X3D Graphics International Standard Version 4 Update and Online Resources

Web3D 2021 Conference

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Abstract

X3D version 4 is a major upgrade to the Extensible 3D (X3D) Graphics International Standard that supports HTML5 integration, advanced Physically Based Rendering (PBR) supporting glTF, Projective Texture Mapping (PTM), Humanoid Animation (HAnim2), enhanced spatial audio supporting the W3C Web Audio standard, plus numerous other improvements.

Available file encodings include XML, ClassicVRML, JSON and Turtle. Additionally open-source programming libraries are available in JavaScript, Java, and Python. Strict validation of models allows exceptionally high levels of Quality Assurance (QA).

This tutorial summarizes new capabilities and describes author support in modern browsers, updated tools and a growing set of examples. An emphasis on design principles illustrates how this important standard has steadily and consistently evolved for archival publication of interactive 3D graphics across the Web.

This presentation provides a regular annual progress update, and a follow-on discussion period is welcome.

Presentation Topics

X3D version 4 Architecture progress update

- Summary report of status
- ISO/IEC specifications
- Liaison relationships

Resources

- Provide synopses, snapshots and links for a wide ecology of X3D tools, examples and learning aids.

X3D4 Specfication Update

Web3D Consortium Role and Relationships

Web3D Consortium is a non-profit Standards Development Organization (SDO) holding a Class A liaison relationship with ISO/IEC since 1997.

- About Web3D Consortium: https://www.web3d.org/about (Web3D Introduction Video)

Web3D Consortium prepares, verifies and submits functional specifications to ISO, receives comments back, resolves them, and resubmits specs in accordance with ISO/IEC processes. To date these specifically include the VRML, HAnim and X3D standards. Each has corresponding, complementary volumes and parts.

- Standards Adoption Process https://www.web3d.org/standards/adoption-process

We are happy to work with all ISO/IEC working groups, SC24 WG6 is primary. Many other working groups and standardization groups hold related interest.

- Web3D Consortium Liaisons and Partnerships https://www.web3d.org/about/liaisons

X3D4 Architecture Revision is Approaching Completion

- **X3D® version 4 (X3D4) is a major upgrade to the Extensible 3D (X3D) Graphics International Standard** that provides close support for the HTML5 Recommendation, Khronos glTF Physically Based Rendering (PBR), Web Audio API and other capabilities.
  - https://www.web3d.org/x3d4
- This work is a major update that builds upon prior versions of X3D and Virtual Reality Modeling Language (VRML). Overall development is guided by the Web3D Consortium Standards Strategy.
  - https://www.web3d.org/strategy
- This effort is driven by the X3D Graphics Working Group with many contributions from other working groups and daily community outreach.
  - https://www.web3d.org/working-groups

X3D4 Overview References

X3D specification relationships:

- https://www.web3d.org/specifications/X3dSpecificationRelationships.png

Detailed information on X3D4 is found online at Web3D 2020 Conference site

- Tutorial: https://web3d.siggraph.org/archive/web3d2020/tutorial-2/
- Slideset: https://drive.google.com/file/d/1VCgdLaWMmZUu-TZgRAMsSobR6CC5Okt5/view
- Video: https://drive.google.com/file/d/1zVRysi1pl7iC1nBMiVK_iXsAM93Jlrlv/view

Current draft X3D4 specification:

- https://www.web3d.org/specifications/X3Dv4Draft/ISO-IEC19775-1v4-CD1

One architecture, many supporting specifications, all functionally equivalent and fully compatible

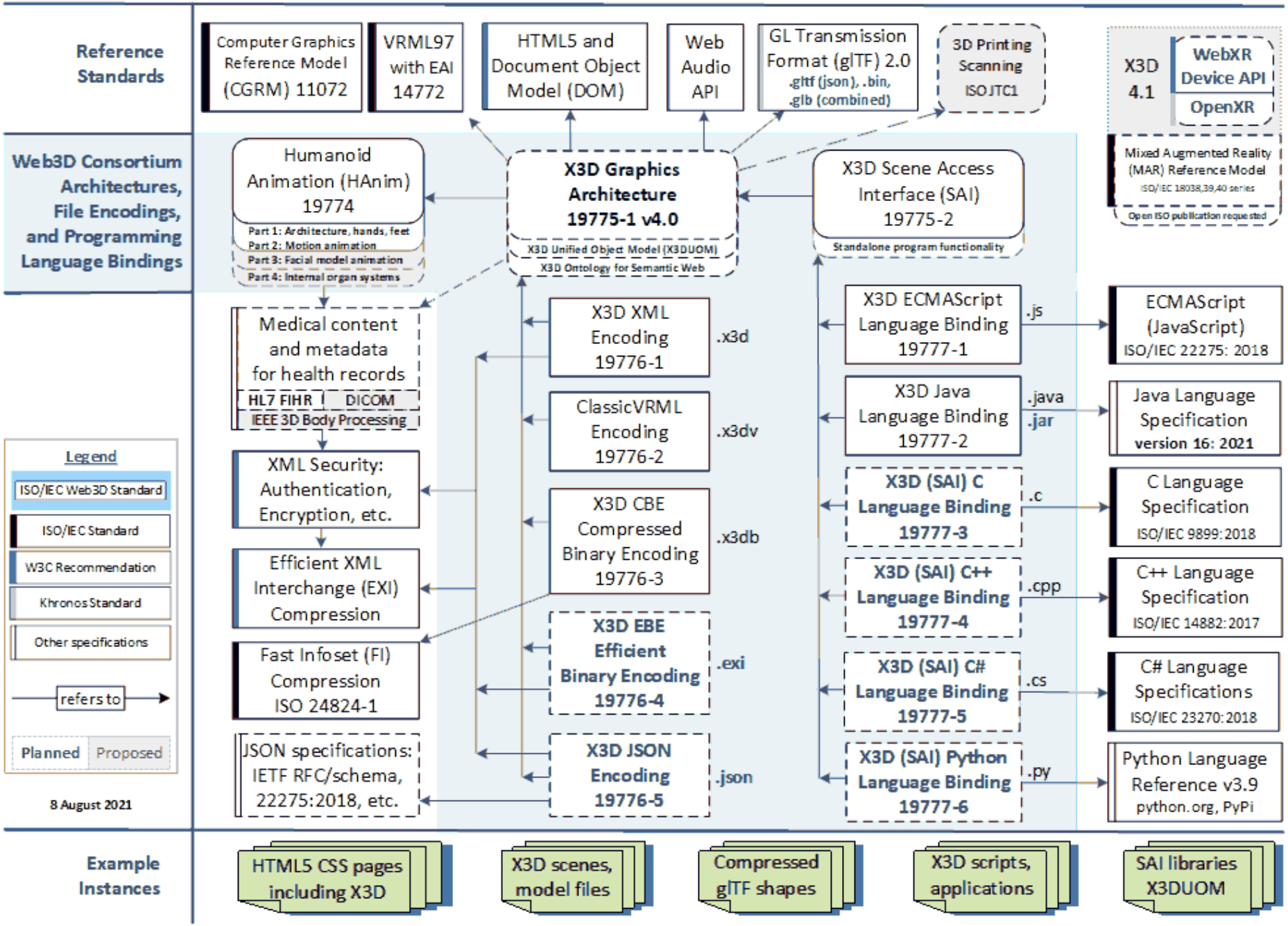
- 19775-1 X3D Architecture
- 19775-2 X3D Scene Access Interface: corresponding API requirements

- 19776 X3D file encodings

- 19777 X3D bindings for various programming languages

- 19774 Humanoid Animation (HAnim)

X3D Graphics Standards Relationships



Khronos glTF v2.0 capabilities now part of X3D4

Full-coverage correspondence defined in glTF and X3D4 specifications

- Adds Physically Based Rendering (PBR) and Non-Photorealistic Rendering (NPR)
- X3D4 players can Inline glTF models, or support visually equivalent X3D models

Working on automatic X3D player support for glTF examples archive

- https://github.com/KhronosGroup/glTF-Sample-Models/tree/master/2.0#readme
- X3D4 goal is to demonstrate correct, consistent rendering throughout all examples
- Paper: “diff” testing continues for structured text, viewpoint images, animations

Formal liaison between The Khronos Group and Web3D Consortium

- https://www.web3d.org/news-story/web3d-consortium-and-khronos-group-deepen-cooperation-open-standards-3d-web
- Planning to match correspondences between respective metadata models

Autogeneration of languages and encodings

The X3D Unified Object Model (X3DUOM) definitions exactly match the X3D Architecture and are used to autogenerate other representations.

- Derived from formal X3D XML schema with added object-model annotations
- Under discussion: considering possible addition to X3D specification suite
- https://www.web3d.org/specifications/X3DUOM.html
- (Functional descriptions are possible annex addition to 19775-1 Architecture)

To achieve a second implementation for C, C++, C# source implementations (for example) we can adapt demonstrated source-generation patterns already developed for:

- Java https://www.web3d.org/specifications/java/X3DJSAIL.html
- Python https://www.web3d.org/x3d/stylesheets/python/python.html
- JSON https://www.web3d.org/x3d/stylesheets/X3dToJson.html
- Turtle https://www.web3d.org/x3d/content/semantics/semantics.html
  (which may further get submitted to SC24 as specification 19776-6)

Prominent capability additions in X3D4

- HTML5 recommended integration guidelines for authors, implementers
  - Annex L HTML authoring guidelines
- Full support for Khronos glTF v2.0 via Inline or matching X3D nodes
  - https://www.khronos.org/gltf
- Web Audio API W3C Recommendation
  - https://www.w3.org/TR/webaudio
- Addition of Projective Texture Mapping (PTM)
- Support for properties of point clouds and scanning requirements
- Support for HAnim version 2, particularly motion animation

Current Efforts, X3D 4.0 Architecture 19775-1

- ✓ Support achieved for glTF advanced rendering, W3C *Web Audio API*
  - plus integration with HTML5/CSS
- ✓ X3D4 new work item proposal (NP) approved by national bodies 2021
  - 8 affirmative, 4 abstain
- ISO/IEC Committee Draft (CD) submitted, review and editing in progress
  - Over 200 “editorial” comments identified during last ballot, each being addressed
  - Only a handful of minor functional issues remain, evaluating implementations
  - HTML/CSS specification editing in GitHub version control, also productionized
- Necessary next milestone: finish ballot/editing, final version resubmitted
  - Then pursue programming language bindings and file encodings, at a faster pace
  - No plans to pursue v4.1 future functionality until current v4.0 work all complete

Suggested path forward for C, C++, C# APIs, namely programming language bindings ISO/IEC 19777-3,4,5

A. Share draft implementation, example scenes, and draft specification (now in GitHub) for Web3D Consortium member and public review
B. Show design patterns for expressing X3D nodes and statements in each programming language, to allow autogeneration of consistent source code libraries and provide independent 2nd implementation
    1. Rephrase: syntax for minimalist implementations matching SAI requirements
    2. Similar design-pattern approach to matching syntax for Java, Python, JSON
C. Public review period – ready to implement/evaluate/finalize?
D. Web3D member, Board of Directors approval of submission to SC24
E. Submit CD 3.3 to ISO/IEC for ballot, next draft becomes version 4.0

Human Animation (HAnim) Status

HAnim second edition approved as International Standard (IS)

- Part 1 matches original HAnim first edition (with small improvements)
- Part 2 adds Motion Animation (both interpolators and BVH-style motion files)

X3D support exactly matches functionality in latest 19774, tested OK

- Active work improving tool support and published examples
- https://www.web3d.org/x3d/content/examples/HumanoidAnimation

Future work on HAnim will apply similar technical approaches for

- Facial and expression encodings, variety of internal organs
- Long-term goals include clothing/fashion and 3D medical records

Addition of X3D Ontology implementing Semantic Web relationships has obviated need for continued definition of alias names.

