An Introduction to COLLADA

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Talk Roadmap

- What's the COLLADA Initiative?
- Why do we care?
- What is it?
- Format Details
- Current Tool Implementations
- Future Developments

COLLADA: What is it?

- A COLLAborative Design Activity
- To design a 3D data interchange format
  - Allowing import and export from tools
  - Designed by the community
- Collaboration with the tool manufacturers
  - Natively supported by modeling tools
  - Fully supports “next-gen” features (shaders, assets)
  - Multiple target platforms

COLLADA: Why?

- Content creation has become increasingly complex
  - Capabilities of 3D devices …expanding
  - Size of content …growing
  - Production schedules …tightening
- Developing a custom pipeline is expensive and time consuming!
- Increasing use of an assortment of proprietary & third-party tools
  - Object data is a prisoner of the content creation tool (format)
  - We want to have flexible data and workflows
- A tool, target & workflow-independent file format is a great foundation for a flexible pipeline.

Why create an interchange format?

- No existing *standard* interchange format
- No collaboration to create such format
- For each studio to create its own formats and exporters is hugely redundant
  - If we can do it once, and do it well, we can save a lot of time, effort, and money
- A common interchange format would allow tools to be used interchangeably
  - Simplifying content creation and asset management

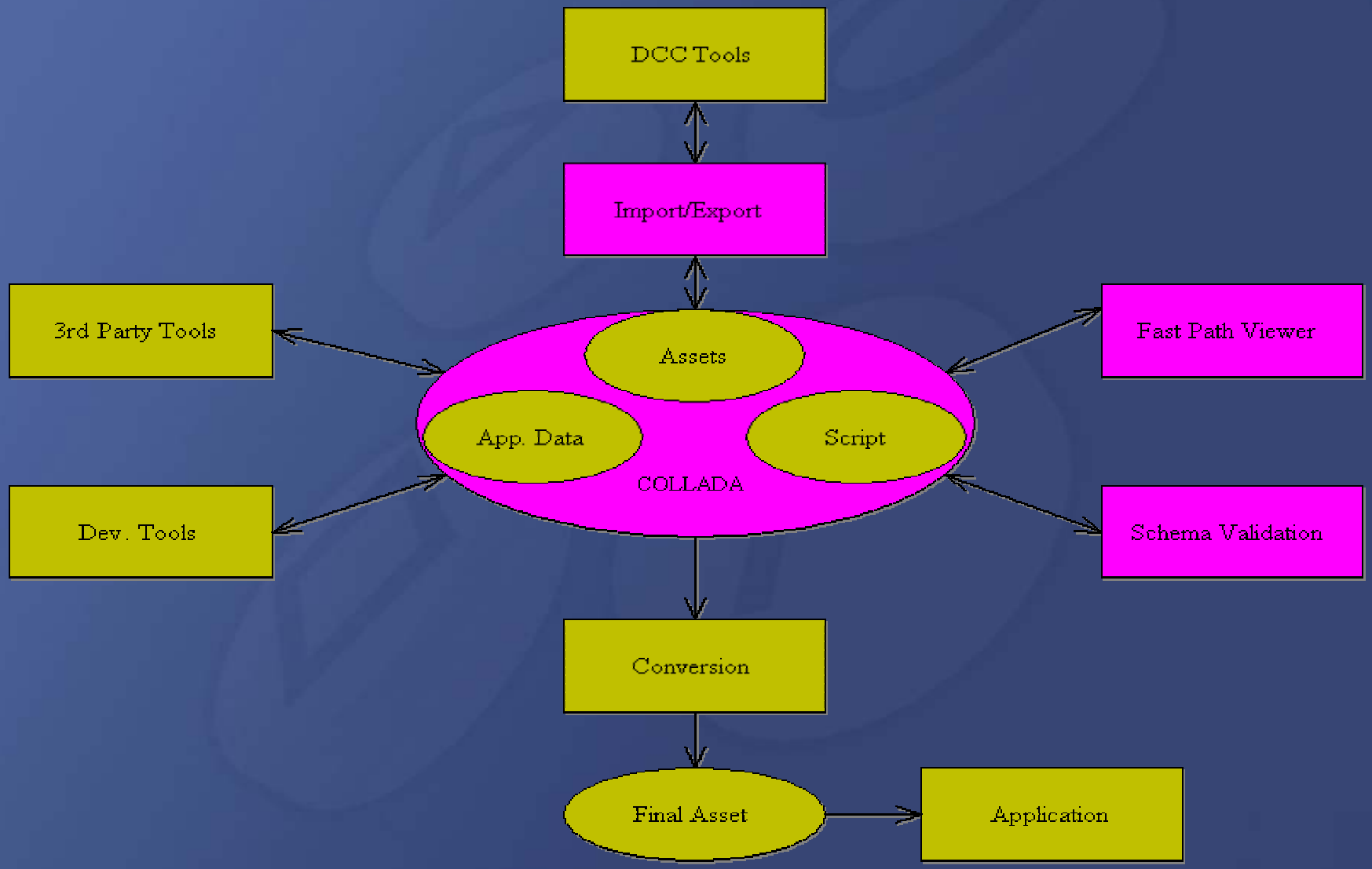
But why not use an existing 3D format?

