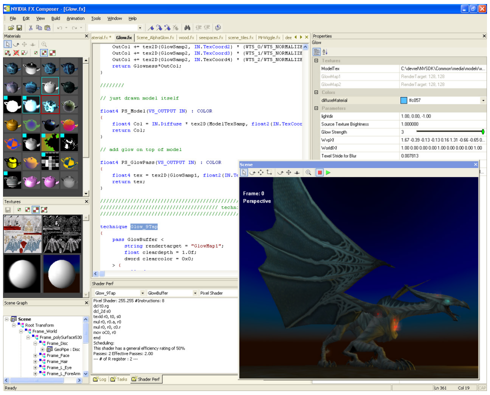
NVIDIA FX Composer

Developer Presentation
June 2004

NVIDIA FX Composer

FX Composer empowers developers to create high performance shaders in an integrated development environment with real-time preview & optimization features available only from NVIDIA.

- **CREATE your shaders in a high powered developer environment**
- **DEBUG your shaders with basic shader debugging features**
- **TUNE your shader performance with advanced analysis and optimization features**



```
    OutCol += tex2D(GlowSamp2, IN.TexCoord2) * (WT5_0/WT5_NORMALIZE
    OutCol += tex2D(GlowSamp2, IN.TexCoord3) * (WT5_1/WT5_NORMALIZE
    OutCol += tex2D(GlowSamp2, IN.TexCoord4) * (WT5_2/WT5_NORMALIZE
    return Glowness*OutCol;
}

////////

// just drawn model itself

float4 PS_Model(VS_OUTPUT IN) : COLOR
{
    float4 Col = IN.Diffuse * tex2D(ModelTexSamp, float2(IN.TexCoor
    return Col;
}

// add glow on top of model

float4 PS_GlowPass(VS_OUTPUT IN) : COLOR
{
    float4 tex = tex2D(GlowSamp1, float2(IN.Te
    return tex;
}

////////////////////////////////////////////
//////////////////////////////////////// techn
////////////////////////////////////////////

technique Glow_9Tap
{
    pass GlowBuffer <
        string rendertarget = "GlowMap1";
        float cleardepth = 1.0f;
        dword clearcolor = 0x0;
    > {
```

Properties

Glow

Textures	
ModelTex	C:\devrel\NVSDK\Common\media\models\x...
GlowMap1	RenderTarget: 128, 128
GlowMap2	RenderTarget: 128, 128
Colors	
diffuseMaterial	ffc057
Parameters	
lightdir	1.00, 0.00, -1.00
Source Texture Brightness	1.000000
Glow Strength	3
WvpXf	1.67 -0.39 -0.13 -0.13 0.16 1.31 -0.66 -0.65 0...
WorldXf	1.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00
Texel Stride for Blur	0.007813

