17 August 2020

Web3D Consortium Report: ISO IEC JTC1 SC24 Annual Meeting

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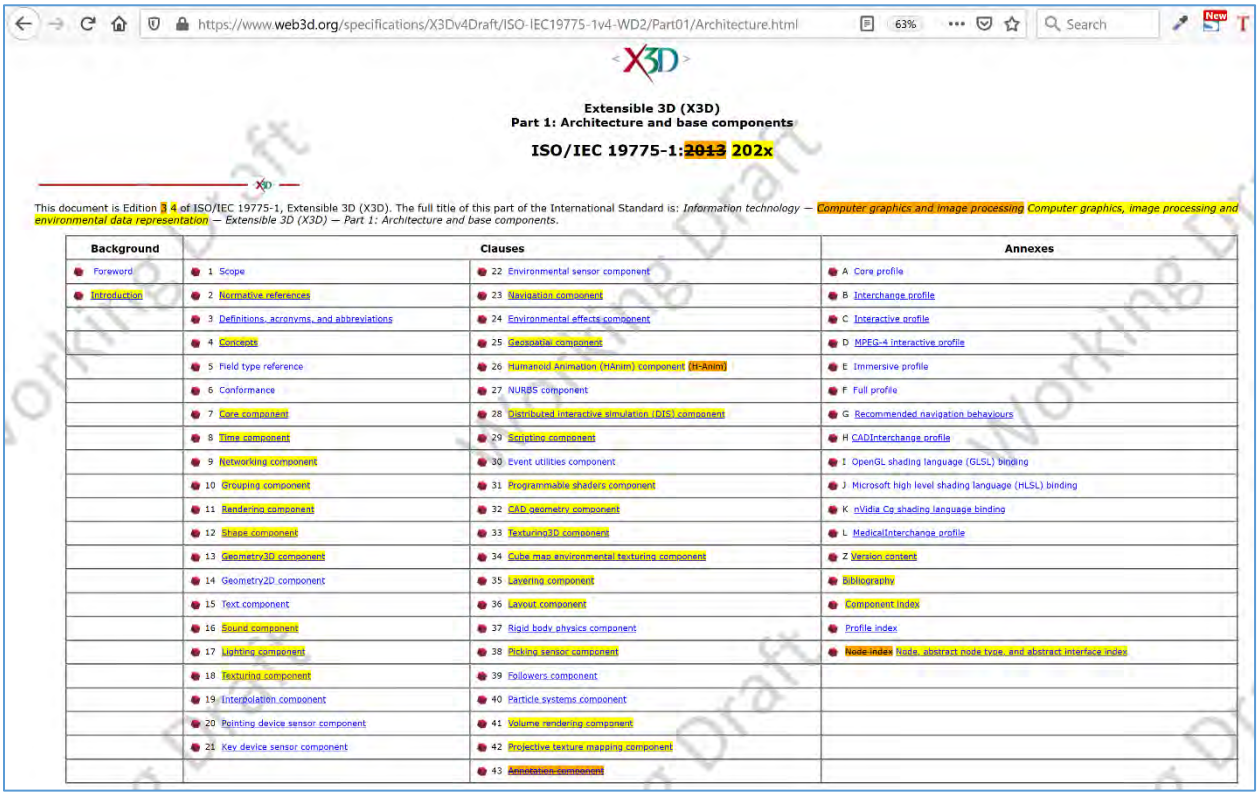
1. **Overview**. Web3D Consortium is again pleased to partner and collaborate with SC24. Thanks to immense efforts by members, community and Working Group 6 (WG6) Convener Dr. Richard Puk, many achievements have been accomplished and much work is in progress.

2. **X3D4 Progress.** Extensible 3D (X3D) Graphics is the royalty-free open standard for publishing, viewing, printing and archiving interactive 3D models on the Web. X3D® version 4 (X3D4) 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 daily community outreach.

    a. X3D version 4 Overview and links: https://www.web3d.org/x3d4

    b. X3D4 Public Working Draft Specification is our second release for SIGGRAPH 2020 conference. https://www.web3d.org/x3dv4-public-working-draft



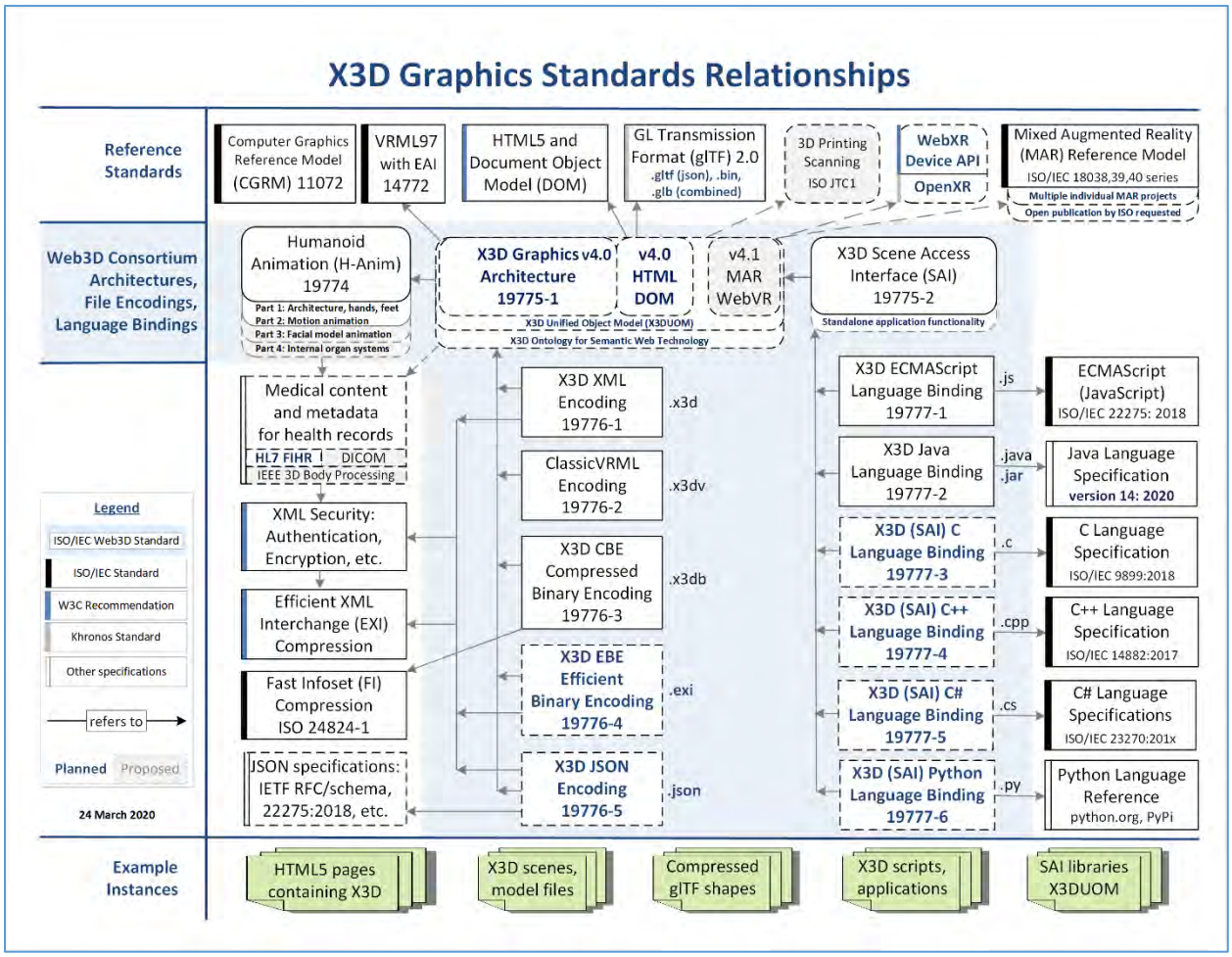
c. X3D4 Highlights provides a quicklook of major features under development.

