

Web3D Quickstart 1

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The Greatest Common Denominator

1997 era VRML worlds runs in :

- 2018 HyperCube
- Samsung GearVR, DayDream Apps
- HTML5
- ...

21 years of asset durability

And reproducibility !!!



VT Visionarium Lab Upgrade

- 26.7 million active stereo pixels:
The HyperCube CAVE
- Intersense, now ARTracking
- Active -> Passive ->
now Active stereo



Something in Common?



Vis.arc.vt.edu

Instantreality.org

3dprint.nih.gov

Web3D.org

Specifications, Resources, Community

VRML -> Web3D Conference Proceedings

- 23 Years in the ACM Digital Library

Google Scholar search:

- 'Extensible 3D' 109,000 hits; 19,500 hits for 'X3D'
- 'Virtual Reality Modelling Language' 258,000 hits; 80,300 hits for 'VRML'



VRML is X3D...

A text editor:

Change the first line of your *.wrl from :

```
#VRML V2.0
```

To:

```
#VRML V3.0
```

... save as *.x3dv

but X3D is so much more!

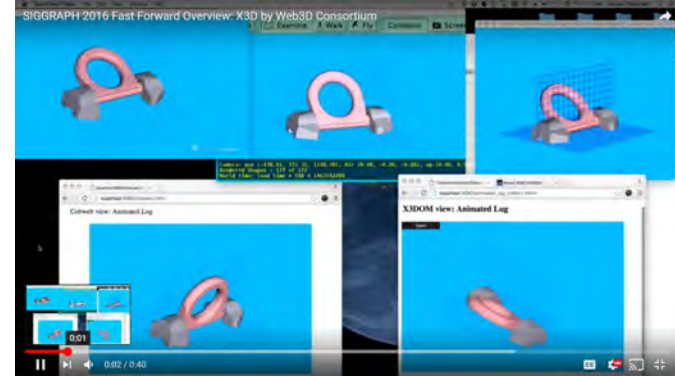
MIME Types

X3D Encoding	File Extension	MIME Type
XML	.x3d, .x3dz	model/x3d+xml
JSON	.x3dj	model/x3d+json
Classic VRML	.x3dv, .x3dvz	model/x3d+vrml
Binary	.x3db, .x3dbz	model/x3d+binary
VRML	.wrl, .wrz	model/vrml

YouTube

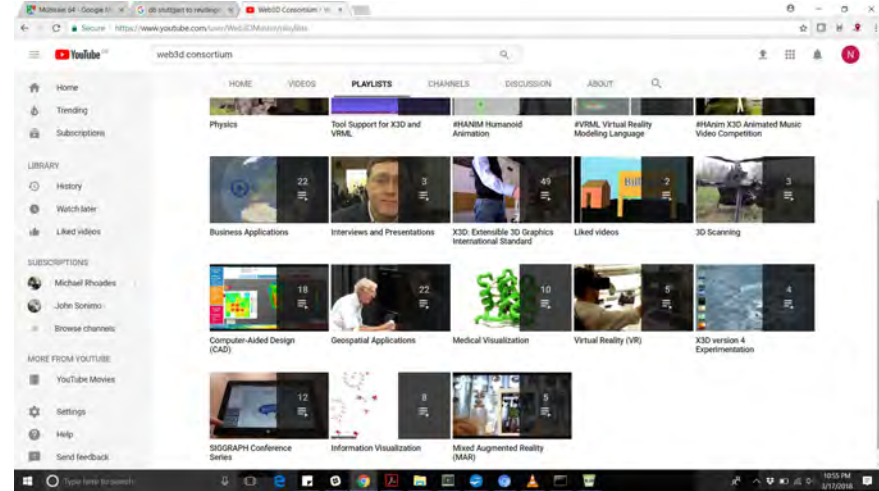
Web3D Consortium Channel

<https://www.youtube.com/user/Web3DMaster/playlists>



Twitter

<https://twitter.com/Web3DConsortium>



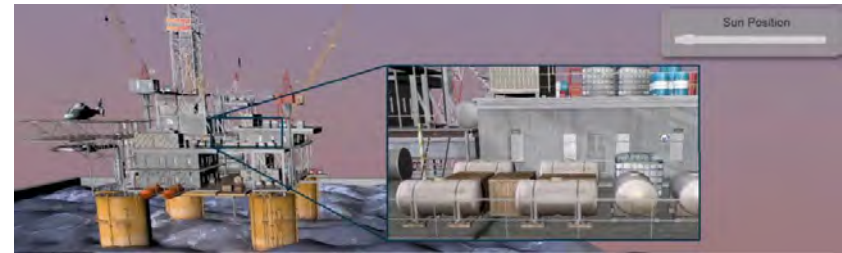
Standards make the Web go round!

