Creating 3D Scenes for the Browser

Leonard Daly
President, Daly Realism
20 Jan 2014

What is X3D

Extensible 3D Graphics

A royalty-free format and run-time for interactive, animated 3D scenes with real-time rendering in the browser

X3D Capabilities

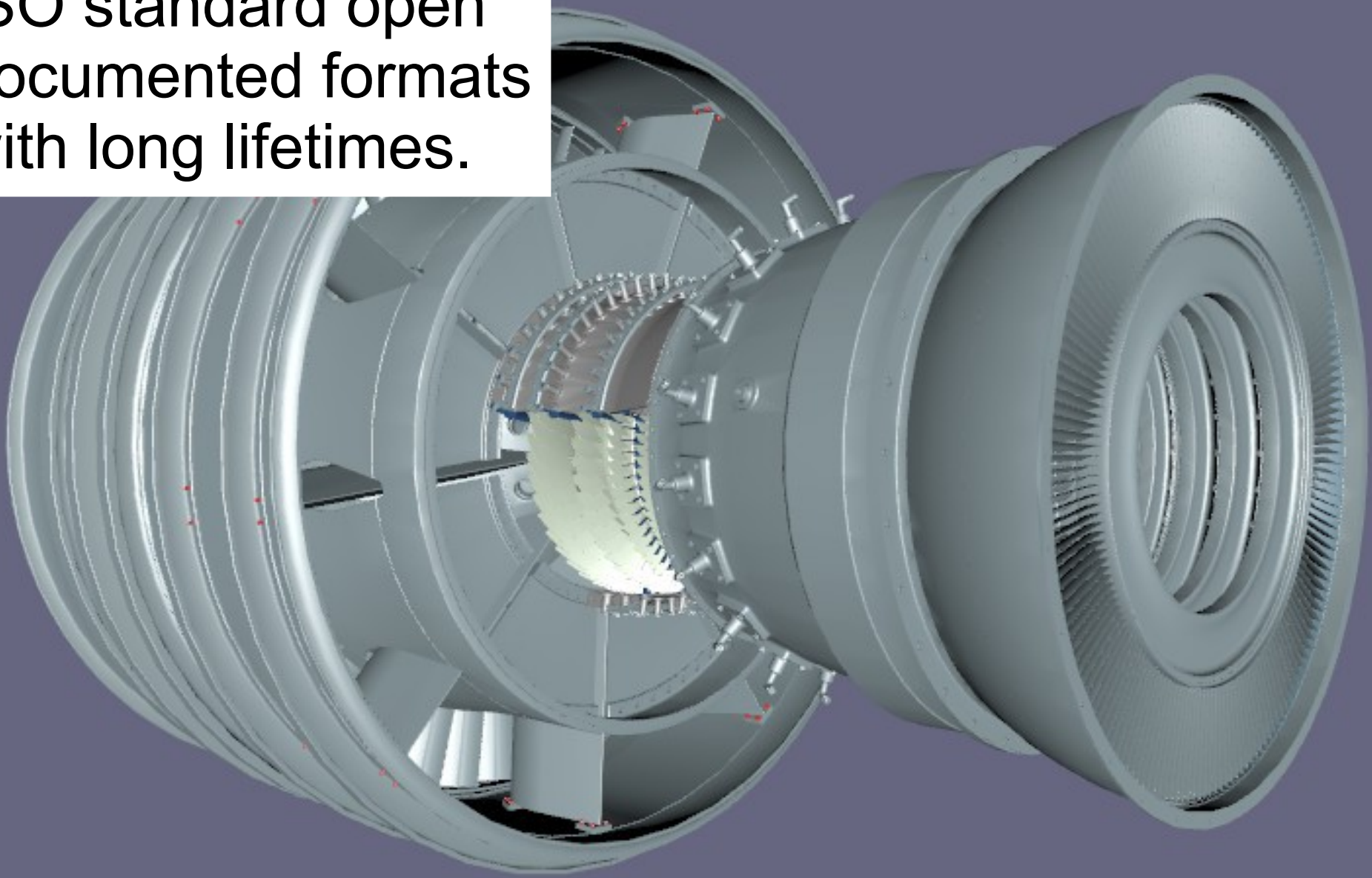
Technical

- Interactive
- Lighting
- Shaders
- Movable Cameras
- NURBS / CAD
- Volume Rendering
- Geospatial
- Particle Systems
- Physics

Business

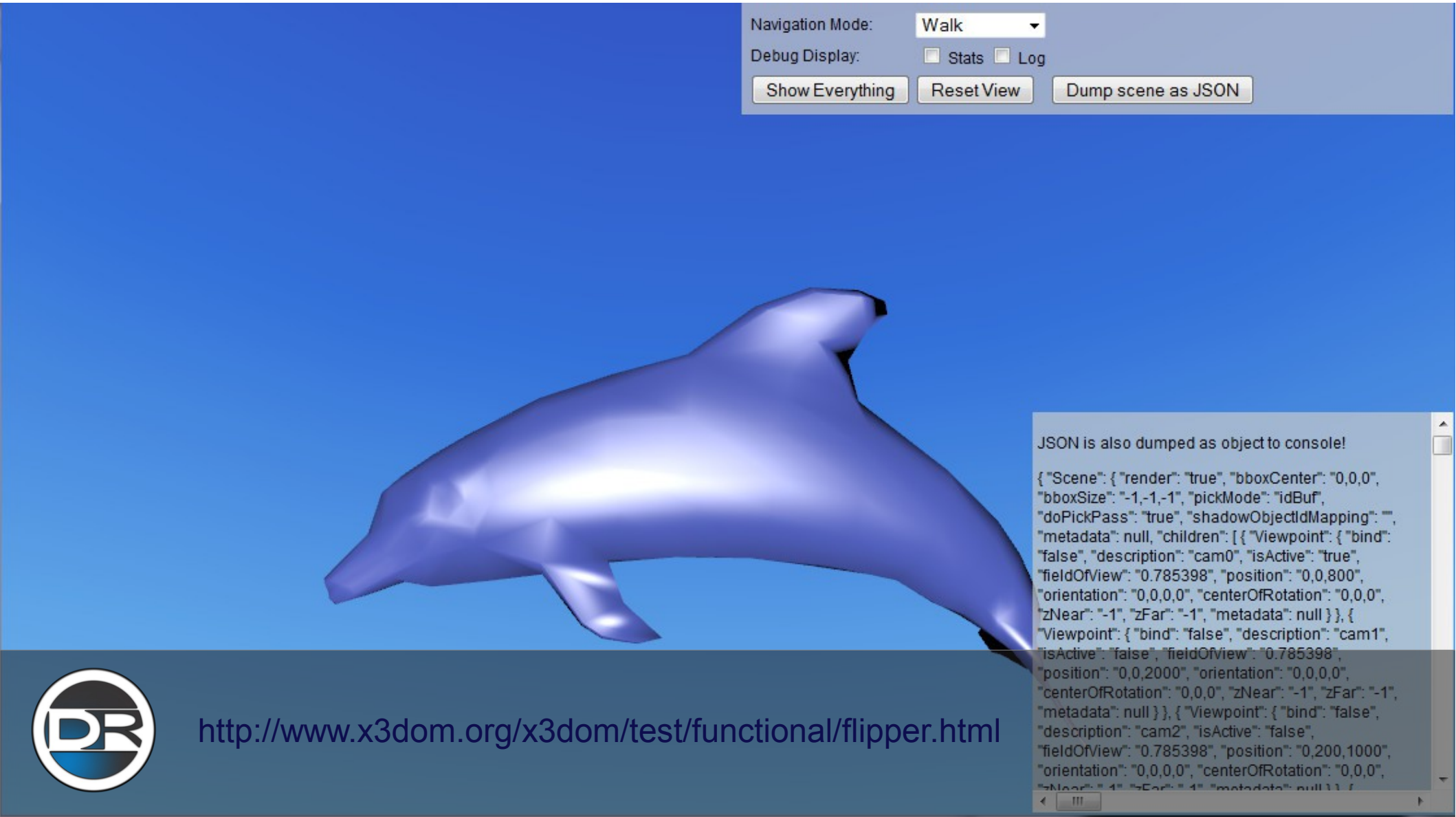
- ISO approved
- Open standard
- 5 encodings
- HTML5 Compatible
- Well documented

ISO standard open documented formats with long lifetimes.



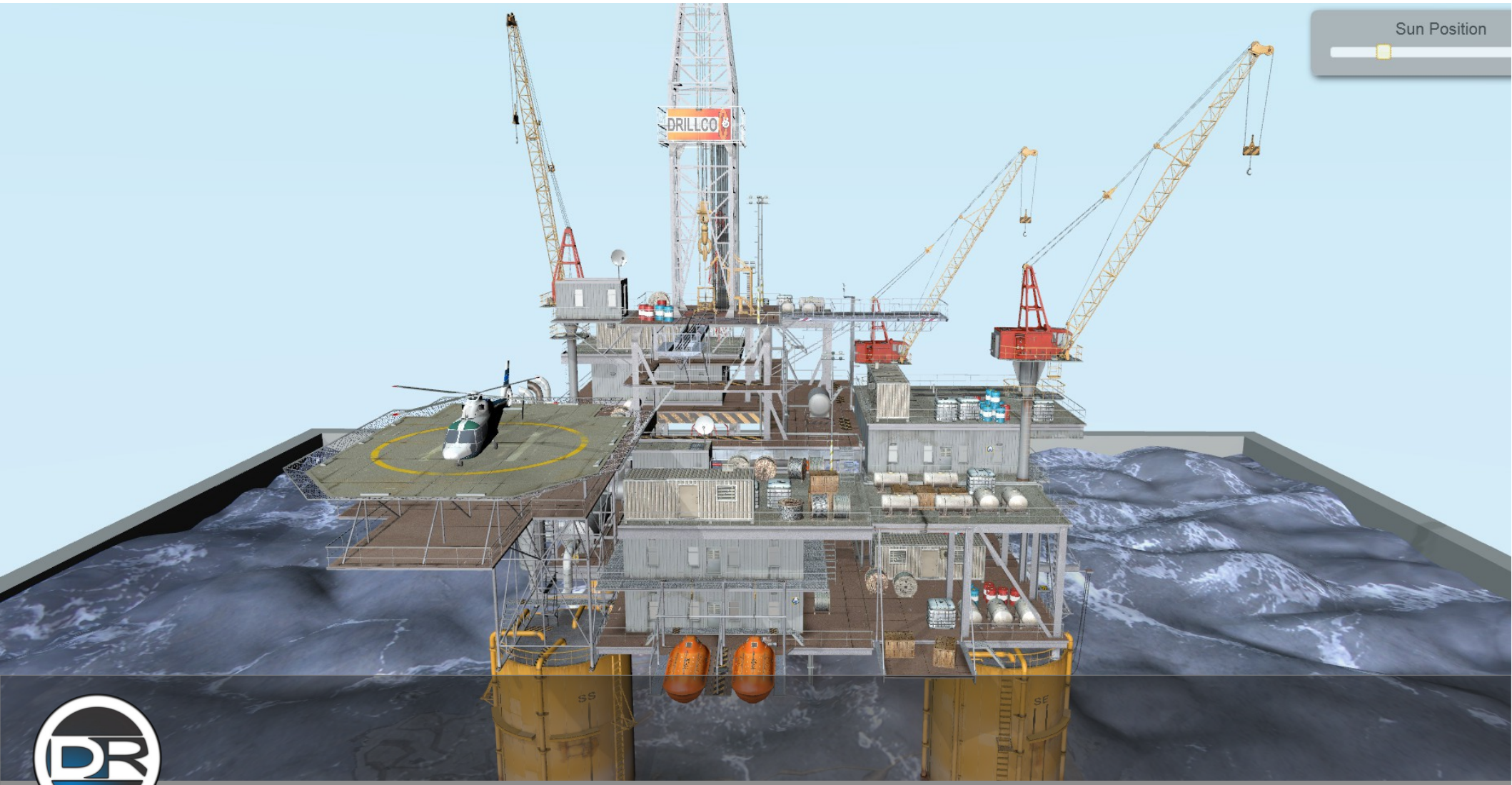
http://examples.x3dom.org/binaryGeo/engine/model-bg.html

