X3D Version 4 Working Draft

Online Release, Ready for Early Adoption!

Web3D Consortium Webinar

3-5 August 2020

Don Brutzman

X3D Working Group

Welcome Aboard!

- Web3D has published X3D4 working draft 2 for public review
- Full compatibility demonstrated for full X3D and VRML ecology
- Now is time for earlier adopters to improve codebases, test models
- We continue to implement and evaluate with excellent results
- Final version likely at Web3D 2020 Conference November 2020 when Web3D Consortium members decide on readiness for ISO ratification

- Your questions, comments and improvements are always welcome.
- Execution is a team sport – have fun with X3D4! ☺ ☺ ☺ ☺

X3D Highlights https://www.web3d.org/x3dv4-highlights

- Major: HTML5 integration allows X3D on any web page
- Major: multiple file formats and programming languages
- Major: glTF asset materials, lights, Physically Based Rendering (PBR)
- Major: integrate Web Audio API
- Major: no plugins required, multiple open-source implementations
- Major: backwards/forwards compatibility with X3D and VRML
- Numerous and growing set of converters, tools, models, support
- Active working groups and community steadily driving forward…
- Here we go!

X3D4 Highlights: Benefits and Opportunities

- Benefits of International Standard with ISO review
- 3D Printing, 3D Scanning, CAD models
- Humanoid Animation (HAnim) upgraded
- Partnerships with other Standards Development Organizations (SDOs) including ISO, W3C Khronos, Open Geospatial Consortium (OGC)
- Semantic Web and structured metadata for querying 3D models
- Influential enabler for emerging new work: Medical representations, cultural and natural heritage, Web3D User Experience (Web3DUX)
- Shared pool of knowledge, forums for tackling tough challenges

X3D Version 4 Strategy: Straight Ahead

2016-2020 Annual Milestones Follow

X3D® Version 4 is a major upgrade to the Extensible 3D (X3D) Graphics International Standard that aligns with the HTML5 Recommendation. This is major work in progress, expected to include several future versions. This effort is driven by the X3D Graphics Working Group with regular community outreach.

X3D is always evolving, and the Web3D Consortium Standards Strategy carefully guides all these improvements. X3D Version 4 enables authors to publish any interactive 3D content anywhere on the Web, without restrictions or plugins.

Next-generation evolution + revolution is combined with archival compatibility of existing legacy content.

- X3D Implementations Status and X3D Version 4.0 Development show specific details and planned evolutionary changes to the baseline X3D architecture.
- Next year: X3D Version 4.1 will add Mixed Augmented Reality (MAR) capabilities and consider improved geometric compression.

W3C Workshop on Web and Virtual Reality

Samsung San Jose, October 19-20, 2016; San Jose, CA, USA

White paper: **X3D Capabilities for Declarative Virtual Reality**

Web3D 2017, Brisbane Australia: Future of X3D

"**Future of X3D**" presentation and detailed notes from Web3D 2017 Conference, Brisbane Australia, 7 June 2017 (photograph).

Web3D 2018, Poznan Poland: Future of X3Dv4

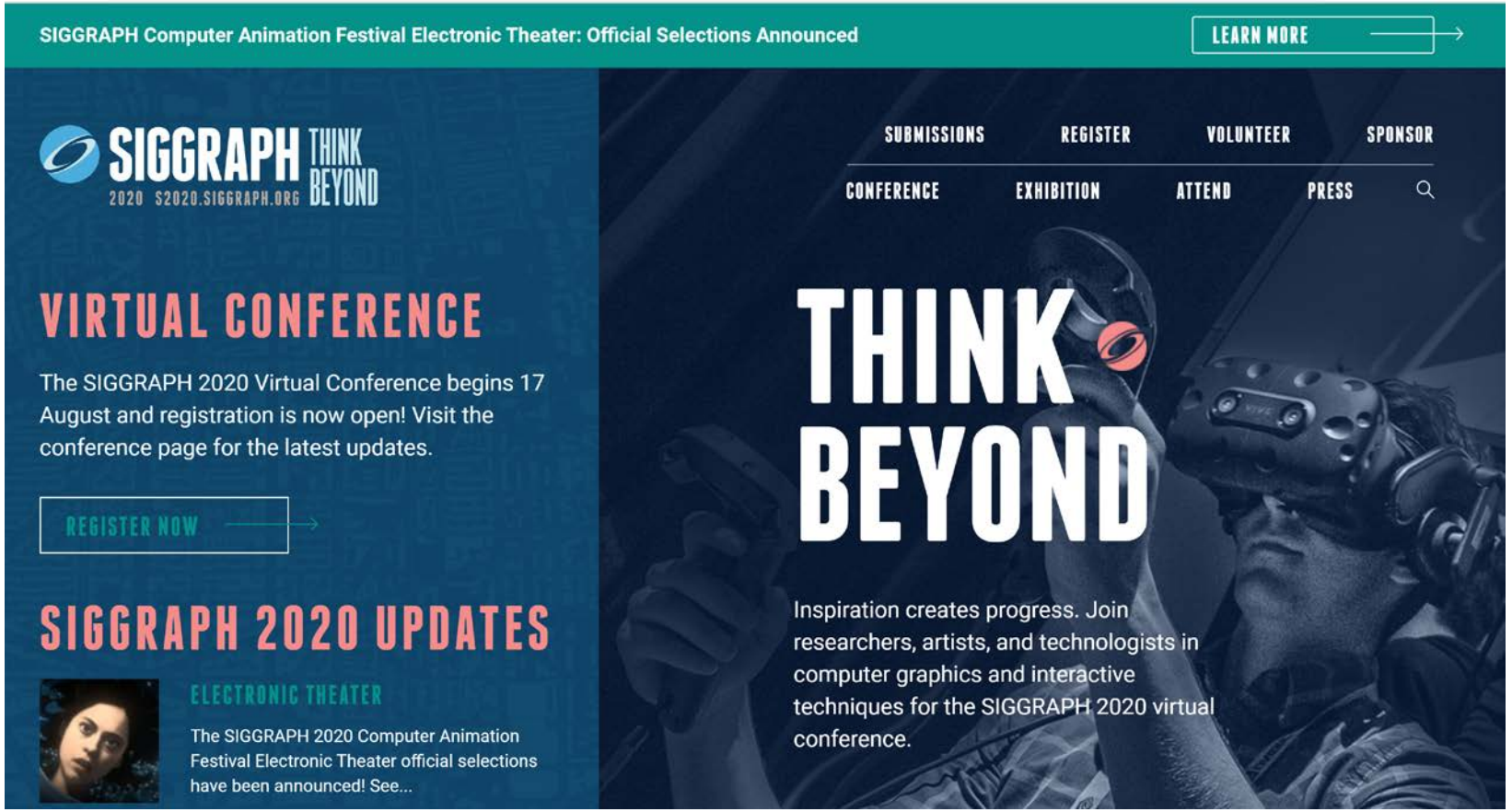
"**Future of X3D**“ progress presentation from Web3D 2018 Conference, Poznan Poland, 20-22 June 2018. Continued scrutiny and development.