Glow_9Tap | GlowBuffer | Pixel Shader

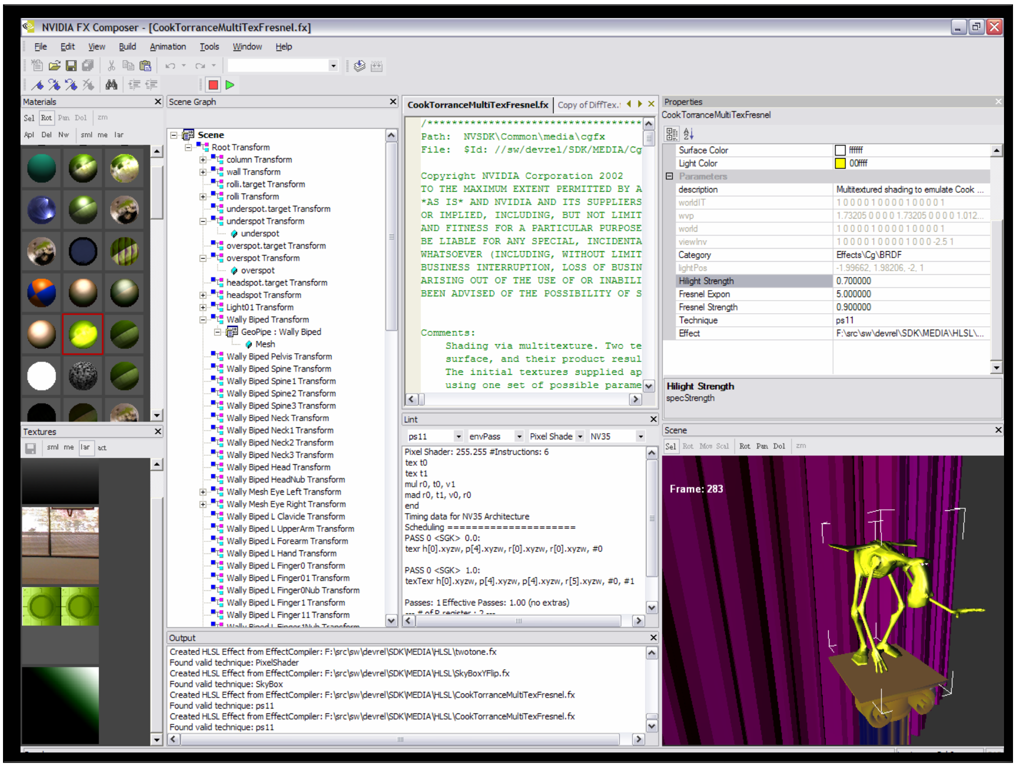
```
Pixel Shader: 255.255 #Instructions: 8
dcl t0.rg
dcl_2d s0
texld r0, t0, s0
mul r0, r0.a, r0
mul r0, r0, c0.r
mov oC0, r0
end
Scheduling:
This shader has a general efficiency rating of 50%
Passes: 2 Effective Passes: 2.00
--- # of R register : 2 ---
```

EverQuest® content courtesy Sony Online Entertainment Inc.

NVIDIA CONFIDENTIAL

Be sure to check out the complete User Guide and helpful tutorials!

EverQuest® content courtesy Sony Online Entertainment Inc. EverQuest is a registered trademark of Sony Computer Entertainment America Inc.


NVIDIA FX Composer - [CookTorranceMultiTexFresnel.fx]
File
Edit
View
Build
Animation
Tools
Window
Help
Materials
Sel Rot Pan Dol zm
Apl Del Nw sml me lar
Textures
sml me lar act
Scene Graph
Scene
Root Transform
column Transform
wall Transform
rolli.target Transform
rolli Transform
underspot.target Transform
underspot Transform
underspot
overspot.target Transform
overspot Transform
overspot
headspot.target Transform
headspot Transform
Light01 Transform
Wally Biped Transform
GeoPipe : Wally Biped
Mesh
Wally Biped Pelvis Transform
Wally Biped Spine Transform
Wally Biped Spine1 Transform
Wally Biped Spine2 Transform
Wally Biped Spine3 Transform
Wally Biped Neck Transform
Wally Biped Neck1 Transform
Wally Biped Neck2 Transform
Wally Biped Neck3 Transform
Wally Biped Head Transform
Wally Biped HeadNub Transform
Wally Mesh Eye Left Transform
Wally Mesh Eye Right Transform
Wally Biped L Clavicle Transform
Wally Biped L UpperArm Transform
Wally Biped L Forearm Transform
Wally Biped L Hand Transform
Wally Biped L Finger0 Transform
Wally Biped L Finger01 Transform
Wally Biped L Finger0Nub Transform
Wally Biped L Finger1 Transform
Wally Biped L Finger11 Transform
CookTorranceMultiTexFresnel.fx
Copy of DiffTex.
Properties
Lint
Output
Scene
Sel Rot Mov Scal Rot Pan Dol zm
Frame: 283

```
/************************************
Path:  NVSDK\Common\media\cgfx
File:  $Id: //sw/devrel/SDK/MEDIA/Cg

Copyright NVIDIA Corporation 2002
TO THE MAXIMUM EXTENT PERMITTED BY A
*AS IS* AND NVIDIA AND ITS SUPPLIERS
OR IMPLIED, INCLUDING, BUT NOT LIMIT
AND FITNESS FOR A PARTICULAR PURPOSE
BE LIABLE FOR ANY SPECIAL, INCIDENTA
WHATSOEVER (INCLUDING, WITHOUT LIMIT
BUSINESS INTERRUPTION, LOSS OF BUSIN
ARISING OUT OF THE USE OF OR INABILI
BEEN ADVISED OF THE POSSIBILITY OF S


Comments:
    Shading via multitexture. Two te
    surface, and their product resul
    The initial textures supplied ap
    using one set of possible parame
```