Three standardized encodings (XML, Binary, Text) two in development (JSON, Encrypted)



http://www.x3dom.org/x3dom/test/functional/flipper.html

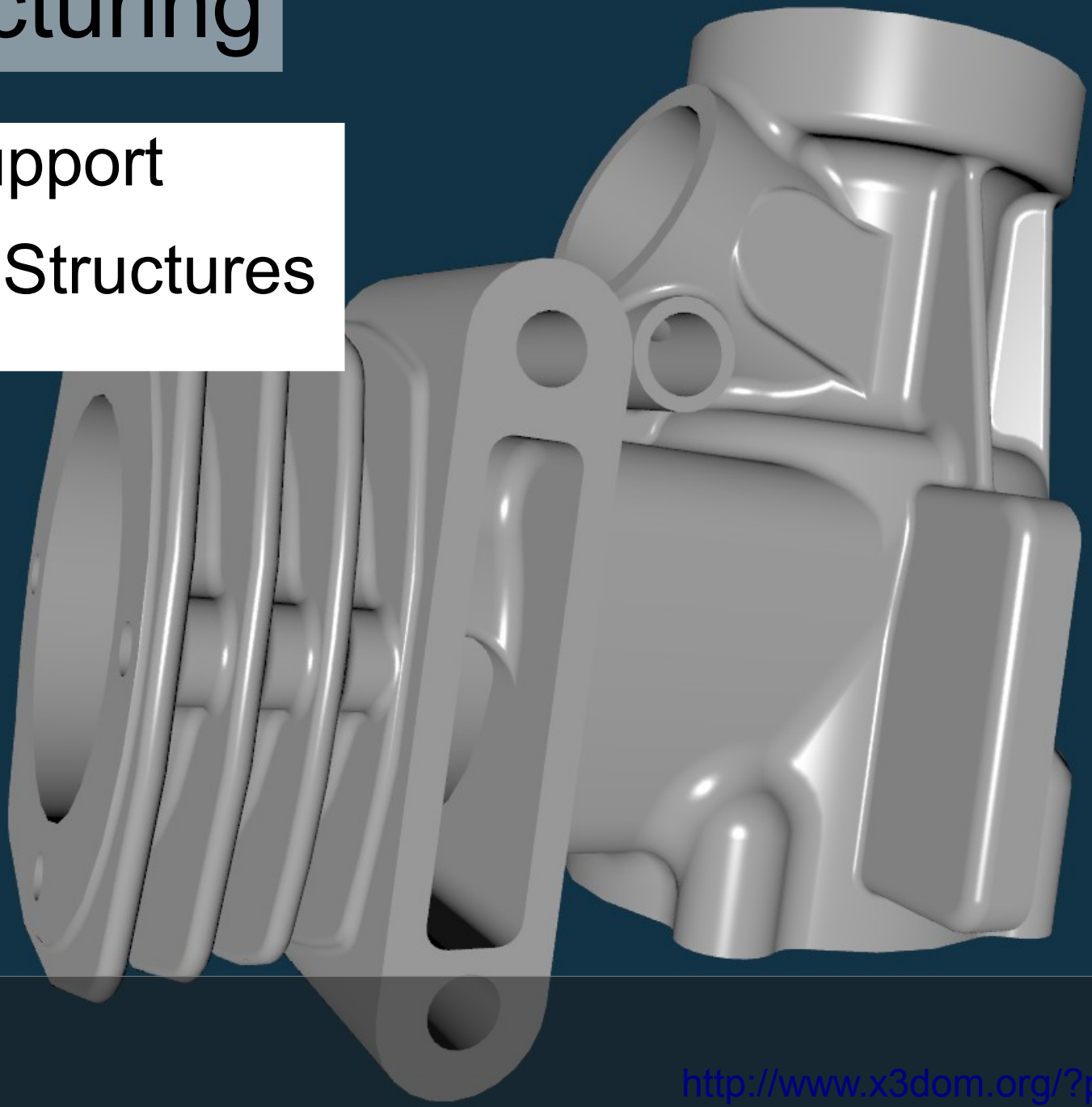
Industrial – Drilling rig w/shadows



http://examples.x3dom.org/binaryGeo/oilrig_demo/index.html

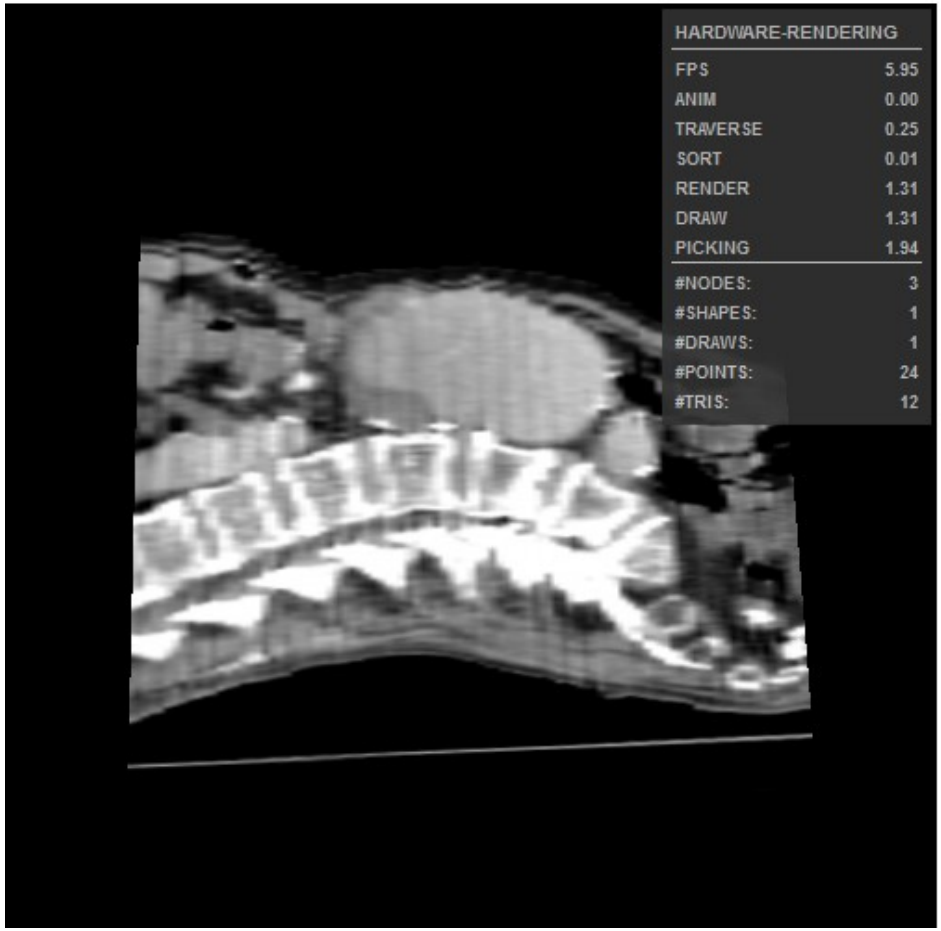
Manufacturing

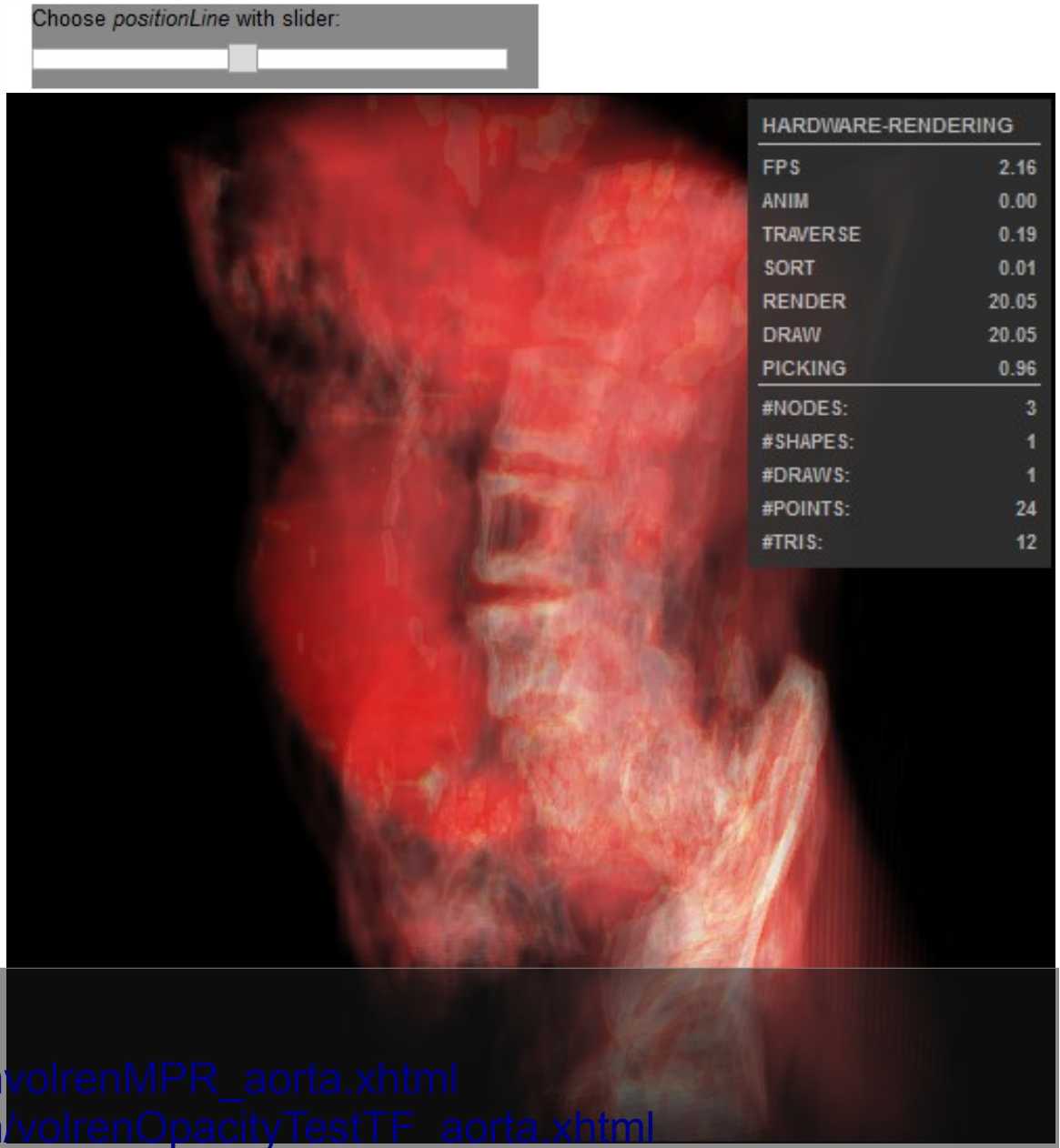
- NURBS support
- CAD Data Structures



http://www.x3dom.org/?p=3985

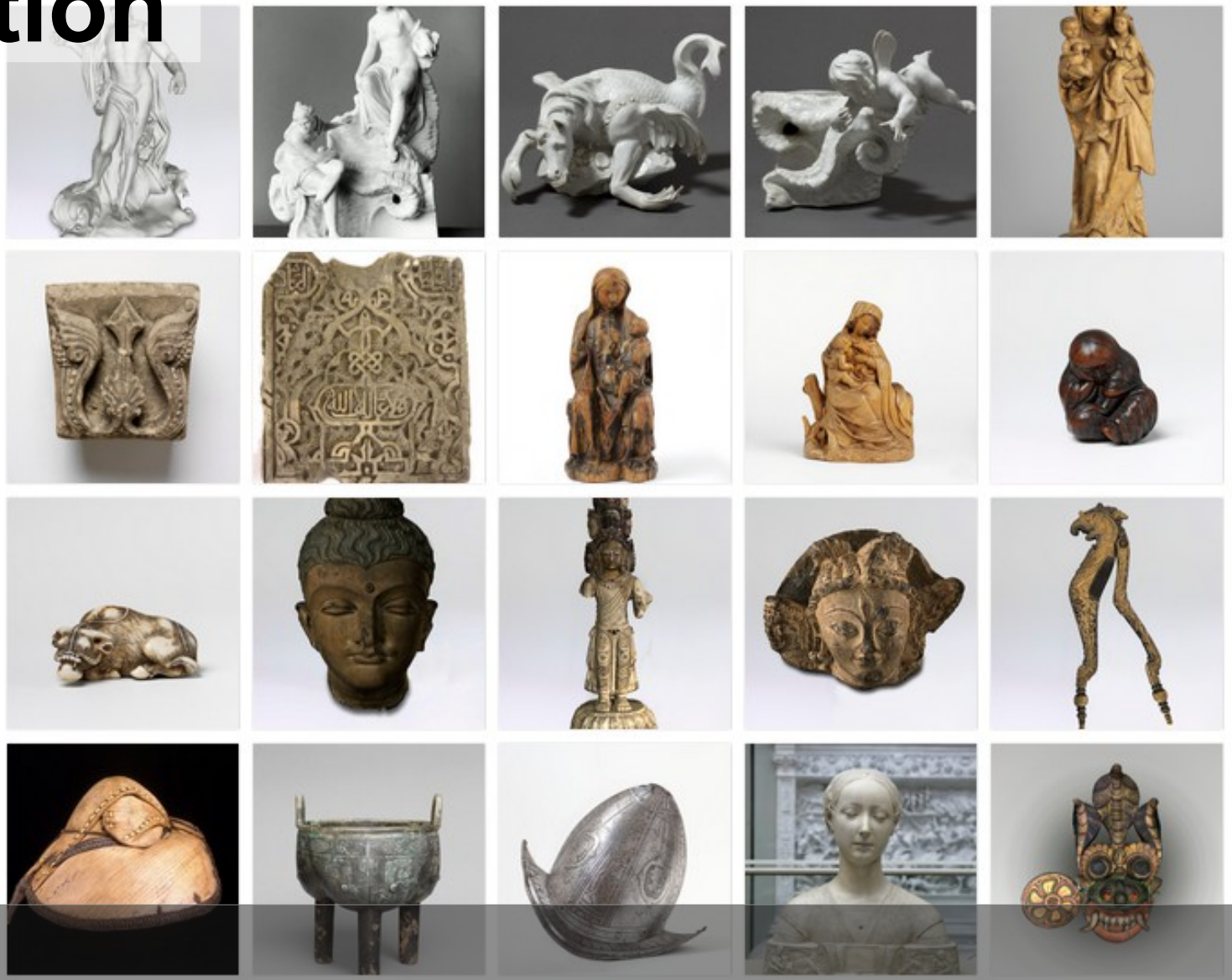
Medical





http://examples.x3dom.org/volren/volrenMPR_aorta.xhtml
http://examples.x3dom.org/volren/volrenOpacityTestTF_aorta.xhtml

