The Keys to an Open, Interoperable Metaverse

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Web3D 2022 Conference – Evry, France – November 2022

The Keys to an Open, Functional, and Interoperable Metaverse

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The Term "METAVERSE"

"Let's name everything the Metaverse" – Micheal Zyda

outline

History/Background

Current Status

Key Issues

Workable definition of the Metaverse

What do we need?

Examples – X3D

The Future.

History/Background

The metaverse has been around since the 1990s. Mostly proprietary for gaming and socializing platforms. Many of these don't exist today

History/Background

WWW
GIS
HAnim
Multimedia
Archival 3D

- The vision of shared digital worlds was established in the early 1990 by the Web 3D Community using Web technologies and HTML

It was called real-time 3D in a browser (plug-ins)

- These worlds still exist. As they were built on the open interoperable web platform.
- They played well with others in the WWW ecosystem of Standards

Current Status of the Metaverse

Walled Gardens: Roblox, Fortnite, The Sandbox, Decentraland, and Horizon Worlds
Platforms: Propriety with no interoperability
Functions: Mostly Gaming and Socialize – Some Commercial or Professional
User devices (HMD): VR headsets , AR glasses – expensive – cybersickness – Visual strain

.

Where are we now?

Open Web Based Immersive 3D (AR/VR) : Lots of different data from different domains, several solutions available but not necessarily interoperable or open

User experience: Many propriety headsets and devices

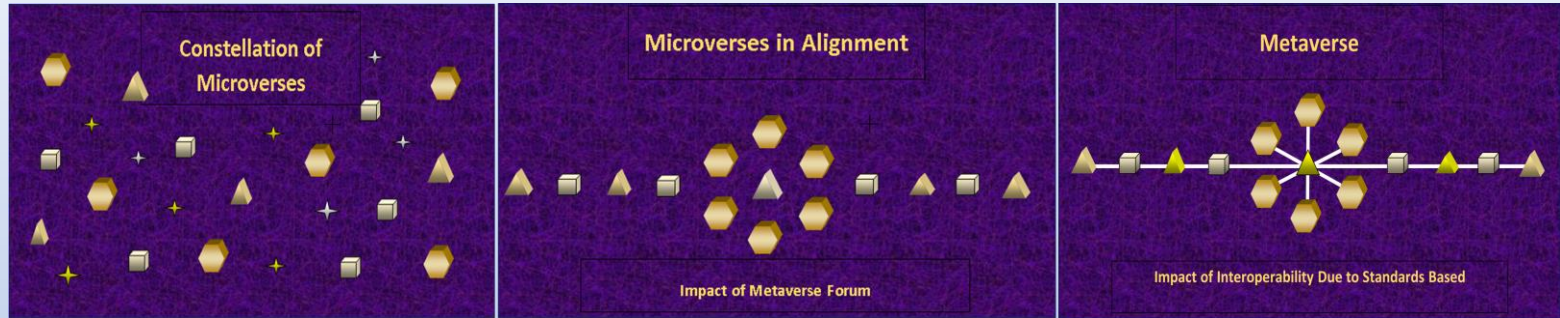**Security: Very little awareness for Metaverse safety, security, Privacy & Ethics**

Interoperable standards: Many specifications available but few global standards available for interoperability

Corporate Cooperation: Very limited

Key issues: Poor user experience and poor corporate cooperation

Workable Definition for the next Metaverse

A constellation of connected microverses, that are multidimensional, realistic worlds where people will perform their task without the constraints of physical space and time.

A unified metaverse with movement between microverses without dropping out of 3D mode.

We believe - the metaverse will emerge as a property of the current 2-dimensional Web. Web 3.0/Metaverse. With the interconnection and interoperability between microverses provided by the Web itself.

What do we need?

- **Open Web Based Immersive 3D standards**

  Real-Time 3D/Browsing the Metaverse

  Avatar Standard

- **Improved user experience and Improved user security**

- **Corporate Cooperation**

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Open Web 3D Standards

Creating real-time 3D is easier now and 3D assets can also be reused
Interoperability, open web standard and a technology to facilitate seamless movement between worlds

Many technologies and specifications available today to create real-time 3D but very few widely used global standards.

X3D provides a unique value proposition to quickly integrate many existing systems in a proven framework of royalty free, internationally ratified standards. It is a proven and time tested standard. Used in enterprise and serious 3D applications.

