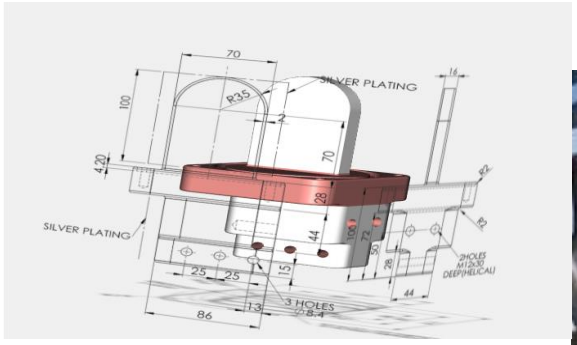
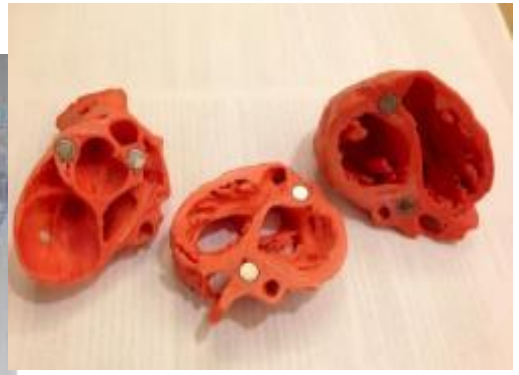
Web3D Standards

X3D: Open royalty-free interoperable standard for enterprise 3D



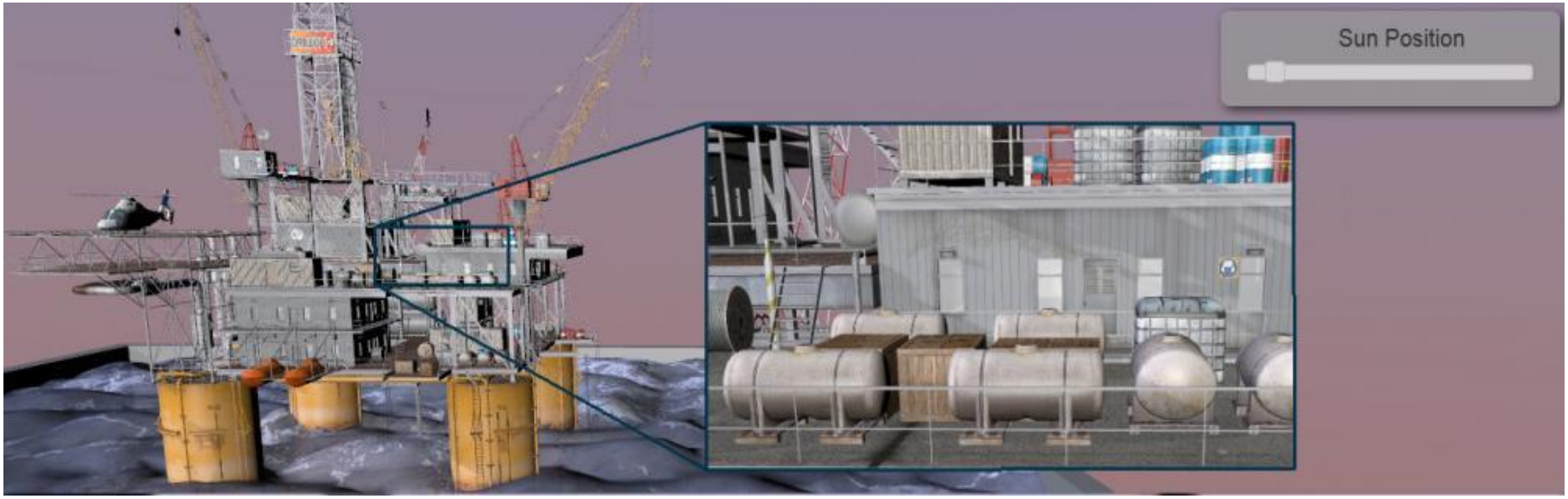


ISO/TC 184/SC 4 - WG 16 Meeting - Visualization of CAD data November 8, 2018 Chicago IL