- Vocabulary synonyms, correspondences are queryable and portable across versions
- https://www.web3d.org/x3d/content/semantics

ISO/IEC document considerations

All specifications in git version control, privately hosted by Web3D Consortium

- https://github.com/Web3dConsortium/X3D
- https://github.com/Web3dConsortium/HAnim

Each draft/final version published equivalently with ISO/IEC, Web3D copyrights

- Publicly Available Standards (iso.org) https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html

Editorial CSS styles facilitate comment resolution by marking up HTML drafts

- Details for all issues formally tracked by Web3D Consortium in Mantis system
- Stable process, slow but steady progress – relentless!

Styling issue: does ISO/IEC have improved HTML document layouts? Ready to adopt.

- Consistent presentation of international standards is important for reader understanding and broad adoption worldwide. HTML style guidelines are essential for creating high-quality results.

Logged in as: *brutzman* (Don Brutzman - developer) 2021-10-21 01:22 PDT Project: X3D

Main | My View | View Issues | Report Issue | Change Log | Roadmap | My Account | Logout Issue # Jump

Search Apply Filter Create Permalink Simple Filters X3D4 Resolution Use Filter Manage Filters Save Current Filter

Viewing Issues (1 - 50 / 252) [Print Reports] [CSV Export] [Excel Export] [First Prev 1 2 3 4 5 6 Next Last]

		P	ID	Tags	#		Category	Severity	Status	Updated	Summary
☐		–	0000764	V4.0 Resolution	2		19775-1 (Abstract)	minor	resolved (brutzman)	2021-10-18	07.3.4 X3DMetadataObject - Is name field required?
☐	✎	–	0001092	V4.0, V4.0 Resolution	11		19775-1 (Abstract)	minor	assigned (brutzman)	2021-10-18	07 Core component - MetadataSet or Metadata* node(s) as root nodes
☐		–	0001089	V4.0 Resolution	1		19775-1 (Abstract)	minor	resolved (rpuk)	2021-10-14	04.4.8.2 Route - Ambiguity about route statement location
☐		–	0001174	V4.0, V4.0 Resolution	3		19775-1 (Abstract)	minor	resolved (brutzman)	2021-10-14	07.2.5.1 Organization - Comments are not clearly defined
☐		–	0001185	V4.0, V4.0 Resolution	2		19775-1 (Abstract)	minor	resolved (brutzman)	2021-10-11	30.2.4 Sequencing single field (SF) events - Discrete value sequencing function
☐		–	0001093	V4.0 Resolution	10		19775-1 (Abstract)	minor	resolved (brutzman)	2021-10-11	30.2.4 Sequencing Single Field (SF) events - Notation in sequencing function
☐		–	0001151	V4.0, V4.0 Resolution	4		19775-1 (Abstract)	minor	resolved (brutzman)	2021-09-30	09.4.2 Inline - Inline is silent about head, component, unit, and meta statements
☐	✎	–	0000351	V4.0, V4.0 Resolution	8		19775-1 (Abstract)	minor	assigned (brutzman)	2021-09-30	8.3.1 X3DTimeDependentNode: include TimeSensor outputOnly field cycleTime?
☐		–	0001080	V4.0, V4.0 Resolution	6		19775-1 (Abstract)	minor	resolved (brutzman)	2021-09-28	08.4.1 TimeSensor - TimeSensor cycleInterval needs to be modifiable when running
☐		–	0001106	V4.0 Resolution	13		19775-1 (Abstract)	minor	resolved (brutzman)	2021-09-28	08.2.4.4 Pausing time - Settings on resuming after pause
☐		–	0001070	V4.0 Resolution	2		19775-1 (Abstract)	minor	resolved (rpuk)	2021-09-28	04.6.1 Overview - Profile lists omit MedicalInterchange Profile
☐		–	0000716	V4.0 Resolution	3		19775-1 (Abstract)	minor	resolved (brutzman)	2021-09-27	07.4.7 WorldInfo fields (title and info) - Change access type to inputOutput
☐		–	0000759	V4.0 Resolution	2		19775-1 (Abstract)	minor	resolved (walroy)	2021-09-20	07.2.5.5 UNIT statement - Missing formulae
☐		–	0000758	V4.0 Resolution	1		19775-1 (Abstract)	minor	resolved (rpuk)	2021-09-20	07.2.5.5 UNIT statement - Misspelling
☐	✎	–	0001373	V4.0 Resolution			19775-1 (Abstract)	minor	assigned (brutzman)	2021-09-17	Ensure uniform and consistent usage of root and top-level terminology for nodes

Resources

X3D Version 4 Overview

- https://www.web3d.org/x3d4

X3D Version 4 Overview

View Edit Revisions

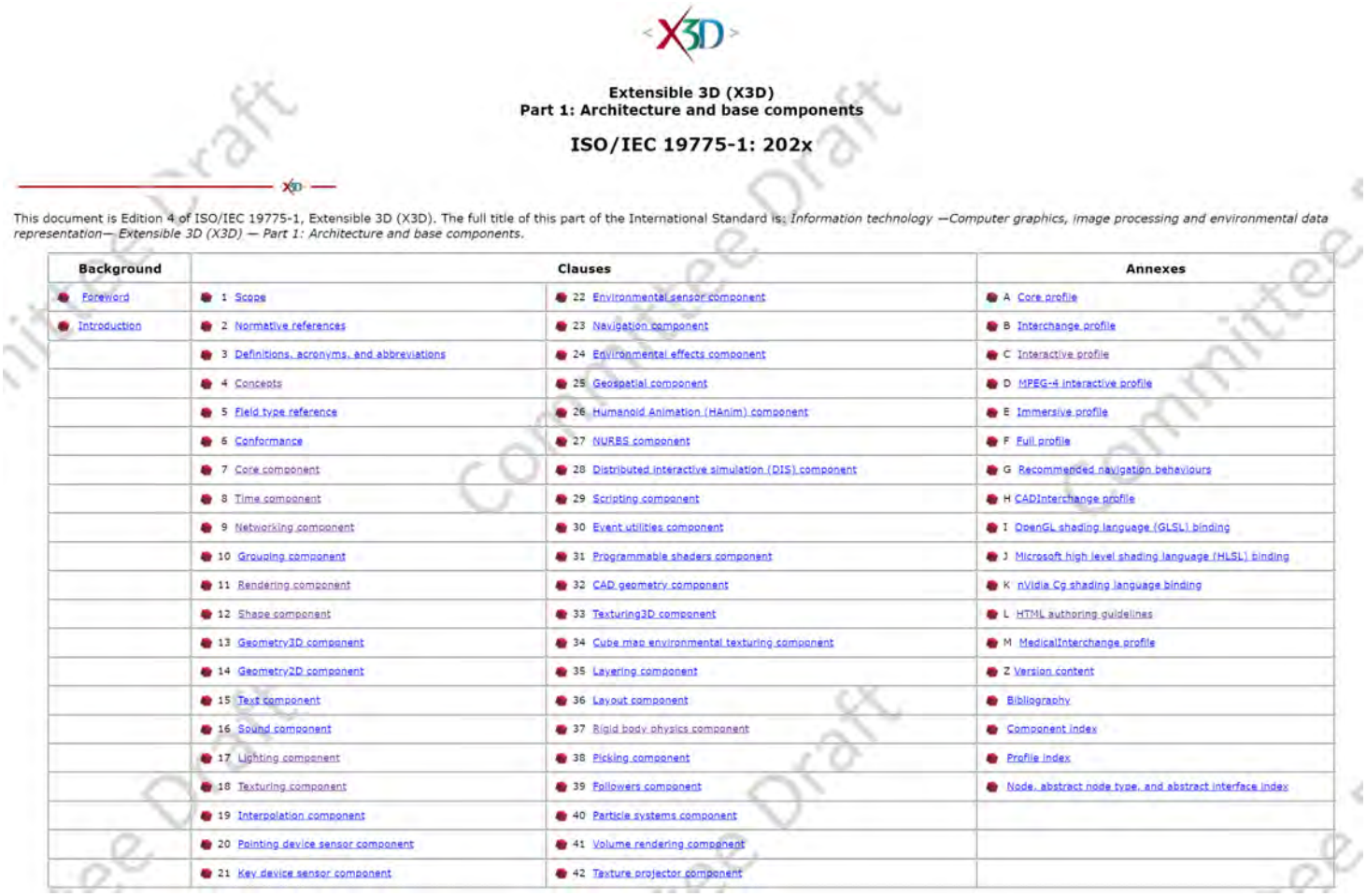
Tags: x3d x3dom X_ITE x3d4 x3dv4 X3D version 4

X3D® version 4 (X3D4) is a major upgrade to the Extensible 3D (X3D) Graphics International Standard that provides close support for the HTML5 Recommendation, Khronos glTF Physically Based Rendering (PBR), and Web Audio API. This work is a major update building on prior versions of X3D and Virtual Reality Modeling Language (VRML). This effort is driven by the X3D Graphics Working Group with many contributions from other working groups and daily community outreach.

- *Progress.* X3D4 Specification Status Report during International Standards Organization (ISO) 4-week annual meeting July-August 2021.
- *Release.* X3D4 Committee Draft (CD) Specification for balloting by national bodies in International Standards Organization ISO/IEC.
- *Preview.* X3D4 Public Working Draft Specification for 25th-anniversary Web3D 2020 Conference and Web3D Consortium ballot.
- *Features.* X3D4 Highlights provides a quicklook of major features under development.
- *Tracking.* X3D4 Implementations Status provides summary links tracking active efforts.
- *Current.* **X3D Version 4 Draft: Released and Ready for Review!** presentation for Web3D 2020 Conference tutorial, online November 2020.
- *Current.* **X3D Version 4 Draft: Ready for Early Adoption!** presentation for Web3D Webinars and SIGGRAPH conference, online August 2020.
- *Rolling.* **X3D4 Draft is Moving In Fast: 3D Everywhere!** presentation from Web3D 2019 Conference, Los Angeles, 26-28 July 2019.
- *Aligning.* **X3D Futures: what is happening, how to get involved!** presentation from Web3D 2018 Conference, Poznan Poland, 22 June 2018.
- *Launch.* **Future of X3D** presentation and detailed notes from Web3D 2017 Conference, Brisbane Australia, 7 June 2017 (photograph).

X3D4 Committee Draft (CD) Specification

- https://www.web3d.org/specifications/X3Dv4Draft/ISO-IEC19775-1v4-CD1/Part01/Architecture.html



Extensible 3D (X3D)
Part 1: Architecture and base components

ISO/IEC 19775-1: 202x

This document is Edition 4 of ISO/IEC 19775-1, Extensible 3D (X3D). The full title of this part of the International Standard is: *Information technology —Computer graphics, image processing and environmental data representation— Extensible 3D (X3D) — Part 1: Architecture and base components.*

Background	Clauses		Annexes
Foreword	1 Scope	22 Environmental sensor component	A Core profile
Introduction	2 Normative references	23 Navigation component	B Interchange profile
	3 Definitions, acronyms, and abbreviations	24 Environmental effects component	C Interactive profile
	4 Concepts	25 Geospatial component	D MPEG-4 interactive profile
	5 Field type reference	26 Humanoid Animation (HAnim) component	E Immersive profile
	6 Conformance	27 NURBS component	F Full profile
	7 Core component	28 Distributed interactive simulation (DIS) component	G Recommended navigation behaviours
	8 Time component	29 Scripting component	H CADInterchange profile
	9 Networking component	30 Event utilities component	I OpenGL shading language (GLSL) binding
	10 Grouping component	31 Programmable shaders component	J Microsoft high level shading language (HLSL) binding
	11 Rendering component	32 CAD geometry component	K nVidia Cg shading language binding
	12 Shape component	33 Texturing3D component	L HTML authoring guidelines
	13 Geometry3D component	34 Cube map environmental texturing component	M MedicalInterchange profile
	14 Geometry2D component	35 Layering component	Z Version content
	15 Text component	36 Layout component	Bibliography
	16 Sound component	37 Rigid body physics component	Component index
	17 Lighting component	38 Picking component	Profile index
	18 Texturing component	39 Followers component	Node, abstract node type, and abstract interface index
	19 Interpolation component	40 Particle systems component	
	20 Pointing device sensor component	41 Volume rendering component	
	21 Key device sensor component	42 Texture projector component	

The Web3D Consortium is proud to offer free public access to the X3D4 Architecture Specification, now in Committee Draft (CD).