X3D: Scene graph for real-time interactive 3D

Developed by [Web3D Consortium](#) (ISO Ratified and Royalty Free)

[X3D Graphics](#) provides a system for the storage, retrieval and playback of real time 3D graphics content, to support a wide array of domains and user scenarios. (Enterprise 3D)

Presentation layer for Scene description with Behavior . It is Extensible! It is archiveable

www.web3d.org
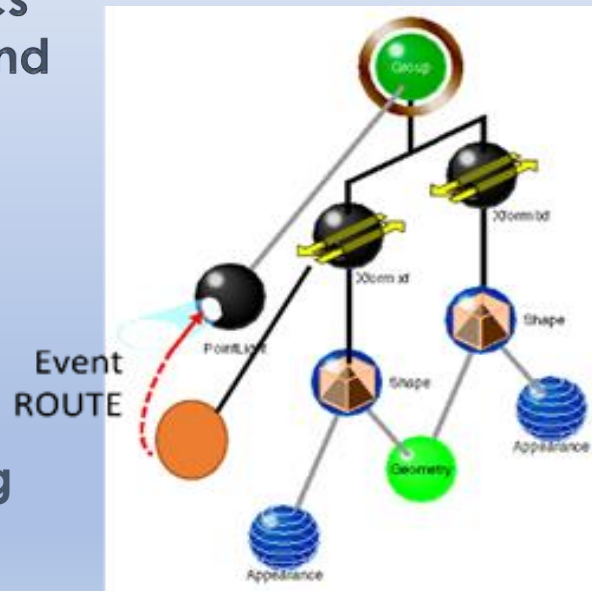
What is X3D (Extensible)

Originated from VRML

- **Large set of nodes for 3D modeling – Declarative 3D**

- **Profile and Component structure promotes interoperability**
  8 Profiles for common use cases X3D Profiles
  35 X3D Components for modular design X3D Components
  233 X3D Nodes for every little thing! X3D Nodes

- **File format and Runtime API (JavaScript, Java, …)**

- **Multiple encodings (file formats): XML, VRML, JSON, Python based on the same abstract scene graph model**

- **A language (presentation layer) to add 3D models, GIS data, AR and more into one system (3D application) . Assets reused across different domains!**