d. X3D4 Implementations Status provides summary links tracking active efforts.

e. Presentation X3D Version 4 Draft: Ready for Early Adoption! is online for Web3D Webinars and SIGGRAPH conference, released August 2020 and attached to this report.

f. Of note: glTF 2.0 physically based rendering (PBR) and lighting capabilities are now supported. X3D4 specification work, Castle Game Engine implementation documented at https://castle-engine.io/wp/2020/07/05/work-on-x3d-version-4-0-in-specification-and-castle-game-engine-gltf-and-x3d-and-more-documentation

g. The X3D Specification Relationships diagram showing all variations on X3D4 capabilities, and relations to other standards, has stayed stable and correct. Online at https://www.web3d.org/specifications and https://www.web3d.org/specifications/X3dSpecificationRelationships.png



h. *Meeting question: people*. "wondering how many people have been involved in developing X3D." Currently perhaps 2 dozen people actively develop X3D capabilities at any given time, as indicated by working group and community activity. Several hundred authors have been involved in VRML and X3D over the past 25 years of Web3D Conference series.

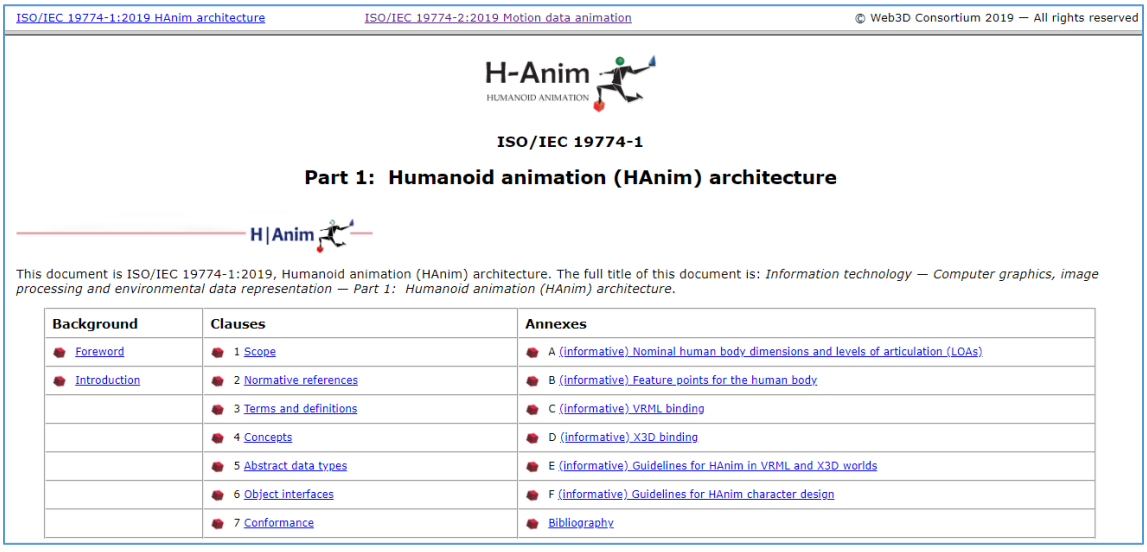
i. *Meeting question: mobile*. "how many projects for (web/mobile) applications have been developed with X3D." Regarding mobile, I just tested our two JavaScript Web implementations X_ITE and X3DOM, both worked today on iPhone and have been demonstrated to work on other mobile devices as well. No plugins are required. X3D is a model format that can be loaded/exported/adapted by a large variety of applications, with an interaction model that is device neutral. This allows playing and interacting with the same X3D model from small devices to tablets to tables to immersive devices to laptops, desktops, and on up to immersive CAVE displays.

3. **Humanoid Animation (HAnim) Progress**.