All major functional requirements are complete.

Editorial refinements continue throughout the ISO/IEC balloting and comment process.

Castle Game Engine *view3dscene*

- Free cross-platform VRML/X3D browser that also supports other 3D model formats (FreeBSD, Linux, MacOS, Windows)
- Best glTF support and conversion, paper in Web3D 2021 Conference
- https://castle-engine.io/view3dscene.php and video

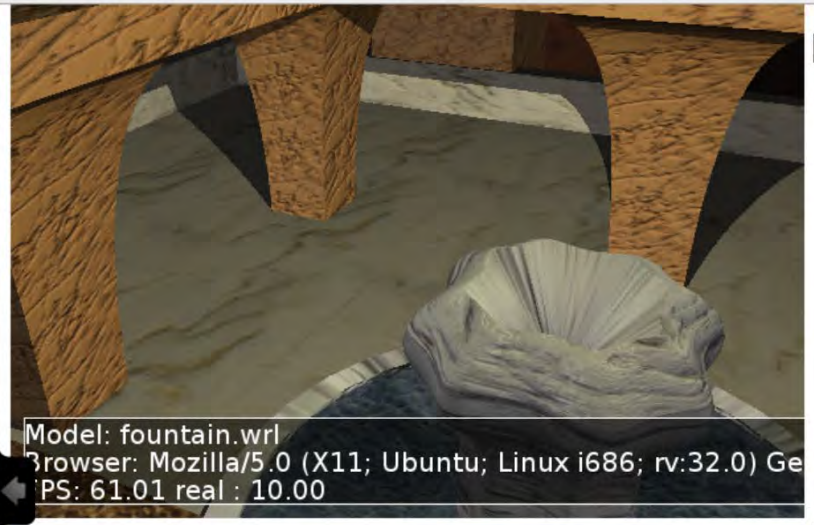
Alien Outpost - Mozilla Firefox

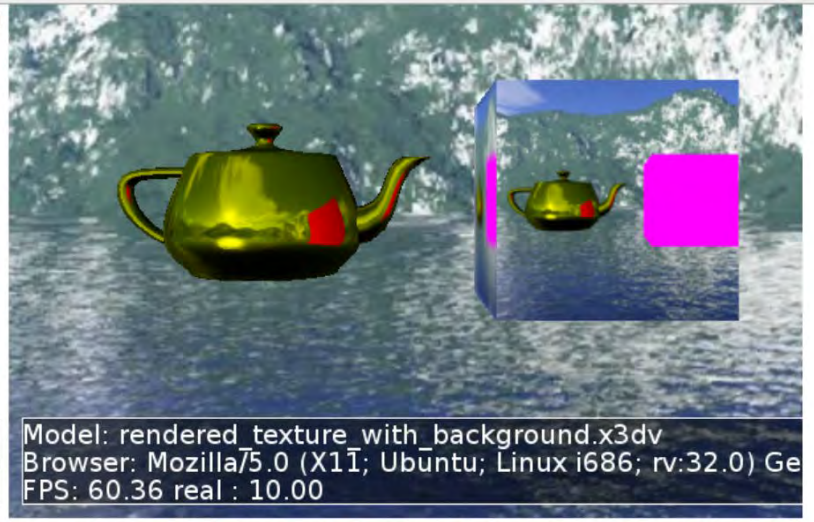
File Edit View History Bookmarks Tools Help