CookTorranceMultiTexFresnel

Surface Color	□ ffffff
Light Color	🟨 00ffff
Parameters	
description	Multitextured shading to emulate Cook ...
worldIT	1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1
wvp	1.73205 0 0 0 0 1.73205 0 0 0 0 1.012...
world	1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1
viewInv	1 0 0 0 0 1 0 0 0 0 1 0 0 0 -2.5 1
Category	Effects\Cg\BRDF
lightPos	-1.99662, 1.98206, -2, 1
Hilight Strength	0.700000
Fresnel Expon	5.000000
Fresnel Strength	0.900000
Technique	ps11
Effect	F:\src\sw\devrel\SDK\MEDIA\HLSL\...

Hilight Strength
specStrength

ps11 envPass Pixel Shade NV35

```
Pixel Shader: 255.255 #Instructions: 6
tex t0
tex t1
mul r0, t0, v1
mad r0, t1, v0, r0
end
Timing data for NV35 Architecture
Scheduling =====================
PASS 0 <SGK>  0.0:
texr h[0].xyzw, p[4].xyzw, r[0].xyzw, r[0].xyzw, #0

PASS 0 <SGK>  1.0:
texTexr h[0].xyzw, p[4].xyzw, p[4].xyzw, r[5].xyzw, #0, #1

Passes: 1 Effective Passes: 1.00 (no extras)
--- # of R register : 2 ---
```

```
Created HLSL Effect from EffectCompiler: F:\src\sw\devrel\SDK\MEDIA\HLSL\twotone.fx
Found valid technique: PixelShader
Created HLSL Effect from EffectCompiler: F:\src\sw\devrel\SDK\MEDIA\HLSL\SkyBoxYFlip.fx
Found valid technique: SkyBox
Created HLSL Effect from EffectCompiler: F:\src\sw\devrel\SDK\MEDIA\HLSL\CookTorranceMultiTexFresnel.fx
Found valid technique: ps11
Created HLSL Effect from EffectCompiler: F:\src\sw\devrel\SDK\MEDIA\HLSL\CookTorranceMultiTexFresnel.fx
Found valid technique: ps11
```

The user interface features highly configurable *drag-n-dock* panels:

Materials: real-time 3D preview of .FX files

Textures: source and intermediate textures for selected material

Text Edit: syntax highlighting & intellisense for auto-completion

Properties: HLSL variables exposed via standard semantics and annotations
Convenient editing with sliders, color-picker and matrix editor tear-offs

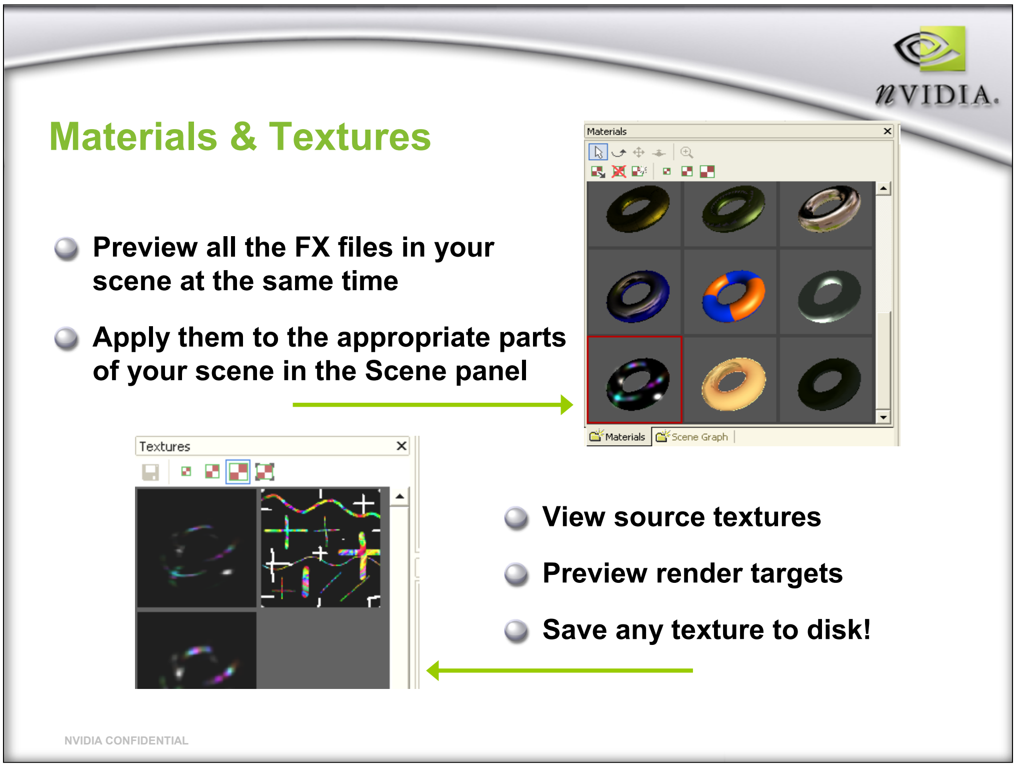
Scene Graph: navigate, select & edit properties