The HAnim version 2 (HAnim2) standard includes strict support for the entire human skeleton along with Motion Animation similar to BVH and related motion capture (mocap) capabilities.

a. HAnim standards are jointly published by ISO IEC and Web3D Consortium under terms or our Class A Liaison Agreement. HAnim standards are publicly available at https://www.web3d.org/standards/hanim
"Extensible 3D (X3D) Graphics and Humanoid Animation (HAnim) include a coordinated set of steadily evolving ISO standards. The Web3D Consortium Standards Strategy carefully improves and evolves our standards while maintaining long-term archival stability. These standards are developed, tested, maintained and updated by Web3D Consortium members. Following public comment and approval by the Web3D Consortium, they are submitted to International Standards Organization (ISO) for a series of annual reviews. The X3D Working Group proceeds at the best speed supported by member and public contributions."

b. HAnim2 available at https://www.web3d.org/documents/specifications/19774/V2.0


ISO/IEC 19774-1:2019 HAnim architecture | ISO/IEC 19774-2:2019 Motion data animation | © Web3D Consortium 2019 — All rights reserved

H-Anim HUMANOID ANIMATION

ISO/IEC 19774-1

Part 1: Humanoid animation (HAnim) architecture

H|Anim

This document is ISO/IEC 19774-1:2019, Humanoid animation (HAnim) architecture. The full title of this document is: *Information technology — Computer graphics, image processing and environmental data representation — Part 1: Humanoid animation (HAnim) architecture.*

Background	Clauses	Annexes
Foreword	1 Scope	A (informative) Nominal human body dimensions and levels of articulation (LOAs)
Introduction	2 Normative references	B (informative) Feature points for the human body
	3 Terms and definitions	C (informative) VRML binding
	4 Concepts	D (informative) X3D binding
	5 Abstract data types	E (informative) Guidelines for HAnim in VRML and X3D worlds
	6 Object interfaces	F (informative) Guidelines for HAnim character design
	7 Conformance	Bibliography

c. All draft Web3D/ISO SC24 standards are maintained in version control to facilitate collaboration by multiple editors with supporting build tools for HTML Tidy validation, careful control of both ISO and Web3D versions, creation of zip archives, etc. Access is granted to Web3D and SC24 members on request. Online at https://github.com/Web3DConsortium

d. Of note with this latest specification is that improvements were made to ISO editorial policy for publishing standards in HTML. We look forward to further improvements.

e. Current work is focusing on strict support and alignment of X3D versions 3.0-3.3 with HAnim1 and X3D version 4 with HAnim2. Rules are steadily improving for strict validation of naming and parent-child relationships for joints, segments and sites in the Joint/Segment skeletal model for humans. Strict conformance with human anatomy is possible with tool improvement continuing. Many of the most critical rules are automatically generated from X3D Unified Object Model (X3DUOM).

f. X3D3 HAnim1 and X3D4 HAnim2 examples available at https://www.web3d.org/x3d/content/examples/HumanoidAnimation

g. Ongoing work by SC24 Korean delegates (also part of Web3D Korea Chapter) on facial expressions and internal organs all seem directly implementable as additional future Parts in the HAnim 19774-2 standard. Labeling progressive Level of Articulation (LOA) complexity in HAnim2 joints and segments are useful for animation and quite similar to the proposed Level of Expression (LOE) considered in current draft work on facial animation. Especially encouraging is that a large majority internal organs can all apparently be modeled with tree-like constructs for spine/joint/segment/skin. These structural similarities facilitate facial modeling, organ modeling, organ animation, validation capabilities and implementation support using X3D4 and HAnim2 extensions together. The evolved models for human organs are quite advanced share common design patterns as HAnim part 1: skeleton (centerlines), skin surfaces and sites, with medical relevance feasible through the choice of names and labels. Part 2 is motion animation, again applicable. I recommend sharing, disseminating, applying these proposals as new parts for HAnim, and inviting HL7 and DICOM to comment on medical terms of reference and metadata practices for direct utilization by medical standards. This addition of new parts can augment the capabilities of the HAnim specification, possibly achievable within a year.

h. Recommended action: all of the examples shown today by Dr. Kwan-Hee Yoo and Dr. Myeong Won Lee appear appropriate for inclusion with other HAnim examples, if releasable under open-source license. https://www.web3d.org/x3d/content/examples/HumanoidAnimation

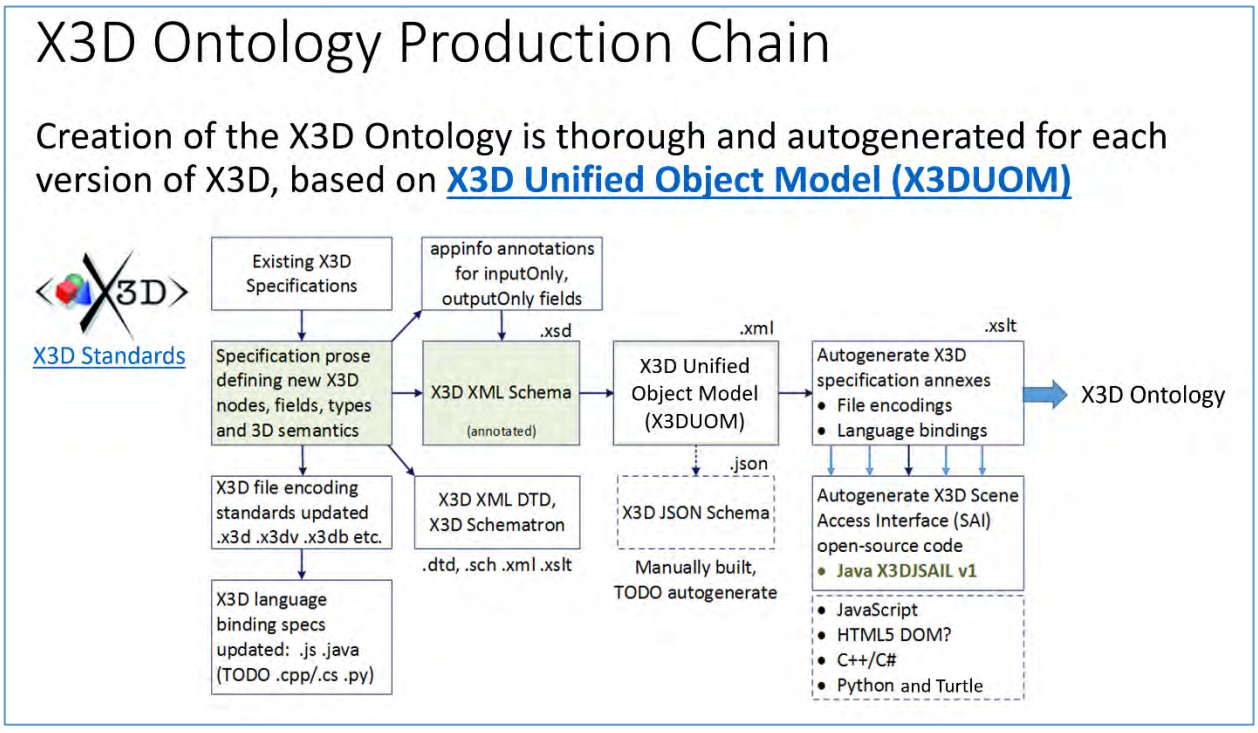
i. As noted by meeting participants, “HAnim functionality seems directly applicable to models and simulations of healthcare systems for Smart Cities.”