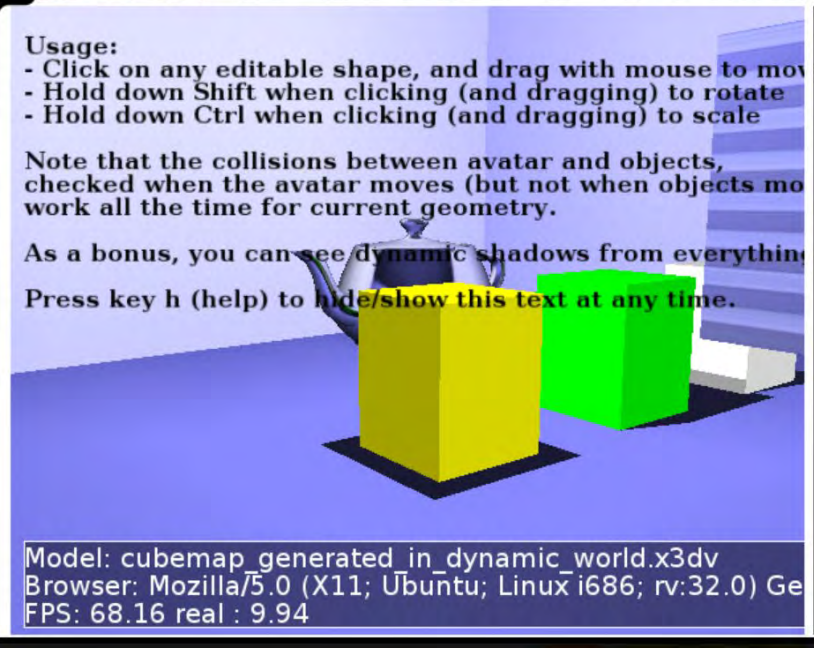
Alien Outpost

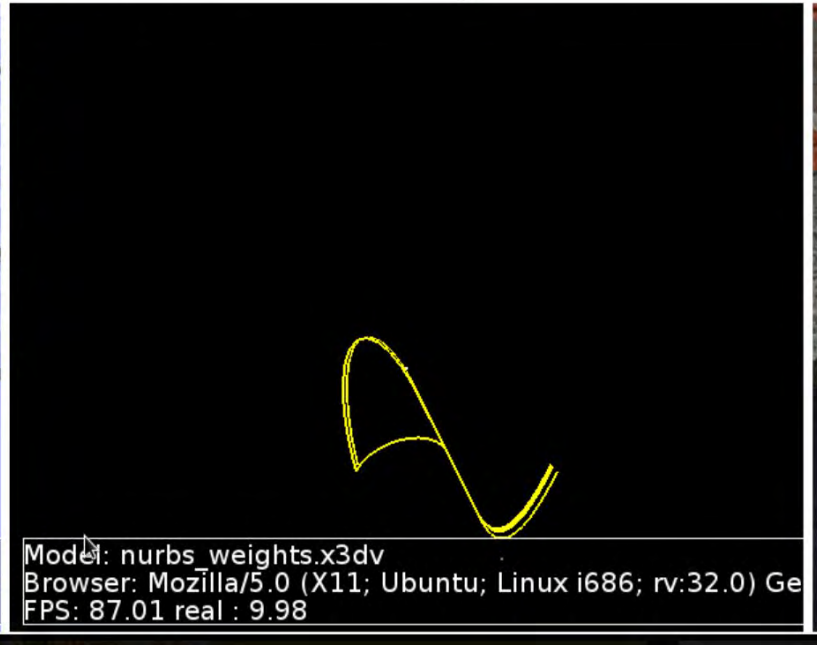
127.0.0.1/~michalis/plugin_test/

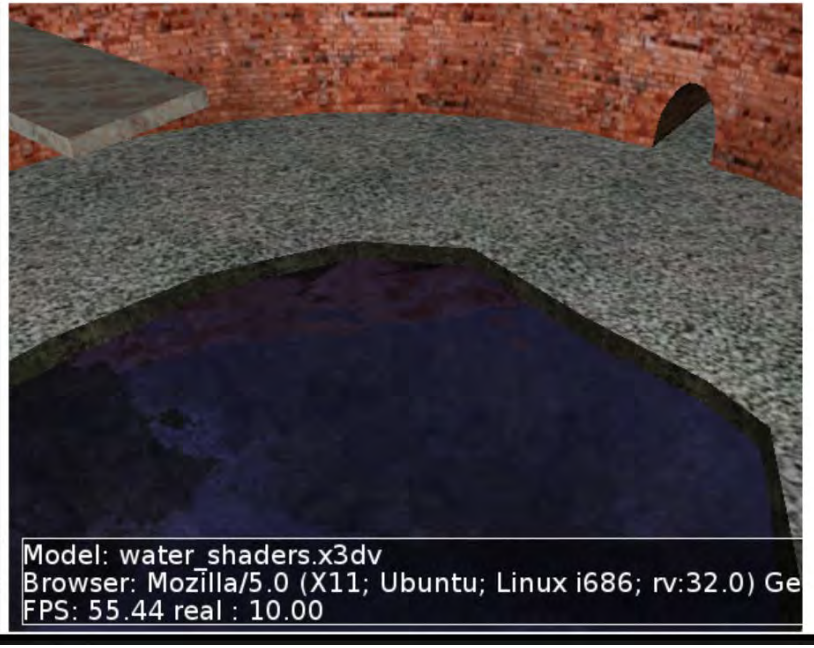
Google





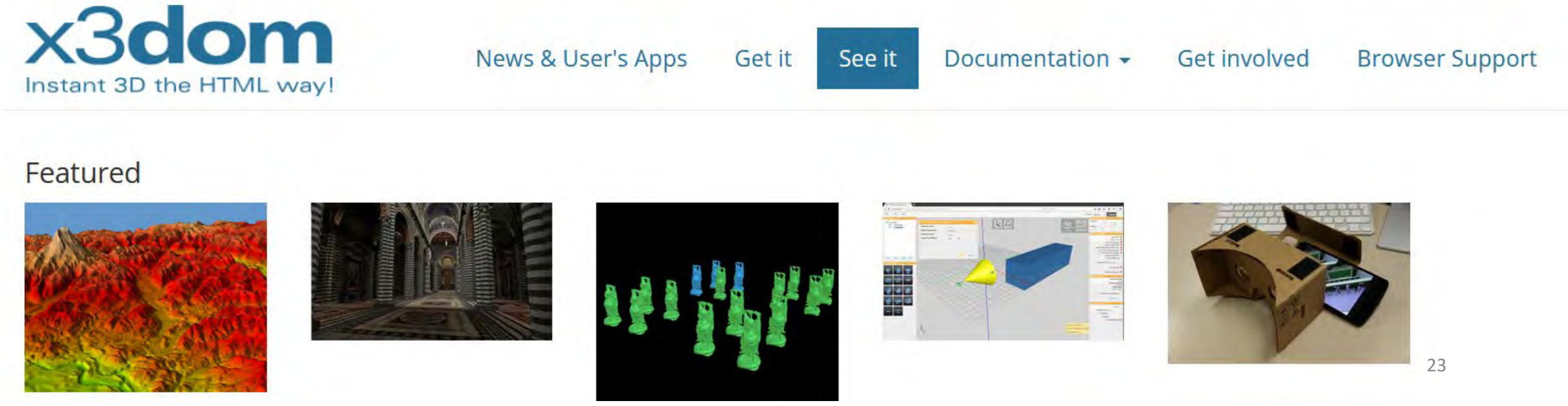






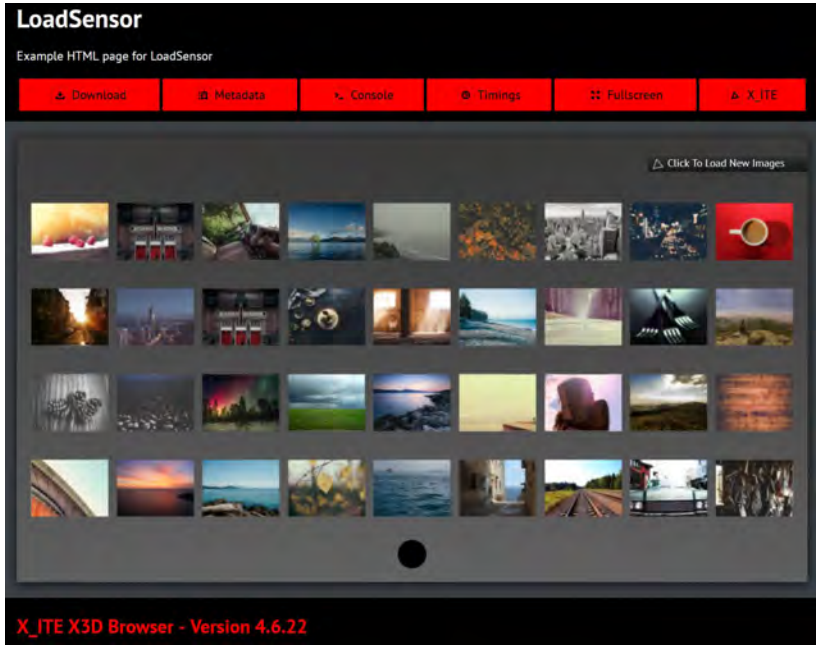
X3DOM for X3D in HTML

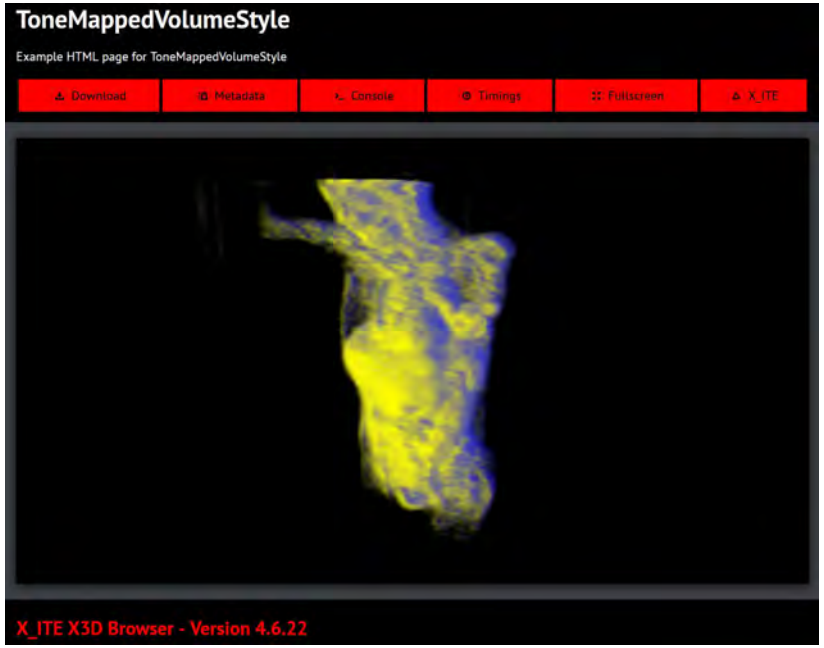
- High-performance X3D player in open-source JavaScript. Authors can publish X3D source within an HTML5 page that works in modern Web browsers without prior plugin installation.
- https://www.x3dom.org



X_ITE for X3D in HTML

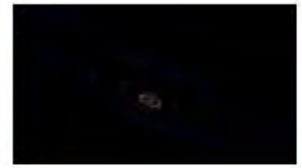
- X_ITE is a full standard X3D JavaScript WebGL Browser for all major web browsers and operating systems. Open source.
- All X3D Examples include X_ITE presentation, linked and as default inset.
- https://github.com/create3000/x_ite and Web3D tweet

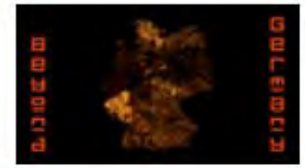


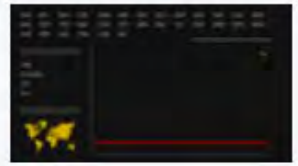


X3D Examples

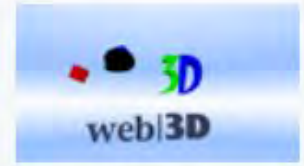




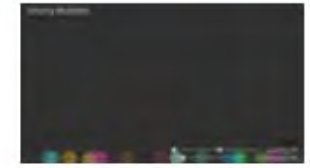











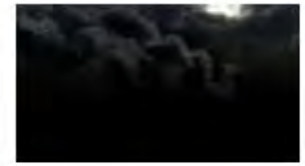







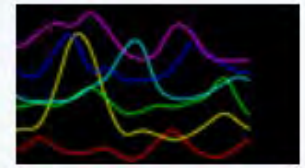
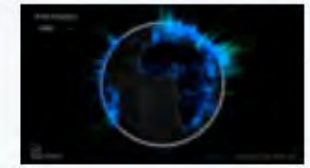




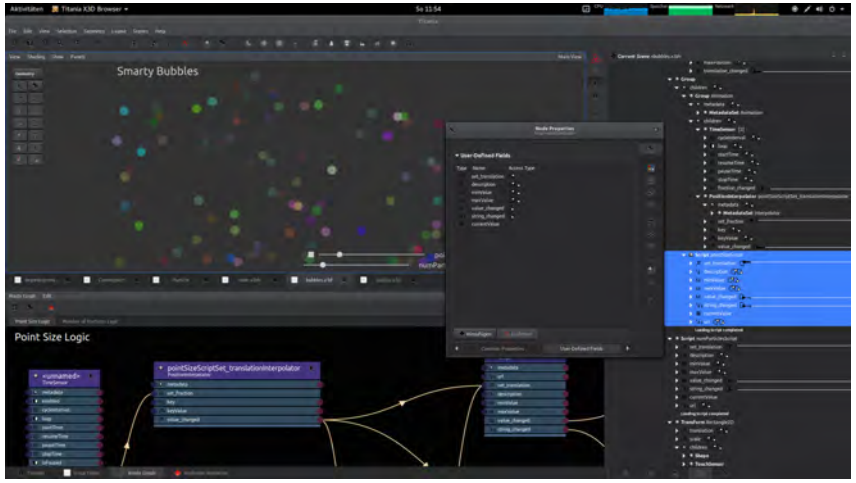


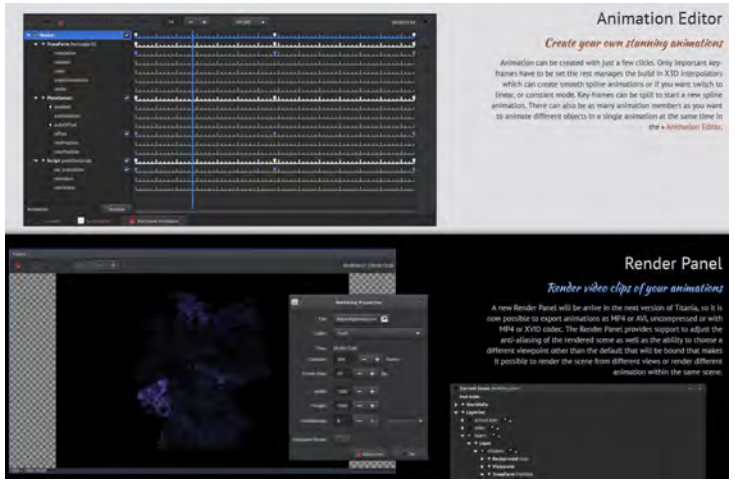


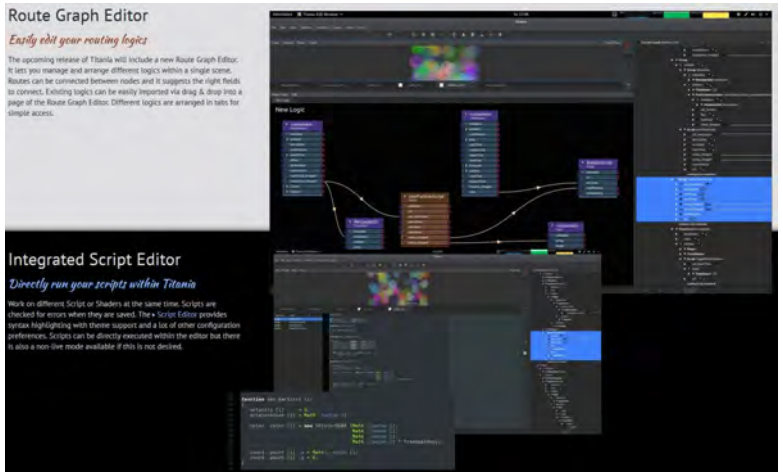



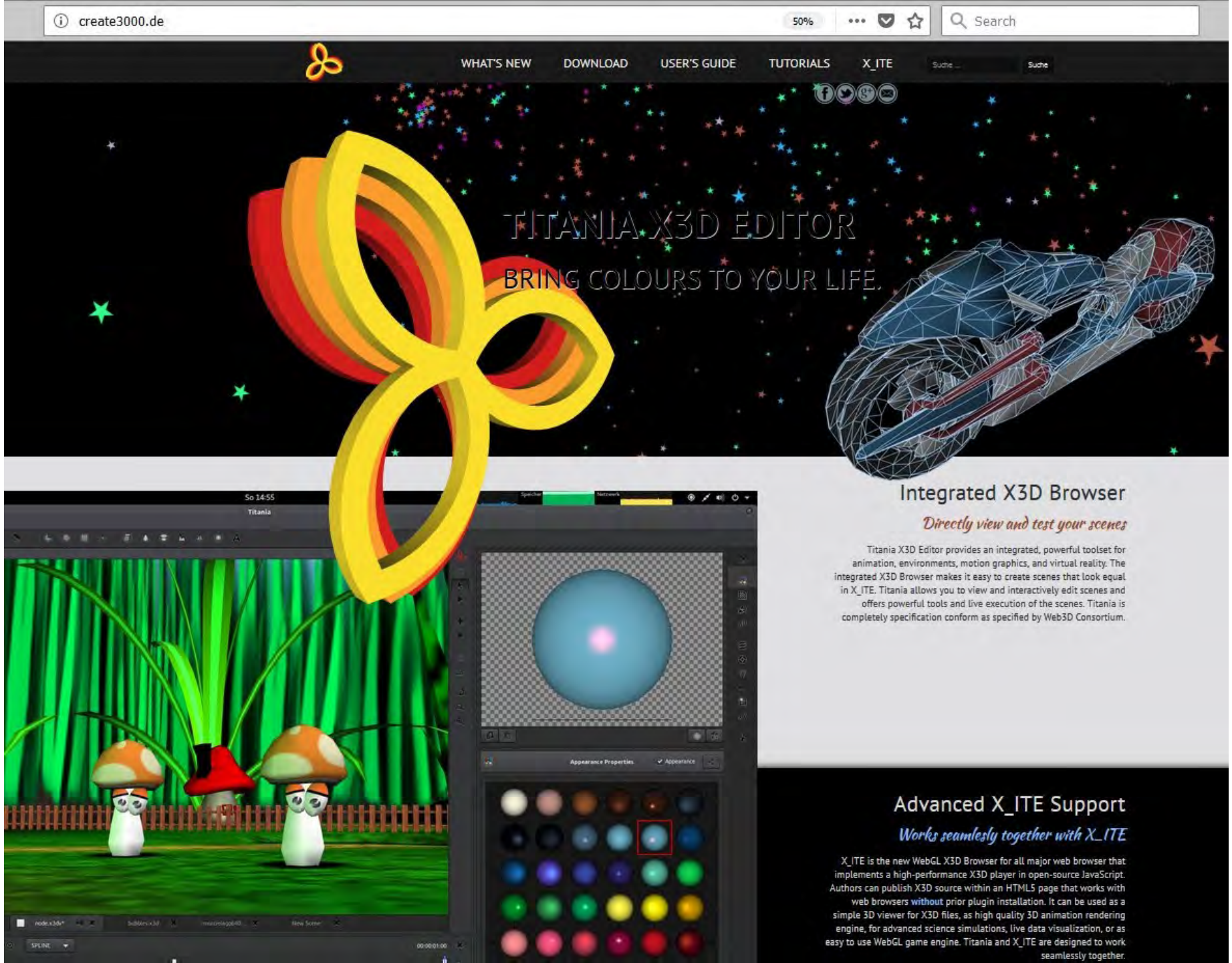
Titania X3D Authoring Tool

- Titania has everything you need to create dynamic web graphics quickly and easily. (Linux only)
- Great support for animations, interpolator timing, ROUTE connections
- https://github.com/create3000/titania/wiki
- https://twitter.com/web3dconsortium/status/943504674660925440