Anita Havele, Executive Director Web3D Consortium

Anita.Havele@Web3D.org

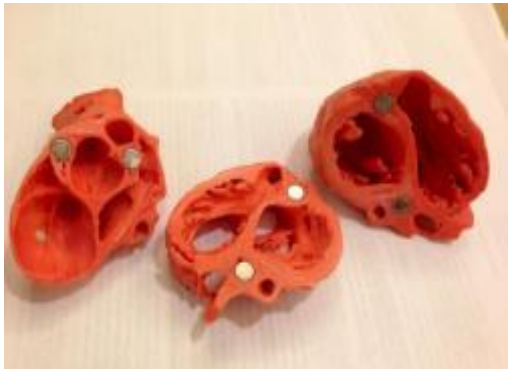
3D Visualization



A Picture is Worth a Thousand Words - But a 3D Model Is Priceless
Makes it easier to understand the design intent

Why Are Open Standards Important for 3D?

- Creating quality 3D content is expensive
  Both in time and software costs
- Something just as expensive is recreating 3D content
  when the underlying technology no longer works
- Well-kept secret of proprietary 3D technologies
  Rarely interoperable
- Single vendor solutions are almost always limited



A lifetime of 3D … ‘Mission-critical data’

- Requires durability longer than Silicon Valley cycles and market hype
- Requires IP protection
- Emerging technologies and Access

STANDARDS DEVELOPMENT ORGANIZATION
BUILDING WORLD CLASS OPEN WEB3D TECHNOLOGY

DEVELOPING THE ISO STANDARD X3D

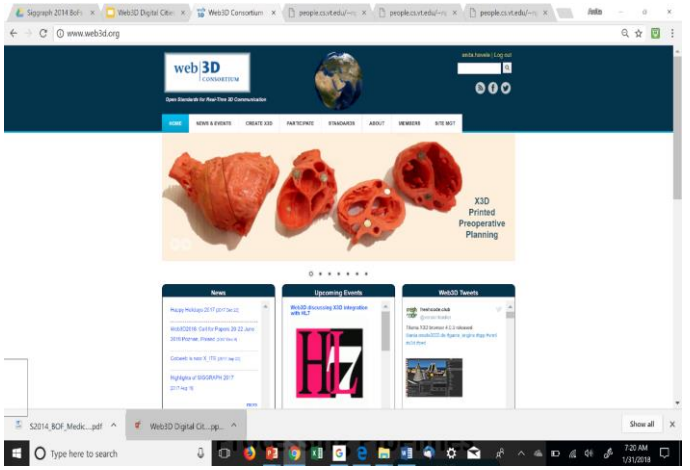
INTERNATIONAL PRESENCE AND PARTICIPATION

Our Standard: X3D – Enterprise X3D

Interactive Real-time 3D publishing standard for the Web

- Evolutionary - 1997
- Originated from VRML now in XML
- Open ISO Standard
- International recognition and support
- Royalty Free – IP independence
- Durable
- Interoperable
- Portable

www.web3d.org



What is X3D (Extensible) 3D

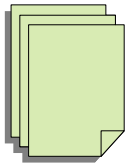
Scene graph for real-time interactive 3D

Delivery of virtual environments over the web

X3D - Second Generation VRML

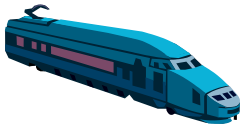
A complete solution for 3D on the Web

Real-Time • Web-based • Interactive • Animation • Extensible • Scriptable

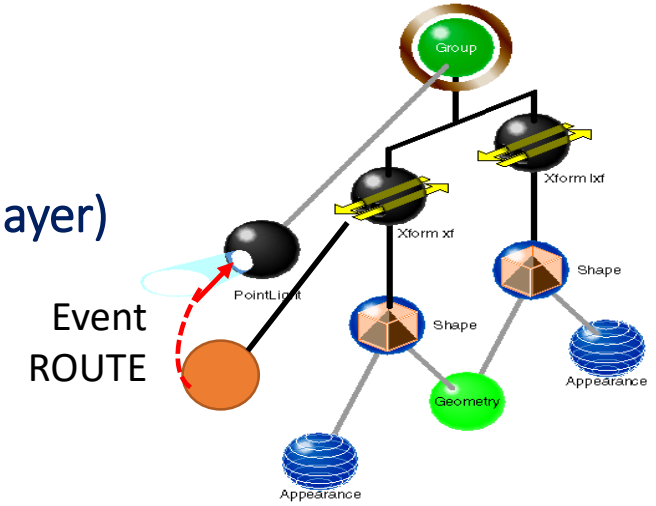


File Format

+



Run-Time Engine (player)