Runtime approaches:

1) Installed engines import, export render X3D and VRML with different node Profiles

2) Javascript Polyfills ('native' in browser):

- X3DOM: <https://www.x3dom.org/>
- X_Cite: http://create3000.de/x_cite/



X3D Engines

(March 2018)

- Instant Reality
- Covise/OpenCover
- GearVR
- Castle3D
- FreeWRL
- H3D (Haptics, py)
- Coin3D
- Titania
- Octaga
- Xj3D
- BS Contact
- ...

HTML5 + WebGL Javascript Polyfills:

- X3DOM
- X_CITE
- NIH 3D Viewer
- Smithsonian X 3D

...

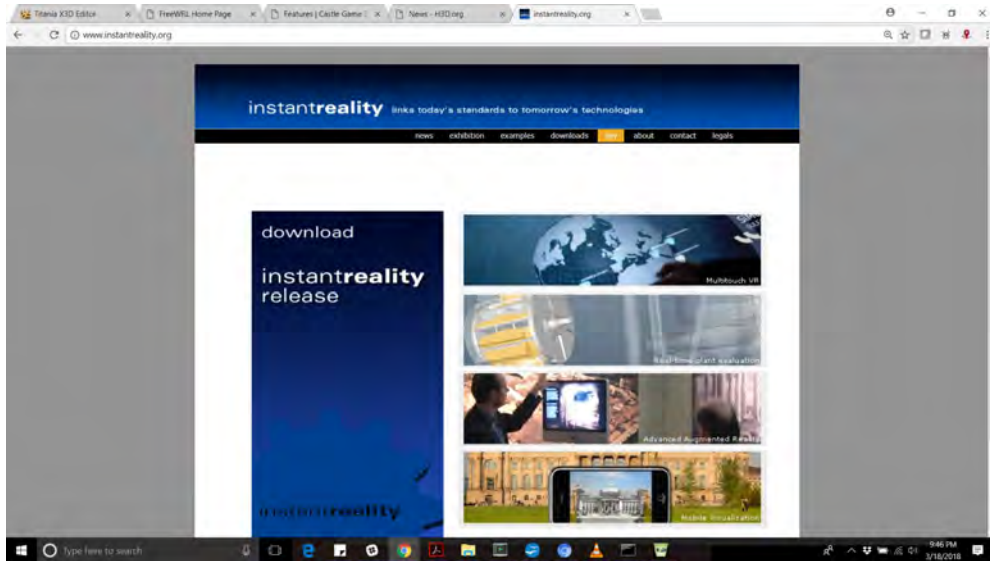
Three.js

...