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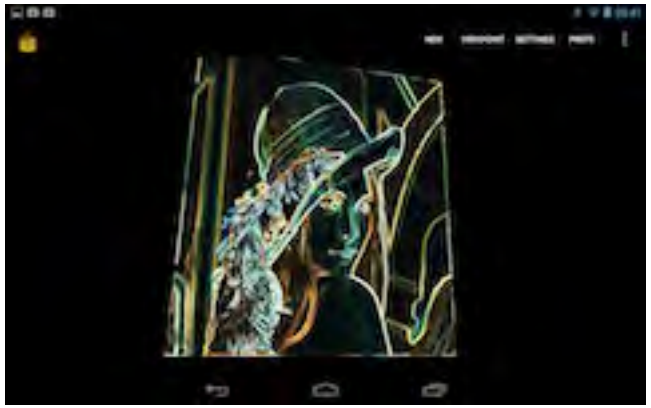
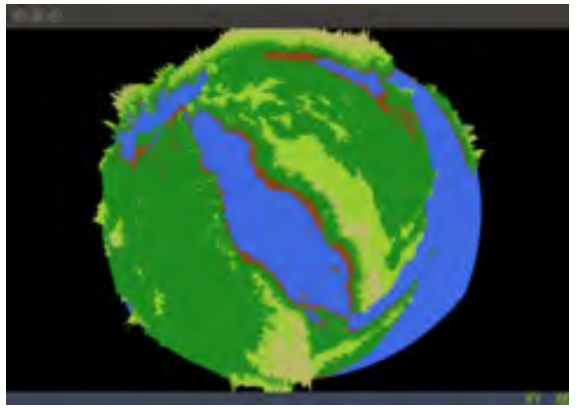
TUTORIALS
X_ITE
Suche
TITANIA X3D EDITOR
BRING COLOURS TO YOUR LIFE.
Integrated X3D Browser
Directly view and test your scenes
Titania X3D Editor provides an integrated, powerful toolset for animation, environments, motion graphics, and virtual reality. The integrated X3D Browser makes it easy to create scenes that look equal in X_ITE. Titania allows you to view and interactively edit scenes and offers powerful tools and live execution of the scenes. Titania is completely specification conform as specified by Web3D Consortium.
Advanced X_ITE Support
Works seamlesly together with X_ITE
X_ITE is the new WebGL X3D Browser for all major web browser that implements a high-performance X3D player in open-source JavaScript. Authors can publish X3D source within an HTML5 page that works with web browsers without prior plugin installation. It can be used as a simple 3D viewer for X3D files, as high quality 3D animation rendering engine, for advanced science simulations, live data visualization, or as easy to use WebGL game engine. Titania and X_ITE are designed to work seamlessly together.

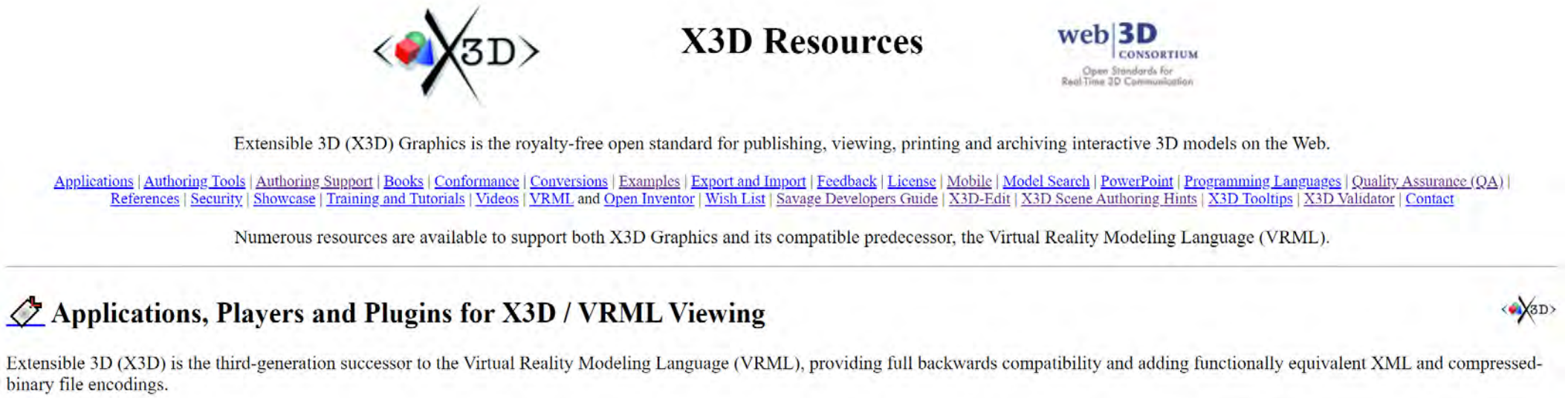
freeWRL

- FreeWRL is an X3D/VRML open source viewer for Windows, Linux, OSX and Android. FreeWRL has had a long track record, is here to stay. X3D Components get added, problems get resolved.
- http://freewrl.sourceforge.net


X3D Resources

- Extensible 3D (X3D) Graphics is the royalty-free open standard for publishing, viewing, printing and archiving interactive 3D models on the Web.
- https://www.web3d.org/x3d/content/examples/X3dResources.html



X3D Resources

web3D CONSORTIUM
Open Standards for Real-Time 3D Communication

Extensible 3D (X3D) Graphics is the royalty-free open standard for publishing, viewing, printing and archiving interactive 3D models on the Web.

Applications | Authoring Tools | Authoring Support | Books | Conformance | Conversions | Examples | Export and Import | Feedback | License | Mobile | Model Search | PowerPoint | Programming Languages | Quality Assurance (QA) | References | Security | Showcase | Training and Tutorials | Videos | VRML and Open Inventor | Wish List | Savage Developers Guide | X3D-Edit | X3D Scene Authoring Hints | X3D Tooltips | X3D Validator | Contact

Numerous resources are available to support both X3D Graphics and its compatible predecessor, the Virtual Reality Modeling Language (VRML).

Applications, Players and Plugins for X3D / VRML Viewing

Extensible 3D (X3D) is the third-generation successor to the Virtual Reality Modeling Language (VRML), providing full backwards compatibility and adding functionally equivalent XML and compressed-binary file encodings.

X3D Scene Authoring Hints

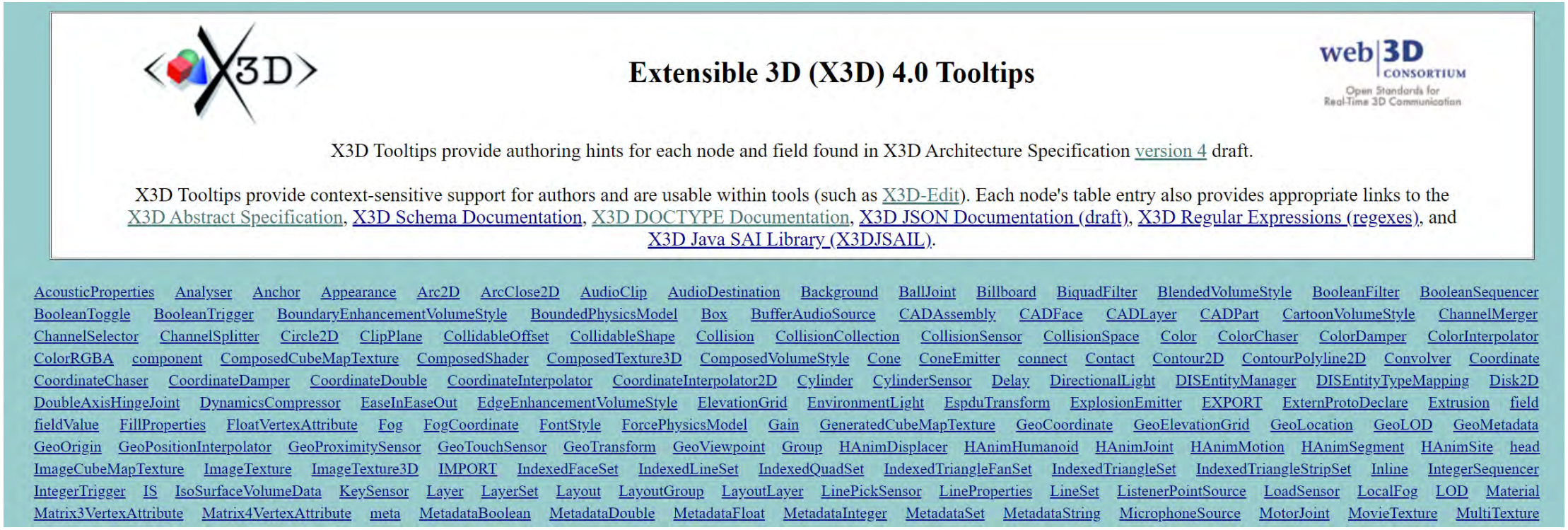
- These hints provide a collection of style guidelines, authoring tips and best practices to improve the quality, consistency and maintainability of Extensible 3D (X3D) Graphics models.
- https://www.web3d.org/x3d/content/examples/X3dSceneAuthoringHints.html

These hints provide a collection of style guidelines, authoring tips and best practices to improve the quality, consistency and maintainability of Extensible 3D (X3D) Graphics models.

Audio | Authoring | Color | containerField | Coordinate Systems, Rotations | CORS | Credits | Dates | Encodings | HTML | Images and Videos | Inlines and Prototypes | License | Meshes | meta Statements and Metadata Nodes | Motion Capture (MOCAP) | Naming Conventions | Scale Factors and Unit Conversions | Scripts (Java, JavaScript, JSON) | Strings | SVG | URL Links | Validation | Viewpoints and Navigation | Volumes | VRML | Savage Developers Guide | X3D-Edit | X3D for Web Authors | X3D Resources | X3D Tooltips | X3D Validator | Contact

X3D Tooltips

- X3D Tooltips provide authoring hints for each node and field found in X3D Architecture Specification version 4 draft.
- https://www.web3d.org/x3d/tooltips/X3dTooltips.html



Extensible 3D (X3D) 4.0 Tooltips

X3D Tooltips provide authoring hints for each node and field found in X3D Architecture Specification version 4 draft.

X3D Tooltips provide context-sensitive support for authors and are usable within tools (such as X3D-Edit). Each node's table entry also provides appropriate links to the X3D Abstract Specification, X3D Schema Documentation, X3D DOCTYPE Documentation, X3D JSON Documentation (draft), X3D Regular Expressions (regexes), and X3D Java SAI Library (X3DJSAIL).