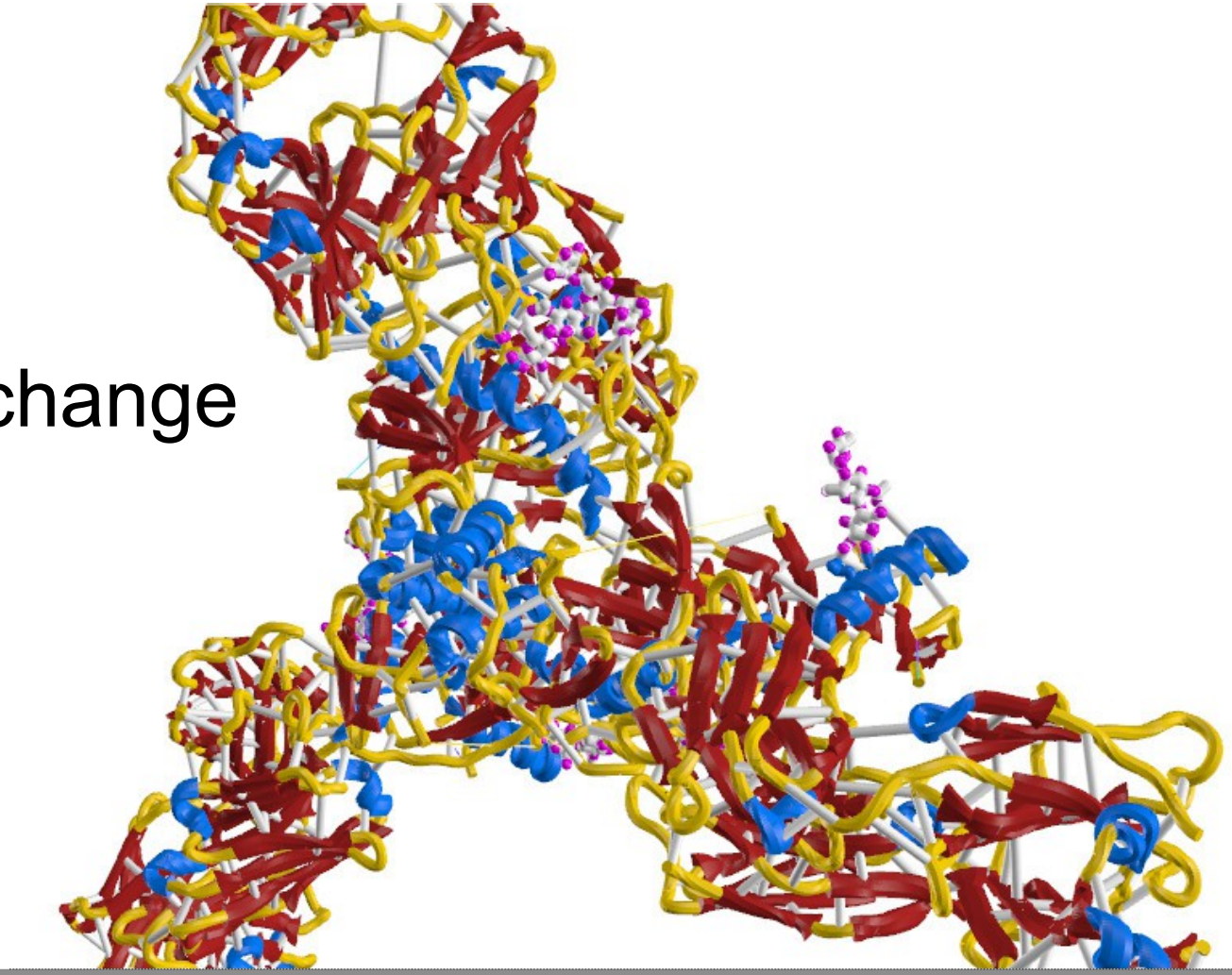
Cultural Preservation



http://www.3dcoform.eu/x3domCatalogue/

3D Printing

NIH 3D Print Exchange



http://3dprint.nih.gov/discover/3dpx/000626/x3d

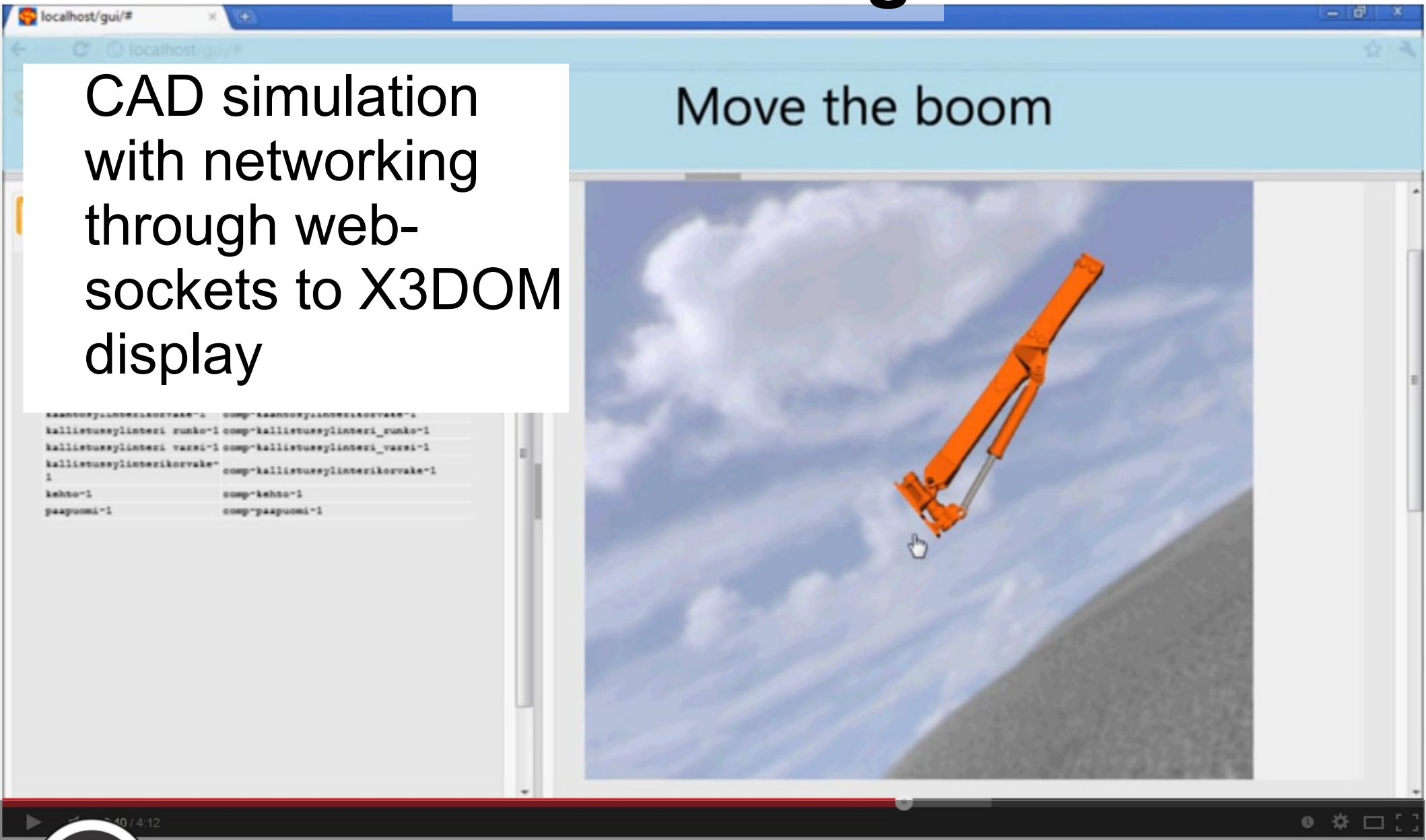
GIS

Darmstadt building visualization with CityServer3D

http://www.cityserver3d.de/en/webvisualisation/

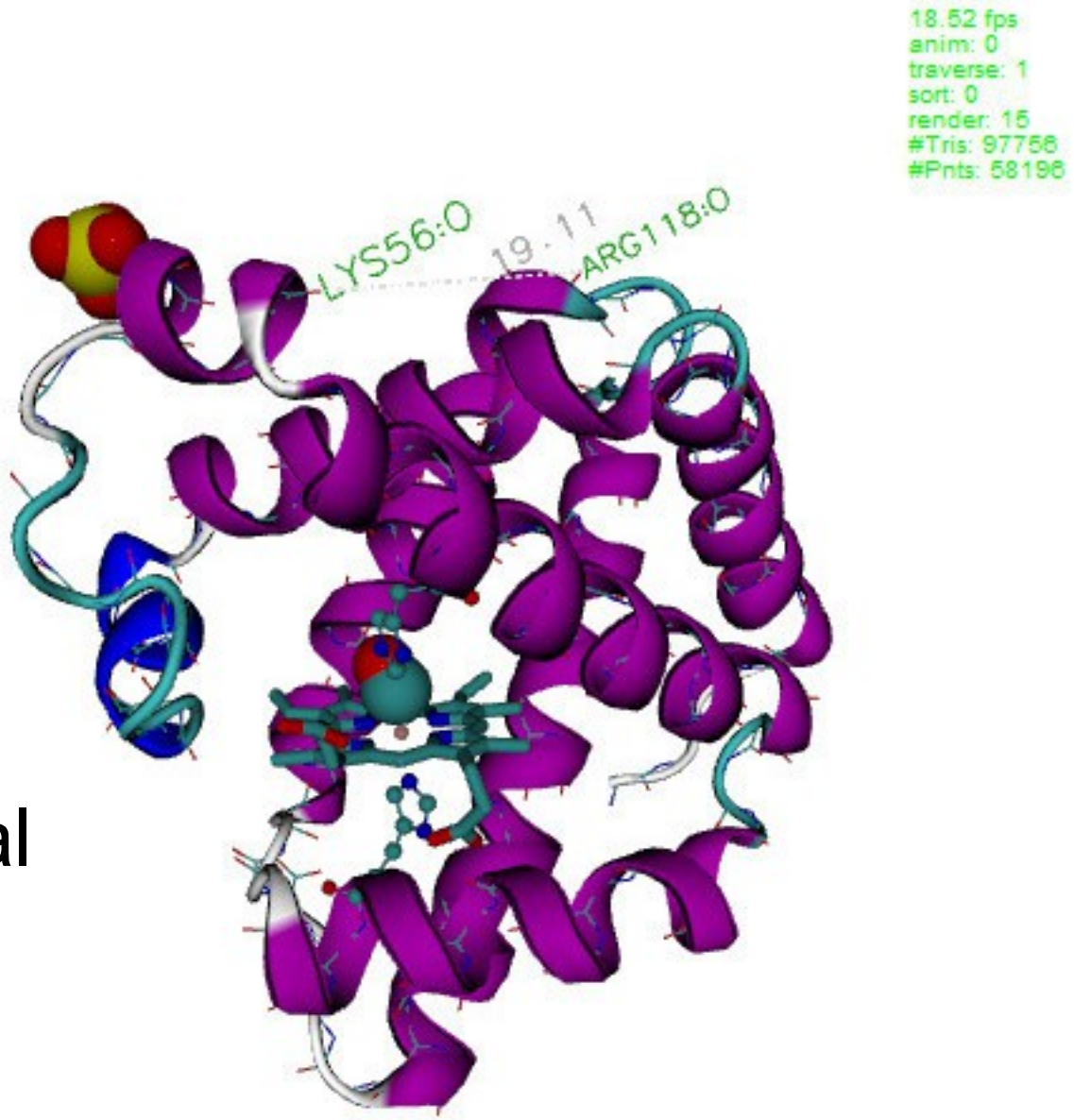
Networking

CAD simulation with networking through web-sockets to X3DOM display



http://www.x3dom.org/?p=2826

Scientific Visualization

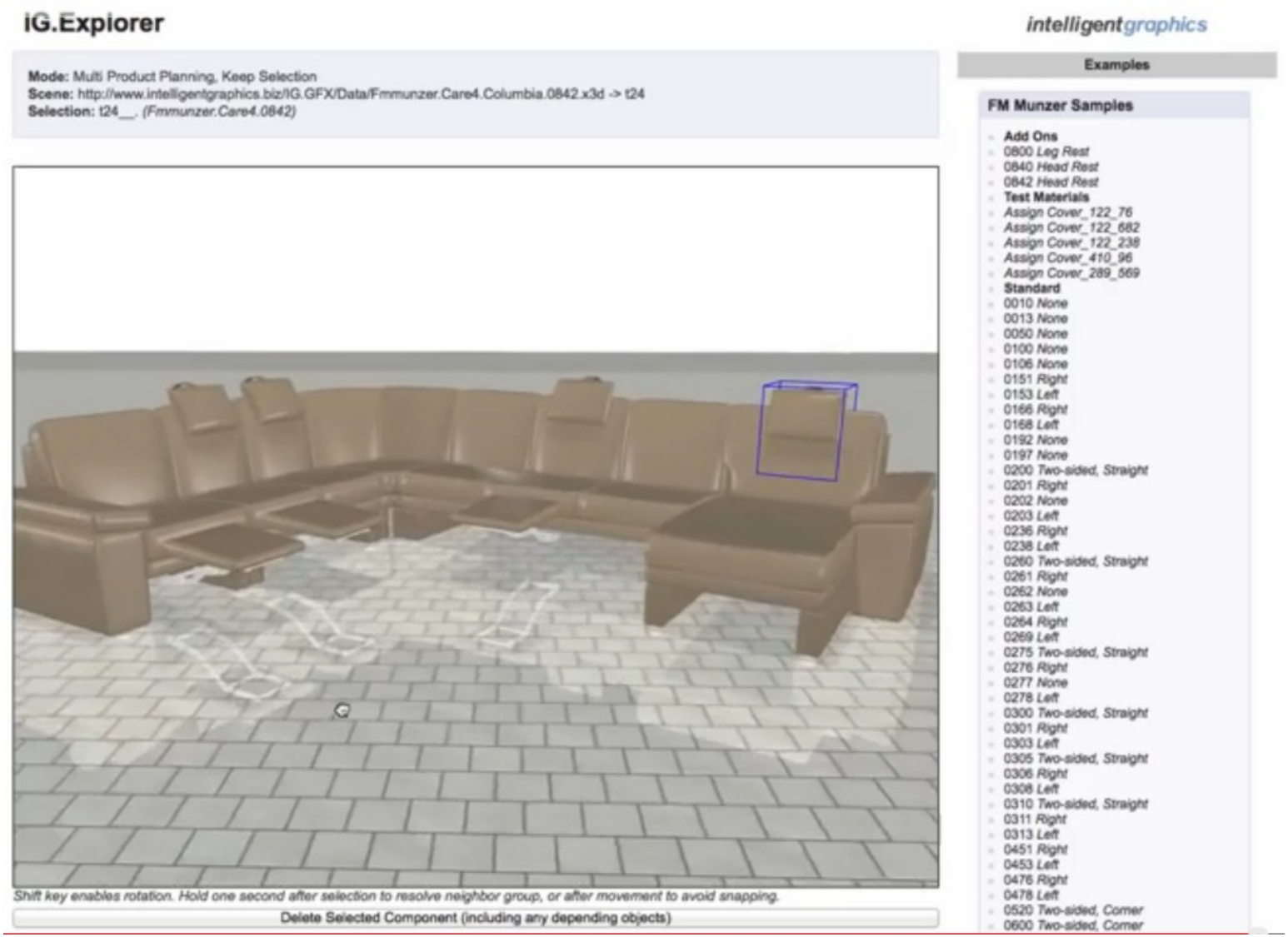


Myoglobin from Visual Molecular Dynamics

http://www.x3dom.org/?p=1919

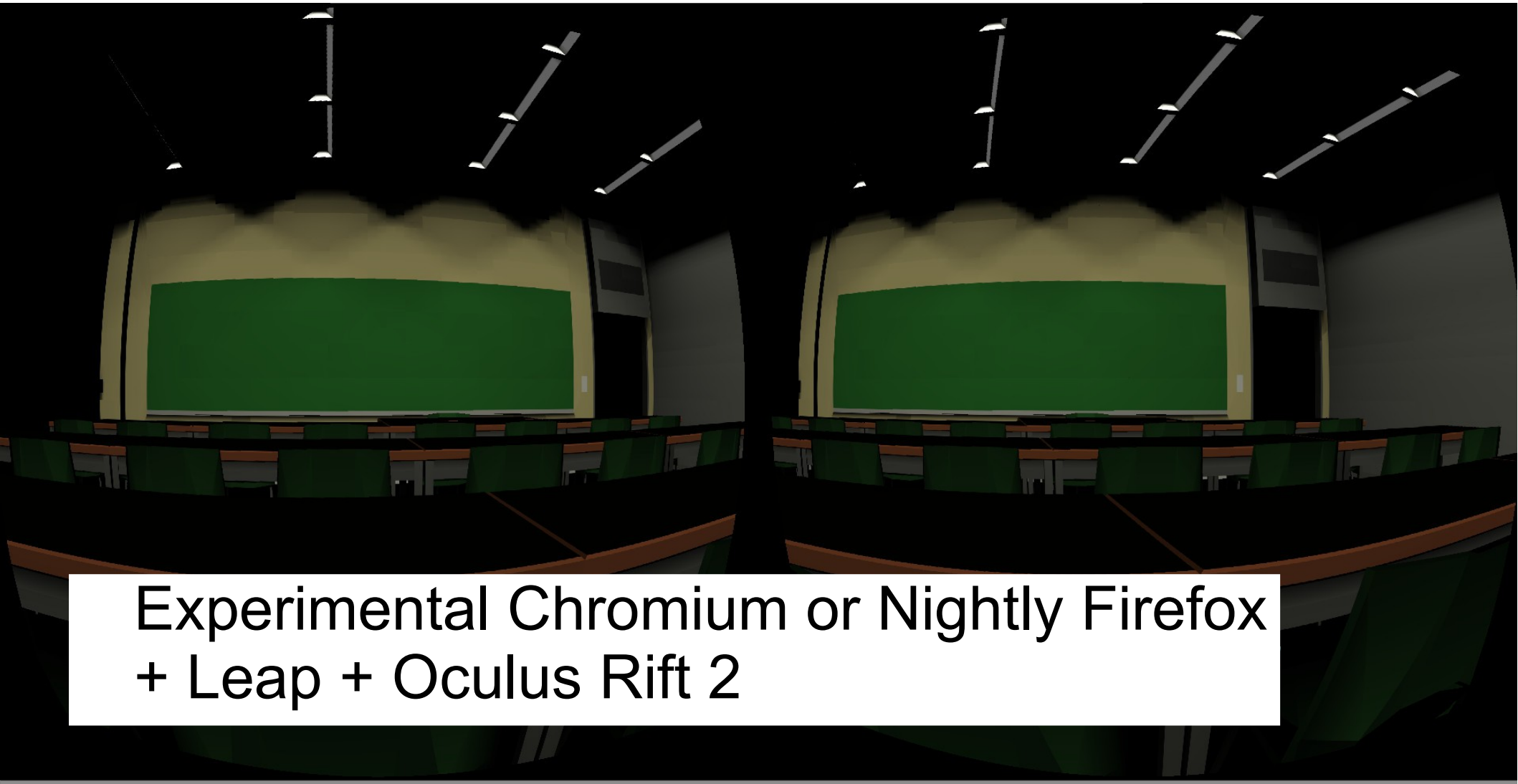