- X3D
  - Is designed for productivity and communication apps
  - 3D tool support is inconsistent
  - VRML legacy
- FBX
  - Owned by Alias
  - Largely bound to Filmbox and Maya
  - Not collaboratively designed
  - Binary format
  - Missing important features: meta-data, version headers, extensibility, multi-texture
- dotXSI
  - Owned by Softimage
  - Good format, but not UTF8 encoded

Why an intermediate format?

- Why not a binary format?
  - Final binary format needs to be optimized to target platform
    - Can be expensive to create
    - Should be a super-efficient direct memory image
    - Format may change during product development
  - Easier to use the intermediate format to create the final binary
    - Rather than invoking Maya/Photoshop/etc for each asset
- A readable intermediate format is easier to debug and browse by a programmer

Uses for COLLADA



Why might you want to use COLLADA?

- Use as your intermediate file format
  - Prior to binary optimization for platform
- Makes the life of tool developers simpler
- Easy to create and edit COLLADA files
  - For rapid prototyping of content
- Human readable

COLLADA: The Goal

- Ease content development and prototyping, by
  - Freeing your data from your 3D modeling program
  - Getting collaboration from all 3D tool manufacturers
  - Making import/export simple

Who's working on it?

- Sony Computer Entertainment R&D Project
  - Separate from other projects, own timeline
  - Designed to be multi-platform, for all targets – no, really!
  - No strings attached or hidden agenda (I swear!)
- Current contributors
  - Sony family: SCE[IJEA], Naughty Dog, Insomniac
  - 3D Tools: Alias, Discreet, Softimage, …
  - Middleware: Criterion, Hybrid, Emdigo, Metrowerks, Ageia, Virtools, Vicarious Visions, Novodex…
  - Gamedevs: Digital Eclipse, Electronic Arts, Epic, Secret Level, Ubisoft, Vicarious Visions, …
  - Others: 3Dlabs, NVIDIA, ATI, dnahelix

What's the status?

- Work started at Siggraph 2003
  - Collaborating with major 3D tool manufacturers and developers
- COLLADA 1.0 rollout at Siggraph 2004
  - With Alias, Discreet, Softimage, Criterion, Vicarious Visions, Novodex, Emdigo
    - COLLADA 1.0 spec
    - COLLADA 1.0 XML Schema
    - Sample code, data and importers/exporters
    - COLLADA website, http://www.collada.org
- COLLADA 1.1 released December 3rd
  - Updated plug-ins from Alias, Discreet, Softimage.
  - New features: animation and skinning.
- COLLADA 1.2 releasing January 26th
  - Patch release, improved importers and exporters.

What makes up COLLADA?

- COLLADA spec document
- XML Schema

  http://www.collada.org/2004/COLLADASchema
- Partner Importers/Exporters: Maya, 3DSMax, XSI
- COLLADA.org website
- OpenGL pre-viewer, with Cg 1.2 support
- Sample data

Format Details

COLLADA element list

- Geometry
  - Mesh
  - Skin
- Collation
  - Lines
  - Linestrips
  - Polygons
  - Triangles
  - Trifans
  - Tristrips
- Data flow
  - Accessor
  - Array
  - Input
  - Param
  - Source

Transform
- Lookat
- Matrix
- Perspective
- Rotate
- Scale
- Skew
- Translate

Material and Shading
- Image
- Light
- Material
- Pass
- Shader
- Texture

Procedural Elements
- Code
- Entry
- Param
- Program

- Object Elements
  - Camera
  - Instance
- Meta Elements
  - Asset
  - Extra
  - Technique
- Hierarchical Elements
  - Bounding box
  - Node
  - Scene
- Categorical elements
  - Animation
  - Geometry
  - Library

Higher-level features

- By combining these elements, COLLADA supports many higher level concepts
  - Scene hierarchy
  - Mesh geometry
  - Cameras
  - Light sources
  - Materials
  - Textures
  - Shading language programs
  - Procedural geometry and texture
  - Character skins and skeletons
  - Content modularity
  - Multi-representation
  - Internationalization
  - External references
  - Key-frame animation
  - Document level asset management
  - Element level asset management

Show me the good stuff!