AcousticProperties Analyser Anchor Appearance Arc2D ArcClose2D AudioClip AudioDestination Background BallJoint Billboard BiquadFilter BlendedVolumeStyle BooleanFilter BooleanSequencer BooleanToggle BooleanTrigger BoundaryEnhancementVolumeStyle BoundedPhysicsModel Box BufferAudioSource CADAssembly CADFace CADLayer CADPart CartoonVolumeStyle ChannelMerger ChannelSelector ChannelSplitter Circle2D ClipPlane CollidableOffset CollidableShape Collision CollisionCollection CollisionSensor CollisionSpace Color ColorChaser ColorDamper ColorInterpolator ColorRGBA component ComposedCubeMapTexture ComposedShader ComposedTexture3D ComposedVolumeStyle Cone ConeEmitter connect Contact Contour2D ContourPolyline2D Convolver Coordinate CoordinateChaser CoordinateDamper CoordinateDouble CoordinateInterpolator CoordinateInterpolator2D Cylinder CylinderSensor Delay DirectionalLight DISEntityManager DISEntityTypeMapping Disk2D DoubleAxisHingeJoint DynamicsCompressor EaseInEaseOut EdgeEnhancementVolumeStyle ElevationGrid EnvironmentLight EspduTransform ExplosionEmitter EXPORT ExternProtoDeclare Extrusion field fieldValue FillProperties FloatVertexAttribute Fog FogCoordinate FontStyle ForcePhysicsModel Gain GeneratedCubeMapTexture GeoCoordinate GeoElevationGrid GeoLocation GeoLOD GeoMetadata GeoOrigin GeoPositionInterpolator GeoProximitySensor GeoTouchSensor GeoTransform GeoViewpoint Group HAnimDisplacer HAnimHumanoid HAnimJoint HAnimMotion HAnimSegment HAnimSite head ImageCubeMapTexture ImageTexture ImageTexture3D IMPORT IndexedFaceSet IndexedLineSet IndexedQuadSet IndexedTriangleFanSet IndexedTriangleSet IndexedTriangleStripSet Inline IntegerSequencer IntegerTrigger IS IsoSurfaceVolumeData KeySensor Layer LayerSet Layout LayoutGroup LayoutLayer LinePickSensor LineProperties LineSet ListenerPointSource LoadSensor LocalFog LOD Material Matrix3VertexAttribute Matrix4VertexAttribute meta MetadataBoolean MetadataDouble MetadataFloat MetadataInteger MetadataSet MetadataString MicrophoneSource MotorJoint MovieTexture MultiTexture

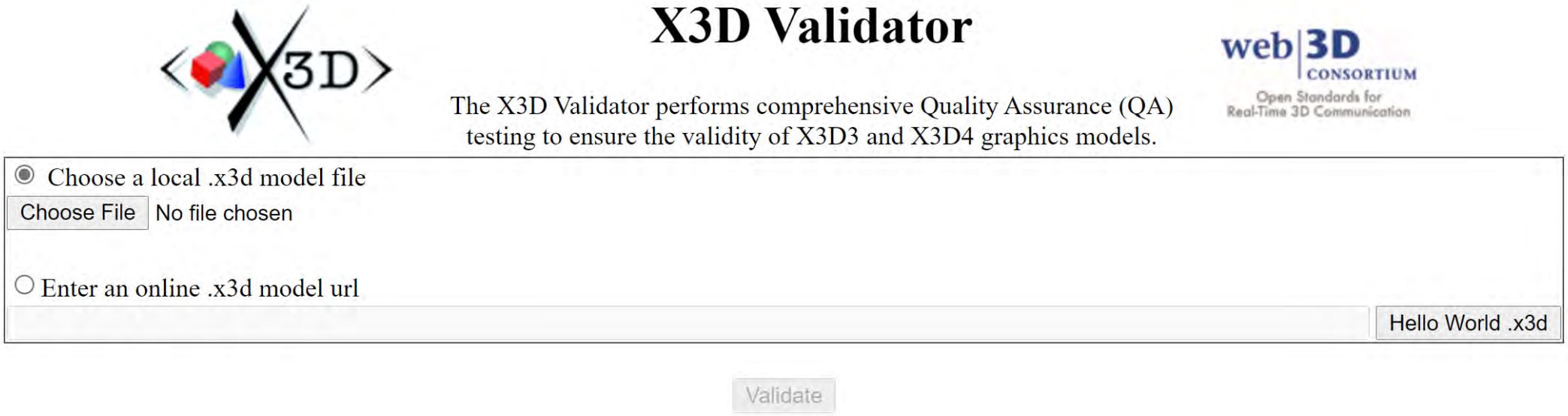
Conversions, Translation Tools, Import/Export

- Extensible 3D (X3D) Graphics is the royalty-free open standard for publishing, viewing, printing and archiving interactive 3D models on the Web.
- Numerous conversion tools are available for various encodings of X3D and VRML.
- Many 3D modeling systems include X3D and VRML import/export as well.
- https://www.web3d.org/x3d/content/examples/X3dResources.html#Conversions
- https://www.web3d.org/x3d/content/examples/X3dResources.html#Export

- Blender https://www.blender.org
- CADExchanger https://cadexchanger.com
- MeshLab https://www.meshlab.net

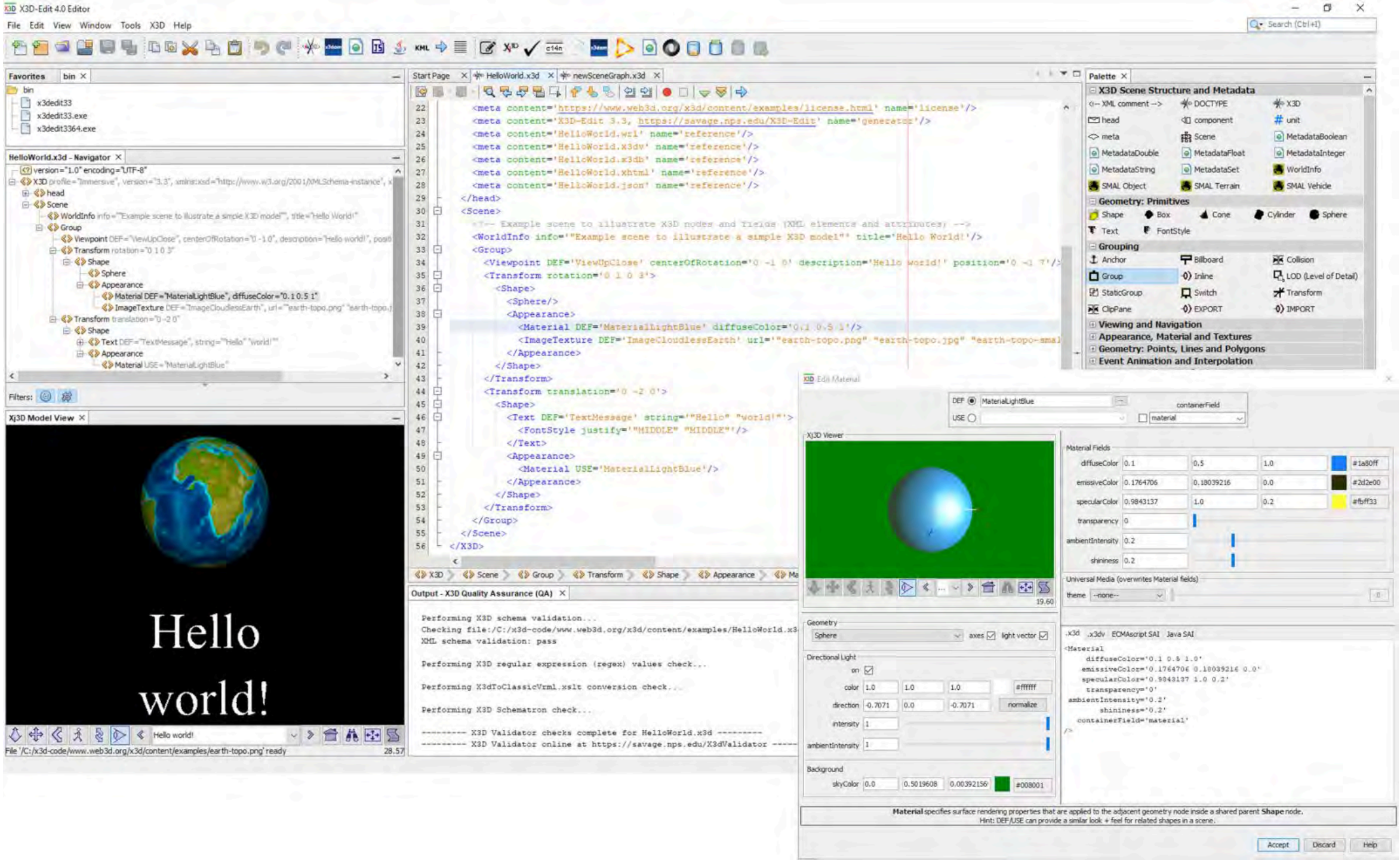
X3D Validator

- The X3D Validator performs comprehensive Quality Assurance (QA) testing to ensure the validity of X3D3 and X3D4 graphics models.
- https://savage.nps.edu/X3dValidator



X3D-Edit 4.0 Authoring Tool for X3D Graphics

- X3D-Edit is a free, open-source Extensible 3D (X3D) Graphics authoring tool for simple high-quality authoring, editing, import/export, validation and viewing of X3D scenes.
- https://savage.nps.edu/X3D-Edit


X3D-Edit 4.0 Editor
File Edit View Window Tools X3D Help
Search (Ctrl+I)
Favorites
bin
x3dedit33
x3dedit33.exe
x3dedit3364.exe
HelloWorld.x3d - Navigator
Start Page
HelloWorld.x3d
newSceneGraph.x3d
<meta content='https://www.web3d.org/x3d/content/examples/license.html' name='license'/>
<meta content='X3D-Edit 3.3, https://savage.nps.edu/X3D-Edit' name='generator'/>
<meta content='HelloWorld.wrl' name='reference'/>
<meta content='HelloWorld.x3dv' name='reference'/>
<meta content='HelloWorld.x3db' name='reference'/>
<meta content='HelloWorld.xhtml' name='reference'/>
<meta content='HelloWorld.json' name='reference'/>
</head>
<Scene>
<WorldInfo info='"Example scene to illustrate a simple X3D model"' title='Hello World!'/>
<Group>
<Viewpoint DEF='ViewUpClose' centerOfRotation='0 -1 0' description='Hello world!' position='0 -1 7'/>
<Transform rotation='0 1 0 3'>
<Shape>
<Sphere/>
<Appearance>
<Material DEF='MaterialLightBlue' diffuseColor='0.1 0.5 1'/>
<ImageTexture DEF='ImageCloudlessEarth' url='"earth-topo.png" "earth-topo.jpg" "earth-topo-small
</Appearance>
</Shape>
</Transform>
<Transform translation='0 -2 0'>
<Shape>
<Text DEF='TextMessage' string='"Hello" "world!"'>
<FontStyle justify='"MIDDLE" "MIDDLE"'/>
</Text>
<Appearance>
<Material USE='MaterialLightBlue'/>
</Appearance>
</Shape>
</Transform>
</Group>
</Scene>
</X3D>
Palette
X3D Scene Structure and Metadata
Geometry: Primitives
Grouping
Viewing and Navigation
Appearance, Material and Textures
Geometry: Points, Lines and Polygons
Event Animation and Interpolation
Xj3D Model View
Hello
world!
Output - X3D Quality Assurance (QA)
Performing X3D schema validation...
XML schema validation: pass
Performing X3D regular expression (regex) values check...
Performing X3dToClassicVrml.xslt conversion check...
Performing X3D Schematron check...
--------- X3D Validator checks complete for HelloWorld.x3d ---------
--------- X3D Validator online at https://savage.nps.edu/X3dValidator ---------
Edit Material
DEF MaterialLightBlue
USE
containerField
material
X3D Viewer
Material Fields
diffuseColor 0.1 0.5 1.0 #1a80ff
emissiveColor 0.1764706 0.18039216 0.0 #2d2e00
specularColor 0.9843137 1.0 0.2 #fbff33
transparency 0
ambientIntensity 0.2
shininess 0.2
Universal Media (overwrites Material fields)
theme --none--
Geometry
Sphere
axes
light vector
Directional Light
on
color 1.0 1.0 1.0 #ffffff
direction -0.7071 0.0 -0.7071 normalize
intensity 1
ambientIntensity 1
Background
skyColor 0.0 0.5019608 0.00392156 #008001
.x3d .x3dv ECMAscript SAI Java SAI
<Material
diffuseColor='0.1 0.5 1.0'
emissiveColor='0.1764706 0.18039216 0.0'
specularColor='0.9843137 1.0 0.2'
transparency='0'
ambientIntensity='0.2'
shininess='0.2'
containerField='material'
/>
Material specifies surface rendering properties that are applied to the adjacent geometry node inside a shared parent Shape node.
Hint: DEF/USE can provide a similar look + feel for related shapes in a scene.
Accept
Discard
Help