- **Multiple open-source implementations (X3DOM and X_ite)**

Active Web3D ISO Standards

X3D4 - 19775
HAnim - 19774

- 3D + VR + AR Capable
- Interaction
- Collaboration
- Animation
- Humanoid Animation
- Runs on multiple devices Phones, tablets, desktops, caves
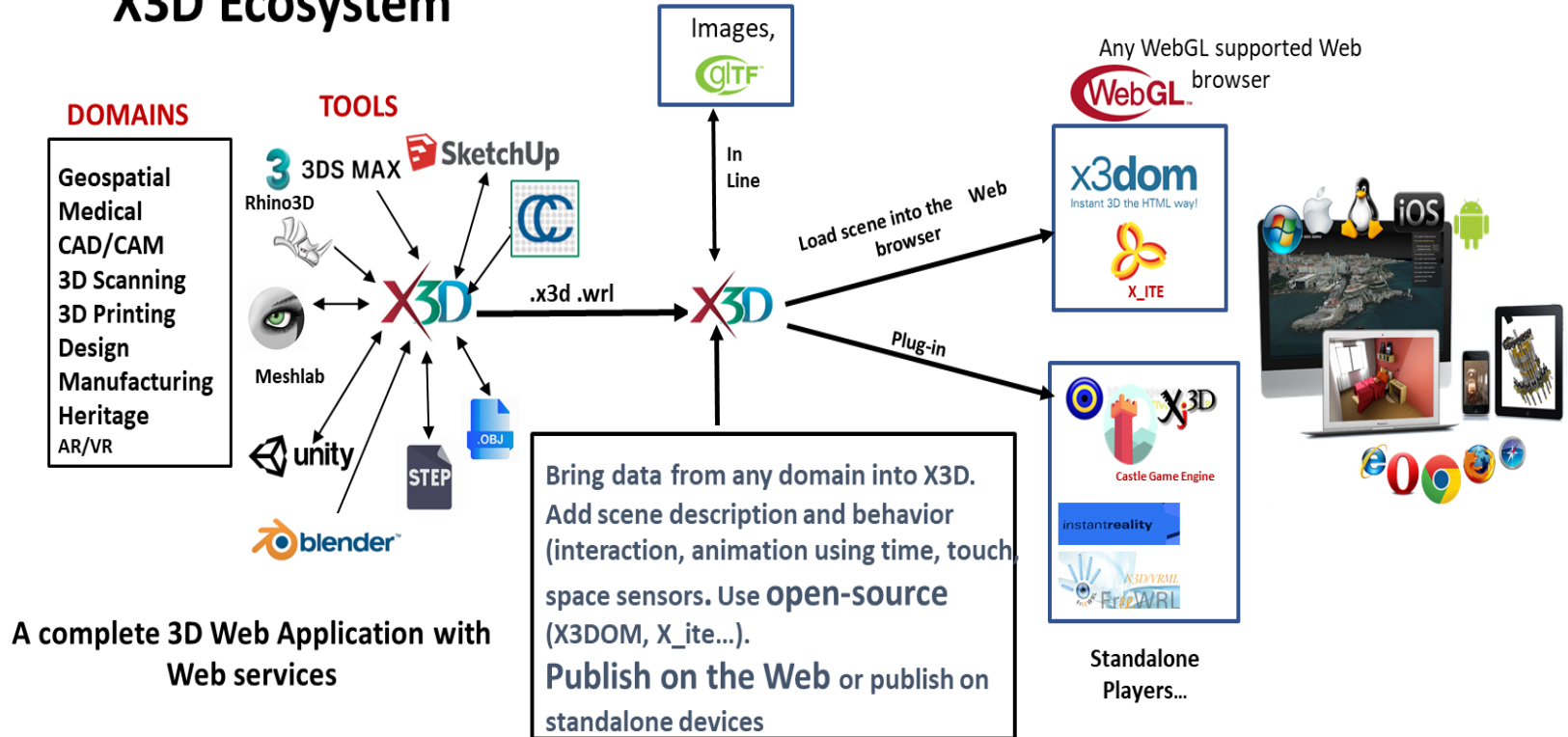- Used in multiple domains Medical, Geospatial, 3D printing/scanning, CAD, AR/VR and more
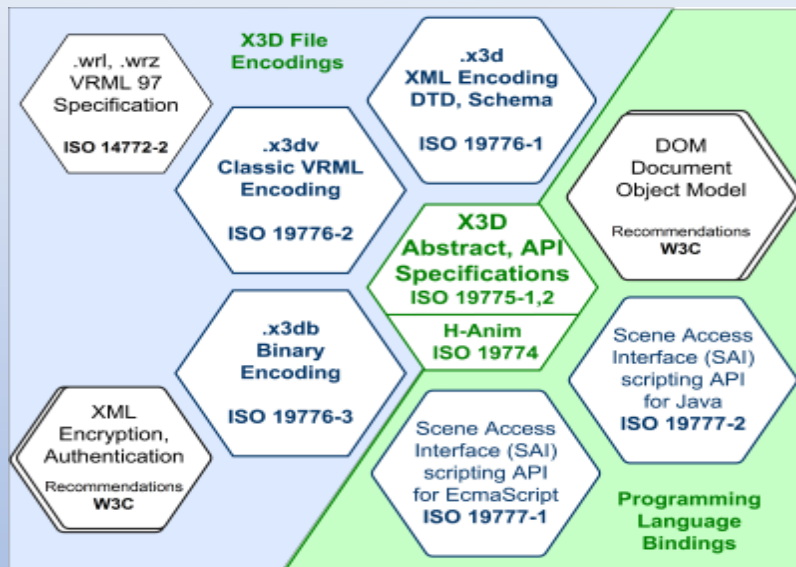
Greatest Common Denominator
Presentation layer for Scene description with
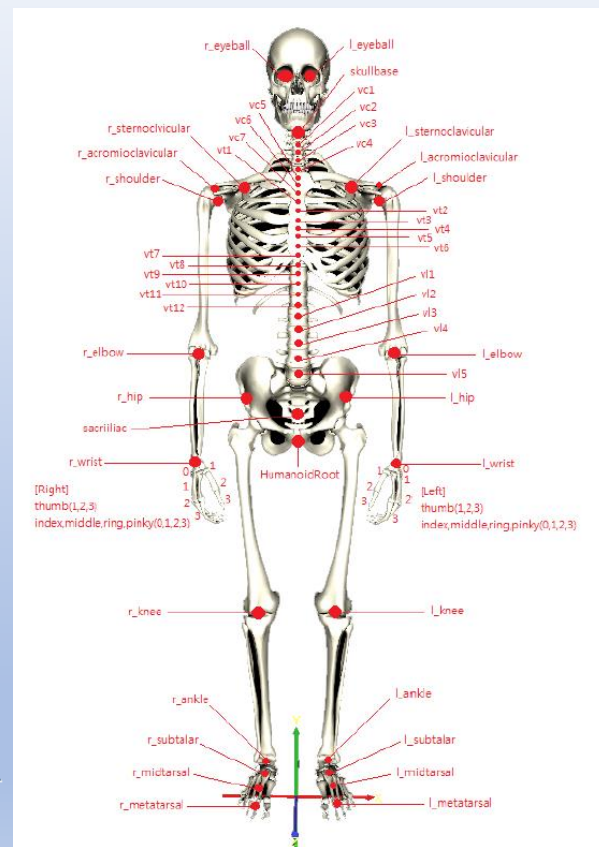Behavior. It is Extensible! It is archiveable

Build - Author - Publish

Web3D ISO Standards

X3D File Encodings

.wrl, .wrz VRML 97 Specification
ISO 14772-2

.x3dv Classic VRML Encoding
ISO 19776-2

.x3d XML Encoding DTD, Schema
ISO 19776-1

DOM Document Object Model
Recommendations W3C

X3D Abstract, API Specifications
ISO 19775-1,2

H-Anim
ISO 19774

.x3db Binary Encoding
ISO 19776-3

Scene Access Interface (SAI) scripting API for Java
ISO 19777-2

XML Encryption, Authentication
Recommendations W3C

Scene Access Interface (SAI) scripting API for EcmaScript
ISO 19777-1

Programming Language Bindings

X3D4 - 19775
HAnim - 19774

X3D – HAnim (Humanoid Animation)
Representing Metaverse Humans with Open Standards

Varied avatars from any kind of character to medically accurate human skeletons.