Consumer Products

Prototype furniture configurator



http://www.x3dom.org/?p=3671

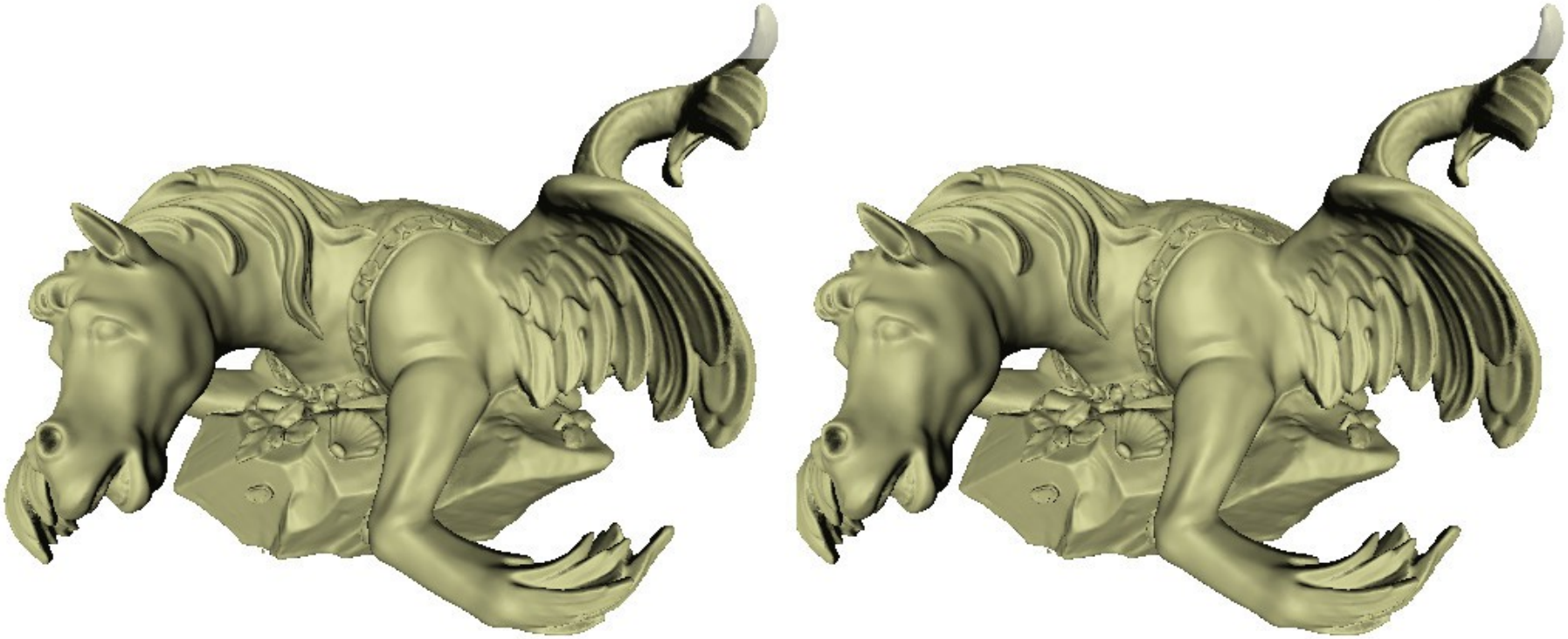
Web VR



Experimental Chromium or Nightly Firefox
+ Leap + Oculus Rift 2

http://www.x3dom.org/?p=3973

Stereoscopic Phone Display



- Use Cardboard to display and rotate models
- Split screen rendering using shaders

Adoption

Too many to list them all!

Production Pipeline

Create 3D Content

- Maya, Blender, etc
- Watch polygons, texture size, animations
- 1,087,716 triangle model http://examples.x3dom.org/buddha/model-bg.html

http://examples.x3dom.org/buddha/model-bg.html

Convert to X3D

- Blender
- Meshlab
- X3D-Edit