Web3D 2019, Los Angeles: X3Dv4 Working Draft

First X3Dv4 Working Draft Specification release, numerous execution discussions in group meetings and technical sessions. Onward we go!

SIGGRAPH 2020, Working Draft 2 Public Release

Second [X3Dv4 Working Draft Specification] release, now reviewing examples implementations and evaluations. Results matter!



[Web3D Webinars 3-6 August 2020]

Web3D 2020 Conference - Online Free November

Papers, Posters, Tutorials, Workshops and Industrial Use Cases will inform Web3D Consortium member vote for ISO Committee Draft submission

Keeping track of what is happening

Strategy: X3D Version 4

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

x3d-public mailing list archives all discussion

- https://www.web3d.org/mailman/listinfo/x3d-public_web3d.org

Twitter announcements

- @Web3DConsortium
- https://twitter.com/Web3Dconsortium

Web3D Standards

- https://www.web3d.org/standards
- https://www.web3d.org/specifications

Weekly Videoconferences
X3D Working Group

X3D4 Working Draft 2 Public Release, August 2020

- Ready for early adopters! X3D4 work is accelerating forward.

X3Dv4 Public Working Draft

https://www.web3d.org/x3dv4-public-working-draft

View Edit Revisions

The Web3D Consortium is happy to release the second public X3Dv4 Working Draft (WD2) Specification.

- Release reviewed satisfactorily by X3D Working Group, 31 July 2020
- Published at web3d.org/specifications/X3Dv4Draft and X3Dv4WorkingDraft.zip (also reviewers .pdf)

Key references:

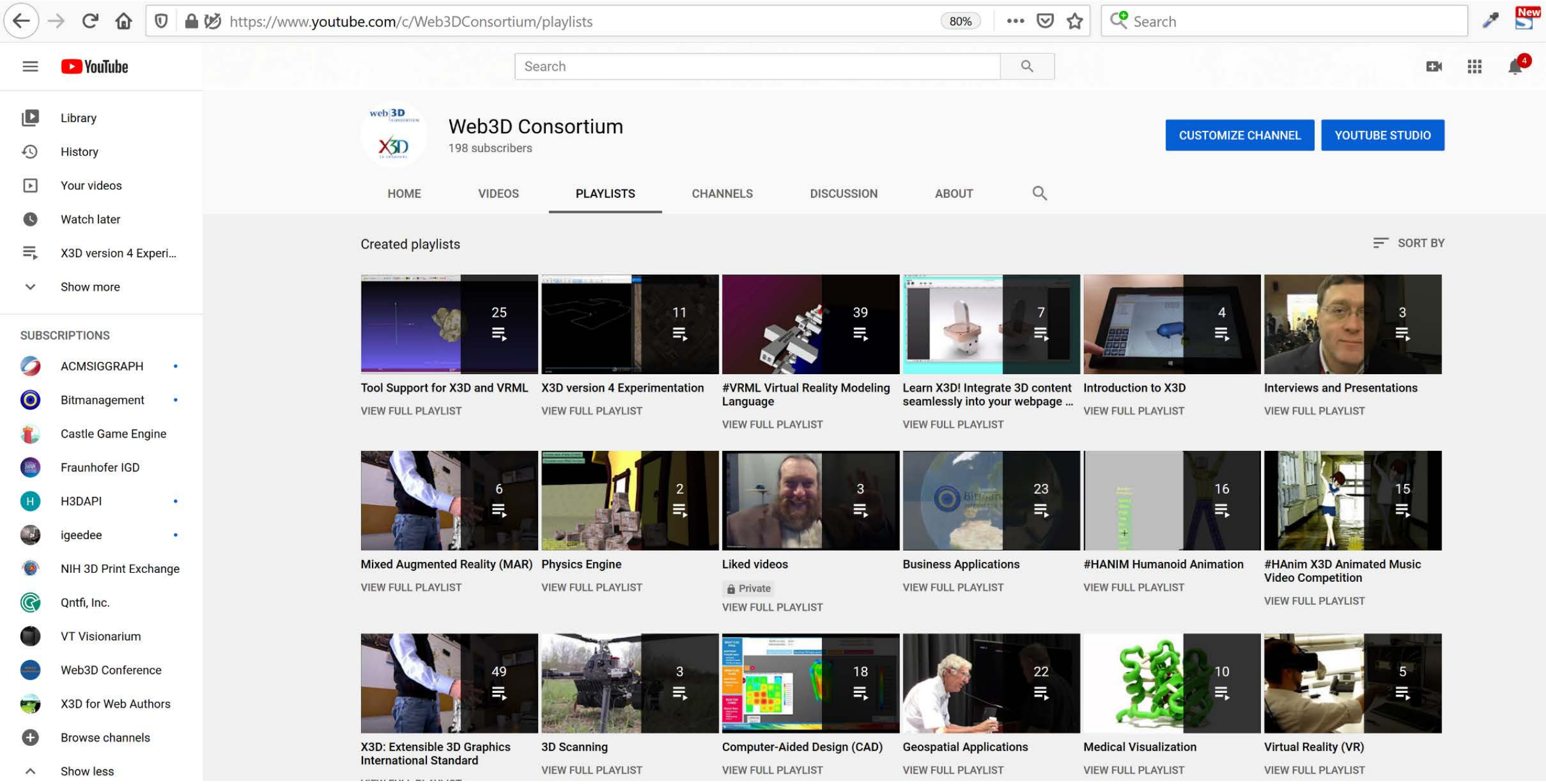
- X3D4 Overview
- X3D4 Highlights
- X3D4 Strategy
- X3D4 Implementations Status