- Material Elements
- Geometry Elements

Materials

- Programmable shading
  - Major area of advancement for content
  - Materials
    - Describes the appearance of geometry
  - Techniques
    - Materials encapsulate techniques
    - Profiles indicate which techniques to use
    - Multiple ways to represent data and algorithms
  - <material>,<shader>,<technique>,<pass>, <program>,<texture>

Example: cube.dae Material

```
<library type="MATERIAL">
  <material name="Blue">
    <shader>
      <technique profile="COMMON">
        <pass>
          <program id="PHONG">
            <param name="AMBIENT" type="ColorRGB">
                0.000000 0.000000 0.000000</param>
            <param name="DIFFUSE" type="ColorRGB">
                0.137255 0.403922 0.870588</param>
            <param name="SPECULAR" type="ColorRGB">
                0.500000 0.500000 0.500000</param>
            <param name="SHININESS" type="float">16.000000</param>
          </program>
        </pass>
      </technique>
    </shader>
  </material>
</library>
```

Geometry

- Geometry as dataflow
  - Vertices are the norm
    - Attributes are variable
  - Meshes contain vertex and polygon data
    - Describes the shape of geometry
    - Lots of high frequency data
  - Higher order surfaces
    - Not widely used; will be supported in <geometry>
  - <geometry>, <mesh>, <source>, <polygons>, <p>

Example: cube.dae Geometry

```
<library type="GEOMETRY">
 <geometry name="box">
  <mesh>
   <source id="box-Pos">
    <array id="box-Position-array" type="float" count="24">
                -0.5 0.5 0.5
                0.5 0.5 0.5
                -0.5 -0.5 0.5
                0.5 -0.5 0.5
                -0.5 0.5 -0.5
                0.5 0.5 -0.5
                -0.5 -0.5 -0.5
                0.5 -0.5 -0.5
    </array>
    <technique profile="COMMON">
     <accessor source="#box-Position-array" count="8" stride="3">
      <param name="X" type="float" />
      <param name="Y" type="float" />
      <param name="Z" type="float" />
     </accessor>
    </technique>
   </source>
   <vertices id="box-Vtx">
    <input semantic="POSITION" source="#box-Pos"/>
   </vertices>
```

```
   <polygons count="6" material="#Blue">
    <input semantic="VERTEX" source="#box-Vtx"/>
                <p>0 2 3 1</p>
                <p>0 1 5 4</p>
                <p>6 7 3 2</p>
                <p>0 4 6 2</p>
                <p>3 7 5 1</p>
                <p>5 7 6 4</p>
   </polygons>
  </mesh>
 </geometry>
</library>
```

Example: cube.dae asset

```
<? xml version="1.0" encoding="utf-8" ?>
<COLLADA xmlns=http://www.collada.org/2004/COLLADASchema version="1.2.0">
  <asset>
    <revision>1.0</revision>
    <authoring_tool>EQUINOX-3D  COLLADA exporter v0.7.4</authoring_tool>
    <modified>2004-07-15T22:09:29Z</modified>
  </asset>
[MATERIAL LIBRARY]
[GEOMETRY LIBRARY]
  <scene name="DefaultScene">
    <node name="Box">
      <instance url="#box"/>
    </node>
  </scene>
</COLLADA>
```

Other Features

- Asset metadata: Every document is an asset
  - Elements that contain content are assets
    - <asset>
      - <author />
      - <authoring_tool />
      - <created />
      - <modified />
      - <revision />
      - <source_data />
      - <copyright />
      - <title />
      - <subject />
      - <keywords />
      - <comments />
      - <up_axis />
      - <unit />
  - COLLADA API will be asset centric

Other Features

- External references: Any element can be an external reference

  <node id="instance6">

  <instance url="file://host ...">

- Extra data
  - User- or tool-defined
  - Platform-specific data

Other Features

- Shader programs
  - Cg
  - GLSL (coming from 3Dlabs)
  - HLSL not yet
  - Multi-pass and FX metadata
- Cg in COLLADA
  - An example of advanced functionality
  - Implemented as a custom technique
  - Cg shaders currently working with XSI

Tool Support

- Maya
- 3DSMax
- XSI
- Renderware
- Alchemy
- Ageia

Alias - Maya

- Maya translator (v1.1) available for import/export
  - Out of the box COLLADA integration
  - Open source
- Extendable to include your custom data
  - Or as a starting point for your own translator
  - Uses <extra> to add Maya custom content

