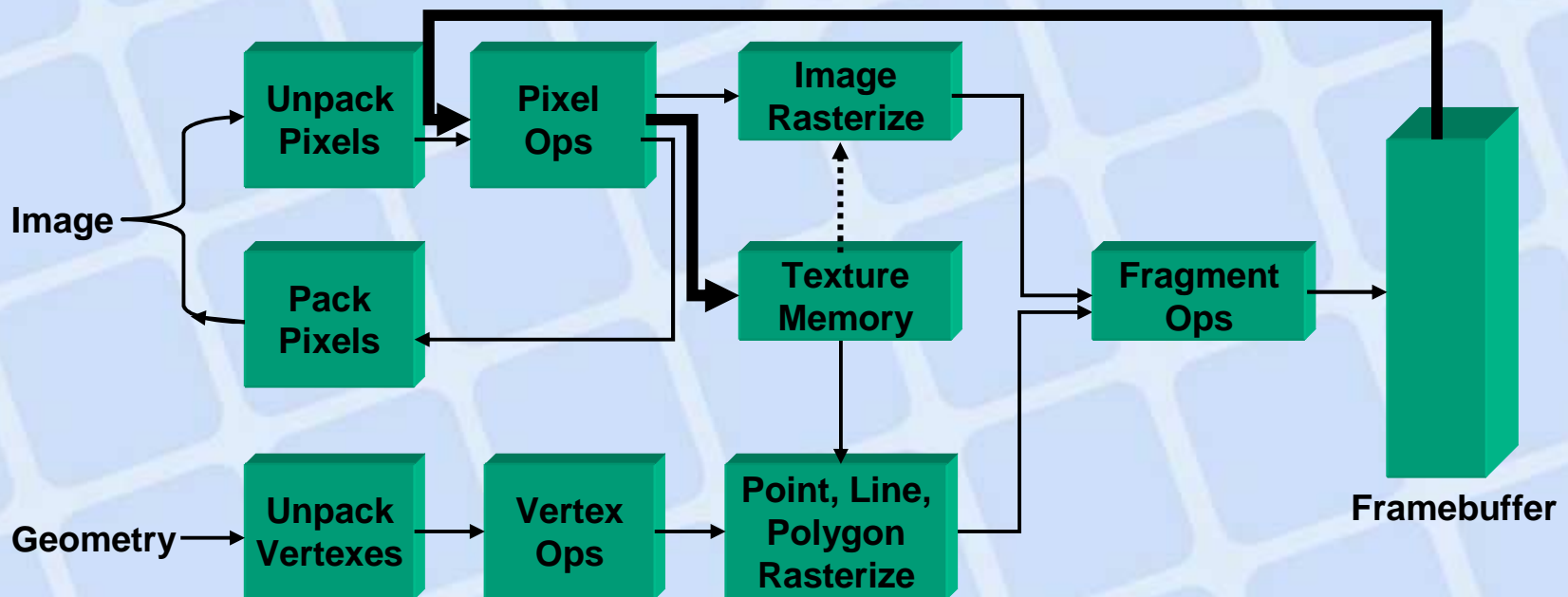
OpenGL Pbuffers



- Use `WGL_ARB_pbuffer`
 - For floating point color buffers
 - For off screen rendering
 - To optimize render to texture