Shader Perf: DirectX assembly, GPU cycle count, efficiency/utilization rating, register usage, FPS, etc.

Scene: preview your own scene with lighting and animation

Tasks: lists errors and support jump-to-error debugging of .FX files

Log: displays compiler output and tells you what’s happening in the background



Materials & Textures

- Preview all the FX files in your scene at the same time
- Apply them to the appropriate parts of your scene in the Scene panel

- View source textures
- Preview render targets
- Save any texture to disk!

NVIDIA CONFIDENTIAL

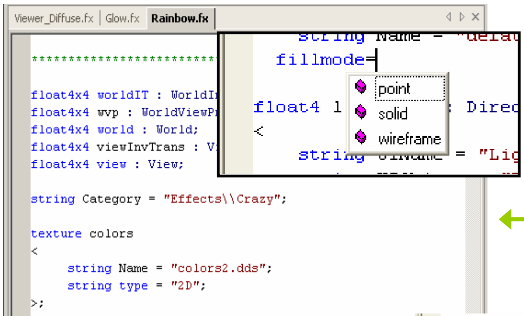
Visual Debugging

Real-time preview of your materials and textures can quickly reveal problems in your shader code

Performance improvement technique

The ability to save a texture target to disk makes it easy to “bake” expensive math into a texture and then modify your shader to do a less expensive texture lookup.

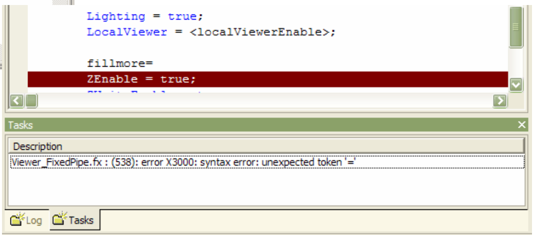
Editing and Debugging



```
*************************

float4x4 worldIT : WorldI
float4x4 wvp : WorldViewP
float4x4 world : World;
float4x4 viewInvTrans : V
float4x4 view : View;

string Category = "Effects\\Crazy";

texture colors
<
     string Name = "colors2.dds";
     string type = "2D";
>;

texture swirl
```

```
    string Name = "defau
  fillmode=

float4 l                : Direc
<
    string         = "Lig
```