- FBX Converter
- Other conversion tools (partial list below)

http://realism.com/x3d-tools/fbx-converter/
http://www.web3d.org/x3d/content/examples/X3dResources.html#Conversions

Insert into Web Page

- Use HTML5
- Add X3DOM Libraries
- Add X3D tags
- Instructions below

http://realism.com/blog/add-x3d-your-webpage

Add Page/X3D Interactions

- JavaScript Based
- Supports jQuery
- Supports AJAX
- JSON loader

- Respects Cross-Site Scripting security restrictions
- Future support for XML encryption

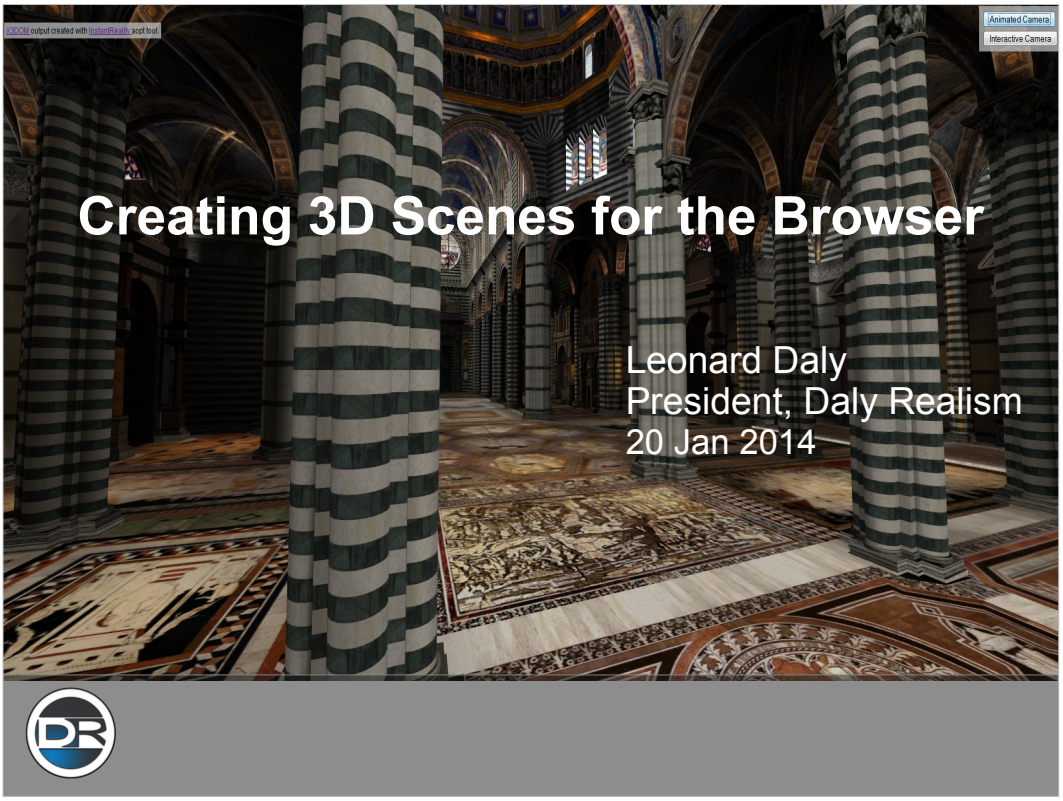
Summary

- Technical capabilities
- Long-lifetime
- Public safety
- International review
- Well specified and documented