Event
ROUTE

Meshes • lights • materials • textures • shaders
Interaction • Animation • Audio/Video

Multiple encodings

- XML (.x3d)
- Classic VRML (.x3dv)
- Compressed Binary (.x3db)
- JSON

Multiple APIs

- JavaScript, Java
- C++, C#
- Python

www.web3d.org/what-x3d

What is X3D (Extensible) 3D

- Large set of nodes for 3D modeling
- Profile and Component structure promotes interoperability
  - 8 Profiles for common use cases X3D Profiles
  - 35 X3D Components for modular design X3D Components
  - 233 X3D Nodes for every little thing! X3D Nodes
- Implementations on multiple platforms: desktop, mobile, Web
- Domain components - Design, 3D Printing, Medical, Geospatial, Humanoid Animation, AR and VR

Multiple open source implementations (X3DOM and X-ite)

www.x3dom.org

Instant 3D the HTML way!

X-ite

Our goals with our standards are to:

- Help decision makers understand what is technically possible with innovative 3D web technologies
- Provide an open platform for industry, academia and government entities collaborate and develop world class 3Dapplications
- Support and converge with open standards bodies in their creation of the ‘3D Digital World’ Wide Web
- Foster international partnerships through the joint development of digital 3D world applications for cities, states, and governments

Mission:

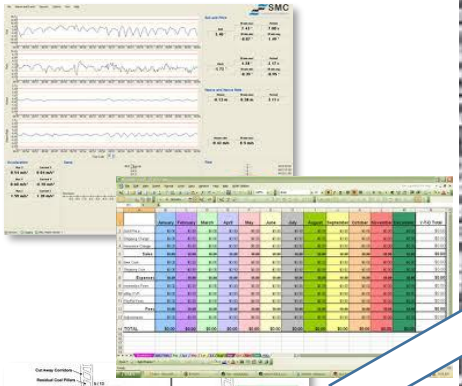
Durability: Stands the test of time

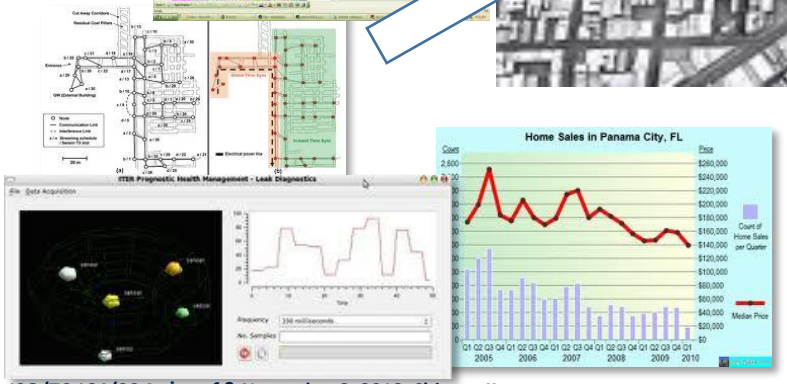
Interoperability: Converge standards

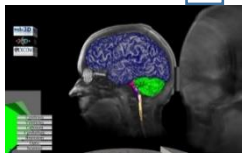
Portability: Industry Support

Community: International Collaboration

Data from different domains have to Coexist







web 3D CONSORTIUM

Industry Standards unify communities

X3D: Create once - Run Anywhere

3D without plugins – *Web platform*

All browsers
All platforms

Key Factors of durable X3D

- Long Term Stability
- Visualization
- Performance
- Integration
- Data Management
- Real-time Interactivity
- Security
- Ease of Use