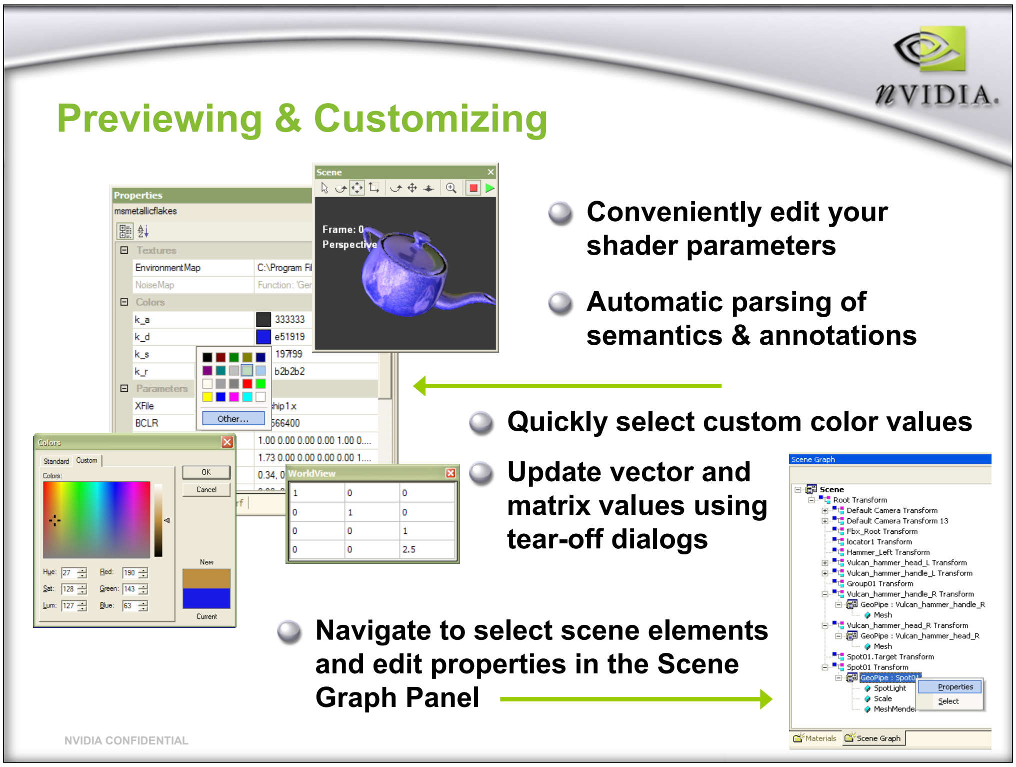
- Edit multiple .FX files
- Intellisense (auto-complete)
- Syntax highlighting



```
Lighting = true;
LocalViewer = <localViewerEnable>;

fillmore=
ZEnable = true;
```

Viewer_FixedPipe.fx : (538): error X3000: syntax error: unexpected token '='

- Jump-to-error helps you find & fix problems quickly



Previewing & Customizing

- Conveniently edit your shader parameters
- Automatic parsing of semantics & annotations
- Quickly select custom color values
- Update vector and matrix values using tear-off dialogs
- Navigate to select scene elements and edit properties in the Scene Graph Panel

NVIDIA CONFIDENTIAL

Load a couple example .FX files & sample projects:

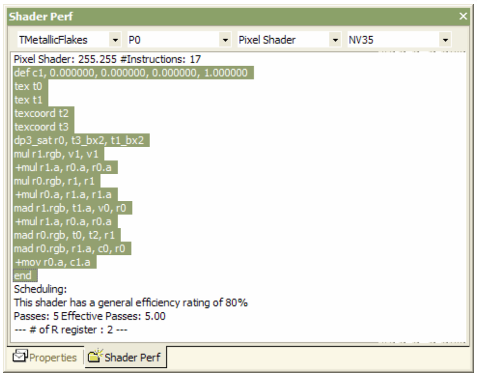
- glow.fx
- uber_mats.fxcomposer
- waves.fxcomposer
- fire.fxcomposer
- alien_gooch.fxcomposer

Some known issues & sticky bits:

- Use mouse pointer to dock panels
- Careful which properties you’re editing!

Tune Your Shader Performance

- User the Shader Perf panel
- Select the technique, pass and vertex or pixel shader to analyze
- Simulate pixel shader performance on any recent NVIDIA GPU
- Optimized DirectX Assembly
- NVIDIA performance analysis
  - GPU cycle count
  - Efficiency / utilization rating
  - Number of passes
  - Register usage