- **X3D is Serious VR**

Attributions

- Web3D logo and X3D mark owned by Web3D Consortium
- Flipper model in public domain from Naval Postgraduate School
- JSON loader from Yvonne Jung (Fraunhofer and Hochschule Fulda)
- Medical models from Virginia Tech and Fraunhofer
- NIH models in public domain from 3D Print Exchange
- CAD Simulation with Networking by Semogen (YouTube video: https://www.youtube.com/watch?v=rx9qEkvtpT8)
- Consumer products sofa from Intelligraphics
- Industrial Pipes by Kabacchi (https://www.flickr.com/photos/kabacchi/5329449840/in/photostream/) CC BY 2.0
- Various logos from their owners, no claim is made on those marks
- All other X3D/X3DOM content reused with permission from Fraunhofer



Leonard Daly is an Internet consultant specializing in web applications and 3D systems architecture. This presentation highlights the capabilities and advantages of using X3D for Serious Virtual Reality

Background from
http://examples.x3dom.org/Demos/Siena/siena.html

What is X3D

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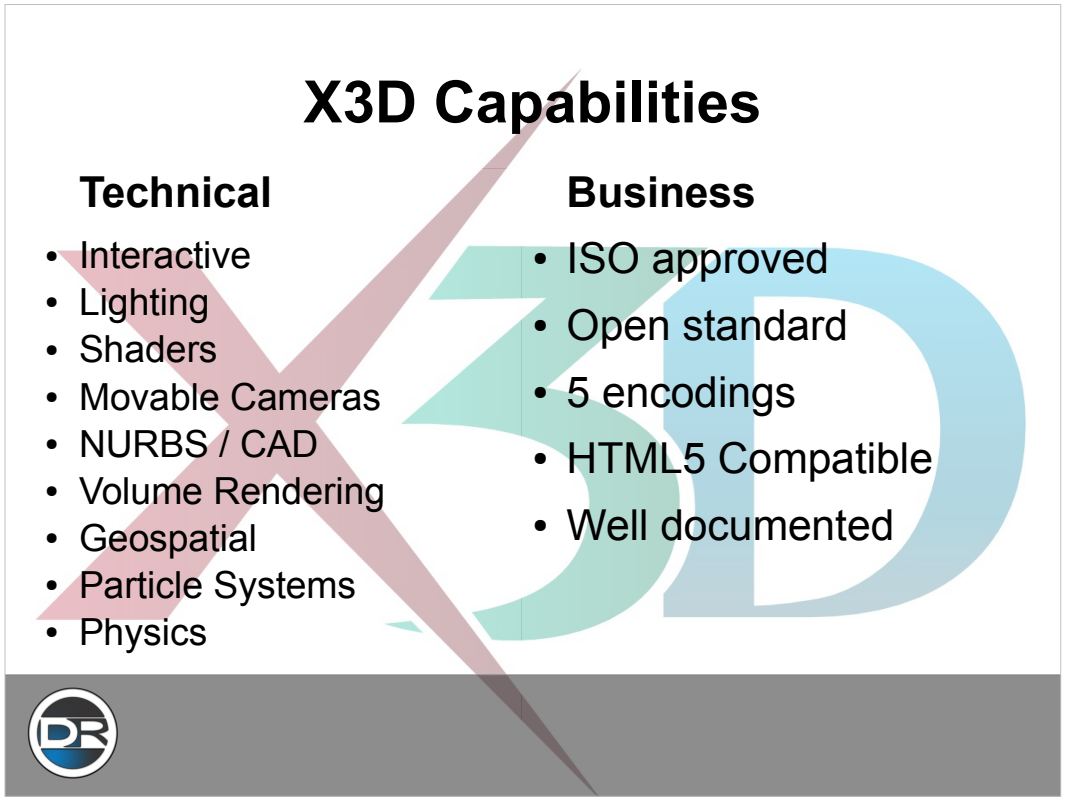
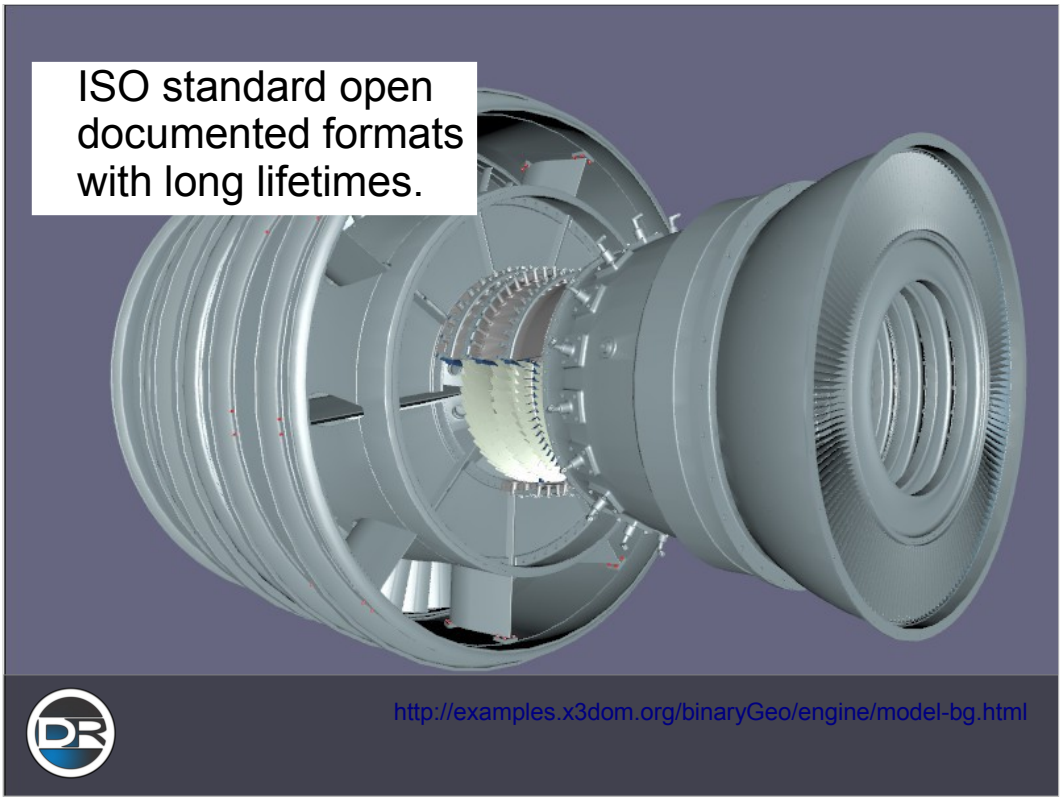
More information available at
http://www.web3d.org/x3d/what-x3d

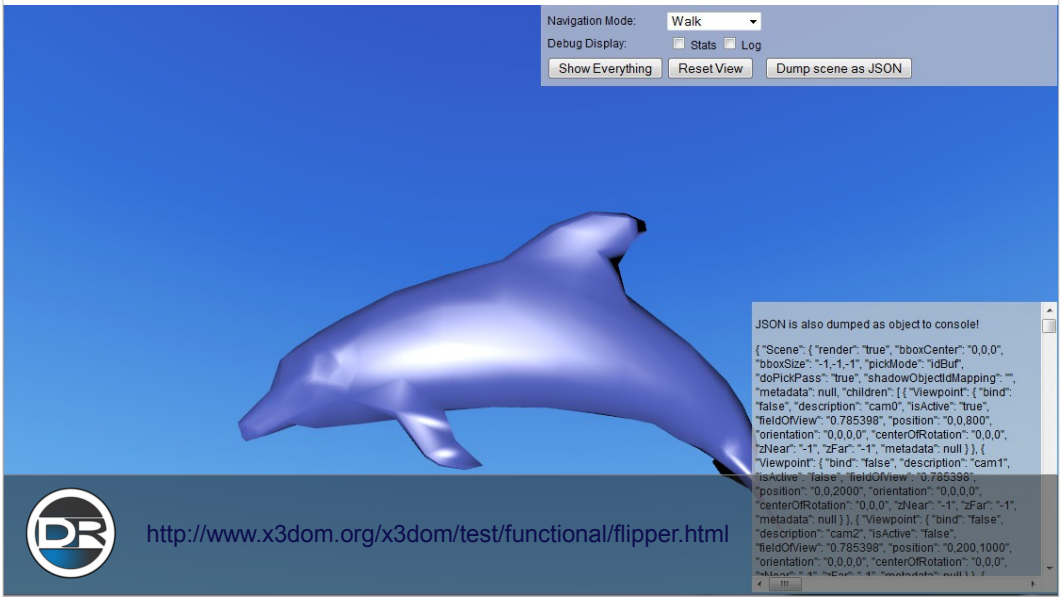


For examples of X3D use, see http://www.web3d.org/example or the slides that follow



Binary encoding of aircraft engine CAD model. Demo at http://examples.x3dom.org/binaryGeo/engine/model-bg.html

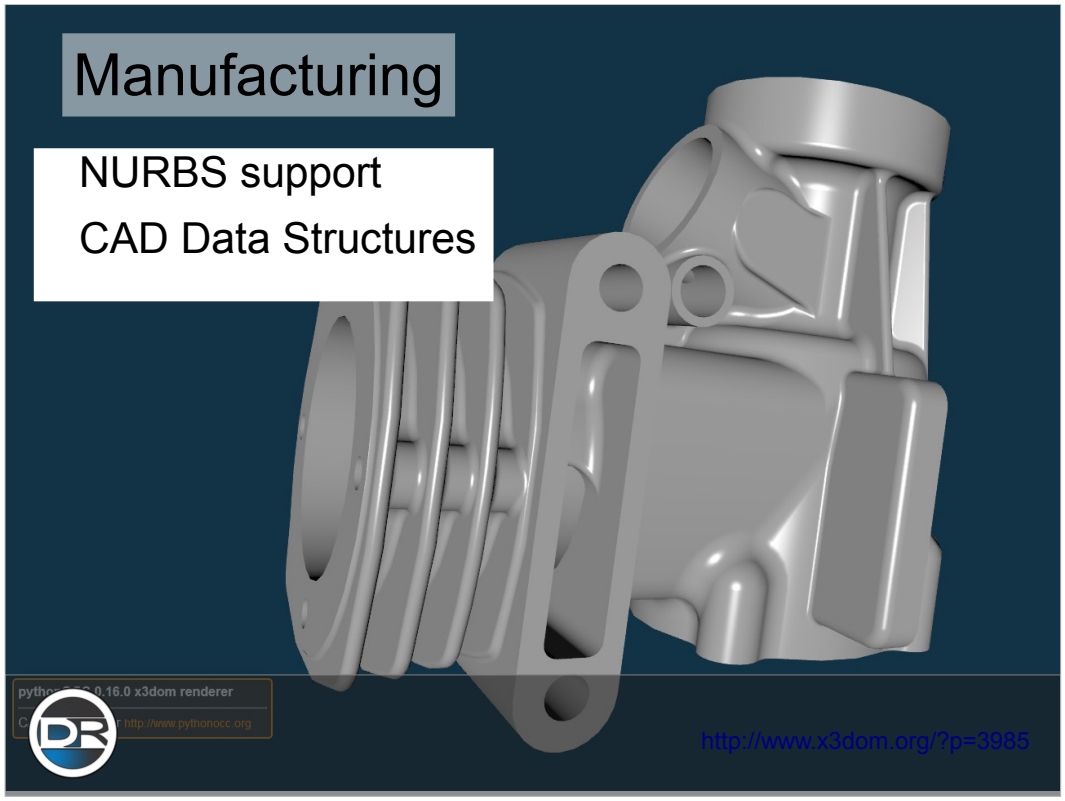
Three standardized encodings (XML, Binary, Text) two in development (JSON, Encrypted)