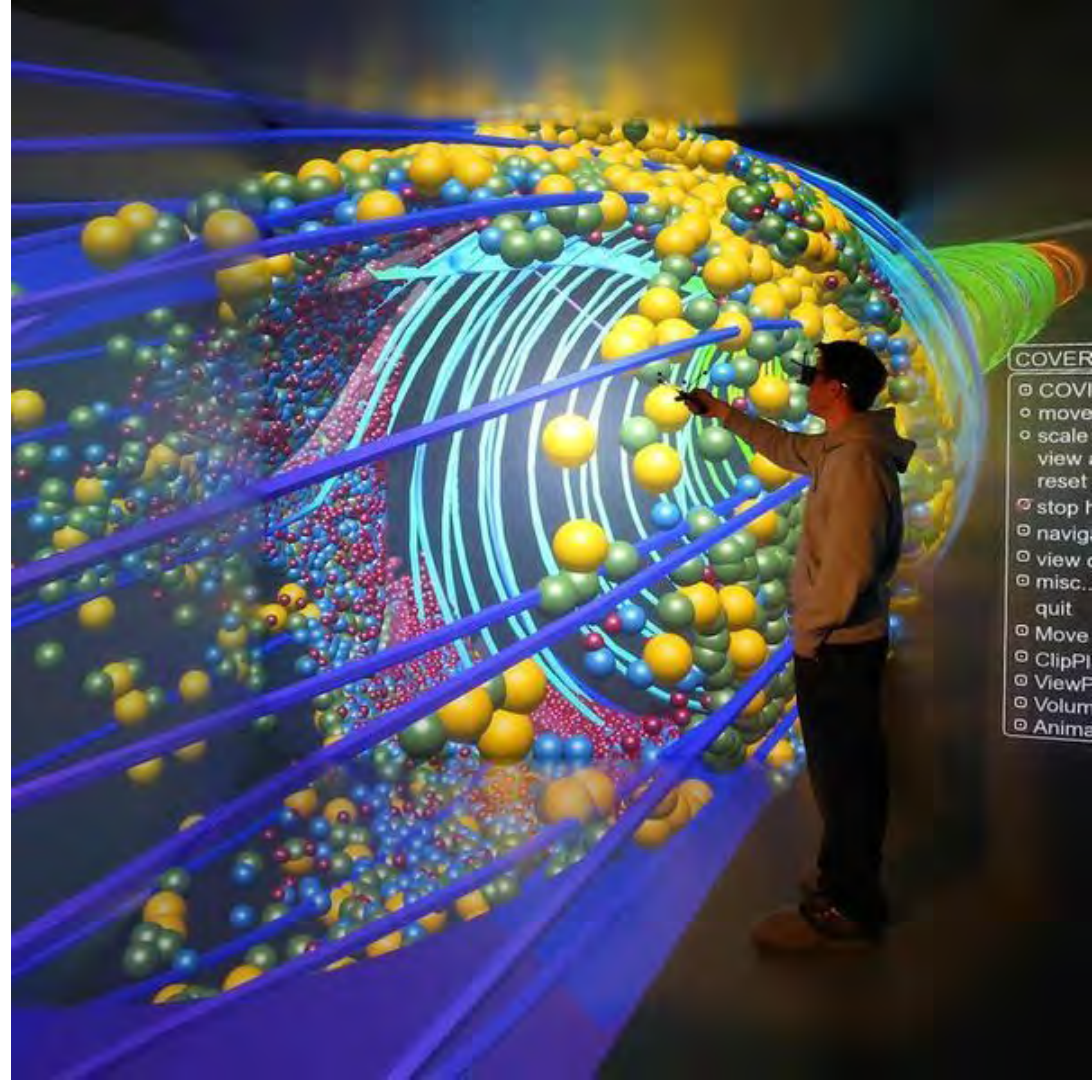
Instant Reality

<http://www.instantreality.org/>



Covise/OpenCover

<https://github.com/hlrs-vis/covise>



X_CITE and LINUX X3D Editor

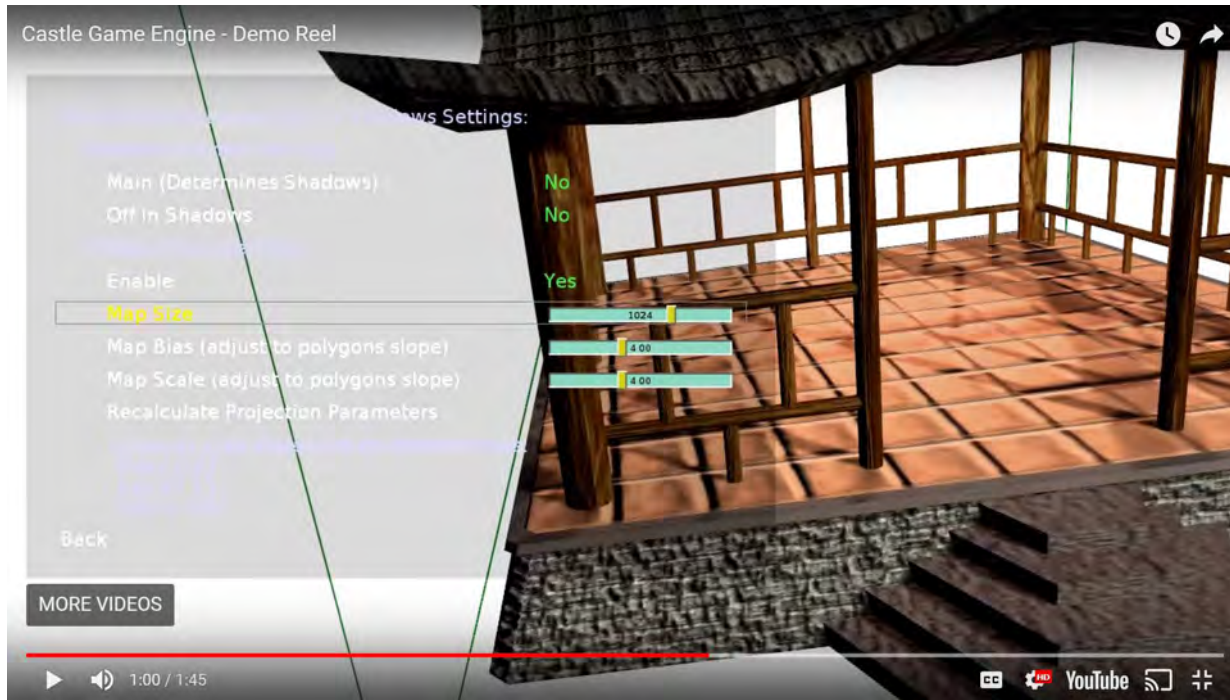
TITANIA

<http://create3000.de/>



