



Driving Evolution of the 3D Web

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Web3D Consortium



Agenda



X3D Graphics in HTML5 Pages

- Introduction
- Demos
- Code
- Support - Past, Present, & Future
- Q&A



Me

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- Computer graphics and analysis experience
- Consultant since 2001
- First web experience: 1995
- Co-founder of Los Angeles VRML SIG
- Co-Chair, Extensible 3D Graphics working group
- Board of Directors, Webmaster; Web3D Consortium



Drilling Rig

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- Real-time shadows
- Sun position sensitive
- Animated



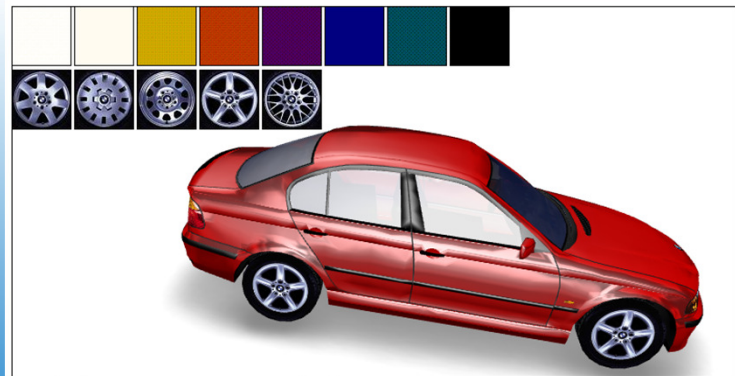
[Demo](#)



Car Configurator

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- Interactively change color, wheel covers
- Full rotation of model with highlights



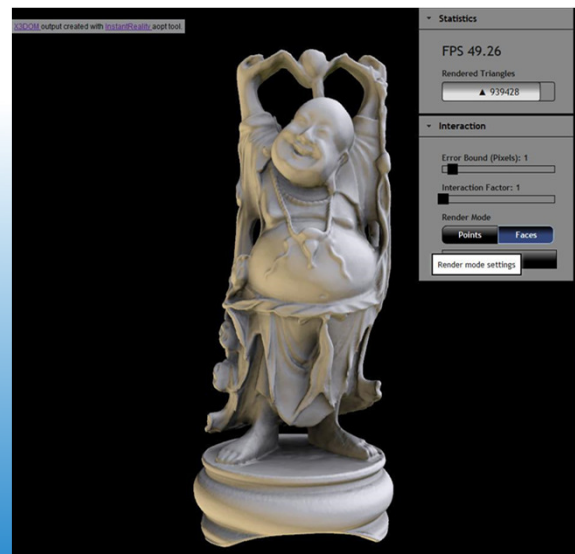
[Demo](#)



Buddha

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- 939,428 triangles
- 50-60 fps
- Progressive download
- Mesh degrading during manipulation



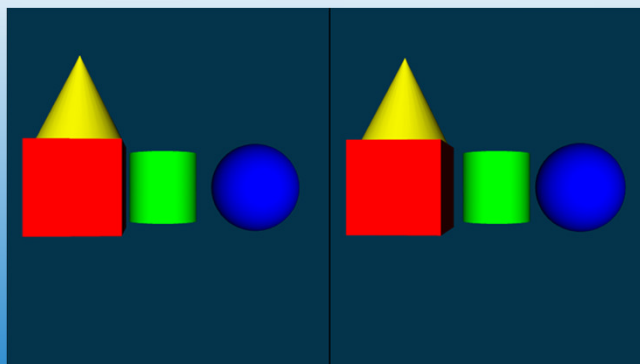
[Demo](#)



3D Stereo

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- Simple X3D statements turn mobile browser into stereoscopic viewer
- Simple scene
- Figurine