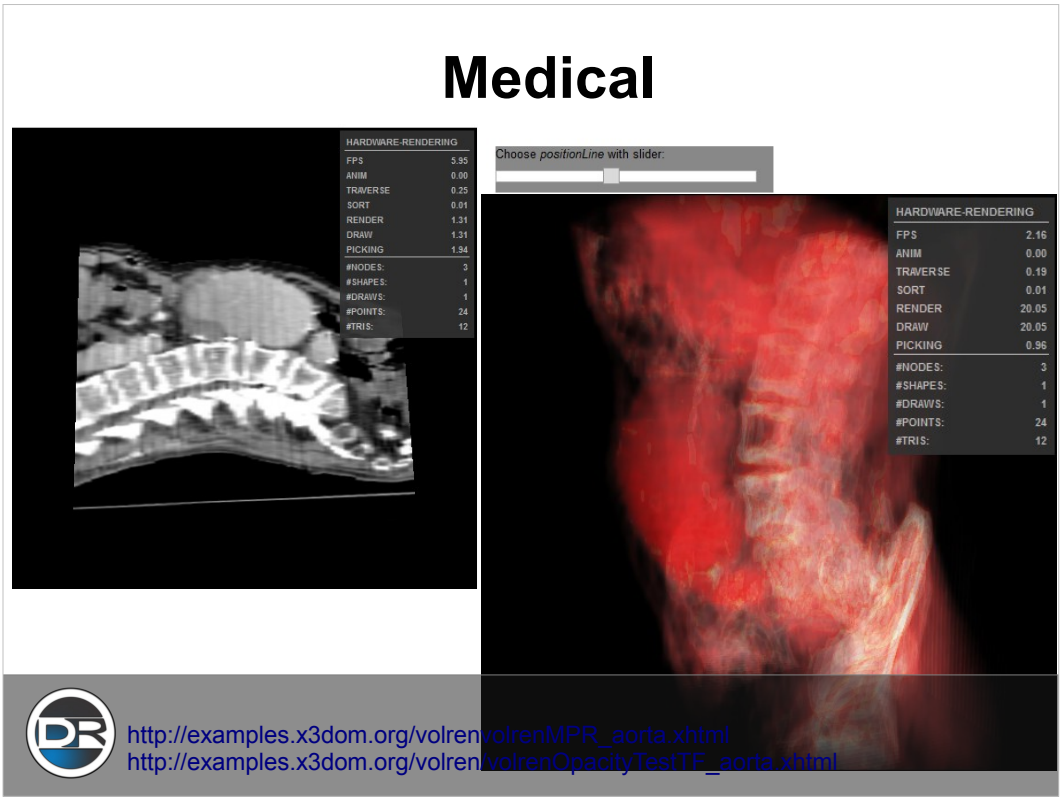
JSON encoded model with loader for X3DOM. Demo at http://www.x3dom.org/x3dom/test/functional/flipper.html

Industrial – Drilling rig w/shadows

Oilrig interactive CAD model with real-time shadows.
Detail down to large bolts. Demo at
http://examples.x3dom.org/binaryGeo/oilrig_demo/index.htm

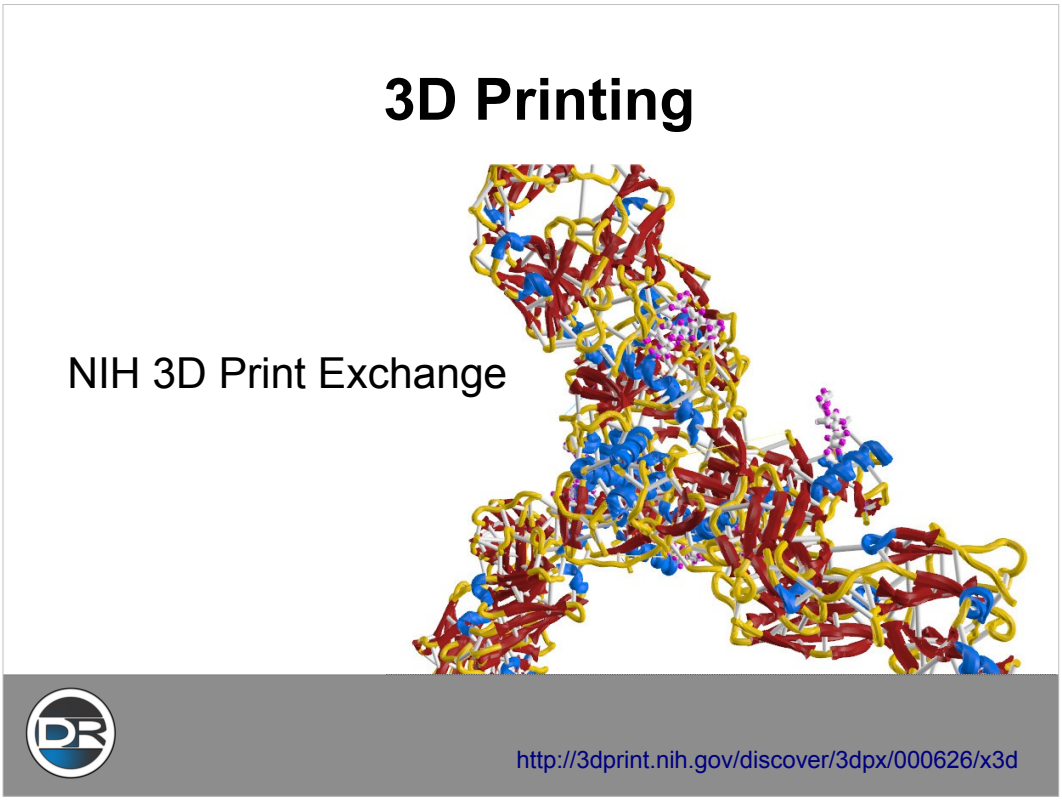


Converted from a CAD model that uses BReps using PythonOCC. Demo at http://www.x3dom.org/?p=3985



Interactive volume rendering. The left image shows a cut plane through the spine (http://examples.x3dom.org/volren/volrenMPR_aorta.xhtml). The right image is a volume render of the chest region (http://examples.x3dom.org/volren/volrenOpacityTestTF_aorta). Both demos are interactive.

Scanned 3D museum artifacts stored with 3D geometry and textures. The catalog is available at http://www.3dcoform.eu/x3domCatalogue//. Each model can be individually examined,

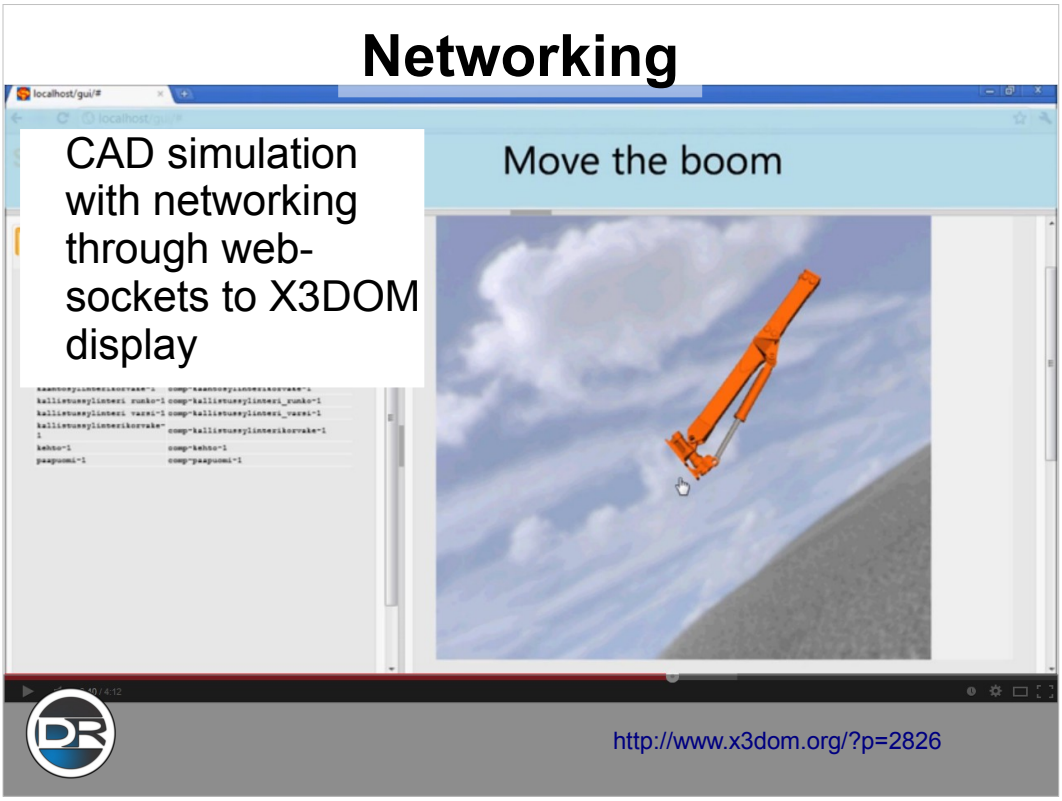


3D model of Ebola from NIH's 3D Print Exchange. The Print Exchange contains printable open source and public domain models of many different health-related objects. These are suitable for education and research. This model is available at http://3dprint.nih.gov/discover/3dpx/000626/x3d