Multiple levels of detail (LOD) for progressive avatar fidelity, essential for scalable worlds. Levels of Articulation (LOA), Levels of Expression (LOE) powerful ways to scale up fidelity.*

Metadata for identity, authentication for secure digital signature, and strong privacy of some data by encryption.

Composing 3D scans and motion-capture (mocap) data for full avatar*.

Avatar with scientific correctness and accurate clothing(soft physics)*.

Best practices for avatar data structures can encourage interoperability and interaction

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HAnim v2

Workflow for modeling Anatomies with Motion animation matching Bounding volume hierarchy (BVH)

ISO/IEC DIS 19774-2

BVH is widely available and unrestricted/open body animation format

-
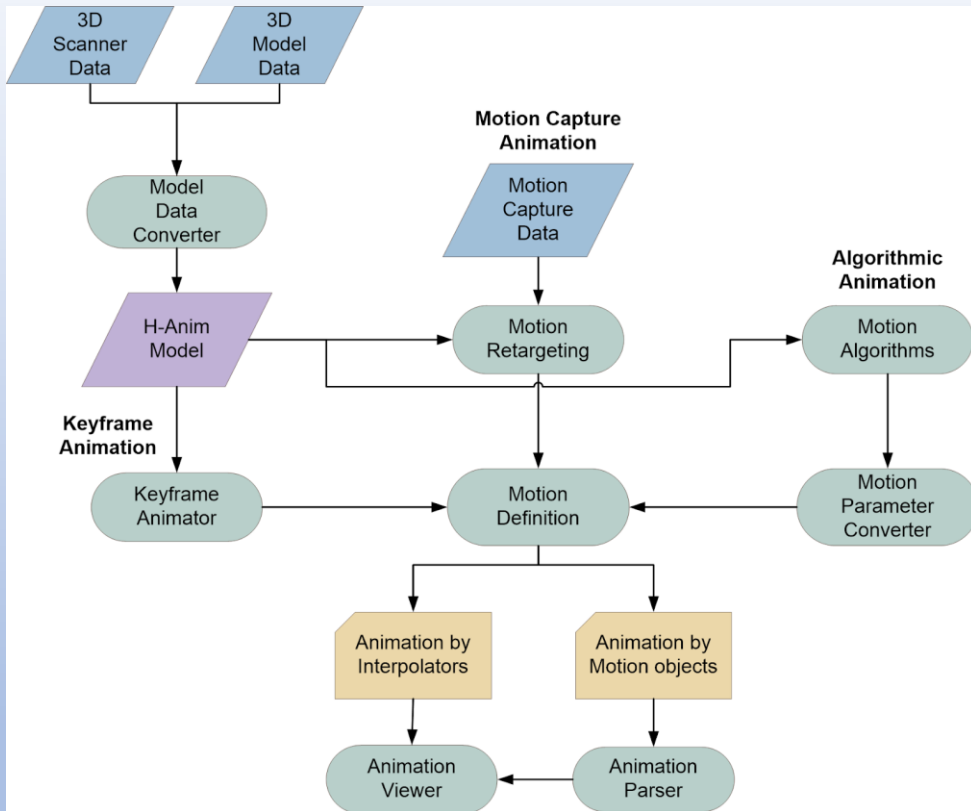
HAnim v2

ISO-IEC 19774 - 1 : H-Anim (2018)

Level of articulation (LOA) represents the complexity and detail of joints for a humanoid skeletal hierarchy, and can be used for generating various motions based on the joints.

There are five levels of articulation:
- **LOA-0** represents only the humanoid_root Joint object without hierarchy.
- **LOA-1** represents the simplest organization and hierarchy of joints for a humanoid. 18 joints and 18 segments. Each segment has a joint in the hierarchy.
- **LOA-2** consists of 71 joints and 71 segments.
- **LOA-3** consists of 94 joints and 94 segments.
- **LOA-4** builds on LOA-3 by adding anatomical details of hands and feet, consisting of 148 joints and 148 segments.
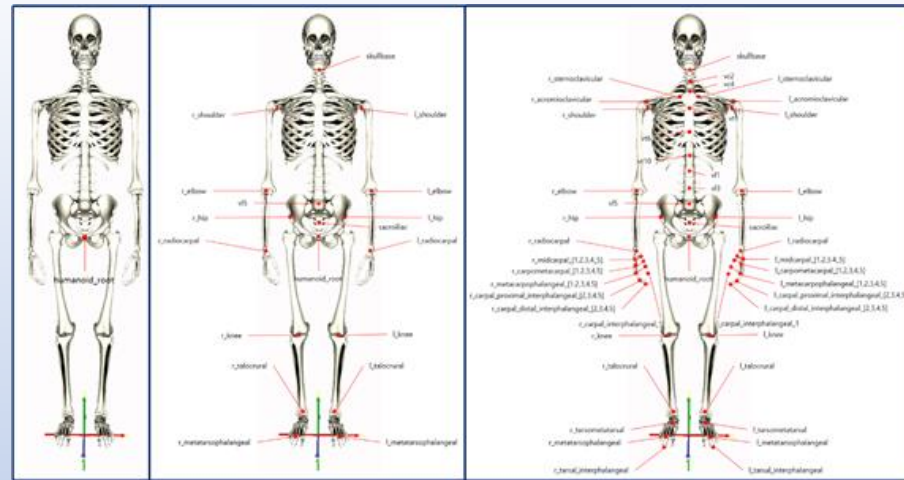