Plug-in free support on all browsers with WebGL

X3D: Foundation for All Industry Verticals

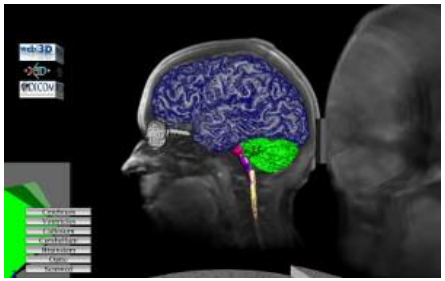
Cultural Heritage

Geospatial

CAD

Mixed Augmented Reality

Medical

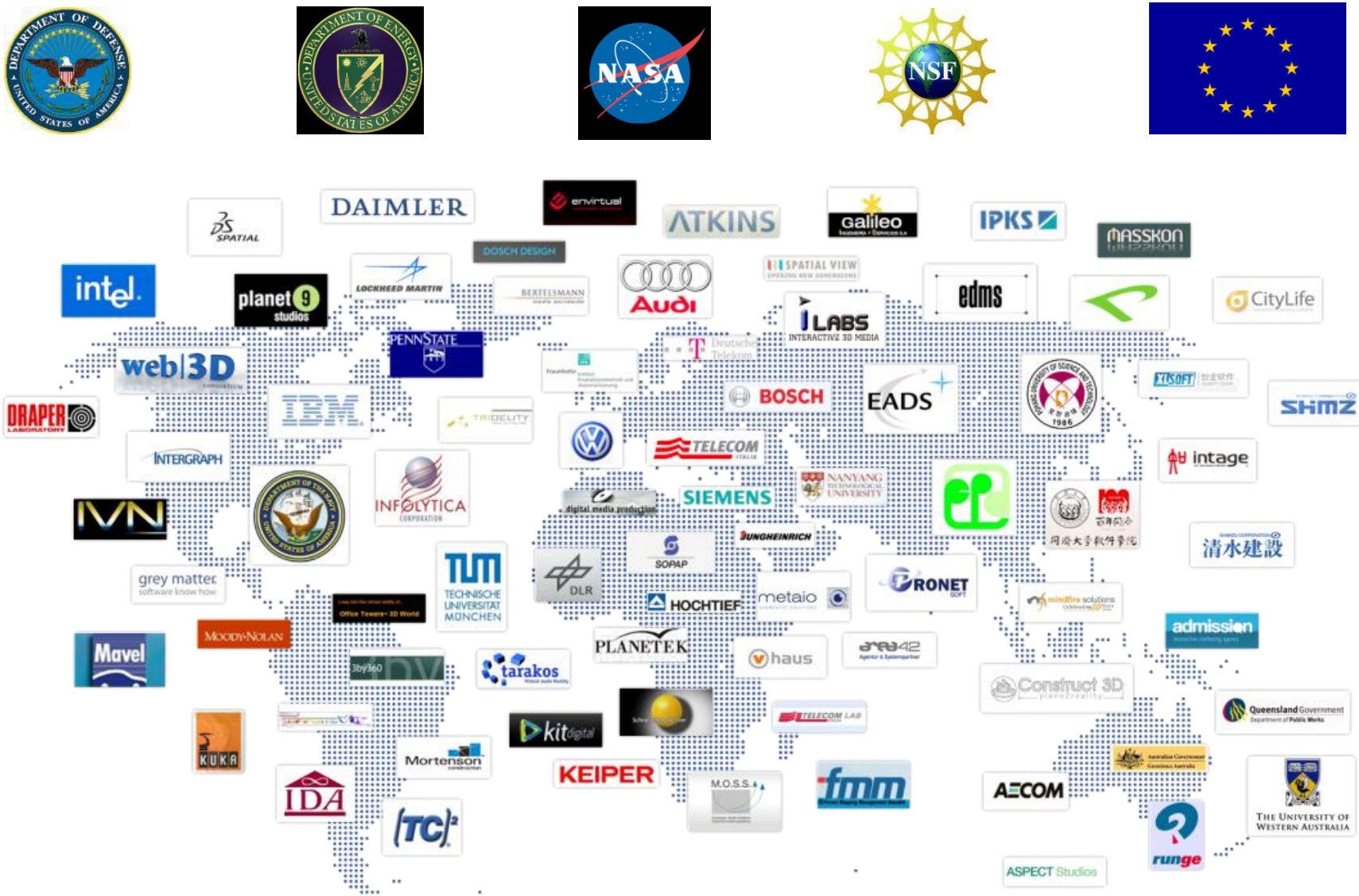


H-Anim

Web3D Consortium's ISO standards

- **X3D - 19775**
- **H-Anim - 19774**
- **JSON -**
- **X3D 4.0**

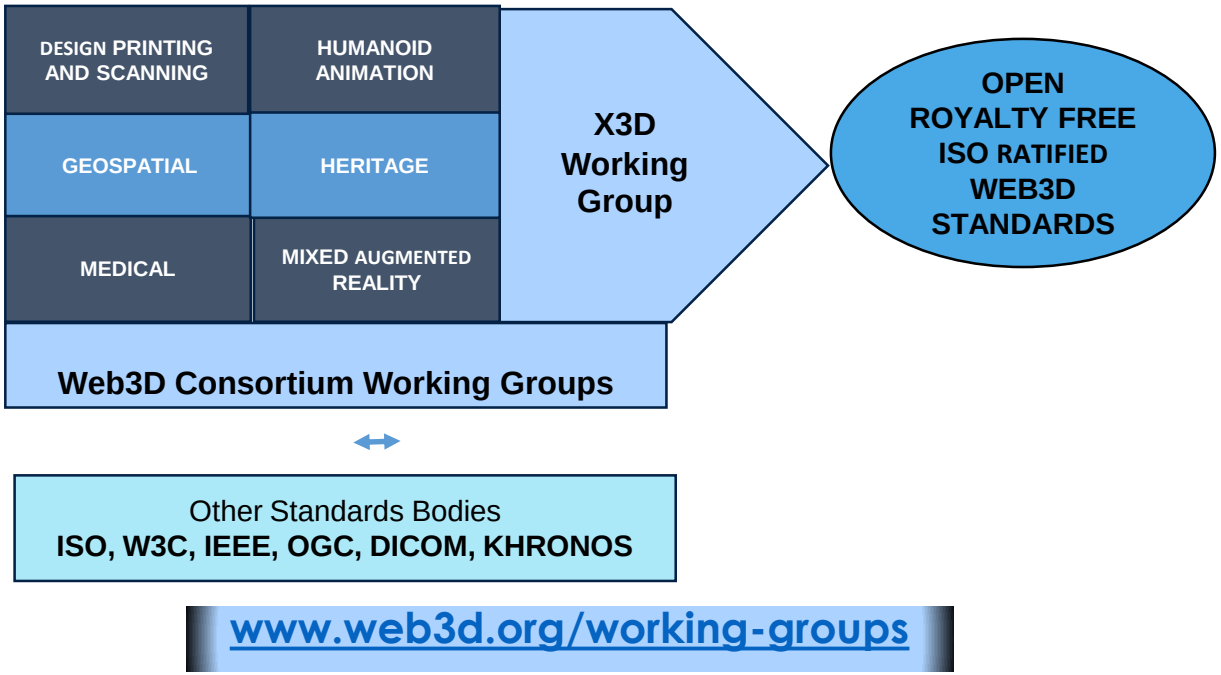
Who else is using these web3D standards?



