X3D Version 4 Working Draft

Moving in Fast: 3D Everywhere!

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

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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

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!
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.
- 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**
Keeping track of what is happening

Strategy: X3D Version 4
- http://www.web3d.org/x3d4

Technology: X3D Version 4 list of potential specification improvements

Web3D Standards
- http://www.web3d.org/standards
Common basis for every kind of X3D model, confirmed by round-trip tests
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

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.
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

1. Define use cases of general interest covering key tasks
2. Examine author workflows for content creation
3. Determine X3D technical capabilities for visual rendering, 3D printing, and 3D scanning
4. Survey whether another standard already exists
5. Existing, available X3D representations usable or adaptable

- New, additional X3D representation is needed
  - Add new node/field, default values match current capabilities
  - Node interface hierarchy additions, or modified to match
  - Additional considerations
    - Memory footprint
    - Computational complexity
    - Hardware/software implementations

- Implement and Evaluate
- Compare Alternatives

- Update X3D file encodings and language bindings
- Update X3D QA quality assurance, schemas, DTD, appinfo, tooltips
- Specification prose in github archive defining new X3D nodes, fields, types and 3D semantics

- Determine if new example scenes or SRC compression modifications are also needed

Web3D process helps us work together to get a big job done!
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 (MOST)

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

• New. Call for participation to start User Experience Working Group that shares, assesses, promotes best practices for X3D + HTML usage.
Rendering

**X3D version 4, HTML5/DOM**
- Inline, ExternalShape:
  - glTF models, 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

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](https://www.nih3dprintexchange.org) and [Navy/Marine X3D Model Exchange](https://www.navy3dmodelexchange.org)
Audio

White paper: Strategies for Improved Sound Support in X3D

W3C Audio Working Group
- Web Audio, Web Midi, Web Audio Processing: Use Cases and Requirements
- MediaStream Processing API

Audio shaders/scripts in combination with configurable pipeline?
Use of audio in annotations to provide assistance in descriptions
Confirmed commitment by Athanasios Malamos, TEI Crete
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 DEC 2019</td>
<td>Deadline for member submissions</td>
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<tr>
<td>Mar 2019</td>
<td>X3D Working Group of Physically Based Rendering (PBVR) meeting</td>
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<tr>
<td>2019</td>
<td>-too Work in Progress by Design Printing Scanning and Medical Imaging (DSPSMI)</td>
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Humanoid Animation (HAnim) + Medical

New HAnim Draft International Standards (DIS) available online!
  • HAnim Architecture (skeleton, skin, hands and feet, precise naming)
  • HAnim Motion Animation (e.g. mocap, BVH conversion)
  • HAnim tool, player and example updates are ongoing

Medical Working Group meets regularly with accelerating progress
  • Liaisons with DICOM imaging, Health Level 7 (HL7), etc.
  • Diverse applications and uses, demonstrated by test cases

• Shared strategy: suitable for archival Electronic Health Records (EHR)

• Metadata and annotations, security, compression, ontologies, standards
Bottom lines all around

An amazing amount of progress is clearly possible, working in parallel. We have a feasible path forward, good process and good procedures.

Web3D membership has value!
  • Can accelerate, focus attention on your project of interest
  • Web3D needs you to Join Our Team as business, university, agency or individual

Community contributions add major value too!
  • Ask questions, review, contribute code and models

Get involved, we want you!
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