VR Hackathon

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VR Hackathon - GoPro



VR Hackathon - Oculus Rift



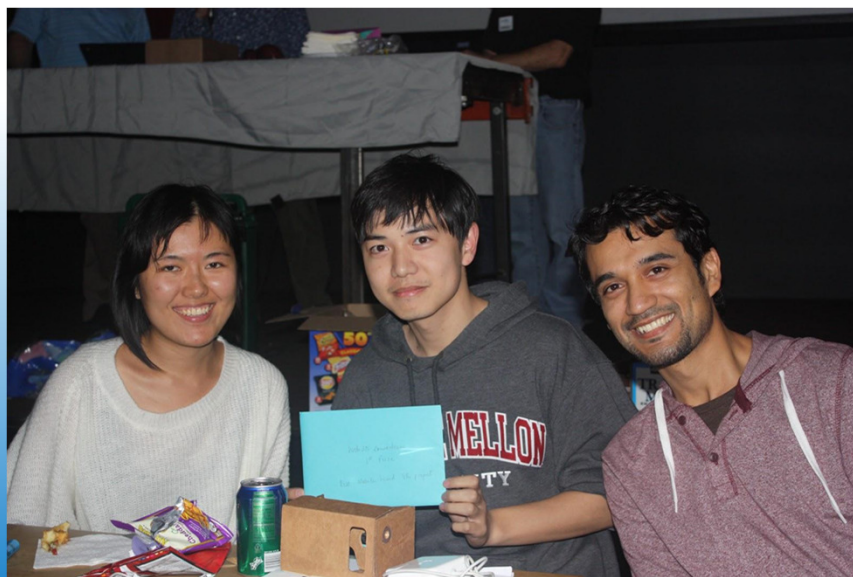


VR Hackathon Winners - X3D

- **Web VR**
 1. Med Explorer - Document 3D display interface
 2. VLSE - Procedural generation of audio from visuals
 3. Rift STOQS - Adding Oculus Rift display capability to scientific visualization application
- **Mobile VR**
 1. VR Awesome - 3D display of web search results
 2. VR Muffin - Virtual treadmill
- See <http://vrHackathon.com/> for more information



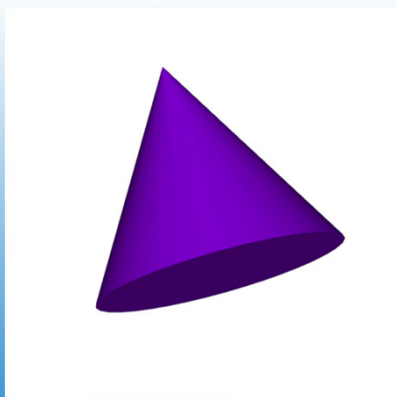
VR Hackathon - Best Mobile VR





Getting Started

- Simplest Example - Static Cone



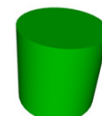
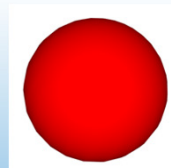
Simplest Example

```
<X3D>
  <Scene>
    <Shape>
      <Cone></Cone>
      <Appearance>
        <Material diffuseColor=".6 0 1"></Material>
      </Appearance>
    </Shape>
  </Scene>
</X3D>
```



Other Shapes Available

- Cube <Box/>
- Sphere <Sphere/>
- Cylinder <Cylinder/>



Advanced Shapes

- Multiple means of defining geometry
 - IndexedFaceSet
 - Triangle sets (individual, strip, and fan)
 - Extrusions
 - NURBS



Animations

- Trigger
 - On scene load
 - Time-based
 - Action (clicking an object)
- Object can change state by
 - Changing Color
 - Changing Shape
 - Moving



Animation Basics

- Time-based keyframe animation
- `<TimeSensor ... >` to track scene time
- Multiple strongly typed interpolators
 - Color
 - Scale/Position
 - Orientation
- ROUTE events from one node/field to another



Interactivity

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- In-scene object
- External (HTML) element
- `onclick` to start event
- `x3d-node.setAttribute` changes value



Stereoscopic

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- Two views of model in separate windows
- Stereoscopic offset of viewpoints to model
- Track phone motion, spin model about Y-axis
- Use Google Cardboard (or crossed-eyes) to merge images



Stereoscopic Examples

- Simple example (Box, Cone, Sphere, Cylinder)
 - [Demo](#)
- Scanned Museum figurine
 - [Demo](#)
 - Courtesy of Fraunhofer and 3D COFORM Project
- Full rotation capability
 - [Demo](#)
- <http://realism.com/x3d/stereo>



Stereoscopic Code

- Create two X3D scenes for left & right view
 - May need to transform Viewpoint
 - Set viewpoints for L & R eyes
- ```

<Viewpoint position='-0.5 0 0'
 orientation='0 1 0 -0.05'>
<Viewpoint position='+.5 0 0'
 orientation='0 1 0 +0.05'>

```



## Stereoscopic Code (cont)

- Create transform for phone rotation
- If necessary, Transform model to view center
- Inline desired 3D model

```
<Transform id='x3d_viewpointR_alpha'
 translation='0 0 0' rotation='0 0 1 0'>
 <Transform translation='-170 -100 -200'>
 <Inline url='VAM_246-6-1870/kelpie.x3d'>
```



## Streaming

- Ordered list of URL resources
- Inline and LOD proximity switching
- In-scene programmatic control of loading
- Progressive mesh streaming is a proposed part of EXI encoding



## External Devices

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- VR Hackaton
  - Oculus Rift
  - Leap Motion
  - Google Cardboard



## X3D Support

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- Open ISO Standard - no cost for any use
  - Standardized since 1997 (VRML)
- X3D is currently being upgraded to V4
- All examples are illustrated with prototype - X3DOM
- Multiple encodings
  - Text and binary
  - Lossless conversion between all encodings



## Encoding Standards

- Existing standardized formats
  - XML
  - ClassicVRML
  - Compressed binary
- In Development
  - Efficient XML Interchange (EXI) in development
  - JSON experimental format



## JSON Example

Example  
JSON  
encoding and  
loader

[Demo](#)