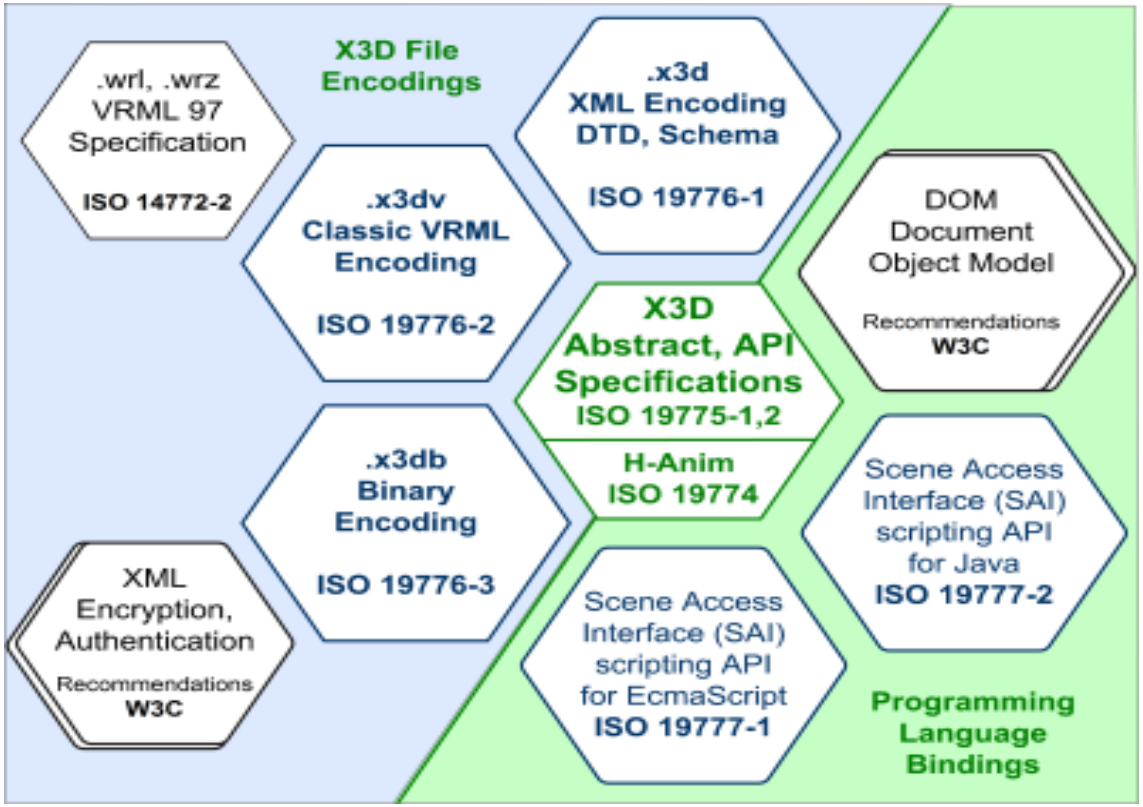
Web3D: Working Groups Structure

- **Domain Specific working groups provide recommendations to the X3D WG for ISO Ratification**

- **Working groups open to all members**



Web3D ISO Documents



Consortium Members

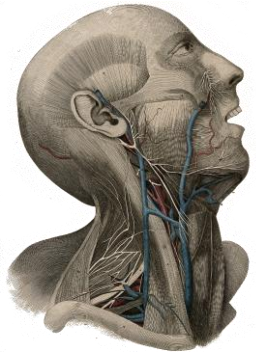
Member Benefits

- Join our Web3D Community
- Join our Working Groups to evolve X3D
- Marketing Partners
- Adoption Partners
- Outreach Partners
- Web3D Chapters
- Web3D Fellows Program

http://www.web3d.org/member-benefits

X3D X3D Use Cases

MIRRROR4all: Volume Rendering

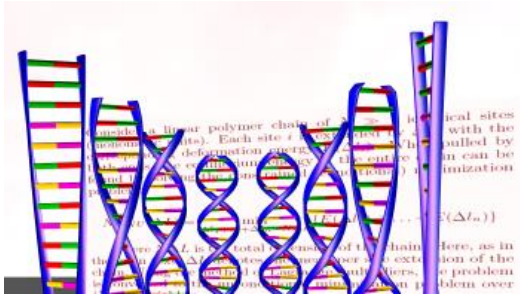


- 3D reconstruction of a medical scan from a series of DICOM images.

3D Printing
(3dprint.nih.gov)

X3D for 3D Printing Interoperability, Portability, and Multipurposing

DNA Molecule (SicViz) : VT



KSHELL: 3D DICOM images presentation

MRI scans:
http://www.kshell.com/pages/dicom_volren/collection001/series03/index.html

This is a Q-Code for the URL of a 3D volumetric image created from DICOM scans. The URL is
http://www.kshell.com/pages/dicom_volren/collection000/series00/index.html

Why Extensible 3D (X3D) for Data Visualization?

- ISO-IEC 1977x suite of standards:
- Scene graph data structure for interactive 3D worlds
  - Defines rendering and interactions for multiple data types (points, lines, meshes, volumes) in *Profiles*
  - 24 year history evolved from Inventor and VRML
- Encoded in XML, Binary, JSON, or utf8
- Interface bindings for common languages (JavaScript, Java; C++, C#, Python,...)