Castle3D Game Engine

<https://castle-engine.io/>



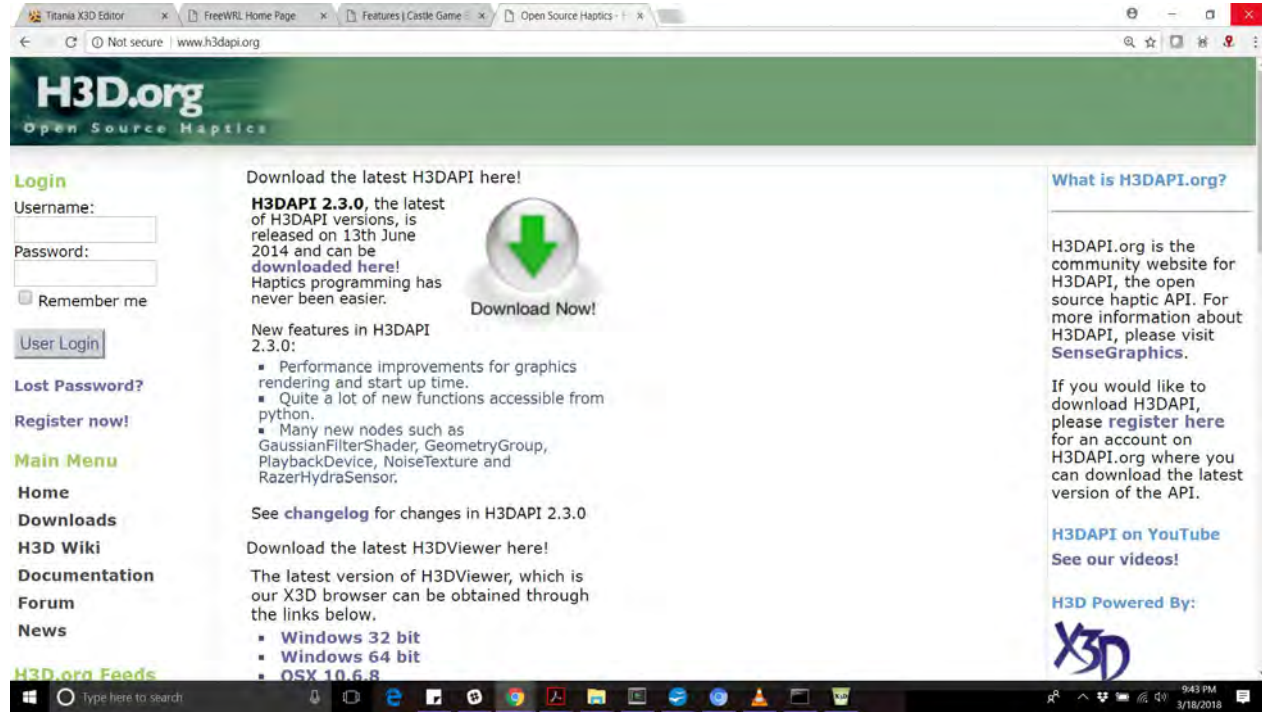
FreeWRL

<http://freewrl.sourceforge.net/>




H3D.org - Haptics

X3D + Volume Component (MEDX3D)



The screenshot shows the H3D.org website with the following content:

- Header:** H3D.org Open Source Haptics
- Login:** Username: [input], Password: [input], Remember me [checkbox], User Login [button]
- Lost Password?** [link]
- Register now!** [link]
- Main Menu:** Home, Downloads, H3D Wiki, Documentation, Forum, News
- H3D.org Feeds** [link]
- Download the latest H3DAPI here!**
 - H3DAPI 2.3.0**, the latest of H3DAPI versions, is released on 13th June 2014 and can be **downloaded here!** Haptics programming has never been easier.
 - 
- New features in H3DAPI 2.3.0:**
 - Performance improvements for graphics rendering and start up time.
 - Quite a lot of new functions accessible from python.
 - Many new nodes such as GaussianFilterShader, GeometryGroup, PlaybackDevice, NoiseTexture and RazerHydraSensor.
- See **changelog** for changes in H3DAPI 2.3.0
- Download the latest H3DViewer here!**


The latest version of H3DViewer, which is our X3D browser can be obtained through the links below.

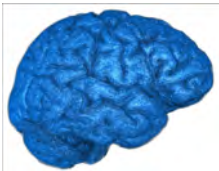
 - Windows 32 bit
 - Windows 64 bit
 - OSX 10.6.8
- What is H3DAPI.org?**

H3DAPI.org is the community website for H3DAPI, the open source haptic API. For more information about H3DAPI, please visit [SenseGraphics](#).

If you would like to download H3DAPI, please [register here](#) for an account on H3DAPI.org where you can download the latest version of the API.

H3DAPI on YouTube
See our videos!

H3D Powered By:




4D: a first-class citizen

- Networked 3D digital assets
 - Objects and components
 - Appearances & materials
 - Environments
- Animation and Timeseries databases
- Metadata & web-aware referencing
- Interaction semantics

X3D Scene graph

Resources & International Community

www.web3d.org



<http://www.web3d.org/documents/specifications/19775-1/V3.3/index.html>

Book:

<http://x3dgraphics.com/>

Online Slides: <http://x3dgraphics.com/slidesets/index.php>

Online Examples: <http://www.web3d.org/x3d/content/#Examples>



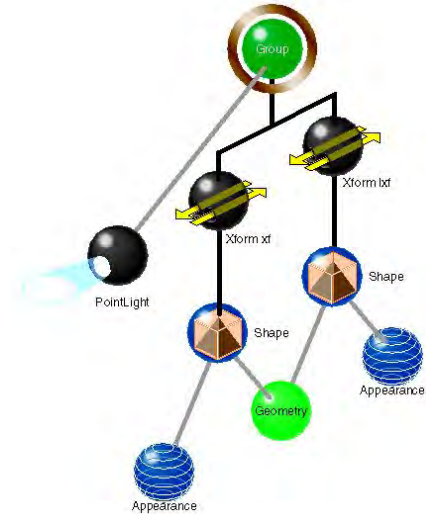


ISO-IEC Standard Scope

Scene graph for real-time interactive delivery of virtual environments over the web:

- Meshes, lights, materials, textures, shaders
- Integrated video, audio
- Animation
- Interaction
- Behaviors
- Scripts
- Application Programming Interfaces

3.3 examples for Medical Imaging, CAD and Geospatial support!

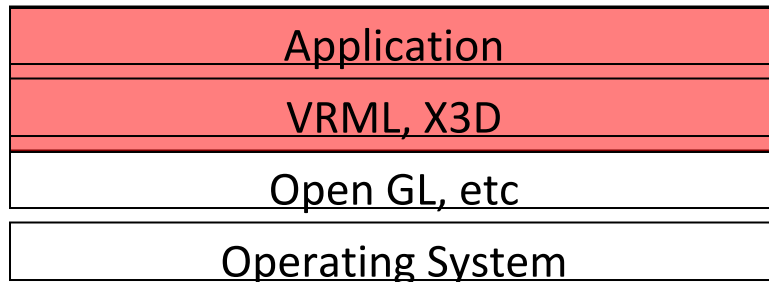


X3D & VRML Scene Graph

- Transformation
 - Directed Acyclic Graph
- Worlds by `URL#Viewpoint`
- Bind-ables
 - `NavigationInfo {} ... modes: WALK, FLY, EXAMINE, ...`
 - Default to lexical order
 - Modifiable through Script and SAI / EAI
 - Background, Fog,
 - Viewpoint

Foundations

- ISO standard, openly published and royalty-free
- A layer above media and rendering libraries
- Multiple implementations including open source codebases
- X3D Scene graph includes the *Transformation graph* and the *Behavior graph*