Discreet - 3DSMax

- Version 1.1 import/export
  - MaxScript based
  - Easy to modify
  - Future version will be a true C++ plug-in
  - Import functionality works with Gmax
  - Useful for data transfer to previous versions

Softimage - XSI

- XSI Import / Export
  - Supports a rich set of the COLLADA 1.1 specification
  - Open source under the MIT license
  - Supports:
    - Hierarchies and transforms
    - Polygon meshes
    - Multiple texture coordinates, normals, colors, and position data
    - Materials and textures
    - Lights and cameras
    - Cg programs
  - Based on Xerces and the XSI FTK (File Transfer Kit)
  - COLLADA interchange fits into “Connect to Softimage” strategy.
    http://www.softimage.com/connect/xsi
  - XSI Viewer Pro with COLLADA import (available soon)

EA/Criterion - Renderware

- COLLADA files are integrated directly into the RenderWare Studio Game Database
  - Become an integral part of the game database asset structure.
  - Sit alongside game entities, objects & behaviors from other packages.
  - Game Production Manager translates assets to be platform optimal
- Longer term, RenderWare 4 will include a node inside the Asset Conditioning Pipeline (ACP) dedicated to COLLADA data
- Can use RW Studio as a COLLADA viewer
  - RWS provides centralized version controlled database
  - Workspace provides assembly and integration of game components
  - Live link to console for in-game visualization of assets

Vicarious Visions - Alchemy

- Alchemy and COLLADA in the future
  - Integrate COLLADA with the tool chain
  - Will greatly simplify exporter pipeline
  - Significantly reduce maintenance overhead
  - Allows further leverage of large art teams & sharing of assets
  - Highly efficient management and integration of art assets
- Activision recently purchased VV
  - Watch this space…

Ageia

- COLLADA Meets PSCL
  - PSCL: The Physics Scripting Language
  - An open standard dynamics data definition language
  - Interactive real-time physics scripting and prototyping
  - Import and export using COLLADA 2.0

Coming soon

- 3Dlabs
  - GLSL implementation and OpenSceneGraph importer
    - Now a sourceForge project
    - Basic framework and import completed

Current Status

- COLLADA 1.1 available
  - XML Schema
  - Importers & exporters
  - Sample code
  - Website open for collaboration
  - Models interchange between modelers easily
    - As seen on TV (I mean, at Siggraph)

Current Status

- COLLADA 1.1
  - New spec, new schema, new importers/exporters, new samples
  - Animation and skinning support
- Feature List
  - Animation
    - <animation>
      - Container for animation data and programs.
    - <channel>
      - Animation channel targets nodes and messhes.
    - <sampler>
      - Animation function.
  - Character skinning
    - <skin>
      - Container for skin mesh data.
    - <combiner>
      - Combines sources into composite sources.
      - Produces aggregated, variable length results.

Current Status

- COLLADA 1.2
  - Patch release to improve quality and robustness
    - Clarify schema ambiguities
    - Improve plug-ins
  - Beta testing now…
  - Releasing January 26th (Wednesday)

Looking to the future…

- COLLADA 2.0
  - Physics, Effects (FX/CgFX), asset management
  - COLLADA API
  - Release on April 1st ☺
- COLLADA at GDC 2005
  - SCE US R&D sponsored session on March 10th
  - We plan to show PSP utilities
- Introducing COLLADA tour
  - Presentations at:
    - IGDA SF chapter meeting January 25th
    - Imagina'05 conference session February 2nd

In summary, what COLLADA provides

- Maya import and exporter from Alias
- 3DSMax import/export in MaxScript from Discreet
- XSI import and export from Softimage
- Sample tools:
  - OpenGL viewer, error checker.
- Source code and sample data files
- COLLADA website: www.collada.org
  - Website has 240+ registrants

Future Plans

- Collaboration
  - Involve Khronos Group
  - Working Groups formed for:
    - Shader Effects
      - 3Dlabs and ATI (RenderMonkey)
      - NVIDIA (FX Composer)
    - Profiles, Physics
- COLLADA API
  - SCEA contracted Emdigo
  - A reflective object model approach
    - Maps to application data model
  - Create and manipulate assets

In Conclusion

- Please check out COLLADA!
  - Can only get stronger through your input
  - Public forum and downloads: http://www.collada.org
- Contact us to become a contributor:

  collada@collada.org
- 3D tool manufacturers are looking for feedback from developers who try out their exporter. Get in touch with them if you check out COLLADA.
  - Alias – Maya Import/Export
  - Discreet – 3DSMax Import/Export
  - Softimage – XSI Import/Export
  - 3Dlabs – OSG Import