j. Once again: high-fidelity modeling and steady progress raises the potential for HAnim2 models to someday be suitable for the high threshold associated with human medical records. Web3D Consortium looks forward to continued partnered efforts with SC24, HL7, DICOM, IEEE 3D Body Processing and other groups towards such a fundamental strategic goal.

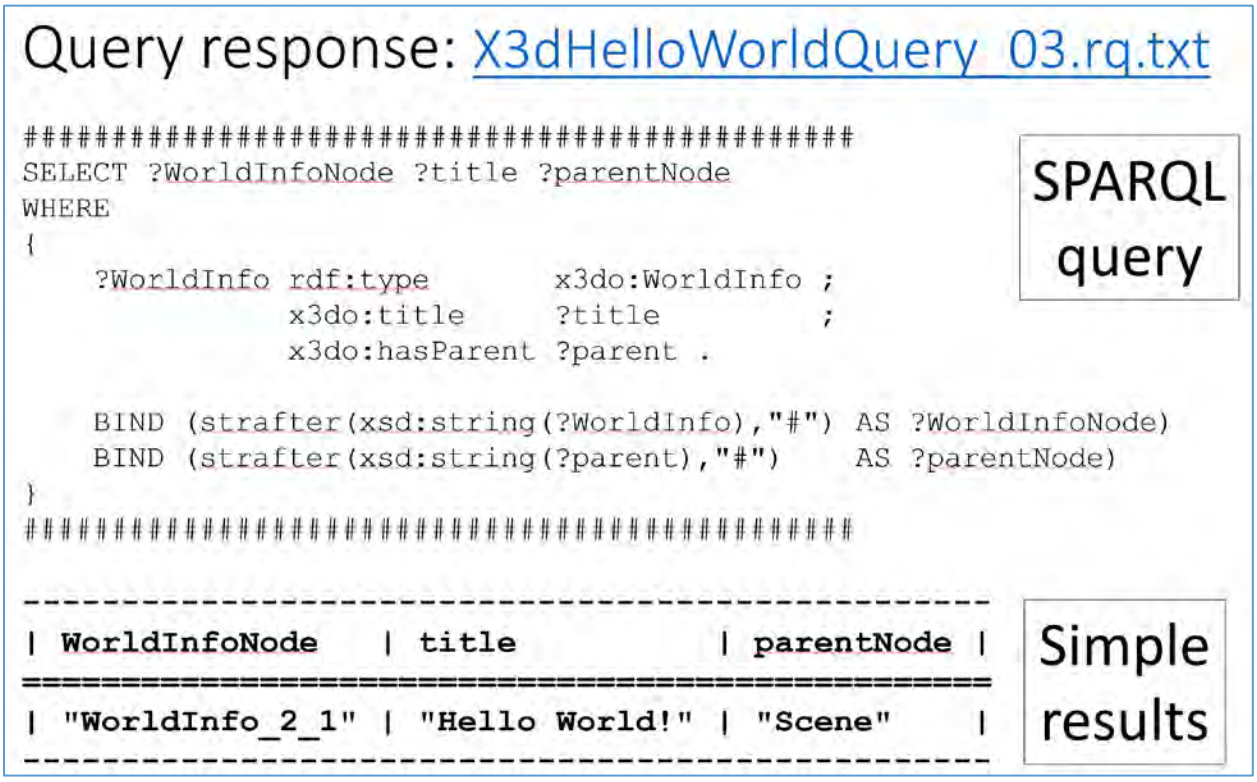
4. **X3D Ontology: querying 3D models.**

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.

a. The X3D Ontology for Semantic Web provides terms of reference for semantic query of X3D models. https://www.web3d.org/x3d/content/semantics
b. The X3D Unified Object Model (X3DUOM) is a full set of object-oriented interfaces for all nodes, fields and statements in the X3D Architecture Specification. Created from an annotated version of the X3D XML Schema, the X3DUOM is a validatable expression of X3D relationships that can be applied to implement various X3D file encodings and programming-language bindings. https://www.web3d.org/specifications/X3DUOM.html
c. The X3DUOM is currently used to produce implementations of X3D programming-language bindings for Java, Python and Turtle (.ttl). Further work is planned for JavaScript and C/C++/C# languages.



d. A full representation of X3D has been achieved. Current activity includes determination of additional inferable properties and advanced queries for model validation and metadata. We expect that metadata terms of reference will be essential for numerous related standards that might use X3D models for 3D presentation and visualization. Example query:




```
##############################################
SELECT ?WorldInfoNode ?title ?parentNode
WHERE
{
    ?WorldInfo rdf:type       x3do:WorldInfo ;
               x3do:title     ?title         ;
               x3do:hasParent ?parent .

    BIND (strafter(xsd:string(?WorldInfo),"#") AS ?WorldInfoNode)
    BIND (strafter(xsd:string(?parent),"#")    AS ?parentNode)
}
##############################################
```

WorldInfoNode	title	parentNode
"WorldInfo_2_1"	"Hello World!"	"Scene"

e. This work is relevant for exposing X3D to a broad range of domains, tools, technologies and capabilities. As query capabilities continue to mature, we expect to submit a NWIP to SC24 and note additional emerging standards connections.

f. Thanks for the opportunity to present in conjunction with meeting for Joint Working Group ISO/TC 184/SC 4/JWG 16. Additional references follow, updates will continue online.
   i. Donald P. Brutzman and Jakub Flotyński, "X3D Ontology for Querying 3DModels on the Semantic Web," submitted to Web3D 2020 Conference.
   ii. Slideset https://www.web3d.org/x3d/content/semantics/documentation/presentations/X3dOntologyForSemanticWeb.pdf

