

Web3D Consortium Report on X3D4 Specification Status

ISO IEC/JTC 1/SC 24 Annual Meeting

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Web3D Consortium Relationships

Web3D Consortium is a non-profit Standards Development Organization (SDO) holding a Class A liaison relationship with ISO 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 SC24 working groups, WG6 is primary. Other working groups and standardization groups hold related interest.

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

X3D4 Activity

- **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

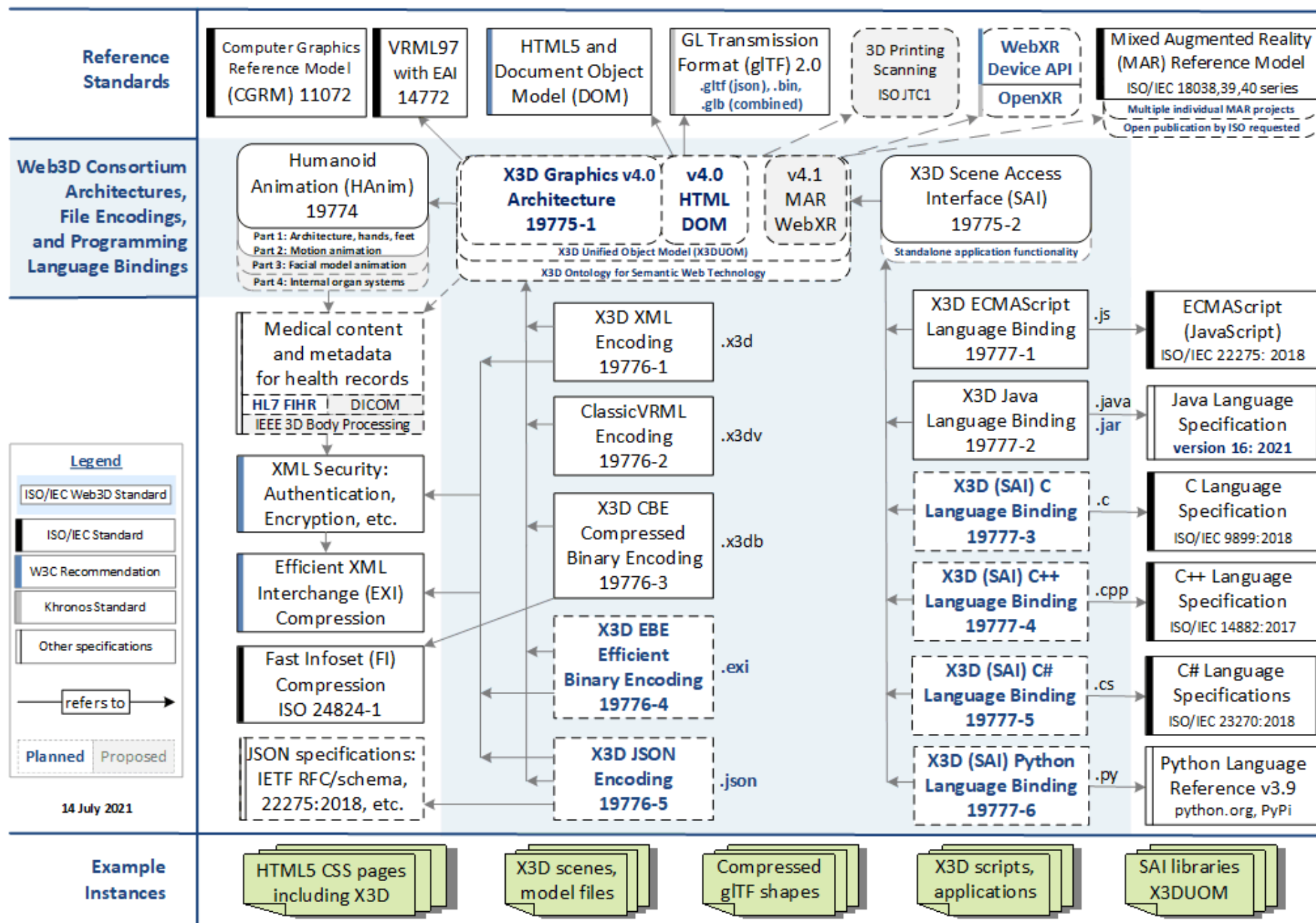
Current draft X3D4 specification:

- <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 load 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
- “Diff” testing under development for structured text, viewpoint images

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>
- Also keen 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 apply demonstrated patterns already used 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 will possibly get formalized as 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 Committee Draft (CD) 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 architecture and CD1 resubmitted
 - Then pursue programming language bindings and file encodings, 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. One month public discussion period – ready to implement/evaluate?
- D. Web3D member, Board of Directors approval of submission to SC24
- E. Submit CD 3.3 to ISO for ballot, next draft can advance to 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 approach 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 queriable 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, Web3D copyrights

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

Open issue: does ISO 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.

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