Much X3D4 execution work is accelerating forward on implementation and evaluation of example models, to good effect. Have fun with X3Dv4!

X3D4 Assets

- X3D Tutorials
- X3D Draft Specification
- X3D Resources
- X3D Scene Authoring Hints
- X3D Tooltips
- X3D Example Archives: over 4000 models in regular regression testing
- Humanoid Animation (HAnim2) Specification and Examples
- Twitter announcements and Web3D Videos

Web3D Consortium YouTube Channel



X3D4 Players and Authoring Tools

- X_ITE open-source Javascript for HTML pages
- X3DOM open-source Javascript for HTML pages
- Castle Game Engine: view3Dscene open-source Object Pascal
- FreeWrl open-source C

- Titania authoring environment (Linux)
- Others in progress: X3D-Edit v4, White Dune
- Blender export improvements in progress

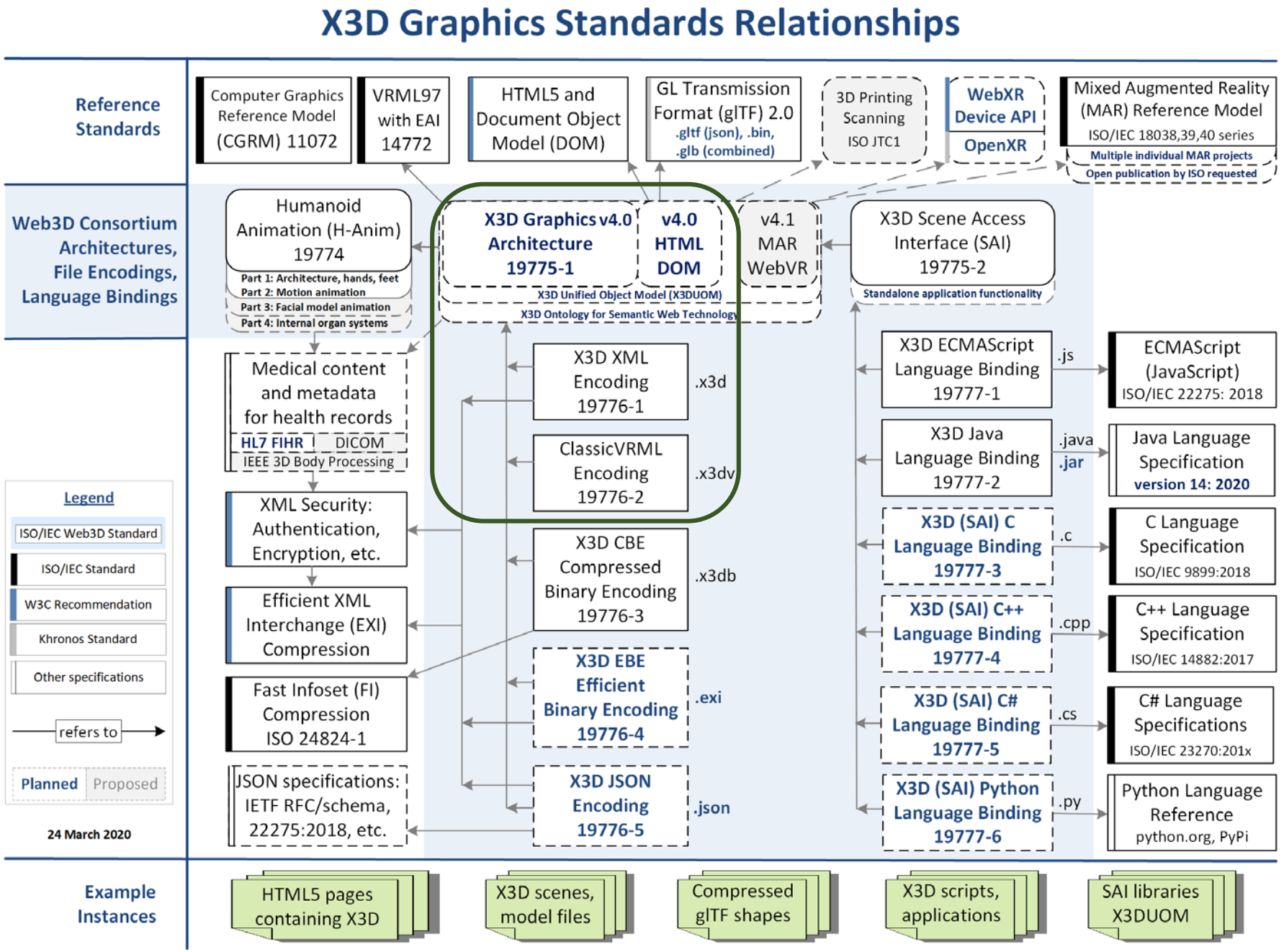
X3D4 Code Libraries and Tools

- X3DJSONLD: Javascript, JSON, Node.js
- X3DJSAIL: Java
- X3DPSAIL: Python
- X3D C++: proposed, under development
- X3D Ontology for Semantic Web
- X3D JavaScript Object Notation (JSON) Encoding

- X3D Quality Assurance (QA): schemas, doctypes, schematron
- X3D Validator: battery of comprehensive tools as online test page, rebuild/redeployment for X3D4 in progress
- Vast suite of XML tools – all still work!