The screenshot shows a web browser window with a 3D scene of a dolphin. The browser's address bar shows the URL `http://www.x3dom.org/x3dom/test/functional/flopper.html`. The page has a navigation mode set to "Examine" and a "Dump scene as JSON" button. The JSON output is displayed in a console-like area on the right side of the browser window.

```

JSON is also dumped as object to console!
{"Scene": {"render": "true", "bboxCenter": "0.0,0.0", "bboxSize": "-1,-1,-1", "pickMode": "idBuf", "doPickPass": "true", "shadowObjectIdMapping": "", "metadata": null, "children": [{"Viewpoint": {"bind": "false", "description": "cam0", "isActive": "true", "fieldOfView": "0.785398", "position": "0.0,0.800", "orientation": "0.0,0.0", "centerOfRotation": "0.0,0.0", "zNear": "-1", "zFar": "-1", "metadata": null }, {"Viewpoint": {"bind": "false", "description": "cam1", "isActive": "false", "fieldOfView": "0.785398", "position": "0.0,0.2000", "orientation": "0.0,0.0", "centerOfRotation": "0.0,0.0", "zNear": "-1", "zFar": "-1", "metadata": null }, {"Viewpoint": {"bind": "false", "description": "cam2", "isActive": "false", "fieldOfView": "0.785398", "position": "0.200,1000", "orientation": "0.0,0.0", "centerOfRotation": "0.0,0.0", "zNear": "-1", "zFar": "-1", "metadata": null }, {"Background": {

```





## Security

- Handles HTTP/HTTPS
- XML Encryption & XML Digital Signature
- Optional custom encryption modules for Compressed Binary
- EXI Compression is compatible

**Only deliver what you trust  
the other person to protect**



## X3D Specification

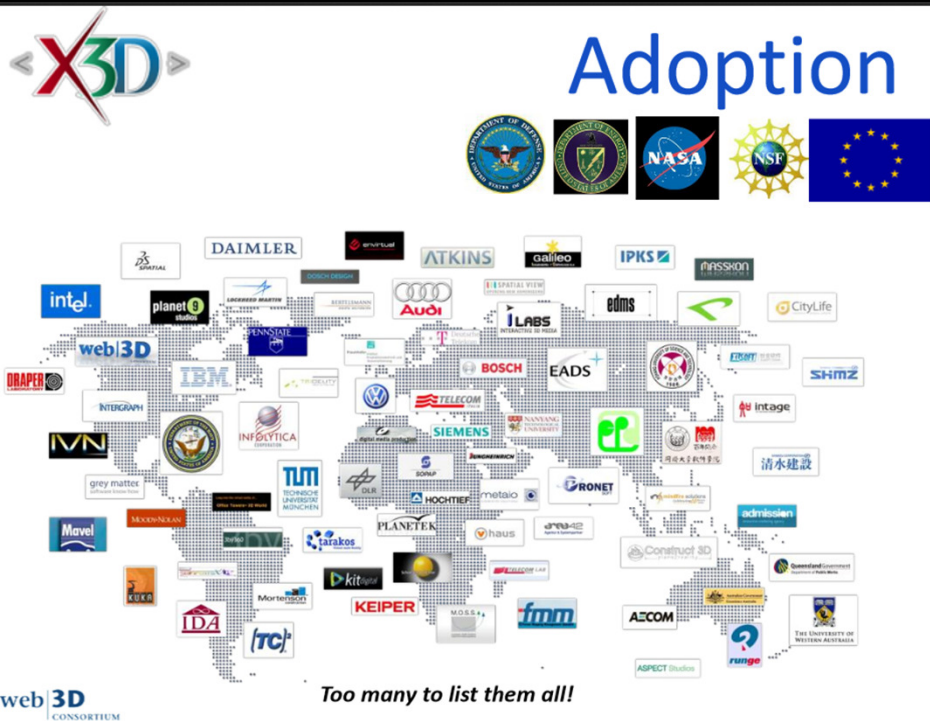
- ISO/IEC Ratified
- 3 documents, multiple parts
  - 19775 - Abstract X3D
  - 19776 - Encodings
  - 19777 - Language Bindings
- All updated within the last two years
- Two independent implementations for each feature are required before standardization



# Web3D Consortium



- Vendor-agnostic forum to advance web-based 3D graphics technologies
- Multiple liaisons with key consortia & organizations





## Discounted Membership

- Discount of 25% available
- Individual memberships only
- Use code SFOct25
- <http://www.web3d.org/join>



## Authoring & Conversion Tools

- [X3D-Edit](#) (stand-alone & Netbeans plugin)
- Blender export
- BS Content Studio
- Okino PolyTrans
- Meshlab
- Titania (Ubuntu) - Announced last week
- Many many more - see [X3D Resources](#)



## Q&A



Daly Realism: <http://realism.com>

Presentation: (will be added online)

Stereo: <http://realism.com/x3d/stereo>

Web3D Consortium: <http://www.web3d.org>

X3DOM: <http://x3dom.org>