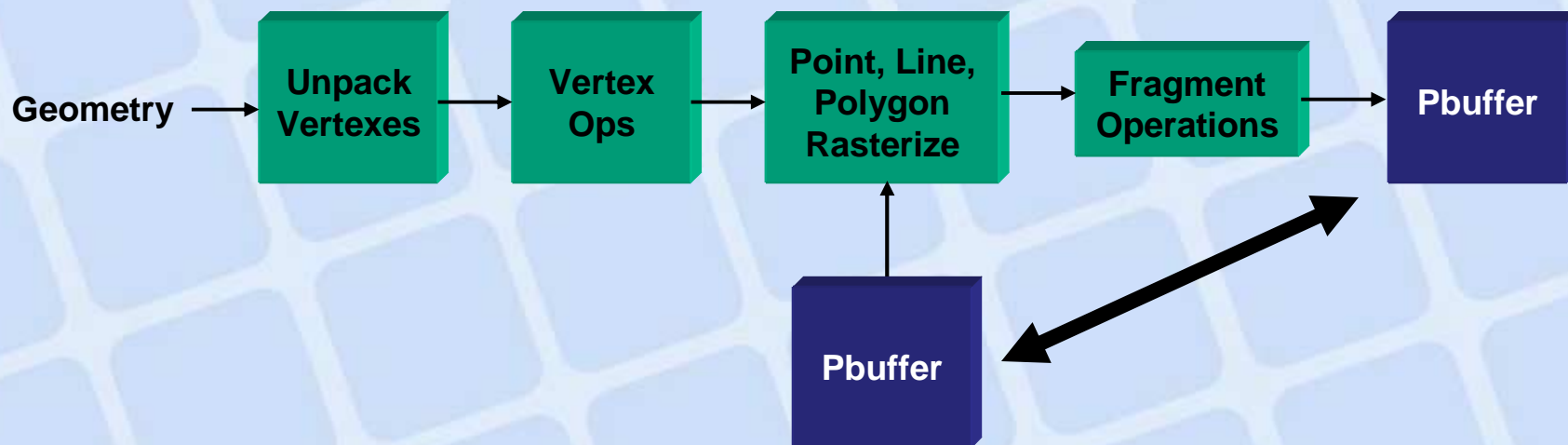
OpenGL Render to Texture

- `glCopyTexImage2D` limitations
 - Data really are copied
 - 2x storage is required



OpenGL Render to Texture

- WGL_ARB_render_texture
 - Use to create special pbuffers
- NV_texture_rectangle
 - Best NVIDIA texture target for pbuffers



Direct3D tips



- Batch, batch, batch ...
- Render front-to-back



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Coming Soon

OpenGL 1.5 and Glslang



- NVIDIA supports
 - All OpenGL revisions
 - All ARB extensions
- NVIDIA is actively implementing
 - OpenGL 1.5
 - OpenGL Shading Language compiler
 - ARB_shading_objects
 - ARB_vertex_shader
 - ARB_fragment_shader

Superbuffers



- Coming OpenGL extension
- Replacement for pbuffers
- Expect
 - Easier usage model
 - Many new capabilities

Cg Language Additions



- Interfaces
 - E.g. separate surfaces and lights
 - More info in the Cg paper presentation
- Unsized arrays
- OpenGL Shading Language profile
 - Improve cross-platform support
 - Virtualize Cg

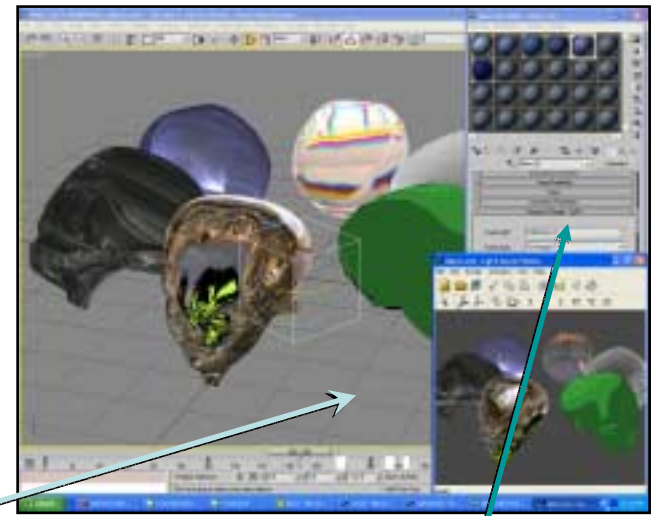
Demo

Kevin Bjorke

NVIDIA Developer Relations



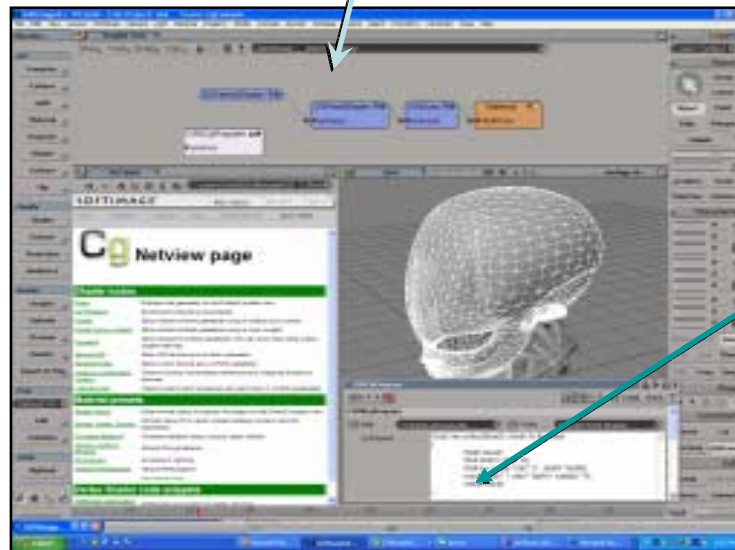
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