We are here!

Common basis for every kind of X3D model, confirmed by round-trip tests



X3D 4 Summary #1

- First X3Dv4 Public Working Draft specification released for Web3D 2019! Scrutiny, feedback and engagement are welcome.
- Big detailed Big Picture: see X3Dv4 Strategy and X3Dv4 Implementations Status.
- Following the path projected by Web3D 2017's Future of X3D session, building on steady progress at Web3D 2018, daily email posts and weekly meetings, multiple Web3D Consortium working groups and community participants continue to build on the architectural stability of the Extensible 3D (X3D) Graphics International Standard.
- Two open-source implementations (X3DOM and X_ITE) adapt X3D content for HTML5 integration, with excellent results showing compatible event models for user interaction and model animation.
- Considering a 3D Printing and 3D Scanning profile for hardware interoperability.
- Virtual, Augmented and Mixed Reality (VR/AR/MR) can all use X3D and continue being explored to good effect – X3Dv4.1 to follow. Strategic timing is valuable.

X3Dv4 Strategy

X3D® Version 4 (X3Dv4) is a major upgrade to the Extensible 3D (X3D) Graphics International Standard that provides close support for the HTML5 Recommendation. This is major work in progress, expected to include several future versions. This effort is driven by the X3D Graphics Working Group with contributions from other working groups and regular community outreach.

- *Imminent.* X3Dv4 Public Working Draft specification release for Web3D 2019 and SIGGRAPH conferences
- *Current.* X3Dv4 Implementations Status provides summary links tracking active efforts,
- *Recent.* "**X3D Futures: what is happening, how to get involved!**" presentation from Web3D 2018 Conference, Poznan Poland, 22 June 2018.
- *Previous.* "**Future of X3D**" presentation and detailed notes from Web3D 2017 Conference, Brisbane Australia, 7 June 2017 (photograph).

X3D is always evolving, and the Web3D Consortium Standards Strategy carefully guides all these improvements. X3D Version 4 enables authors to publish interactive 3D content anywhere on the Web, without restrictions or plugins. Next-generation evolution + revolution is combined with archival compatibility of existing legacy content. Please see:

- **X3D Version 4.0 Technical Development** shows planned evolutionary changes to the baseline X3D architecture.
- X3D Version 4.1 will add Mixed Augmented Reality (MAR) capabilities for diverse virtual and augmented reality (VR, AR) devices.

Normalizing interaction (event model) semantics with HTML5 can further open up X3D for the vast majority of Web authors. The Web3D Consortium has identified X3DOM and X_ITE as prototypes for the next generation X3D Version 4.0 that support direct integration into HTML5 webpages without requiring the use of any browser plug-in. The Consortium and the X3D community are working closely with open-source exemplars to maintain and expand the X3D standard as it progresses and moves into full browser support. The Consortium also continues to support all existing X3D and VRML content.

Steady progress towards X3D Version 4 continues. We cordially invite you to Join Web3D as we continue to reliably build a stable foundation that establishes 3D graphics as a "first-class citizen" in the World Wide Web.

X3Dv4 Implementations Status

X3Dv4 implementations are under way. X3D® Version 4 (X3Dv4) is a major upgrade to the Extensible 3D (X3D) Graphics International Standard that provides close support for the HTML5 Recommendation.

The X3D Working Group is executing the Web3D Web3D Standards Adoption Process and meeting guidance by Web3D Board of Directors, all to good effect. Web3D Consortium membership has value!

Approach Summary

X3D activity includes over 20 years of progressive evolution that maintains durable stability and backwards compatibility. The best way to introduce new capabilities is to propose them on the x3d-public mailing list so that they can be considered in detail. Then we add an agenda item to the next X3D Working Group teleconference so that the proposed capability can be discussed. Then, away we go:

- ***Specification Prose:*** produce draft X3Dv4 Architecture Specification (github) aligning with W3C HTML5/DOM Recommendations.
- ***Implement Code:*** open-source JavaScript X_ITE and X3DOM players (for HTML5) plus other X3D browsers.
- ***Evaluate Examples:*** using all available X3D implementations and ~3500 models in X3D Example Archives.
- ***Finalize and Review:*** iteratively improve specification, implementations and examples until success thresholds are met.

X3D Node and Statement Inventory Comparison tracks progress of all known X3D players, authoring and validation tools.

