Pipeline Integration with FX Composer

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Agenda

- FX Composer 1.6
  - Recap
  - DXSAS
  - Plugins
  - Scripting
- Preview of FX Composer 2
FX Composer History

• FX Composer 1.0 shipped last January
  – ~100 .fx files, ~30 projects out of the box
  – Support for all ps/vs profiles in DX9b

• FX Composer 1.5 shipped November last year
  – Many new features, such as DXSAS .86, scripting, SDK, etc.
FX Composer 1.6

- FX Composer 1.6 update in February
  - Mainly a service release; very stable build
  - New .fxproj format, unpackaged
    - Moving towards a standard XML format (XNA, COLLADA)

- 1.7 in the near future
  - Shaderperf updates
  - Installer improvements
Introducing DXSAS .86

- Specification from Microsoft
  - Updated version in the current DX SDK
  - FX Composer currently supports .86
    - Waiting for scripting additions

- Defines a standard set of semantics and annotations

- Help menu brings up the current list of annotations/semantics
  - You can also use fxmapping.xml to map your own custom annotations/semantics to the spec
## Example Semantics

<table>
<thead>
<tr>
<th>Semantic</th>
<th>Description</th>
<th>Data Type</th>
<th>Supported</th>
<th>FX Composer Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>diffuse#</td>
<td>Color value to be used as the diffuse color. The fourth channel represents diffuse alpha.</td>
<td>float4,float3,texture</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td>specular#</td>
<td>Color value to be used as the specular color. The fourth channel represents specular alpha.</td>
<td>float4,float3,texture</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Color value to be used as</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```cpp
float4 myColor : DIFFUSE;
float4x4 myMat : WORLDVIEW;
float elapsed : TIME;
```
## Example Annotations

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
<th>Data Type</th>
<th>Supported</th>
<th>FX Composer Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>frustum</td>
<td>This is type is associated with a frustum</td>
<td>matrix</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td>uiname</td>
<td>This is a string that describes variable, i.e. a pretty name used for labeling an ui dialog</td>
<td>string</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td>uihelp</td>
<td>This is the string for helpful information that is displayed to a user in a tool.</td>
<td>string</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>uiwidget</td>
<td>Described the widget to be used to edit the value.</td>
<td>string</td>
<td>yes</td>
<td>-</td>
</tr>
</tbody>
</table>

```csharp
float4 myColor : DIFFUSE
<
    UIName="Paint Tint";
    UIWidget = "color";
>;`
**ScriptExecute - .86 style**

- Designed to help the effect interaction problem
- Adds powerful scripting features to effects
- A superset of the XML ‘scene commands’ that FX Composer 1.1 shipped with
  - More powerful/general
- All FX Composer effects support .86
  - Old scene command XML automatically interpreted as ScriptExecute.
  - FX Composer 2 will do SAS 1.x
ScriptExecute: Fur Shells

- Script loops on a per-object basis
- Loop counter used to distance each fur shell
- Properties panel lets you tweak the appearance
ScriptExecute: Renderport

- Rendering from different POV
  - Switch camera from script
- Example scene, Soft Shadows
  - Depth map rendered from POV of light
- Current matrices are changed to use the values from the light
ScriptExecute: Shader Stacks

Tiles.fx + EdgeDetect.fx

Corona.fx + EdgeDetect.fx
ScriptExecute Summary

- Flexible way to solve interacting effect problems
- Not too hard to implement in the engine
  - Sample DXSAS code took about 2 weeks
- Really powerful
- A Standard - but look out for the 1.1 spec from Microsoft
DXSAS Implementations

- DCC Companies are working towards 1.x spec
- FX Composer will try to implement as full support as possible
- Microsoft working on full sample implementation for next SDK
- DXSAS .86 version implementation on latest NVSDK
FX Composer SDK

- FX Composer 1.5 was the first version with an SDK
  - Can write plug-ins
  - Can write scripts in C# or VB.NET
- 1.6 adds samples & documentation
  - .x, .obj
  - Material exporter
Plugin Tutorial in 1.6

- Bumpy shiny triangles!
  - Cutting edge technology 😊
- Already external plugins
  - No problems reported
- Fairly simple to build
  - User guide has full documentation
- VC 2003 does most of the work with a wizard
Scripting with C# / VB

- .NET scripting is a powerful new feature
  - C# and VB.NET
  - Editing & Compilation integrated into FX Composer
  - Errors displayed in task bar
    - Just like working with an effect
  - Full FX Composer engine is exposed to the script

- Disadvantages
  - No single stepping
  - No intellisense, not currently as integrated into the IDE as ‘real’ plugins
Script examples...