LOA-0   LOA-1   LOA-2
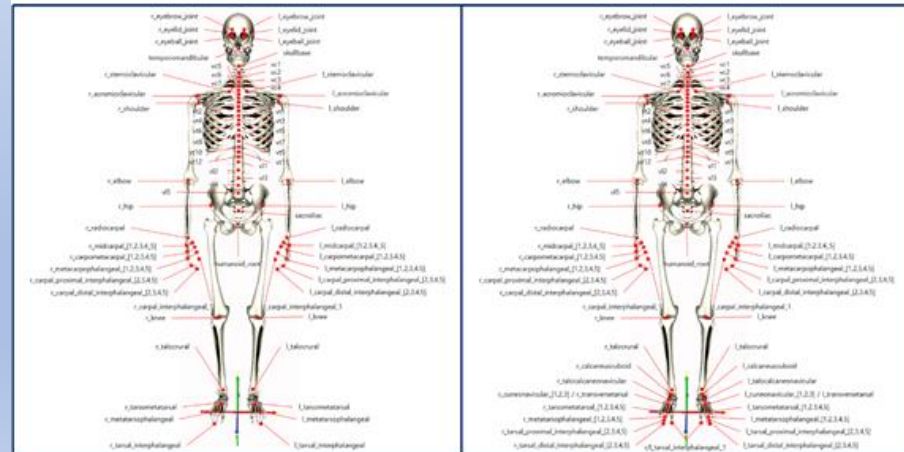
LOA-3   LOA-4

X3D: Avatar Implementations

Web3D X3D VRML compatible avatar designs:

1. 3DMD https://3dmd.com
2. Silhouette Avatars by IVN, https://ivn.net
3. Cybertown https://en.wikipedia.org/wiki/CyberTown
4. Bitmanagement Avatar Studio https://www.bitmanagement.com/en/press/avatar-web
5. VCom3D humans for sign language and training, https://vcom3d.com
6. Body scanning: Size Stream https://sizestream.com and TC2 https://www.tc2.com
7. https://www.donmccurdy.com/2017/11/06/creating-animated-gltf-characters-with-mixamo-and-blender
8. https://www.pluralsight.com/blog/film-games/key-rigging-terms-get-moving
9. https://iaspace.zhdk.ch/wiki/blender-and-makehuman

X3D Data Integration

- **X3D content as payload(container)**
- **X3D files (Metadata, headers, namespaces)**
- **X3D peer applications**
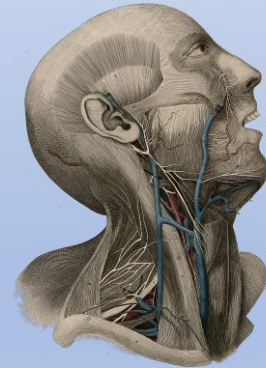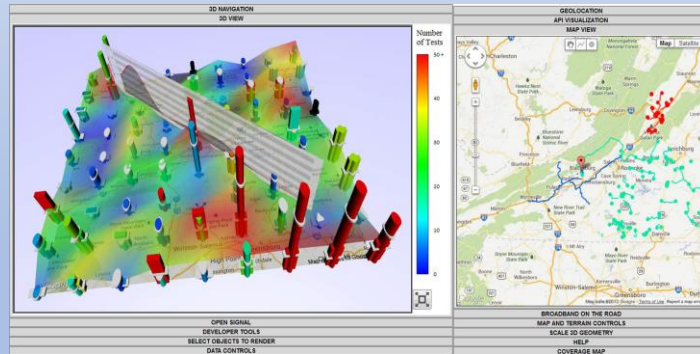
Metadata sets on any node in the scene graph

```xml
<MetadataSet name="DICOM" reference="http://dicom.nema.org">
  <MetadataString containerField="value" name="Recognizable Visual Features" value="'NO'">
    <MetadataSet containerField="metadata" name="tag">
      <MetadataString containerField="value" name="GROUP" value="'0028'"/>
      <MetadataString containerField="value" name="OBJECT" value="'0302'"/>
    </MetadataSet>
  </MetadataString>

  <MetadataString containerField="value" name="Burned In Annotation" value="'NO'">
    <MetadataSet containerField="metadata" name="tag">
      <MetadataString containerField="value" name="GROUP" value="'0028'"/>
      <MetadataString containerField="value" name="OBJECT" value="'0301'"/>
    </MetadataSet>
  </MetadataString>
</MetadataSet>
```