Milestones

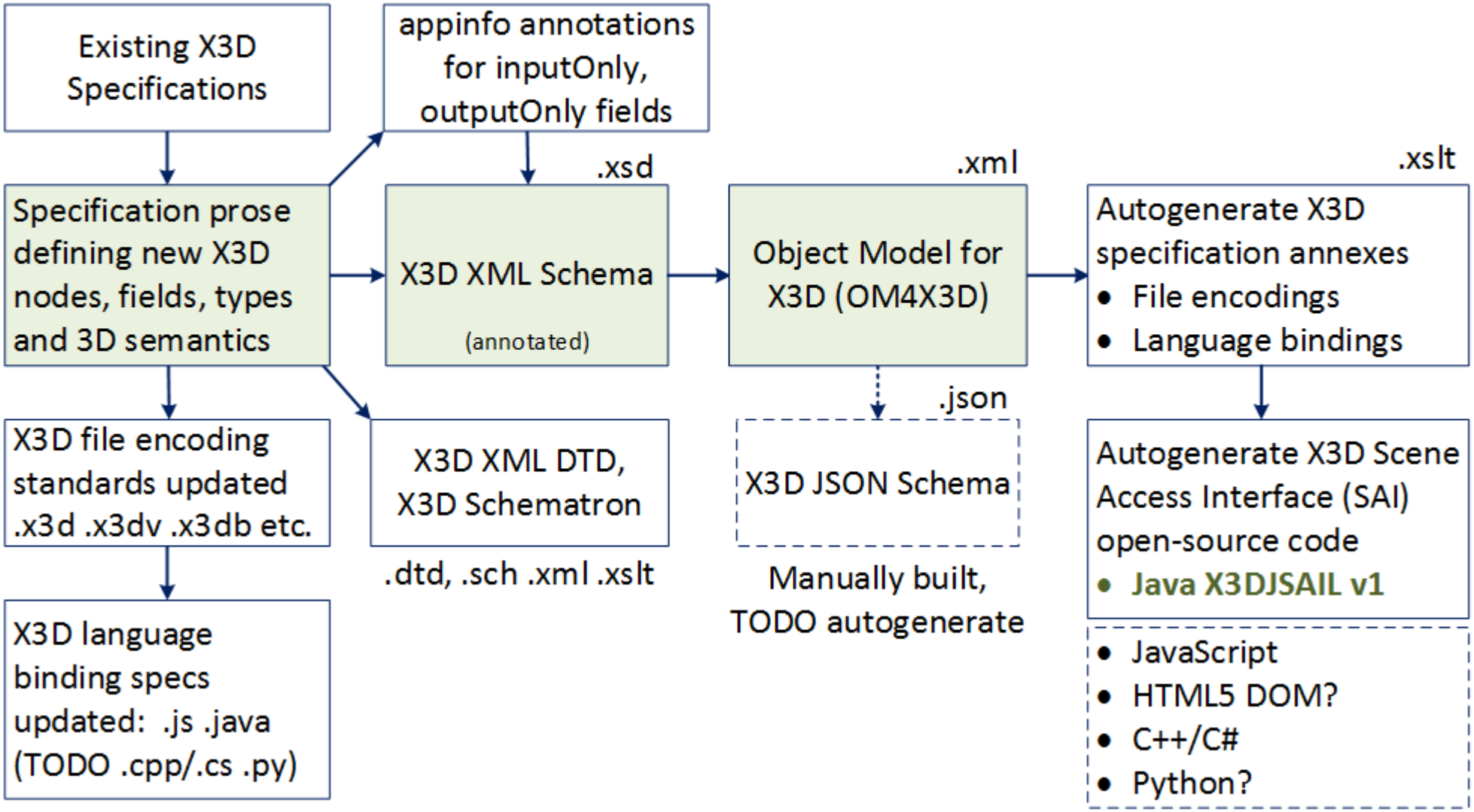
1. *26-31 July 2019.* Publish draft specification plus examples and implementation updates at Web3D2019/SIGGRAPH 2019 conferences.
2. *16 December 2019.* Working group closes new-technology submissions, finalize all efforts. Prepare ISO NWIP document.
3. *First quarter 2020.* Working Draft submitted to X3D Community, Web3D Consortium members, Web3D Board and ISO.

X3Dv4 Summary #2

- Central to these efforts is an X3D Unified Object Model (X3DUOM) that enables consistent implementation and presentation of content across multiple file encodings (XML, ClassicVRML, JSON, binary) as well as multiple programming language bindings (JavaScript, Java and planned adaptations to C/C++/C# and Python).
  - X3D JSON Loader (X3DJSONLD) and X3D JSON Encoding
  - X3D Java Scene Access Interface Library (X3DJSAIL)
  - Turning the corner: **X3D Python Package** alpha release!

- Second-generation Humanoid Animation (HAnim) has stabilized motion-capture (mocap) outputs for both general-purpose and human-specific (i.e. medical) usage. Medical mappings and deployment efforts continue.

Object Model for X3D: Creation, Autogeneration



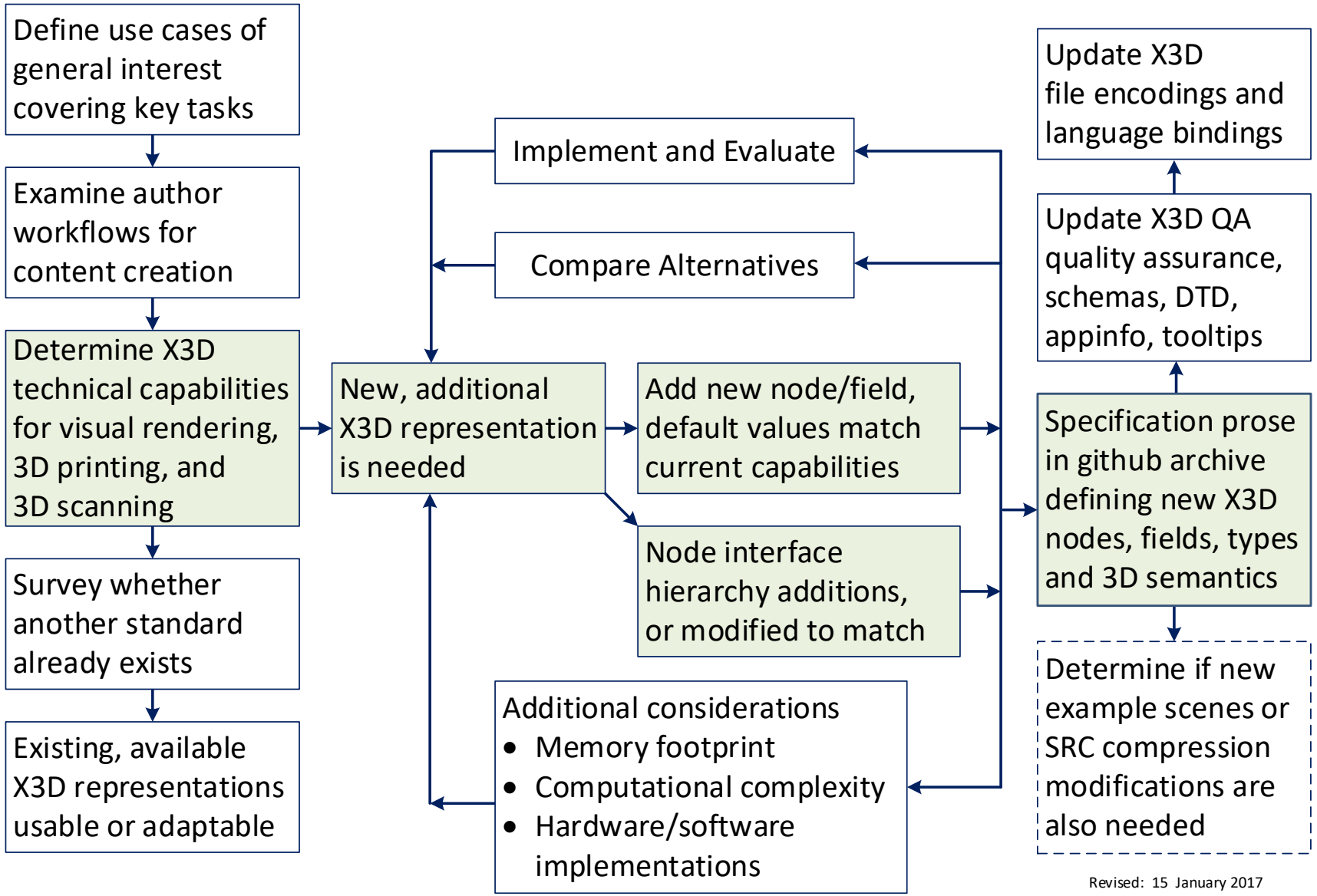
X3D Unified Object Model (X3DUOM)