5. **X3D4 Spatial Sound and W3C Web Audio API.**

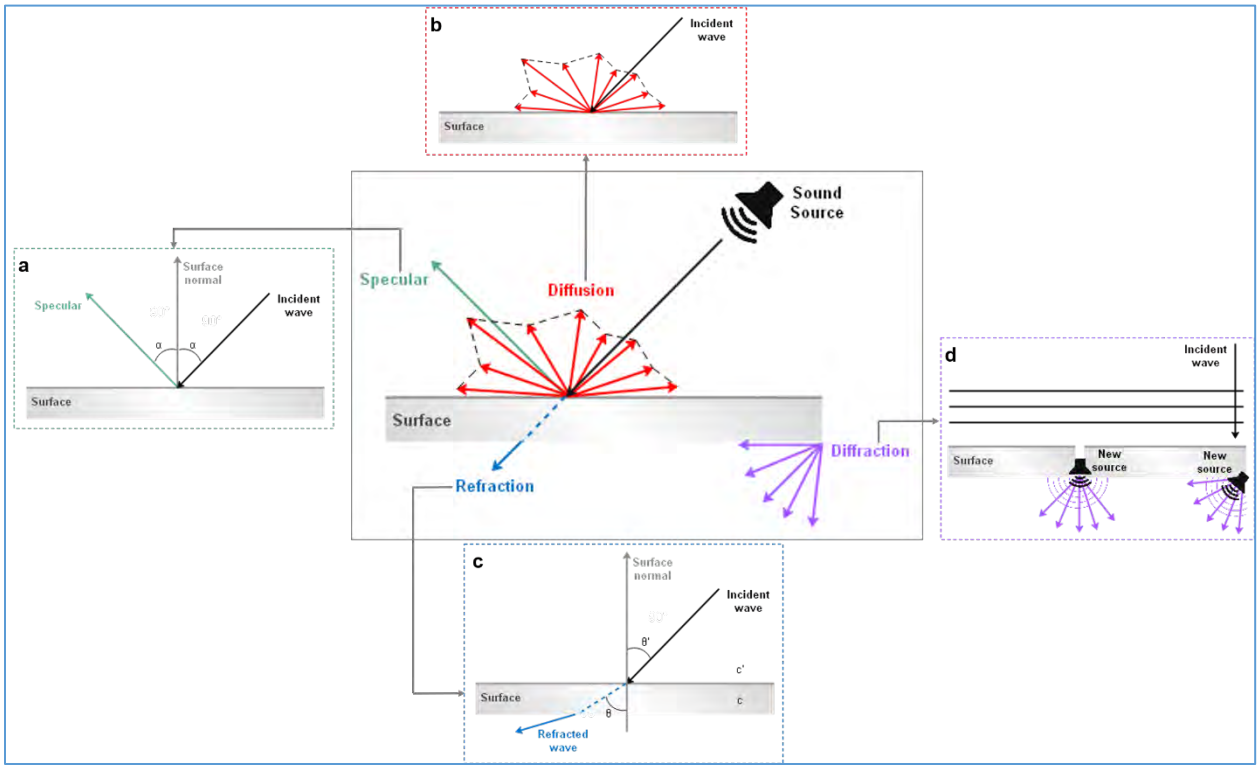
A major addition to X3D4 is upgrading the Sound component. X3D working group contributors are mapping Web Audio API audio graph into scene graph (85% complete) and also adding AcousticProperties with proxy geometry for high-fidelity reflection and refraction.

Proposed X3D4 AcousticProperties description and fields follow. Sound propagation phenomena are shown in the following illustration, draft Figure 16.2 in the X3D4 specification.

12.4.1 AcousticProperties

```
AcousticProperties : X3DAppearanceChildNode  {
  SFFloat [in,out] absorption 0    [0,1]
  SFFloat [in,out] diffuse    0    [0,1]
  SFNode  [in,out] metadata   NULL [X3DMetadataObject]
  SFFloat [in,out] refraction 0    [0,1]
  SFFloat [in,out] specular   0    [0,1]
}
```

The AcousticProperties node specifies the interaction of sound waves with the characteristics of objects in the scene. Properties influencing sound propagation include surface-related physical phenomena such as the specular reflection, diffuse reflection, absorption, and refraction coefficients of materials. These coefficient values are expected to fully account for physical and structural characteristics of the associated geometry such as width, height, thickness, shape, softness and/or hardness, and density variations.



This work is summarized in the attached paper. Abstract:

"A fundamental requirement for both realistic modeling and immersive presence is spatial audio, correctly rendering the presentation of each object with aural characteristics. Auditory attributes involve perceived directions, distances, and the propagation paths from complex sound sources to each listener in a potentially complex 3D scene. Many long-running efforts in both hardware and software have improved the ability to aurally render high-fidelity spatialized sound in real time. Motivated by current progress, this work proposes integrating acoustic properties associated with geometric shapes together with 3D spatial sound in the X3D Graphics specification. This combination is possible by

exploiting the structure and functionality of Web Audio API, an effective framework for processing and synthesizing audio in Web applications. The paper describes design patterns and initial implement work for this spatial composition of audio graphs and scene graphs. Both specifications are device neutral, without dependencies on specific platforms or audio hardware. Examples for evaluation lead to useful conclusions and areas for future model development."

a. Eftychia Lakka, Don Brutzman, Richard Puk and Athanasios Malamos, "Extending X3D Realism with Audio Graphs," submitted for review to Web3D Conference, November 2020.
b. X3D4 WD2 Sound Component https://www.web3d.org/specifications/X3Dv4Draft/ISO-IEC19775-1v4-WD2/Part01/components/sound.html
c. X3D4 WD2 AcousticProperties https://www.web3d.org/specifications/X3Dv4Draft/ISO-IEC19775-1v4-WD2/Part01/components/shape.html#AcousticProperties
d. Web Audio API, W3C Candidate Recommendation, 11 June 2020 https://www.w3.org/TR/webaudio is a useful composition of diverse advanced sound engines that "describes a high-level Web API for processing and synthesizing audio in web applications. The primary paradigm is of an audio routing graph".