- Examples
  - Import/export of scene & material data
  - Custom built scenes
  - Material parameter setting/restoring
  - Generation of effect files, based on data
  - Communication between FX Composer & your engine
  - Regression testing, batch processing of materials/effects

- We have scripts to build screenshots of effects & projects
- Other samples to copy
NVIParameterList Props = |INVIProperties|Mat;
Props.GetParameterList(0, out Params);

for (uint ParamNum = 0; ParamNum < Params.GetNumParameter;

writer.WriteStartElement("param"):
INVIConnectionParameter Param;
Params.GetConnectionParameter(ParamNum, out Param);

// Name
NVString strParamName;
Param.GetName(out strParamName);
writer.WriteAttributeString("name", GetText(strParamName));

writer.FcRpr();

// Value
NVType Value;
Param.Get(out Value);
Soul of FX Composer 2.0

- **Major update**
  - User interface improvements
  - New engine
  - New plugin architecture
  - Device Independence
  - Platform Independence
  - Collada project files

- **Fair warning...**
  - This is still pre-alpha
  - Shipping later this year
FX Composer 2 - Screenshot

- Screenshot shows 4 Viewports, 3 are DirectX, one is OpenGL
- Also visible are the properties panel, the editor & the project browser
Why such a major update?

**Improved user interface**
- Better float dock support, plugin integration, layout management.

**Updated engine**
- More generalized & efficient pipeline
- C#/.NET core

**Multiple device and shader format support**
- DirectX still the ‘first class’ citizen
- Also GLSL, CgFX,…?

**Collada project file support**
- XNA? When it’s available…
User Interface

- Supports more advanced window management
  - Custom user layouts
  - ‘Artist’ mode, ‘Programmer’ mode, etc...
  - Doesn’t need the editor to be visible

- Multiple viewports
  - Each one with different device
  - Each one with different camera
  - Cameras can be shared

Easy viewing of same scene with different material types
User Interface - 2

- Project Explorer
  - Integration of material browser, texture browser and scene window
  - Control over building effects that aren’t based on a metafile
  - Multiple material types
User Interface - 3

- Improved property editor
  - Full support for all types
  - Structures
  - Arrays
- New widgets for editing matrices, colors, etc.
User Interface - 4

- Many usability features based on feedback
- Full drag-drop for materials, projects, tree nodes, etc.
- Better management of media files and paths
- Better management of project paths, etc.

Still work in progress
New Engine

- Supports n-sided polygons & multiple index sets
  - Needed to ensure DCC<->FXC interoperability
  - Tessellation to triangles before rendering
  - Pipeline stages can use polygon data if preferred
- More efficient scripting renderer
  - Enables DXSAS, Collada materials, etc. to run with the same core engine
New Plugin Architecture

- Plugins now much more powerful
  - Can extend the user interface
  - Can add menu items, etc.

- Legacy plugins still supported
  - Wrapper plugin enables them to work

- Boundary between scripting and plugins more blurred
  - The same API, language
  - Can work either way
Device Independance

- **Core application**
  doesn’t know or care about rendering
- **All materials & devices**
  are pluggable
  - CgFX & HLSL out of the box
  - GLSL to follow
  - SDK enables extension
    - User can implement their own device and material support
    - Works alongside existing materials in multiple viewports
**Platform Independence**

- **FX Composer 2 is 100% .NET**
- **The Mono and DotGNU projects enable .NET on other platforms**
  - [www.mono-project.com](http://www.mono-project.com)
  - [www.dotgnu.org](http://www.dotgnu.org)
- **Future version of FX Composer on MAC & Linux**
- **Watch this space!**
Collada Project Files

• FX Composer 1.6 used its own XML project format
  – Proprietary, nobody liked it…

• FX Composer 2.0 can have different project formats
  – Currently Collada
  – Legacy importer/convertor provided if required for old projects
Questions?

- Suggestions, bug reports, early access
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- Me
  - cmaughan@nvidia.com

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