X3D for Web Authors

- Building and interacting with 3D graphics is a "hands on" experience. Throughout this book there are lots of examples to study and modify. Practice helps you learn how X3D works, and assists you in building your own projects. 1200 slides, 3 dozen videos, 268 X3D models.
- The book presents the essential ideas needed to understand how an X3D world is constructed. Book chapters build upon each other, progressing from simple ideas to sophisticated concepts.
- *X3D: Extensible 3D Graphics for Web Authors* assumes that you are interested in learning more about 3D graphics. Some experience with other Web technologies (such as HTML or XML) is helpful. No prior programming experience is needed.
- https://x3dgraphics.com

X3D Examples Archives

- The X3D Examples Archives demonstrate how X3D nodes and scenes work. Thousands of scenes are provided in all X3D encodings. You can browse them individually online or download fully complete, separately installable .zip archives. Links to thousands of X3D example scenes are provided.
- https://www.web3d.org/x3d/content/examples/X3dResources.html#Examples

Quick Links	X3D for Web Authors	X3D for Advanced Modeling	Basic	Conformance Nist	Humanoid Animation (HAnim)	VRML 2 Sourcebook	Savage	SavageDefense
Overview, references:	README	README	README	README	README	README	README	README
Archive examples:	Online	Online	Online	Online	Online	Online	Online	Online
Local links (if present):	Local	Local	Local	Local	Local	Local	Local	Local
Java conversions:	Javadoc	Javadoc	Javadoc	Javadoc	Javadoc	Javadoc	Javadoc	Javadoc
3954 total X3D scenes:	267	118	737	761	79	416	1250	405
Catalog metadata XML:	Content catalog	Content catalog	Content catalog	Content catalog	Content catalog	Content catalog	Content catalog	Content catalog
Ant build scripts:	build.xml	build.xml	build.xml	build.xml	build.xml	build.xml	build.xml	build.xml
Quality Assurance (QA) regression testing:	build.log.txt (history)	build.log.txt (history)	build.log.txt (history)	build.log.txt (history)	build.log.txt (history)	build.log.txt (history)	build.log.txt (history)	build.log.txt (history)
Full download:	zip (MD5 checksum)	.zip (MD5 checksum)	.zip (MD5 checksum)	.zip (MD5 checksum)	.zip (MD5 checksum)	.zip (MD5 checksum)	.zip (MD5 checksum)	.zip (MD5 checksum)

X3DJSAIL, X3D Java Scene Access Interface Library

- X3D Java Scene Access Interface Library (X3DJSAIL) supports programmers with standards-based X3D Java interfaces and objects, all as open source.
- http://www.web3d.org/specifications/java/X3DJSAIL.html

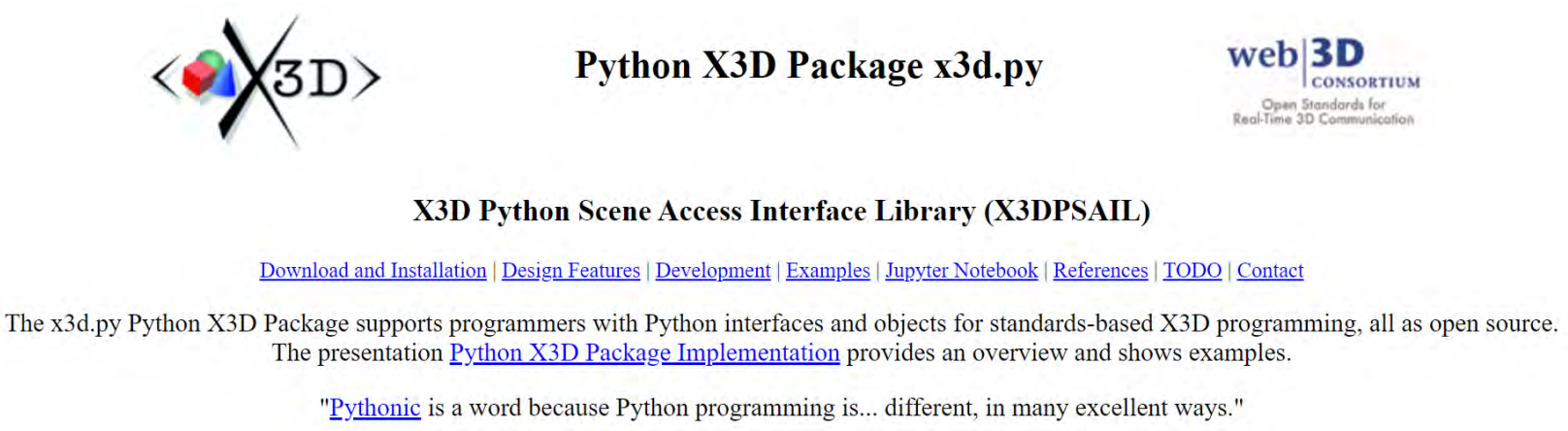
X3D Java Scene Access Interface Library (X3DJSAIL)

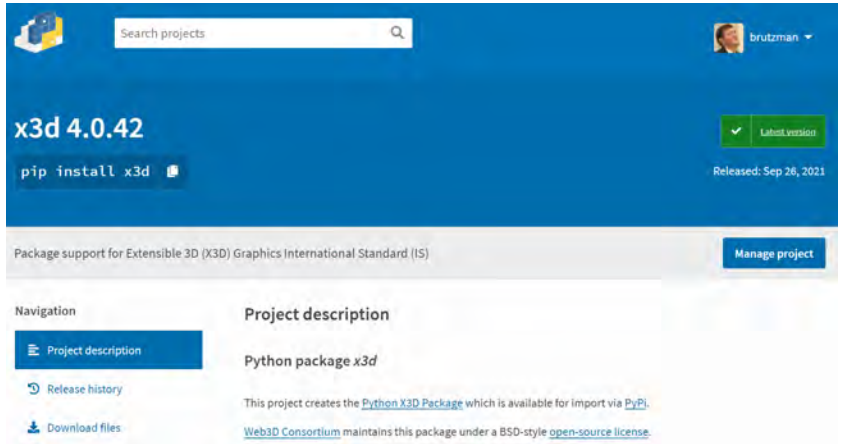
X3D Java Scene Access Interface Library (X3DJSAIL) supports programmers with standards-based X3D Java interfaces and objects, all as open source.

Abstract | Codebase | CLASSPATH and Command Line | Configuration Properties | Conversions including Blender, MeshLab | Design Features | Downloads | Examples | EXI | Javadoc | License | Other Implementations | README | References | Specification Changes | TODO | Utility Methods | Contact

X3DPSAIL, Python Package *x3d.py*

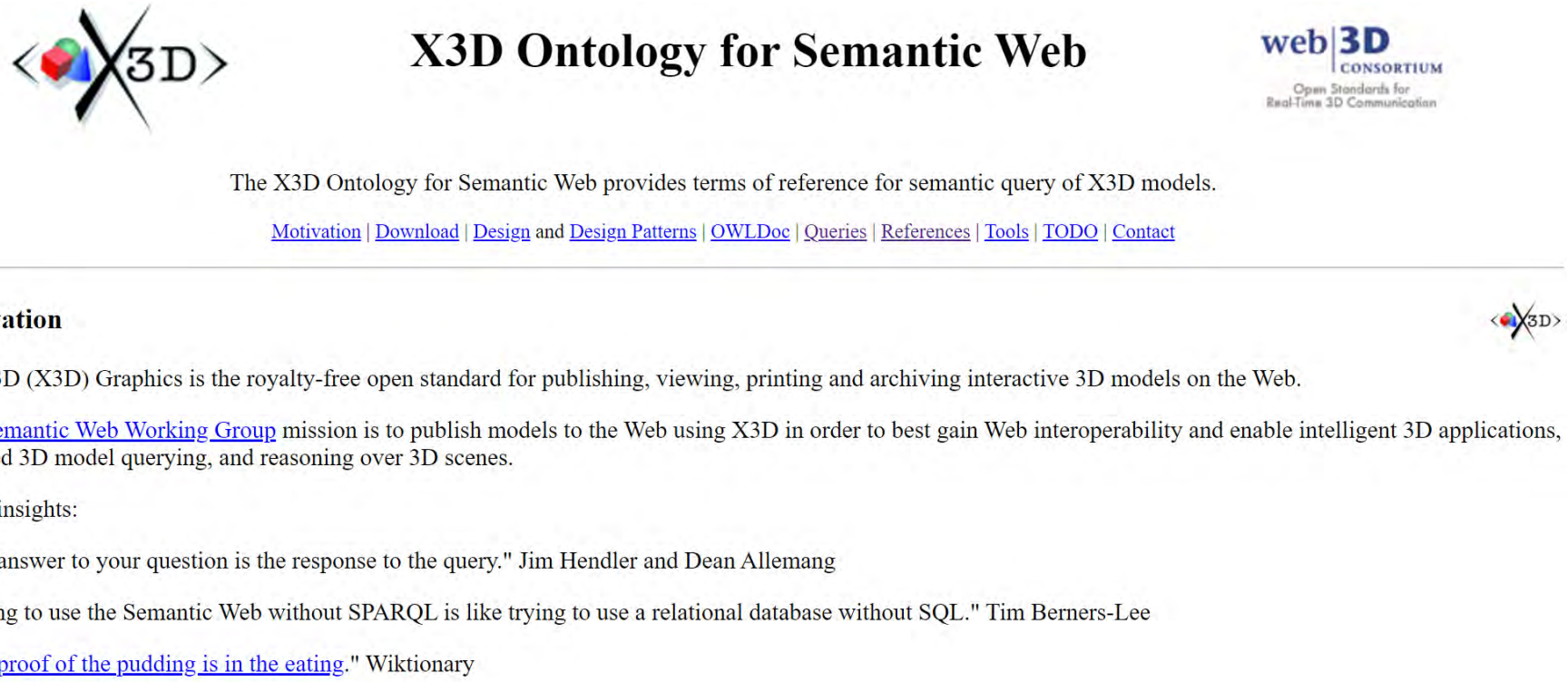
- The x3d.py Python X3D Package supports programmers with Python interfaces and objects for standards-based X3D programming, all as open source.
- https://www.web3d.org/x3d/stylesheets/python/python.html and https://pypi.org/project/x3d





X3D Ontology for Semantic Web

- The X3D Ontology for Semantic Web provides terms of reference for semantic query of X3D models.
- https://www.web3d.org/x3d/content/semantics



X3D Ontology for Semantic Web

web3D CONSORTIUM
Open Standards for Real-Time 3D Communication

The X3D Ontology for Semantic Web provides terms of reference for semantic query of X3D models.