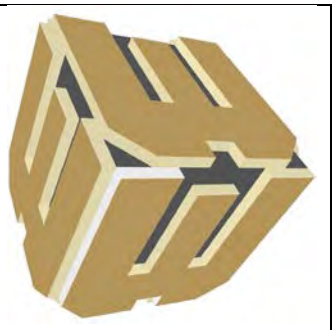
Implementation and evaluation of examples follow to confirm both feasibility and correctness of proposed X3D4 specification additions.

6. **Web3D 2020 Conference.**

This is the 25th anniversary of the Web3D Conference, sponsored by ACM SIGGRAPH in cooperation with Web3D Consortium and Korea Computer Graphics Society. Thanks to special sponsorship, all participation in this online conference is free this year.

Two active websites are essentially identical, site merger in progress:
- https://2020.web3dconference.org and https://web3d.or.kr

Upcoming deadlines:
- https://2020.web3dconference.org/important-dates
- Tutorial and workshop submission: September 12, 2020
- Industrial use cases submission: September 19, 2020
- Standards session submission: September 19, 2020
- HAnim competition submission: October 12, 2020

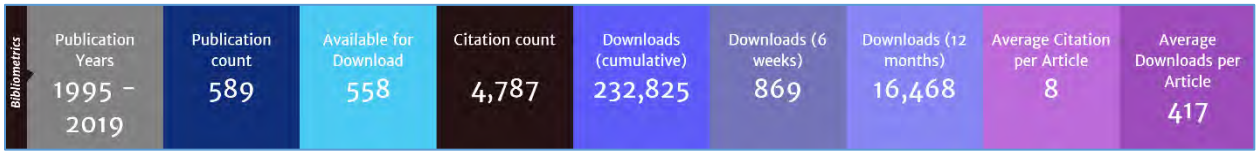


Multiple opportunities hold potential interest to SC24 groups and activities. All events are support by videoconference capabilities, with presentation assets and videos archived afterwards. This conference offers great opportunities for SC24 members to teach, learn, share and collaborate via workshops.

The goal of the conference is to share innovative and creative ideas around the development of 3D applications for a wide range of environments including Web, mobile, and virtual and augmented reality (XR). Work related to various application domains including education, healthcare, e-commerce, informatics, cultural heritage/tourism, entertainment, mass media, military, and construction (and many others) is welcome.

This year's theme, "3D for the Hyperconnected World", emphasizes the increasingly global scope and wide ranging impact of current and future high quality 3D content over high speed networks. The Web3D community seeks to foster and support the increasing development, use, and utility of 3D content over high speed networks by and for application developers, domain experts, and end users. This includes the creation of interactive 3D content, robust and versatile 3D content representation and delivery standards, and presentation and interaction techniques that support the development of user-friendly web-based 3D applications.

Conference publications are maintained in the ACM Digital Library. An impressive body of work has emerged over 25 years, with more to follow. Available online at https://dl.acm.org/conference/web3d



7. **SEDRIS and XML Schemas.** The Working Group 6 efforts presented on XML Schemas for SEDRIS hold excellent promise for increased interoperation between these respective standards.

> "SEDRIS is an infrastructure technology that enables information technology applications to express, understand, share, and reuse environmental data. SEDRIS technologies provide the means to represent environmental data (terrain, ocean, air and space), and promote the unambiguous, loss-less and non-proprietary interchange of environmental data." https://www.sedris.org

a. Wondering if any SEDRIS XML schemas are available online? Warren Macchi reports "There was an EDCS XML encoding submitted to the DoD XML Registry back ~2005. However, that was meant for encoding an EDCS version, not necessarily for EDCS content in other XML namespaces."
b. It would be interesting to look at SEDRIS XML schemas. X3D has XML schemas and the X3D Unified Object Model (X3DUOM) with much work converting to/from various other forms. W3C Efficient XML Interchange (EXI) is a compressed format that may be more compact and more performant than STF. However, the primary benefit will be related to information sharing, rather than relative size considerations. X3D Ontology can use enumeration values for query, having a SEDRIS vocabulary would be good. Apache Data Format Definition Language (DFDL) decorates an XML schema to achieve two-way conversion of a binary form to an XML form. So many data-conversion techniques of interest are available for exploration.

c. From Doug Stapleton: “Doesn’t this debate about XML come down to the general versus the specific? If STF is effectively an internal format between the same group using SEDRIS then it is far more efficient than XML. However where is the use case that has different groups on either side, and therefore XML comes into its own as an interchange format because it hides the complexity and detail from either party. I though that STF was an internal format to SEDRIS.”

d. Good points and, as indicated, is important to be clear on goals. Changing internal transmittal mechanisms or database-centric synchronization approaches within SEDRIS is not an external goal. Interoperability between standards is always useful to consider. Publishing relevant metadata in compatible ways is essential for provenance, cataloging, search queries and cross-linking are always useful.

e. Valuable challenges present themselves. Web3D Consortium looks forward to further dialog and potential work together with SEDRIS and all interested parties.

8. New working group: Systems Integration Visualization.

a. Web3D supports continued progress in working group, which has evolved from a diligent study group. From a “big picture” perspective, this activity has the potential to elevate the role of SC24 standards to a position of great usefulness to many ISO standards.

b. We continue to think that Smart Cities domain is an excellent focus and “forcing function” to encourage combinations of different information sources in a linked complementary fashion, further amplified by 3D presentation and visualization. References of interest:
   i. “Smart cities: essential for global sustainability and urban efficiency,” By Katie Bird, 5 July 2016. https://www.iso.org/news/2016/07/Ref2098.html
   ii. “Significant milestone for Smart City development - standards organizations agree to work together to move cities to greater smartness,” 1 September 2016. https://www.iso.org/news/2016/09/Ref2117.html
   iii. ISO Standards in action: Developing sustainably. ISO standards to promote sustainable growth, https://www.iso.org/developing-sustainably.html

c. Given that relevant data may come from many ISO IEC standards, and given that we use sharable data representations for interactive 3D presentation and visualization, there is a close connection for this working group to Big Data initiatives. Recent overview: "New international standard to enhance big data use across industry sectors," 14 April 2020, IEC Blog by Editorial Team. https://blog.iec.ch/2020/04/new-international-standard-to-enhance-big-data-use-across-industry-sectors

d. Potential use case for 3D presentation and visualization: contact tracing. Contact tracing may be the compelling cross-disciplinary, cross-domain exemplar we have been seeking. Of note: contact tracing cannot be solved by any single nation individually. Airports and transit hubs are large and include smaller zones while connecting into larger urban commons. For