Scene Graph

- Lives above the rendering library
- Specifies object and environmental properties:
 - Lights
 - Camera
 - Transformation and Grouping of Shapes (parent - child)
 - Geometry and Appearance (materials, textures, shaders)
 - Environmental effects (e.g. Fog, Backgrounds)
- Manifests animation and interaction behaviors
- Is 'traversed' for drawing

Scenegraph

Lots of tools export:

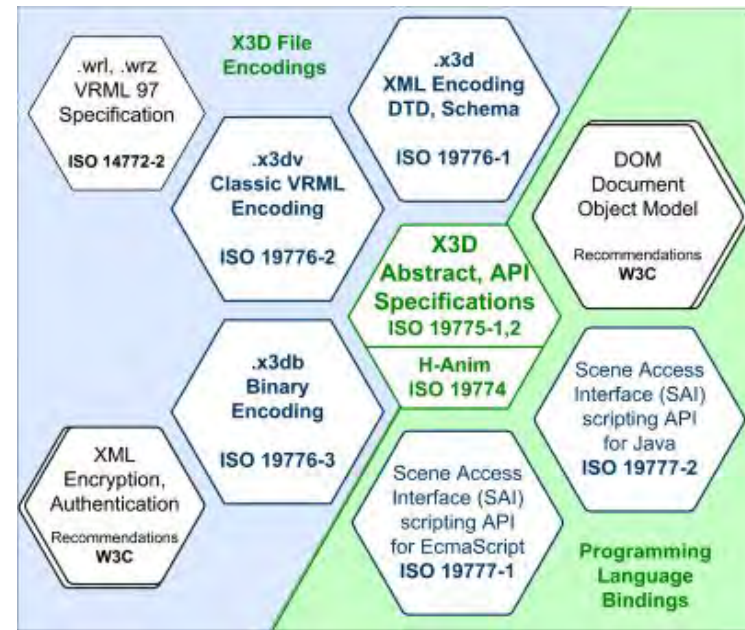
- Virtual Reality Modeling Language (VRML)
- Extensible 3D (X3D)

... lots of other proprietary formats ;
can be converted with

commercial translation tools,

open source tools,

or your own Scripts !



***Target X3D Profiles and Components for different node sets
(functionality)***

Behavior Graph

- How events flow through the system
 - ROUTEs
- The 'Event Cascade' per timestep / frame
 - . Animations (keyframe)
 - Interpolators
 - Sequencers
 - Timesensor
 - . Interactions
 - ROUTE sensors to Event Utilities
 - Or write a Script {} to process events w logic

Lights

- **Have attributes:**
 - position, orientation/direction, on/off, intensity, color, range, attenuation, ...
- DirectionalLight
- PointLight
- Spotlight
- **Scoping rules**
 - Siblings
 - global

Cameras

- Binding Stack
 - Current at top
 - Forward and Back in the Stack (Pg-Up, Pg-Dn)
 - Listed in Browser
 - Scripted
- Viewpoint : perspective camera
- OrthoViewpoint : orthographic camera
 -

Transformation & Grouping

- Transform
- Group
- LOD
- Switch
- Billboard
- Collision
- Anchor

Scenegraph scopes lights and sensors

Shapes

Consist of geometry and appearance data:

- Material, ImageTexture, **Shaders**
- **Primitives** (Box, Cone, Cylinder, Sphere)
- ElevationGrid, Extrusion
- IndexedFaceSet, IndexedLineSet
- PointSet
- **Carries Color, Normals, Coordinate, indices**
- 'ComposedGeometry' component includes triangle fans and strips

Environment nodes

Bindables:

- Background
- TextureBackground

- Fog
- LocalFog

Animation

For each field type you want to animate: position, orientation, scalar, integer, color, coordinate

- Keyframe or Scripts
- Keyframes:
 - InterpolatorS
 - SequencerS

ROUTE TimeSensor.fractionChanged to *Interpolator key

ROUTE *Interpolator keyValue to node's field

Going Immersive @ VT

Instant Player Engine files:

- Stereo Windows and Screens
- 3DUI as Javascript

InstantIO components:

- ART head, wand data
- DTK/TrackD (Intersense)
- Navigator



Data Structures for Computer Graphics

- Raster Images are generated ...
- Vector graphics
- None – pure OpenGL drawing
- Scene Graph:
 - Transformation Graph
 - Behavior Graph
- DOM and styling
-

Scene Graphs

-
- Declarative
 - Rich:
 - Inventor, VRML, X3D, COLLADA, ...
 - Simple
 - Gltf, glb
- Imperative
 - Built / modified programmatically (by API)