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Importance of Metadata

3D model designers want to:

- Track use of the design file
- Compare modified versions
- Indicate original intent
- Provide credit or attribution
- Validate, ensure safety if applicable

1. Workshop follow-up information
2. ccRel Data Model

Healthcare teams want to:

- Include patient identifers
- Validate, ensure safety
- Track versions
- Access a model from a PACS system
- Make the model a persistent and permanent part of the patient's medical record

1. SME Medical 3DP Workgroup
2. DICOM Working Group information (WG-17)

XML can be parsed to prepopulate fields in data repositories, facilitate sharing via APIs, and import/export 3D printing parameters

National Institutes of Health
Turning Discovery Into Health

X3D: Body Data

Surfaces, materials, and Hierarchies: 3D scans
- Clothing
- Dermatology
- Plastic surgery
- 3D Printing

- Imaging and volume rendering
  - X3D Volume Component
  - X3D Medical Interchange Profile
- X3D Ontology for Semantic Web and Metadata integration
 - FMA
  - SNOMED

X3D Use Cases for 3D Body Data

- Humanoid Animation
- Avatar
- Security informed consent
- CAD models (clothing, stents, prostheses)
- 3D Printing
- Visualizing geospatial distributions of data (incident rates, outcomes, etc)
- Presentation of DICOM data, molecules, anatomy

Integration/Interoperability
An Avatar Centric Data Management Interoperable Approach

**Extending standards
by engaging with other
SDOs for data support and
Interoperability**

**Emergent 3D standards that
Web3D Consortium is working
with**
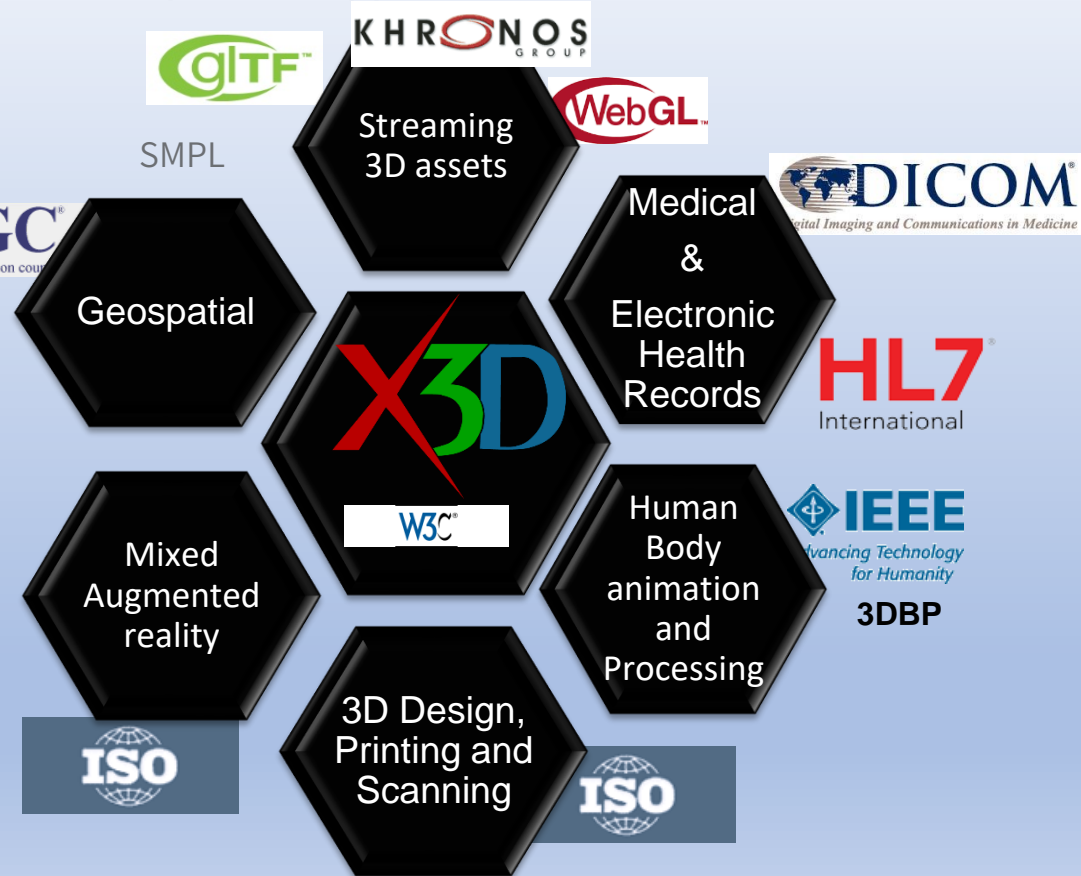
Build - Author - Publish

What do we need?