X3D 4 Summary #3

- Over two decades of progress are steadily evolving to finally unlock full promise of Interactive 3D Graphics within the Web architecture.
- X3D Resources, X3D Scene Authoring Hints, X3D Tooltips, import/export support, forwards/backwards version compatibility, X3D Quality Assurance (QA) validation tools, and a large corpus of open-source version-controlled X3D examples are together ensuring that consistent semantics are emerging for 3D on any platform.
- XML compression, encryption and authentication available already.
- This progress report outlines numerous parallel lines of effort, and also points out individual opportunities to utilize and extend X3D consistently across multiple domains.

Specification design process for new capabilities

Web3D process helps us *work together* to get a big job done!



Revised: 15 January 2017

HTML5 and Open Web Architecture

- Harmonization of ID linkages and event models, HTML DOM and X3D
- Composition with Cascading Style Sheets (CSS)
- Compatibility + usage of Scalable Vector Graphics (SVG)
- Accessibility, annotations, internationalization (I18N), etc.
- X3D as presentation layer compatible with Semantic Web
- Linkage of hybrid model data and information

Some aspects are standardization, others can simply align good design.

- *Now active*. **Web3DUX User Experience Working Group** established to share, assess, and promote best practices for X3D + HTML usage.

Rendering progress is significant

X3D version 4, HTML5/DOM

- Inline
  - glTF model assets, JSON or binary
  - Optional support STL, PLY, others
- Physically Based Materials: glTF
- Advanced lighting model
- Shadows and reflections
- Cloud-based, offline rendering

X3D version 4.1, VR/AR/MAR

- Co-develop 4.1 to immediately follow completion of X3D v4.0
- WebVR as baseline capability set
- Composing see-through/360 video, high-definition, green screen, etc.
- Push “settled issues” to X3D v4.0, defer final WebVR support to v4.1

3D Printing and 3D scanning

- 3D Printing: bits into atoms
- 3D Scanning: atoms into bits

Uh, approximately everything?!

CAD Design Printing Scanning Working Group is building profiles

- Geometry requirements essentially complete
- **Metadata and annotations** getting close scrutiny, building exemplars
- Contributing to multi-standard ISO tech committee, Byoung Nam Lee
- Also STEP Visualization group, Soonhung Han, Christophe Mouton

Simple use case: scan, print, view any object archivally published to X3D
Share via NIH 3D Print Exchange and NPS X3D Model Exchange

Audio

W3C Audio Working Group

- Web Audio, Web Midi, Web Audio Processing: Use Cases and Requirements
- Web Audio API is now W3C Candidate Recommendation (CR) !

"High-level API or processing and synthesizing audio in Web applications"

High-fidelity audio processing chains, *AcousticProperties* for materials

Excellent support emerging in Web browsers plus additional codebases

Audio graphs, realistic audio rendering with configurable pipeline

Now matching online examples and refining design, more to follow!

White paper: Strategies for Improved Sound Support in X3D

Humanoid Animation (HAnim) + Medical

New Hanim version 2 International Standard (IS) available online!

- HAnim Architecture (skeleton, skin, hands and feet, precise naming)
- HAnim Motion Animation (e.g. motion capture, BVH mocap conversion)
- HAnim tool, player, validation and example updates ongoing to match X3D4