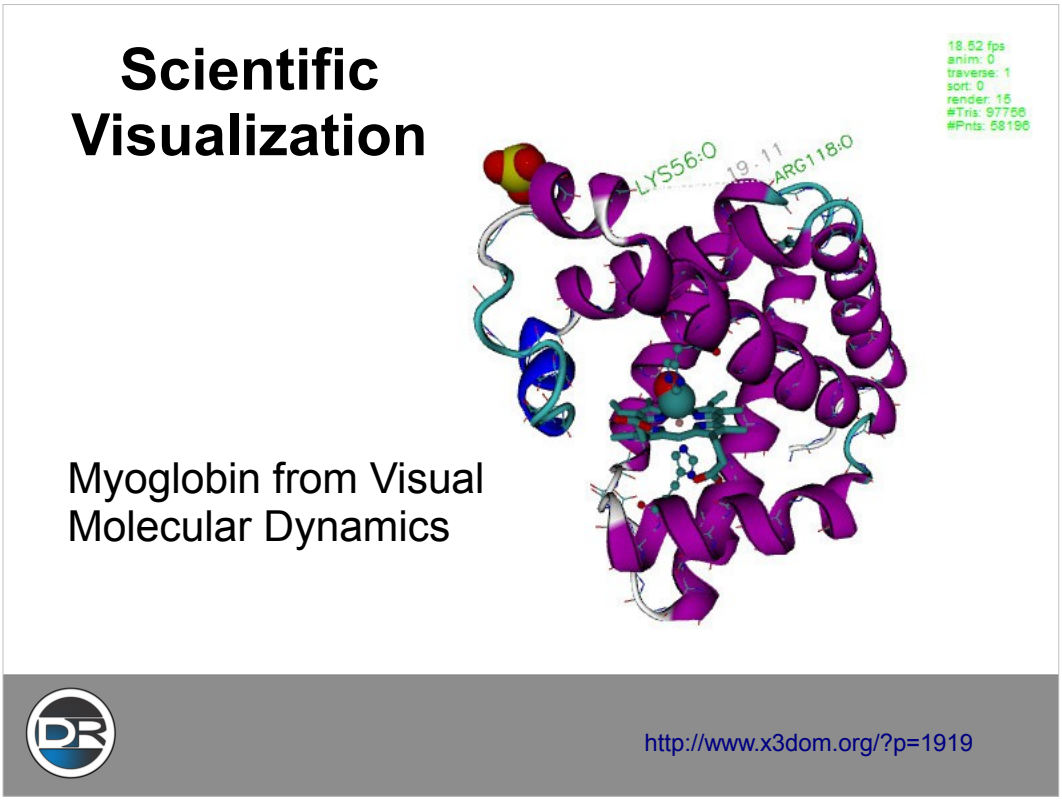
GIS

City model of Darmstadt, Germany. It uses CityServer to provide the models, textures, placement, and other features. The viewable model is at http://www.cityserver3d.de/en/webvisualisation/

Networking



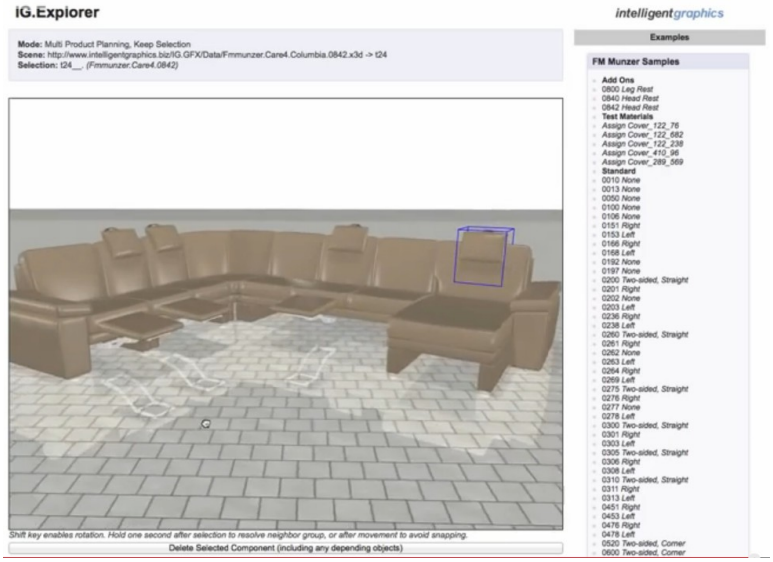
Visualization of CAD simulation through a network (WebSockets) interface. The description along with a link to the screen-capture video is at http://www.x3dom.org/?p=2826.



Visual Molecular Dynamics (VMD) system natively exports X3D for visualization. Description at http://www.x3dom.org/?p=1919

Consumer Products

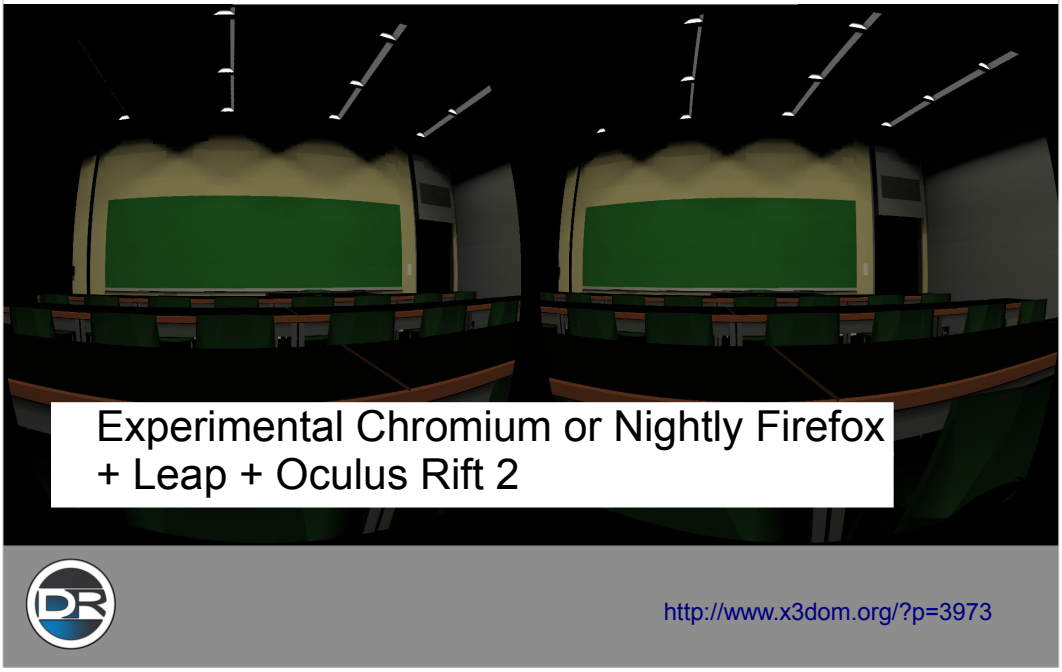
Prototype furniture configurator



http://www.x3dom.org/?p=3671

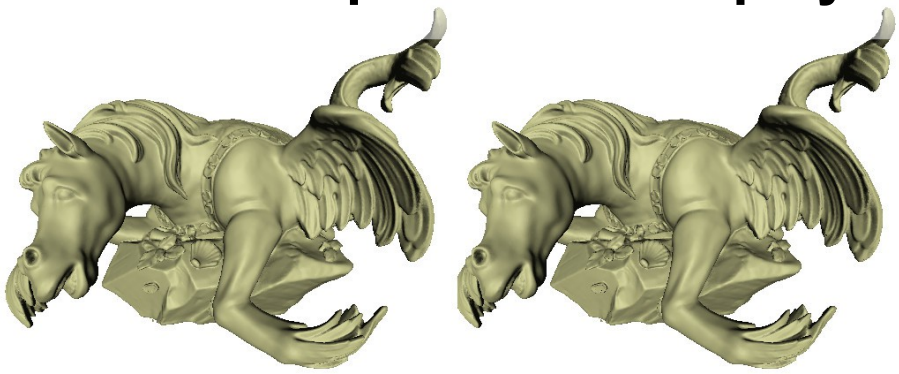
Intelligraphics has developed an online furniture configurator that allows consumers to design their furniture from modular components. The fabric, color, and details can all be selected. See http://www.x3dom.org/?p=1919 for a description with a link to the video showing how it is used.

Web VR



Designed to run in an Oculus Rift with Experimental Chromium or Firefox Nightly builds, this demo shows a classroom. The demo is at http://examples.x3dom.org/Demos/ClassroomVR/classroom-

Stereoscopic Phone Display



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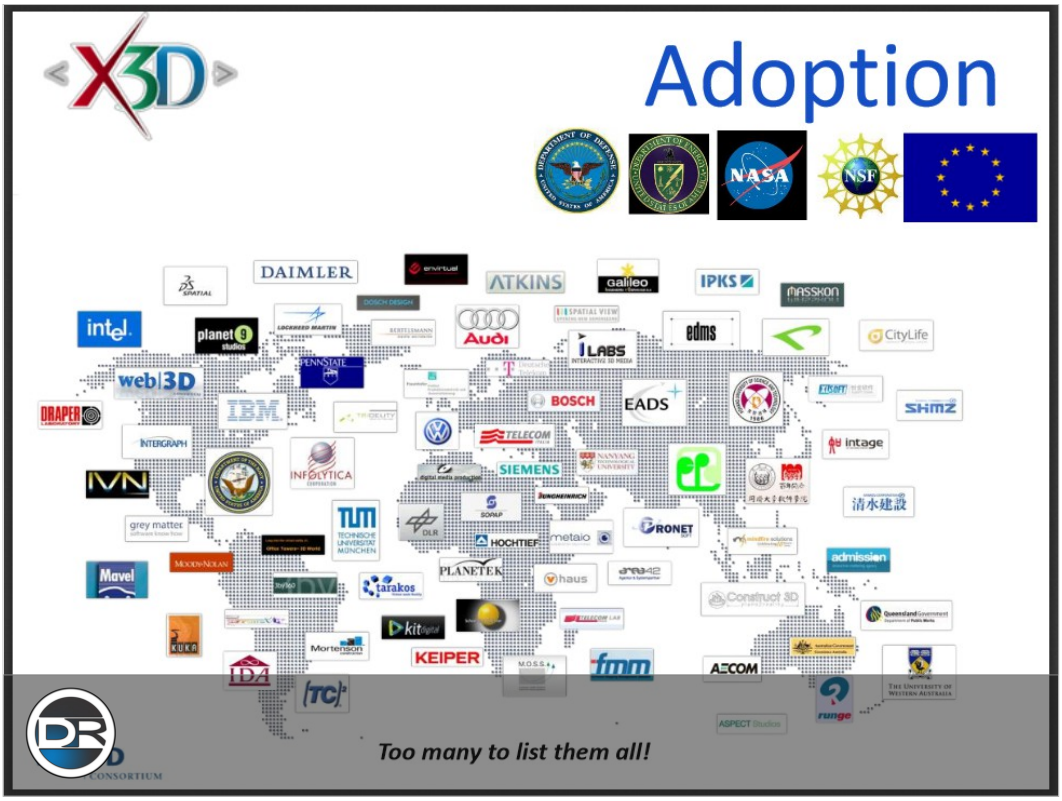
http://realism.com/x3d-tools/fbx-converter/DR-Kelpie


Adoption
DAIMLER
ATKINS
galileo
IPKS
intel
planet 9
Audi
edms
CityLife
web3D
IBM
BOSCH
EADS
SHIMZ
INTERGRAPH
TELECOM
intage
IVN
INFOLYTICA
SIEMENS
grey matter
TECHNISCHE UNIVERSITÄT MÜNCHEN
DLR
HOCHTIEF
metaio
RONET
admissien
Mavel
MOODY-NOLAN
PLANETEK
tarakos
haus
Construct 3D
KUKA
kit digital
Mortenson
KEIPER
fmm
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runge
IDA
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