3D: Design, Print, Scan BOF

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

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Web3D Consortium
www.web3d.org

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Scope & Outline

- Web3D Community
- 3D Print Exchanges
- Workflows & Roundtrips
- Enterprise scale (Mmarc Petit, EDF)

- Discussion
Who are we

An International, non-profit, member funded, standards development organization

Developing the ISO specification X3D for interactive 3D graphics on the Web

Our members span from academia, research, industry, government, and professionals

A community of technologists, artists and enterprise

WWW.Web3D.org
Data from different domains have to Coexist
Mash up 3D data across domains

Design

OPEN
STANDARDS
FRAMEWORK

Geo

Medical

3D Printing
X3D: Create once - Run Anywhere

The Web is the platform

All browsers
All platforms

Making 3D an ordinary media by publishing 3D to the Web
We are laying the foundation

Geospatial
Medical
Design
3D Printing
& Scanning

Simulation
Humanoid Animation
VR Technologies
Augmented Reality

X3D: Your backbone for new dimensions of 3D
Industry Standards unify communities
What is X3D (Extensible) 3D

- Originated from VRML, X3D is an ISO standardized specification for interactive 3D graphics.
- A File Format and Runtime API (Javascript, Java, …)
- Multiple encodings (file formats): XML, VRML, JSON, based on the same abstract scenegraph model
- Includes shaders, animation, interaction, geometry, texturing, lighting, camera
- Extensible - Capabilities added through scripting and node prototyping.
What is X3D (Extensible) 3D

• Large set of nodes for 3D modeling

• Profile and Component structure promotes interoperability

• 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)
Key Factors of durable X3D

- Long Term Stability
- Visualization
- Performance
- Integration
- Data Management
- Real-time Interactivity
- Security
- Ease of Use
Strengths of X3D

An international ISO royalty-free open standard
Robust open source implementations
Hardware and Software agnostic
Bring data from different sources and publish on different platforms
A layer above webGL/OpenGL
Web Authors vs Graphics Programmers
Enterprise solutions
A welcoming open community (x3d-public@web3d.org)
X3D Capabilities

Drilling Rig
Animation, interaction, shadows, details

High Poly,
Progressive Loading
Happy Buddha

Volume Rendering

Oculus Support
Classroom

3D Printing

NIH 3D PRINT EXCHANGE
Web3D members are making this happen
Adoption

Too many to list them all!
Mission

Interoperability: Converge standards
Portability: Industry Support
Durability: stands the test of time
X3D: The Greatest Common Denominator

- **Portability:** multiple tools, workflows, and delivery platforms
- **Interoperability:** sharing & Accessibility
- **Durability:** ISO-IEC recognition, Standards harmonization
- **Community:** Web3D Consortium, International Community

**Acquisition** → **Storage** → **Services** → **3D Visualization 3D Printing**

*Extensible 3D (X3D)*
**X3D Enterprise Case Studies**

- **CAD publishing**
  - Elphel - STEP to X3D pipeline
  - CADExchanger

- **Presentation of Scanning Data**
  - Photogrammetry - Point Cloud to X3D pipeline
  - LIDAR - Las2X3D by Virginia Tech

- **Print Exchanges**
  - NIH: 3dprint.nih.gov
  - NPS: ModelExchange.nps.edu
  - Native printer support: CURA, NetFabb, Shapeways
Web3D Standards Roadmap

X3D Native Support
Autodesk, Maya, Rhino, Blender, Unity
- Discussions with Autodesk – 3DPDF Blender support
- HL7 partnership
- Autodesk Netfabb 2018 release
- May and Rhino Support

3D Printing/Scanning
- X3D printing and scanning support
- Workflows and tools
- Exploit X3D capabilities for universal visualization, Metadata in design and printing of physical parts.

VR, AR, MR, xR
- Extend X3D to support full range of mixed and augmented reality

Full In-browser
- Full integration with HTML, WebVR

Interoperability
- HL7, 3DBP, 3DPDF
- WG - DICOM, STEP, ISO, IEEE

Standards development
- H-Anim – DIS
- X3D V4.0
- X3D V4.1

SIGGRAPH 2018 | Vancouver
NIH 3D Printing / 3DMD scanning
A 3D Print Exchange on Drupal 8 for DOD makers
X3D Design, Printing, and Scanning Working Group

Vince Marchetti, KShell
Co-Chair Web3D Consortium
3D Design, Printing, and Scanning (3DPS) Working Group
3D Scanning: ουσία to X3D and the Web

X3D Scanning, Visualization, and 3D Printing Workflow

Steinbichler Comet 5 optical scanner

.XYZ Point cloud file

Meshlab

Open Source Software

X3D file

3D on the Web

SHAPEWAYS 3D Printing Service

Cura software for desktop 3D printers

x3dom Instant 3D the HTML way!
Workflow for X3D Scene creation from 3D Scan data

1. **XYZ Point cloud file**
   - Point Cloud Editing
     - Decimation
     - Scaling
     - Position
     - Orientation

2. **Meshlab**
   - Construct Mesh from Point Cloud

3. **X3D Geometry**
   - Merge with XSLT

4. **X3D template scene**
   - Material
   - Metadata
   - Navigation

5. **X3D file**
X3D Use Case: CAD Publishing
Publish CAD Data on Web for Customers and Suppliers

Elphel Inc.
Salt Lake City, Utah, USA
https://www.elphel.com

Leverage open source software, X3D/X3DOM, and commercial CAD design application to publish CAD assembly models on any web browser.
Bidirectional Javascript calls between 3D scene and HTML5 UI elements allows interactive inspection and viewing of assembly and internal parts.

Integration of X3D scenegraph and HTML5 DOM allows scripting with common web application frameworks.
3Di --- “intelligent 3D”
Touch sensitive 3D parts allow linking to descriptive Wiki pages.
Workflow: as detailed in Elphel Blog X3D assemblies from any CAD

STEP -> X3D conversion

FreeCAD open source application; Python scripting

X3D files

Loaded from server by web browser HTTP calls

HTML 5 web page
X3dom JavaScript library

Code resources are released with GPL v3 license by Elphel Inc.
Public Git Repository
X3D Use Case:
CAD Assembly Animation

Vince Marchetti, KShell
Co-Chair Web3D Consortium
3D Design, Printing, and Scanning (3DPS)
Working Group
Animated Assembly & Disassembly with X3D & HTML 5

Combining:
• Detailed rendering of CAD assembly model
• Declarative X3D programming of assembly motion sequence.
• Integration with HTML5 UI Controls

http://www.kshell.com/pages/spindle_valve
Workflow and Data Flow for X3D Animated Assembly Model on web page

CAD Application

STEP AP 203 file → SPRI STEP → X3D web application

http://spri.kshell.com

X3D file
- geometry
- assembly

Add:
- Material
- Navigation
- Lighting
- Animation

Web Page

Served from HTTP Server

UI Controls
- sliders

JavaScript + WebGL
X3D browser

X3D file
EDF - Marc Petit
Las 2 X3D

Virginia Tech: landscape scanning
https://vimeo.com/visionarium2018
X3D Anywhere

www.web3d.org/join

Join us to Build the Future of 3D

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Discussion