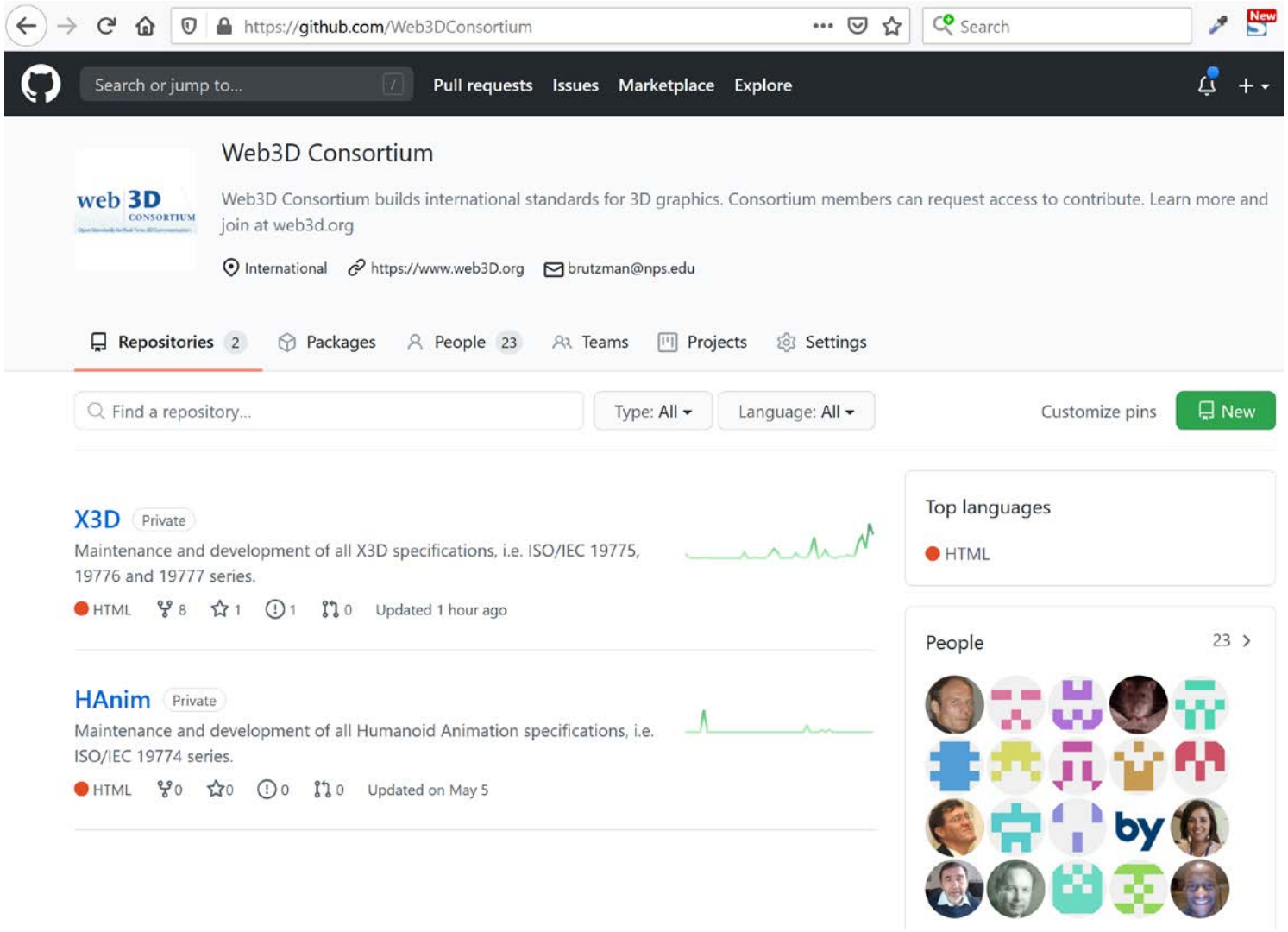
Medical Working Group meets regularly with accelerating progress

- Liaisons with DICOM imaging, Health Level 7 (HL7), etc.
- Diverse applications and uses, demonstrate using test cases

- Shared strategy: suitable for archival Electronic Health Records (EHR)
  - Especially cooperative work with HL7 FHIR standard for health care data exchange

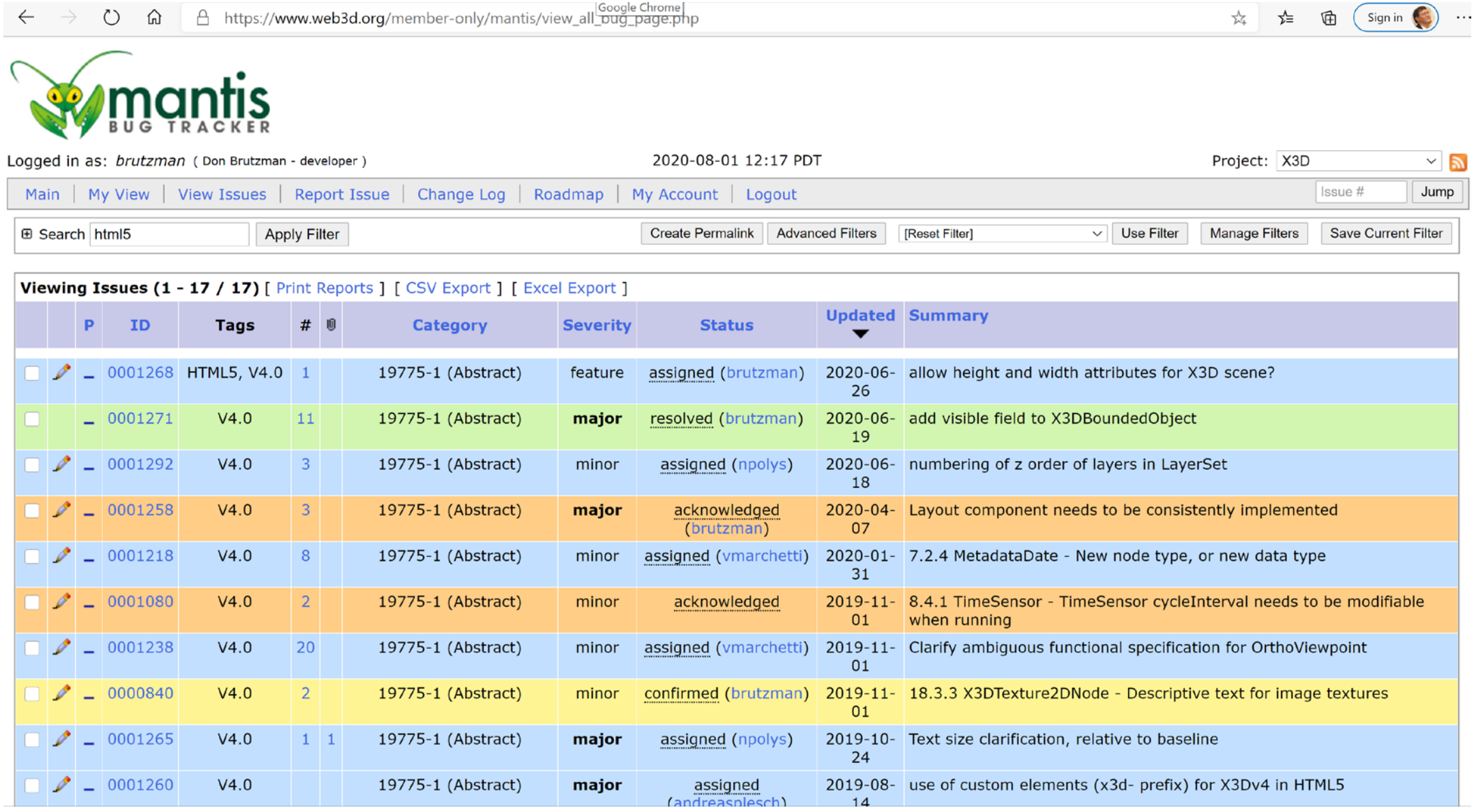
- **Metadata and annotations**, security, compression, ontologies, standards
  - Building all the way to X3D Semantic Web ontologies for all models and domains
  - Full package of necessary technical capabilities now available for proof of capability