TMetallicFlakes | P0 | Pixel Shader | NV35

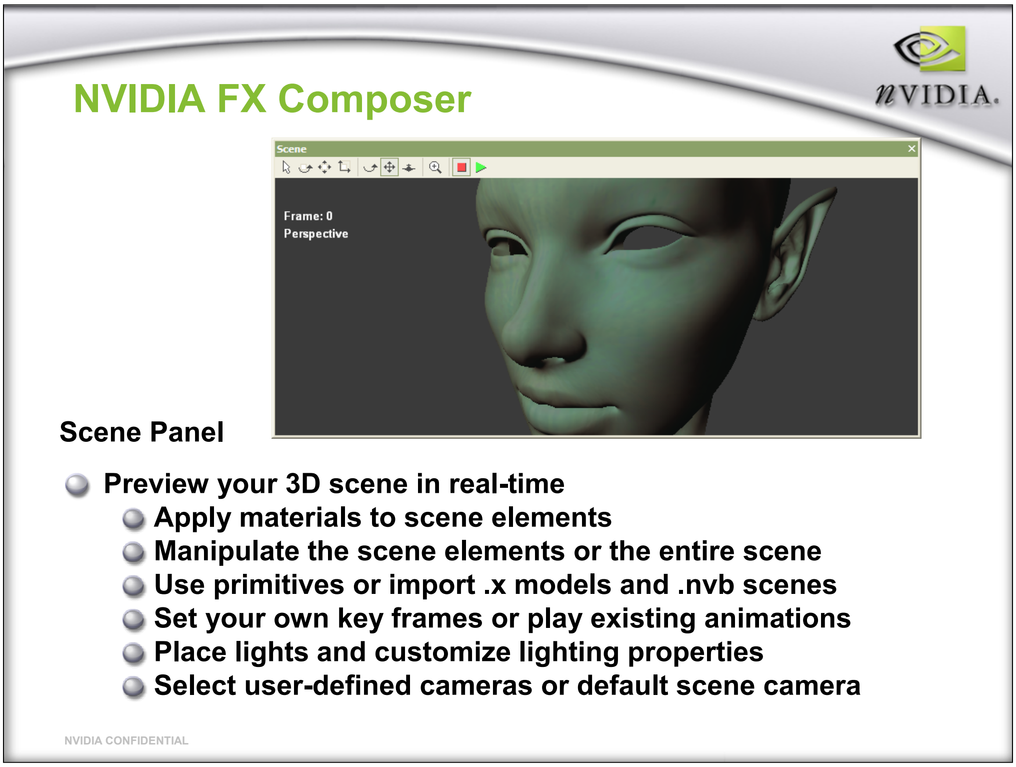
```
Pixel Shader: 255.255 #Instructions: 17
def c1, 0.000000, 0.000000, 0.000000, 1.000000
tex t0
tex t1
texcoord t2
texcoord t3
dp3_sat r0, t3_bx2, t1_bx2
mul r1.rgb, v1, v1
+mul r1.a, r0.a, r0.a
mul r0.rgb, r1, r1
+mul r0.a, r1.a, r1.a
mad r1.rgb, t1.a, v0, r0
+mul r1.a, r0.a, r0.a
mad r0.rgb, t0, t2, r1
mad r0.rgb, r1.a, c0, r0
+mov r0.a, c1.a
end
Scheduling:
This shader has a general efficiency rating of 80%
Passes: 5 Effective Passes: 5.00
--- # of R register : 2 ---
```

Technique, pass and vertex/pixel options updated automatically from your HLSL code

Performance analysis features supported on all GeForceFX and QuadroFX GPU’s.

Simulate performance on the entire family without changing your graphics board!

GPU selection for pixel shader performance analysis only



NVIDIA FX Composer

Scene Panel

- Preview your 3D scene in real-time
  - Apply materials to scene elements
  - Manipulate the scene elements or the entire scene
  - Use primitives or import .x models and .nvb scenes
  - Set your own key frames or play existing animations
  - Place lights and customize lighting properties
  - Select user-defined cameras or default scene camera

NVIDIA CONFIDENTIAL

Placing & connecting additional lights in the scene

- Right-click in Scene Panel and select Create->Point Light
- Click on "lightDir" (grayed out) in the Properties Panel
- Select the newly created light
- Note the updated display of the parameter in the dialog
  - Choose 'rotate object', and spin the light.

Note: It's a direction-only entry in the material, so the position of the directional light is unimportant, just it's orientation.