- **Open Web Based Immersive 3D standards**

- **Avatar Standards**

- **Improved Security and Improved user experience**

- **Corporate Cooperation**

Improved User experience

VR and AR like experiences with easy to wear and use Head mounted devices

Training computers about people

Training devices to communicate with people

Training Devices to Recognize Everyday Interactions

Improved headset design
Improved content design

Improved User Security

How are people protected?
How will accessibility concerns be addressed?
How will one reliably opt off if they have privacy concerns?

Data to last Lifetime? Encrypted data container generated on enrolment?
NFT- 'type' licensing?

Web 2.0=Chaos of Personal Privacy. Web 3.0/Metaverse will fail if we repeat this
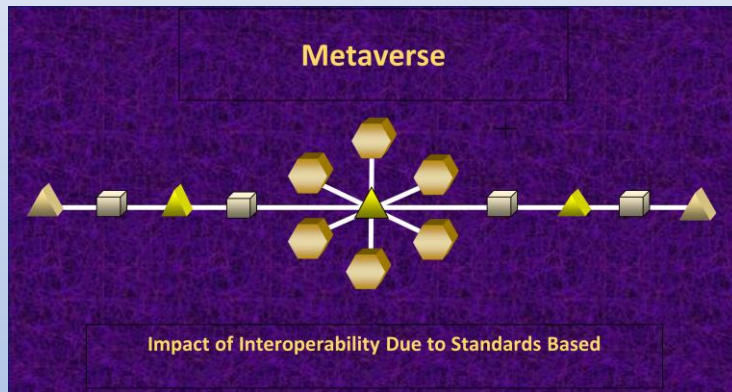
There could be a global setting on the browser or OS for privacy that takes advantage of the WWW security stack.

What do we need?

- **Open Web Based Immersive 3D standards that are interoperable**

- **Improved Security and Improved user experience**

- **Corporate Cooperation**

Corporate Co-operation

If we all play well together

It is possible for aligning technologies and Standards for an interoperable Metaverse

Corporate Co-operation

The recently formed **Metaverse Standards Forum** with over **1,800 members (SDOs and Companies)** have taken up the task to foster interoperable standards by:

- Identify existing standards
- Address interoperability problems
- Foster data requirements
- Find use cases
- Test open-source data

Web3D Consortium is a member and is playing an active role. X3D is listed in their standards registry. We are optimistic about this development. We encourage you to join and be a part of this initiative!

Aligning Standards for an interoperable Metaverse
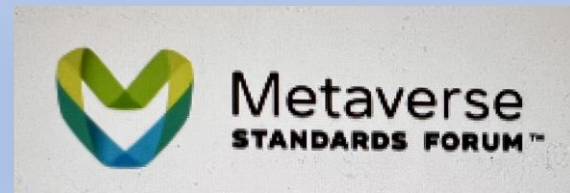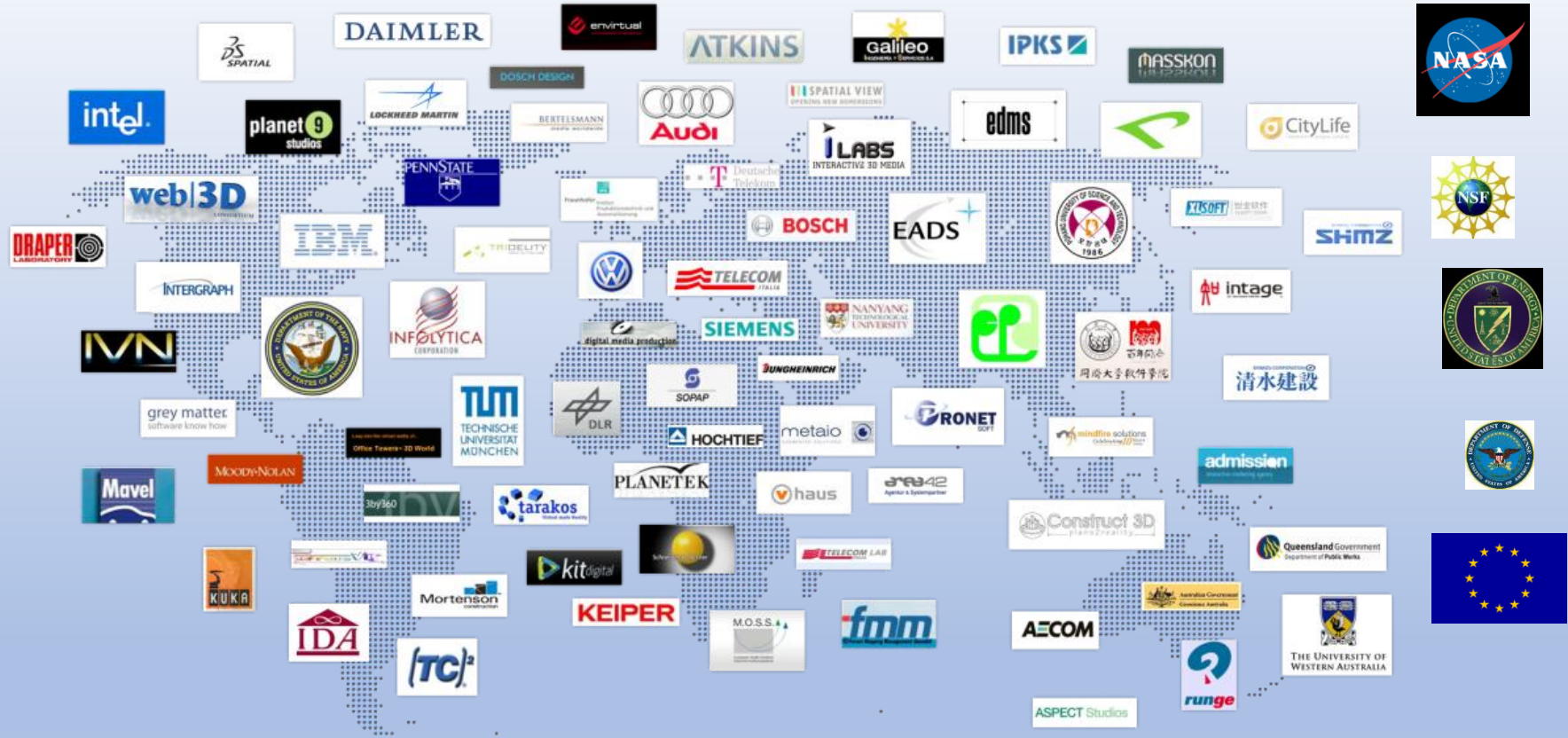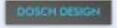