Transparent and accountable: all specifications maintained in github version control for members



Member value: Mantis issue tracker is thorough

https://www.web3d.org/member-only/mantis/view_all_bug_page.php



https://www.web3d.org/member-only/mantis/view_all_bug_page.php

Logged in as: *brutzman* (Don Brutzman - developer) 2020-08-01 12:17 PDT Project: X3D

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

Search html5 Apply Filter Create Permalink Advanced Filters [Reset Filter] Use Filter Manage Filters Save Current Filter

Viewing Issues (1 - 17 / 17) [Print Reports] [CSV Export] [Excel Export]

P	ID	Tags	#	Category	Severity	Status	Updated	Summary
_	0001268	HTML5, V4.0	1	19775-1 (Abstract)	feature	assigned (brutzman)	2020-06-26	allow height and width attributes for X3D scene?
_	0001271	V4.0	11	19775-1 (Abstract)	**major**	resolved (brutzman)	2020-06-19	add visible field to X3DBoundedObject
_	0001292	V4.0	3	19775-1 (Abstract)	minor	assigned (npolys)	2020-06-18	numbering of z order of layers in LayerSet
_	0001258	V4.0	3	19775-1 (Abstract)	**major**	acknowledged (brutzman)	2020-04-07	Layout component needs to be consistently implemented
_	0001218	V4.0	8	19775-1 (Abstract)	minor	assigned (vmarchetti)	2020-01-31	7.2.4 MetadataDate - New node type, or new data type
_	0001080	V4.0	2	19775-1 (Abstract)	minor	acknowledged	2019-11-01	8.4.1 TimeSensor - TimeSensor cycleInterval needs to be modifiable when running
_	0001238	V4.0	20	19775-1 (Abstract)	minor	assigned (vmarchetti)	2019-11-01	Clarify ambiguous functional specification for OrthoViewpoint
_	0000840	V4.0	2	19775-1 (Abstract)	minor	confirmed (brutzman)	2019-11-01	18.3.3 X3DTexture2DNode - Descriptive text for image textures
_	0001265	V4.0	1 1	19775-1 (Abstract)	**major**	assigned (npolys)	2019-10-24	Text size clarification, relative to baseline
_	0001260	V4.0		19775-1 (Abstract)	**major**	assigned (andreasplesch)	2019-08-14	use of custom elements (x3d- prefix) for X3Dv4 in HTML5

Thanks for many contributions!!

… we continue tuning testing and deploying all of these great new capabilities

Web3D membership has value!

X3Dv4 Draft Specification Implementation Status

Components and Nodes	X3D Specification Paragraphs	Examples	Implementations	Tooltips, links to Validation	Notes
Annotation	42 Annotation component	TODO	Xj3D (partial)		Work in progress by Design Printing Scanning and Medical Working Groups
Event model alignment	Modifications to Concepts, 4.4.8 Event model		X_ITE (complete), X3DOM (partial)		X3D Script/ROUTE events via DEF, HTML5/DOM events via id, browsers exchange event changes after render loops
Field name changes	Affects child SF/MFNode field naming for ~10 nodes		X3D-Tidy conversion updates once resolved		See Potential future changes for improved consistency of field names
glTF file loading	Multiple nodes for scene graph integration and advanced rendering		X3DOM, others		glTF closely related to Lighting model, also provides geometric compression.
HAnim v2	26 Humanoid Animation (HAnim) component, updating HAnimHumanoid and adding HAnimMotion node for BVH-style motion animation	TODO update Basic Archives: HAnim	X3DJSAIL Ready for update by other existing applications.	HAnimMotion, HAnimHumanoid	HAnim v2 is undergoing ISO Final Draft International Standard editors review, expected completion 7 August 2019.
Inline	9 Networking component Allow loading other model types, security precautions	TODO	X3DOM		Mantis 744, Mantis 1151, Mantis 1171, Mantis 1257 TODO support STL, PLY?
Lighting model	TODO add new capabilities while retaining optional backwards compatibility with X3Dv3 17 Lighting component	TODO	TODO confirm: Castle Game Engine X3DOM		Satisfactory review by X3D Working Group of Physically Based Rendering (PBR) proposals by Michalis Kamburelis

Bottom lines all around

Our X3D + HTML future now arriving. Take advantage of new capabilities!

- An amazing amount of progress is available for early adopters, now.
- We have a formal path forward, proven process and good procedures.

Web3D membership has value!

- Can accelerate, focus attention, offer help, support for your project of interest
- Web3D needs you to Join Our Team as business, university, agency or individual

Community contributors adding major value too!

- Ask questions, review, contribute code and models

Get involved, share benefits!

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