Motivation | Download | Design and Design Patterns | OWLDoc | Queries | References | Tools | TODO | Contact

Motivation

Extensible 3D (X3D) Graphics is the royalty-free open standard for publishing, viewing, printing and archiving interactive 3D models on the Web.

The X3D Semantic Web Working Group mission is to publish models to the Web using X3D in order to best gain Web interoperability and enable intelligent 3D applications, feature-based 3D model querying, and reasoning over 3D scenes.

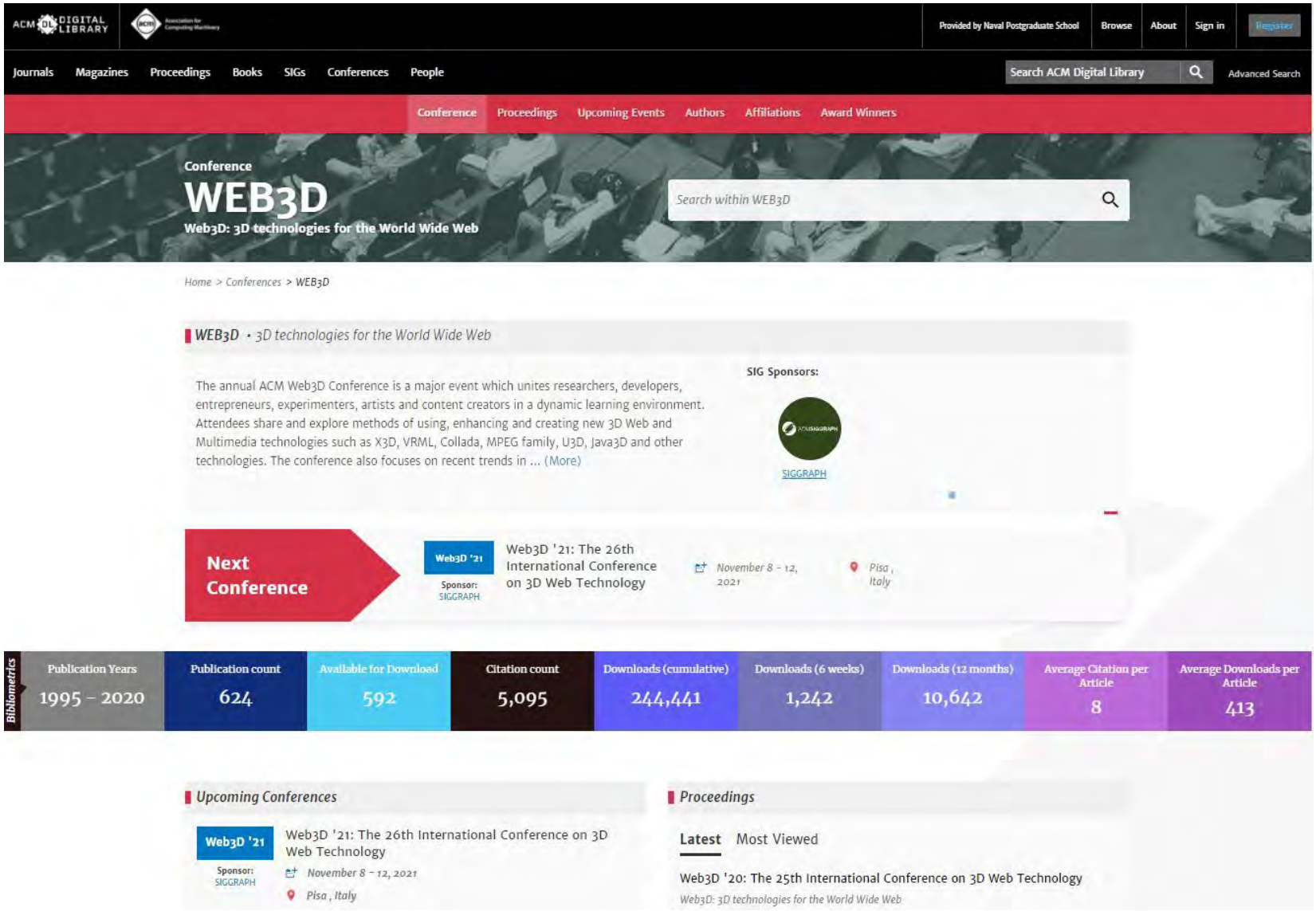
Motivating insights:

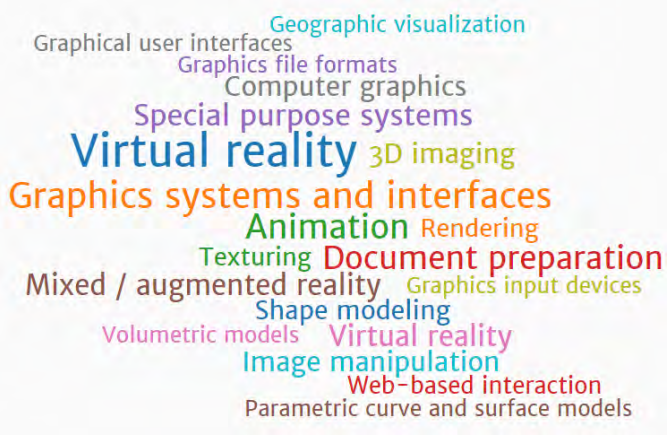
"The answer to your question is the response to the query." Jim Hendler and Dean Allemang

"Trying to use the Semantic Web without SPARQL is like trying to use a relational database without SQL." Tim Berners-Lee

"The proof of the pudding is in the eating." Wiktionary

ACM Digital Library Web3D Conference

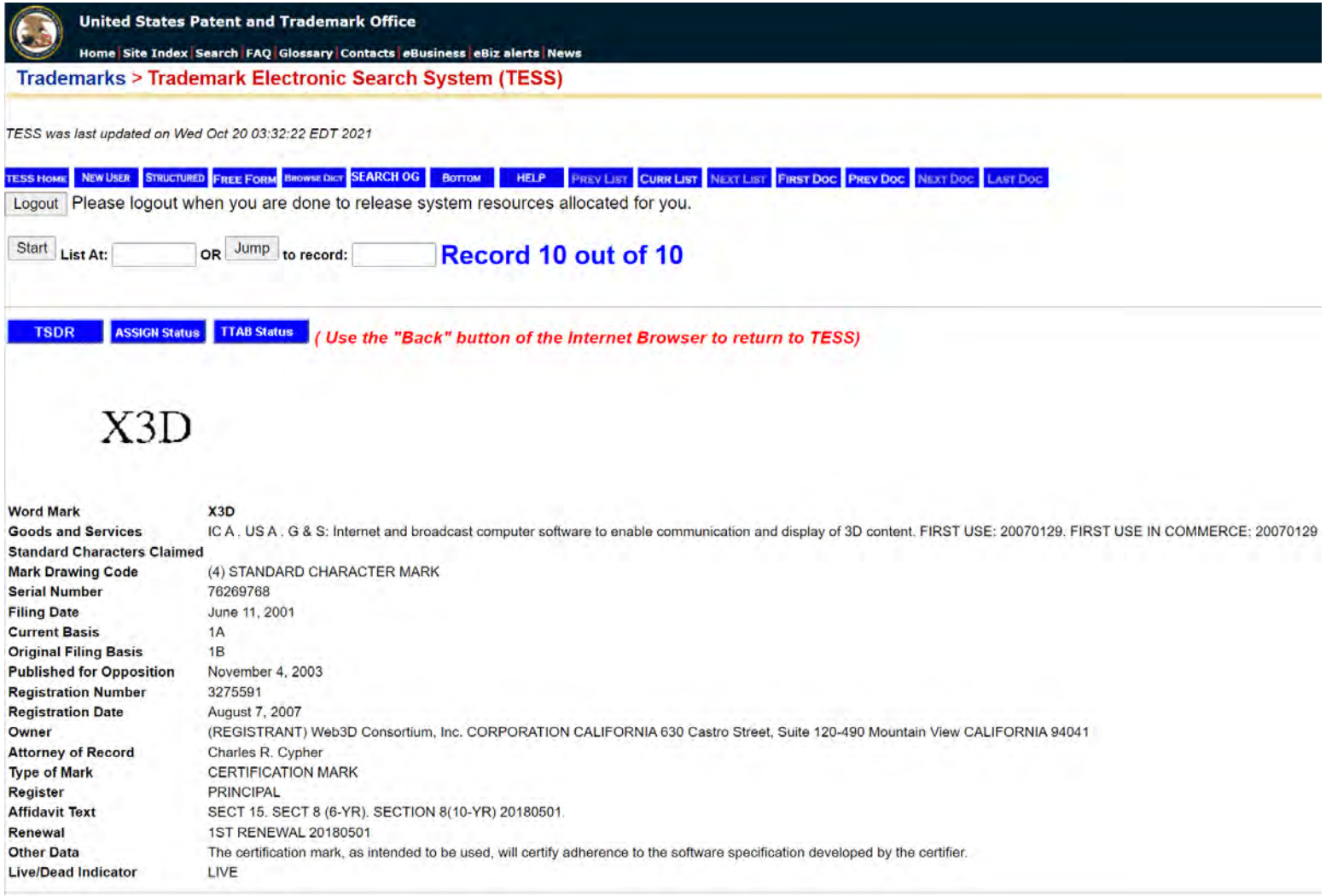




- ACMDL Web3D conference site
- @Web3D2021
- @ACMDL
- recent tweet

X3D® Registered Trademark

https://tmsearch.uspto.gov/bin/showfield?f=doc&state=4801:5y2iyq.3.10



United States Patent and Trademark Office

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Trademarks > Trademark Electronic Search System (TESS)

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TESS Home | New User | Structured | Free Form | Browse Dict | Search OG | Bottom | Help | Prev List | Curr List | Next List | First Doc | Prev Doc | Next Doc | Last Doc

Logout Please logout when you are done to release system resources allocated for you.

Start List At: OR Jump to record: **Record 10 out of 10**

TSDR | ASSIGN Status | TTAB Status *(Use the "Back" button of the Internet Browser to return to TESS)*

X3D

Word Mark	X3D
Goods and Services	IC A . US A . G & S: Internet and broadcast computer software to enable communication and display of 3D content. FIRST USE: 20070129. FIRST USE IN COMMERCE: 20070129
Standard Characters Claimed	
Mark Drawing Code	(4) STANDARD CHARACTER MARK
Serial Number	76269768
Filing Date	June 11, 2001
Current Basis	1A
Original Filing Basis	1B
Published for Opposition	November 4, 2003
Registration Number	3275591
Registration Date	August 7, 2007
Owner	(REGISTRANT) Web3D Consortium, Inc. CORPORATION CALIFORNIA 630 Castro Street, Suite 120-490 Mountain View CALIFORNIA 94041
Attorney of Record	Charles R. Cypher
Type of Mark	CERTIFICATION MARK
Register	PRINCIPAL
Affidavit Text	SECT 15. SECT 8 (6-YR). SECTION 8(10-YR) 20180501.
Renewal	1ST RENEWAL 20180501
Other Data	The certification mark, as intended to be used, will certify adherence to the software specification developed by the certifier.
Live/Dead Indicator	LIVE

Eye candy: USNA Annapolis Maryland

- Work by Versar and Virginia Tech composing many 3D models
- README, video and Web3D tweet for SIGGRAPH 2021

Acknowledgements

Collaboration with ISO/IEC SC24 participants and organizations continues to be very helpful in all WeB3D Consortium activities.

We gratefully thank technical contributors including Myeong Won Lee, Kwan Hee Yoo, Michalis Kamburelis, Efi Lakka, Athanasios Malamos, Christophe Mouton, Vince Marchetti, Nicholas Polys, and all others who have helped improve the X3D and HAnim International Standards.

We gratefully applaud everyone publishing 3D graphics on the Web. Have fun with X3D! ☺ ☺

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