Metaverse Standards Forum

Metaverse will bring many new opportunities

This is a hard problem

?

What resources and technologies will your brand need to develop a presence in the metaverse?

Do we understand the data?

Do we understand the applications? (Games, Enterprise, Commerce, Health …)

Do we have most of the requirements to restart the Metaverse/web3.0/Web4.0

What role will you play to manifest a successful metaverse this time around?

The real world is merging with the virtual world

Time has come for co-operation, serious implementation and further standardization!
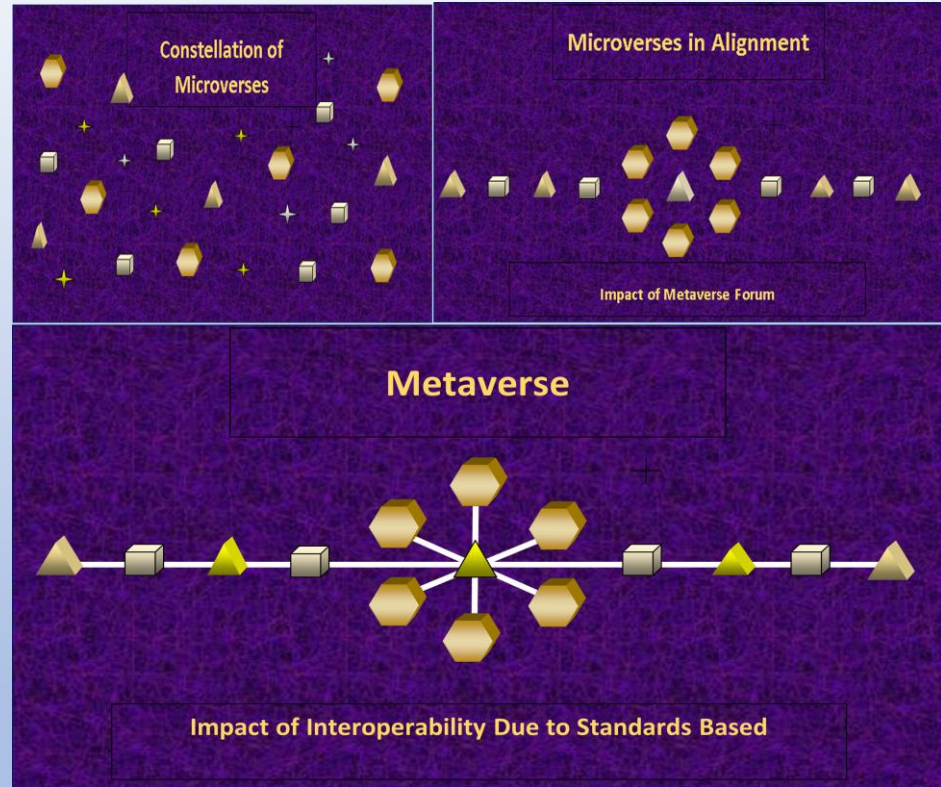
Future
Our Aspiration

A Metaverse with aligned standards, that is:

OPEN

EASY

SECURE

INTEROPERABLE

Thank you

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