X3D Use Cases for Data Visualization

- Web publication of CAD and CAM information to customers and suppliers.
- Innovative display of product and assembly structure
- Declarative approach to interactivity and animation for CAD visualization.
- 3D Printing
- Visualizing geospatial distributions

X3D Features

- Volume rendering & DICOM presentation
- Isosurfaces, text, lighting, animations
- Visualization of model databases
- Surface modelling with primitive shapes, meshes, NURBS surfaces
- annotation
- Flexible and extensible metadata.
- 3D Printing

Metadata in X3D

Lossless record information can travel with the 3D model / interactive world:

- Metadata sets on any node in the scene graph
  - Similar strategy to using SNOMED terms w/ X3D models
- In XML encoding:
  - Create mixed namespace documents
  - use W3C's authentication & encryption

3D Printing File format Comparison: X3D Wins

File formats 3MF · ACIS · AMF · CKD · DWG · DXF · DWF · DWFX · IGES · OBJ · OpenDWG · PLY · PSpice · **STL** · STEP

	Mesh	Binary format	Unzipped	XML	color	texture	material	"Scene" info	DRM	extensible
STL	✓	✓	✓							
OBJ	✓		✓		✓	✓	/			?
DAE	✓		✓	✓						?
AMF	✓			✓	✓	✓	✓			✓
3MF	✓			✓	✓	✓	✓		✓	✓
X3D	✓	✓	✓	✓	✓	✓	✓	✓	?	✓

National Institutes of Health
Turning Discovery Into Health

NIH 3D PRINT EXCHANGE

Forward

Identify Projects and Partners for Integration Strategies

- Partnership Strategies
  - Liaison agreements and MoU,
  - Membership
    - Working Group collaborations
    - Member inreach
- Feasibility study, Implementation profiles
- Pilot projects

International Mobilization

- Annual Outreach activites engage communities of interest
- SIGGRAPH/ Eurogaphics Web3D Conference (22 years)
- Workshops & exhibits at SIGGRAPH
- VR Hackathons worldwide
- Showcases & regional meetings
- X3D and members appear regularly at:

  IEEE VR, Supercomputing, MMVR, IITSEC,
- X3D as enabler in many fields (astrophysics, …)

Current Development

- X3D Version 4.0
- JSON Encoding for X3D
- 3D scanning and 3D Printing Profile
- H-Anim - Facial modeling, Physical Sensors, Projective Texture Mapping, Data driven visualization, Internal Organ animation and Haptics.
- SRC (Shape Resource Container) External Shape and Geometry Nodes

glTF and X3D Feature Comparison

- https://docs.google.com/spreadsheets/d/1iiVWeJkC16nNYuJe7pMBDTEE_KcaKZYyDApXapd2vwY/edit#gid=0

glTF™ (GL Transmission Format) is a specification for efficient transmission from server to client

- glTF is the appropriate choice if the primary goal is viewing 3D scenes in a Web browser.
- glTF binary is a file format for mesh, appearance and animation to be loaded directly on a GPU/CPU for a Web
- glTF Animation is done using key frames, metadata annotation (markup) is not yet a feature
- glTF is a changing format to support evolving GPU capabilities and future features might not guarantee backward compatibility.
- glTF is primarily used for moving low-level assets across the network (uri) that map directly to GPU data structures

X3D™ is a file format allowing 3D scenes to be used by a wide variety of applications.

- X3D involves a dynamic interactive scenegraph with elements of
  - 3D Geometry
  - Material Appearance (colors, visual properties)
  - Navigation and Perspective
  - Interactivity
- X3D exist in the world of copyright, licenses, proprietary and intellectual rights, secur , ı needs, version control, and traceability
- X3D can be used by Web browsers and other viewers, authoring tools, 3D Printing applications, text editors, and XML tools.
- X3D is the appropriate choice if the primary goal is saving your interactive 3D scenes for use over time and multiple application
- X3D includes metadata and various extensions to support data interchange and future compatibility.
- X3D can be used by many 3D applications and Web browsers: viewers, authoring tools, text editors, 3D Printing apps, AR/. VR, and XML tools
- X3D is an appropriate choice for sharing interactive 3D scenes among multiple applications and preserving future archival compatibility.

How to Contribute and Partner with us?

- Join our Web3D Community
- Join our Working Groups to evolve X3D
- Marketing Partners
- Adoption Partner
- Outreach Partners
- Web3D Chapter(s) – Korea Chapter

Join the Web3D Team

Make open 3D standards work for you!
www.web3d.org/join

WWW.Web3D.org

Upcoming Events:

Web3D 2019 Conference
26-28 July 2019
Los Angeles, California

Contact:
Anita Havele, Executive Director
anita.havele@web3d.org

X3D For ALL

www.web3d.org

Join us to Build the Future of 3D

web|3D CONSORTIUM

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