COVID pandemic, it is clear that not all transmission vectors are yet fully understood, so greater insight is needed on cause/effect.

i. Wikipedia: contact tracing. “In public health, contact tracing is the process of identification of persons who may have come into contact with an infected person ("contacts") and subsequent collection of further information about these contacts. By tracing the contacts of infected individuals, testing them for infection, isolating or treating the infected and tracing their contacts in turn, public health aims to reduce infections in the population.” https://en.wikipedia.org/wiki/Contact_tracing
ii. NIST Airflow Model Could Help Reduce Indoor Exposure to Aerosols Carrying Coronavirus, 11 June 2020, NIST https://www.nist.gov/news-events/news/2020/06/nist-airflow-model-could-help-reduce-indoor-exposure-aerosols-carrying
iii. CONTAM is a multizone indoor air quality and ventilation analysis computer program, v3.2 (Windows and Linux), NIST. https://www.nist.gov/services-resources/software/contam

e. Workshop thought exercise: perhaps this group might host a workshop inviting active contributions by experts from all ISO IEC committees with information streams related to the Smart Cities initiative. The goal of a workshop (and subsequent report) might be:
   i. Focus on cross-cutting use case for compelling Smart City challenges and needs.
   ii. Participants identify types of well-defined standards-related data and information available to support study and information sharing.
   iii. Participants identify ISO and SDO standards that support well-defined sharing of such data.
   iv. Present a range of information presentation and visualization techniques supporting study of such data.
   v. Prepare, show and plan a short set of hybrid examples that demonstrate the power of "mashup" information analysis using interactive visualization to gain insight.
   vi. Identify gaps and summarize capabilities as workshop conclusions.
   vii. Identify immediate opportunities for progress and necessary next-step strategies for future work.

   Workshop outcomes:

   viii. Clearly articulated report enabling concerted efforts by ISO IEC Smart Cities standards committees, for next year and over longer term.
   ix. Establish SC 24 collaborative role as standards basis for information architectures supporting presentation and visualization.

9. **BSI proposed work on safety, health and security for AR/VR/XR**.

   a. Web3D Is glad to see this activity. The proposed working group on "Health, Safety, Security and Usability of AR/VR" looks excellent.

   b. Imperatives for health/safety and security can be found in Mixed Augmented Reality (MAR) Architecture. We have continued to urge review of that document.

   c. Accessibility work is highly relevant, essentially anyone immersed in some kind of environment is both access impaired and vulnerable to unperceived external factors. World Wide Web Consortium (W3C) work on Web Accessibility Initiative (WAI) and Accessible Rich Internet Applications (ARIA) standards for the Web are relevant. https://www.w3.org/WAI

   d. Security issues are cross-disciplinary and cross-cutting across hardware, software and data. For example, interocular and interaural distances are Personal Identifying Information (PII). Adjustments for vision, audio and other factors can also be considered PII. In addition to privacy, safety and vulnerability considerations come to the fore. Permissions for proper control of such information is difficult to maintain. Subsequent discussion that PII definitions and delineations can vary by country and technology support the rationale to keep such protections under the broader heading of Privacy, as long as their special nature and attendant vulnerabilities are considered.

   e. *WebXR Device API* (https://www.w3.org/TR/webxr) "describes support for accessing virtual reality (VR) and augmented reality (AR) devices, including sensors and head-mounted displays, on the Web." This work by *W3C Immersive Web Working Group* (https://www.w3.org/immersive-web) is relevant.

   f. This domain still has a number of "unknown unknown" factors. Root causes, physiology and psychology of VR sickness and vertigo are not well understood. Infection vectors from sharing devices are anecdotally common but not publicly addressed. Risks to immersed subjects and non-participating individuals are rarely considered, declared or addressed. Such uncertainty doubtless leads to Institutional Review Board (IRB) uncertainties and unrecognized legal liabilities.

   g. Parenthetically wish to note that this is a long-running hot topic in military modeling and simulation, with broad international interest and relevant expertise to gain.

   h. Web3D Consortium working groups will be glad to participate in this endeavor. Continued evolution and advancement of the X3D Standard can accelerate implementation work.

10. **Khronos Submission of glTF 2.0 to JTC 1 for approval as Publicly Available Specification (PAS).**

An excellent briefing by Neil Trevett described Khronos activities and plans. Of specific note to X3D4 efforts is that Khronos plans to request direct balloting of the already-completed glTF 2.0 specification, typically conducted in a straight pass/fail vote. Surprisingly such votes involve national bodies, not standards committees such as SC 24, even when direct relevance and topic dependencies are involved. JTC 1 chairperson Phil Wennblom explained how ISO rules precluded any discussion while such a vote was in progress. Subsequent discussion clarified that SC 24 participants might work with national bodies individually, and that all dialog with Khronos was permitted beforehand. This arrangement can be most effective for X3D4 if direct engagement between SC 24, Khronos and Web3D occurs early in the process.

11. **MPEG Coding of 3D Graphics**. A series of questions have been raised and considered in regards to this relationship. Background information from a Web3D Consortium perspective follows.

Collaborations between SC29 and SC24 during the late 1990s resulted in an initial mapping to between X3Dv3.1 Interchange Profile and MPEG4. After initial mappings, no further collaboration continued despite several years of inquiry in this regard. This mapped 70 nodes of central interest, based on VRML97, but over 250 nodes now exist in X3D.

X3D now has multiple encodings (XML, ClassicVRML, X3DB binary, compressed Efficient XML Interchange EXI, JSON and Turtle). X3D also has updated language bindings for JavaScript, Java, Python with additional specifications planned for C/C++/C#. Some are formal ISO standards, one is a W3C Recommendation, six have New Work Item Proposals (NWIP) planned upon completion of X3D4.