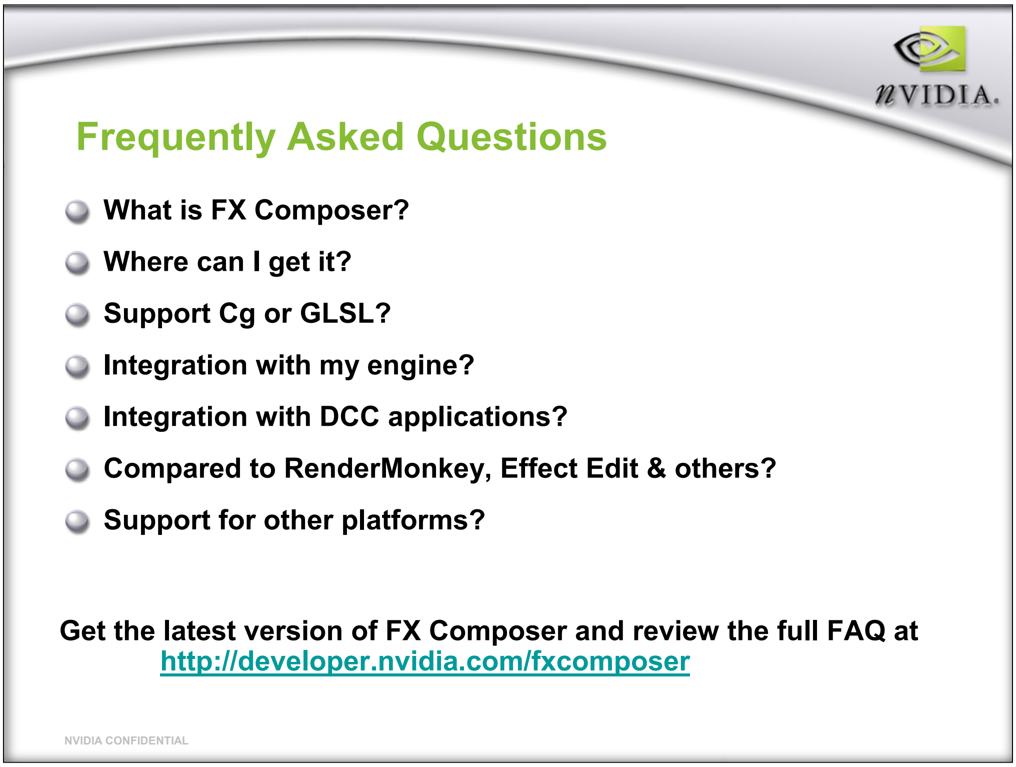
Support for multiple, user-defined cameras and camera path animation

Animation

Best results = import your animation from a DCC application

In FX Composer, just set the frame (F9/F10) and position your scene elements

Note: No way to delete key frames yet...



Frequently Asked Questions

- What is FX Composer?
- Where can I get it?
- Support Cg or GLSL?
- Integration with my engine?
- Integration with DCC applications?
- Compared to RenderMonkey, Effect Edit & others?
- Support for other platforms?

Get the latest version of FX Composer and review the full FAQ at http://developer.nvidia.com/fxcomposer

NVIDIA CONFIDENTIAL

What is FX Composer?
FX Composer is an integrated development environment that provides developers with the features they need to create high performance HLSL shaders.

> *FX Composer empowers developers to create high performance shaders in an integrated development environment with real-time preview & optimization features available only from NVIDIA.*

Support Cg or GLSL?
FX Composer was created to support the large number of developers using HLSL. We currently have no plans to add support for Cg or GLSL, but would like to hear from developers for whom this would be valuable.

Integration with my engine?
Developers can use FX Composer to create .FX files that can be used directly in their applications. NVIDIA is preparing an FX Composer SDK that will allow developers to import their own geometry and much more.

Integration with DCC applications?
NVIDIA works closely with Microsoft to define DirectX features, including standard semantics and annotations that will enable you to share shaders between FX Composer and DCC applications. We will also work with DCC application vendors to ensure FX Composer works well with their products.

Compared to RenderMonkey, Effect Edit & others?
With FX Composer you work directly with .FX files and have access to detailed performance analysis & optimization features that help you create compelling, high performance content for real-time applications.

Support for other platforms?
FX Composer was written from the ground up to be a Windows application; however the performance analysis module of FX Composer may be available on other platforms in the future. We currently have no plans to create MacOS X or Linux ports, but would like to hear from developers for whom this would be valuable.