Issues with the identified work by SC29:

a. Agreed that it is not clear what "MPEG Coding of 3D Graphics" means. Multiple standards documents by this group refer to coding of 3D graphics elements, apparently within context of MPEG4

b. Prior collaborative work was inhibited by Intellectual Property Rights (IPR) restrictions by SC29.

c. Originally joint working groups created ability to work on Mixed Augmented Reality (MAR) which is largely based on 3D. This effort has become SC24 WG9 but no collaboration or discussion is evident.

d. Much dialog on this topic during this year's meeting seemed uninformed by any information from SC29. As discussion wound down, Dr. Charles Whitlock sharing a recent memo (dated 1 JAN 2020) providing minutes of a meeting between SC24 and SC29 that seemed to touch on primary issues.

Web3D remains dedicated to the broadest possible utility and adoption of X3D standards, including with respect to SC29 MPEG4 interoperability. Web3D Consortium continues to operate under Intellectual Property Rights (IPR) policy that ensures all X3D technology remains Royalty Free (RF) for any purpose.

12. **Problems with Working Group 9, Mixed Augmented Reality (MAR).**

Working Group 9 finished ISO/IEC 18039 standard — "Mixed and augmented reality (MAR) reference model" in early 2019. This directly pertains to all activities of the working group and the larger charter of SC24. Despite their critical value to public safety and multiple requests to review, relevant sections of this standard on Safety, Security and Health were not consulted during the current SC24 meeting consideration of a new working group in the area. Such a determined lack of due diligence is distressing. To assist, relevant section excerpts follow, taken from 2018 FDIS version of the ISO/IEC 18039 standard.

11 Safety

MAR systems are used by human users to interact in the real world, and entail various safety issues. For example, most MAR systems require the use of special displays which can distract users and create potentially dangerous situations. Minimum safety guidelines are necessary to ensure that the given MAR system and content includes components for safeguarding the user during the usage of the system. The issue of performance is closely related to that of safety.

Development of policies or software that increase the safety of users, assets and systems reduces risks resulting from:

- obstruction of dangerous conditions that could lead to injury of humans during MAR system use;
- hardware necessary for MAR system operation that has not been safety certified for specific environments;
- lack of sufficient instructions, presentations and highlighting of information for safe and proper use of the MAR contents;
- distraction of attention from potential hazards in the real world;
- temporary disconnection of the network service causing false confidence in the currently presented information;
- not considering special operational safety and health (OSH) requirements (such as in construction zones, traffic, operating vehicles and working at height in proximity to hazards);
- human movements necessary for operating an MAR system;
- insufficient level of performance for requirements of MAR system-assisted tasks; and
- sickness from mismatched stimuli to the human vestibular system, restricted field of view and other potential factors. Disruptive effects can in turn lead to disorientation, nausea, blurred vision, loss of spatial acuity and multiple other symptoms, which can last even after a user is no longer immersed in the MAR systems and services.

12 Security

Most MAR system services and implementations, like many other modern information systems, often rely on network-based solutions and are prone to the usual information security problems and the potential to mislead the user. Even as a standalone system many MAR applications and services, by their nature, tend to deal with a lot of personal information, and therefore pose an attractive target for security attacks. In general, MAR systems should exhibit a level of security (for their contents and information) comparable to other digital contents services, such as web documents and systems (http://www.w3c.org/Security) and geospatial systems (http://www.opengeospatial.org/projects/groups/securitywg).

In particular, the MAR-RM should outline the minimum set of features and components for architects and developers to consider for the sake of general security:

- encrypt digital assets;
- encrypt sensor readings captured by MAR systems;
- encrypt display output as presented by MAR systems; and
- encrypt other communications between MAR components.

13 Privacy

Personal privacy and potential exposure of personal information to unauthorized systems or third parties via cameras or other sensors on the MAR-assisted device are out of scope of the MAR-RM, but are highly relevant to the adoption of MAR systems. Developers may consider how to use existing or new systems and include components in their MAR systems that:

- authenticate user identity (e.g. registration with an account);
- authorize system access to users' personal data; and
- define the duration of periods during which data access and/or storage is authorized.

A long-standing problem with this working group has been lack of public visibility. Much active work in VR AR XR immersive 3D and related fields is ongoing at other standards organizations, but it appears uninformed by MAR Reference Model or related efforts.

a. World Wide Web Consortium (W3C) Immersive Web Working Group https://www.w3.org/immersive-web which is working on
b. WebXR Device API https://www.w3.org/TR/webxr and multiple other drafts such as
c. WebXR Augmented Reality Module - Level 1 https://www.w3.org/TR/webxr which in turn are each built on
d. Khronos Group OpenXR, "an open, royalty-free standard for access to virtual reality and augmented reality platforms and devices." https://www.khronos.org/openxr

A second major criticism for the past several years is that the group has been publishing standards which only have (at best) single/partial implementations, with no apparent connection to other relevant standards. It is hard to understand how this represents consensus or relevance that leads to any kind of interoperability, much less the possibility of repeatable solutions.

- From the "ISO: About Us" page at https://www.iso.org/about-us.html
- "Through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that support innovation and provide solutions to global challenges."

A third major problem is that years of effort by Web3D Consortium to collaborate and remedy this situation have had no discernable influence. While apparently valuable, group impact is not evident.

As a result, despite importance and relevance of the subject matter, Web3D Consortium practitioners currently see no path forward that justifies continued collaboration. This situation is regrettable.

Suggested actions for Working Group 9 and SC24 to address these major problems include developing a strategy based on advancing the MAR Reference Model that includes W3C, Khronos Group, Web3D Consortium and multiple additional related Standards Development Organizations (SDOs).

Positive influence of MAR standards by WG9 is not a one-shot activity resolved by simply publishing a white paper or assigning an industry liaison. Each SDO working group has regular recurring activities, processes and strategies. WG9 needs to engage regularly and align its work in a complementary fashion to achieve possible influence. In turn this will benefit WG9 progress over the long term.

This is an SC24 problem, not just a WG9 difficulty. Thanks for all consideration of this strategic matter.

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