Web3D Consortium

ISO X3D + ISO glTF

Anita Havele
Executive Director, Web3D Consortium
anita.havele@web3d.org

Johannes Behr
CTO, Threedy
Johannes.behr@threedy.io

Web3D Consortium
ISO X3D + ISO glTF

Driving open standards for 3D content creation, delivery, and interaction across the web ecosystem

Web3D® Consortium Overview

Who We Are

Member funded, community driven, nonprofit organization developing royalty-free ISO specifications for interactive 3D Graphics on the Web

Our Community

Diverse ecosystem of technologists and enterprises including academia, government, industry, research institutions, and professionals

Open-Source Implementation

Multiple implementations including X_ITE, X3DOM, Castle Game Engine, and more - making standards accessible to all

Implementation

Several open-source implementations available for developers and users

Our mission is to develop and maintain open standards that enable the creation, delivery, and interaction of 3D content across the web and various platforms.

Web3D® Consortium

Member funded; community driven; nonprofit organization

■ Our Community

Academia, Government, Industry, Research, and Professionals collaborating to advance web 3D standards

■ Open Standards

Developing royalty-free ISO specifications for interactive 3D Graphics X3D® and HAnim,

■ Implementation

Several open-source implementations available for developers and users

WWW + X3D: 3D Anywhere

Cross-Platform Capability

3D + VR + AR Capable, runs on multiple devices (phones, tablets, desktops, CAVEs)

Versatile Applications

Used in medical, geospatial, 3D printing/scanning, CAD and more

Rich 3D Features

Interaction, Animation, Archivability, Security

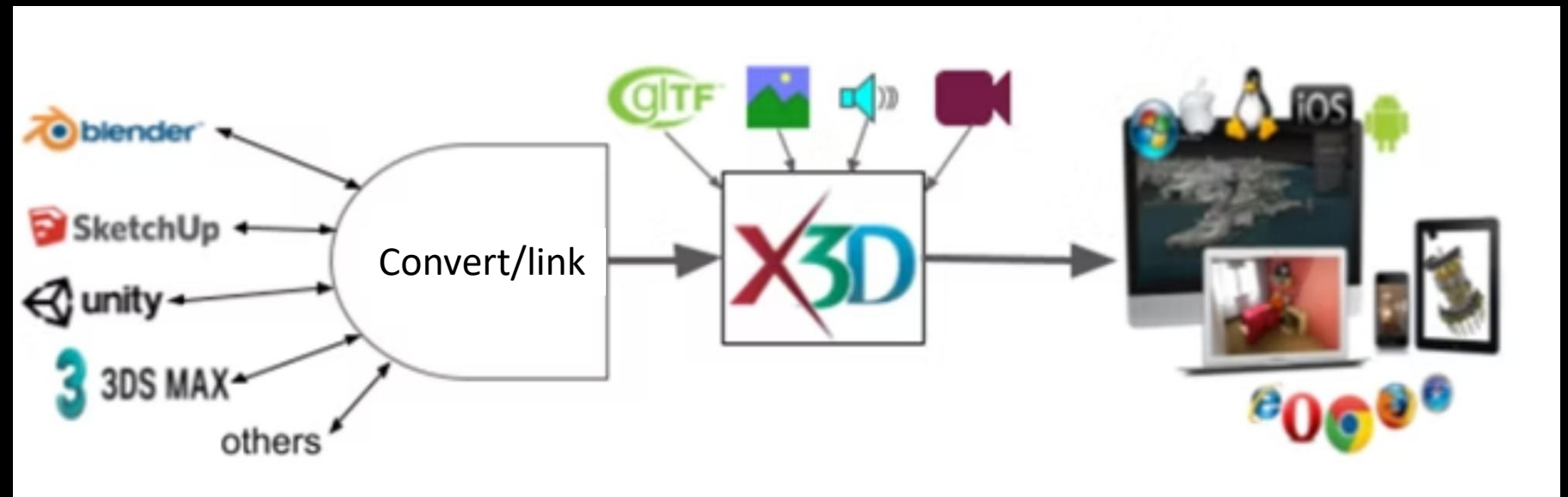Learn more: www.web3d.org/x3d/why-use-x3d

X3D: 3D Anywhere

Comprehensive 3D Capabilities

- 3D + VR + AR Compatible
- Multi-domain applications
- Rich interaction
- Animation support
- Archival-quality format
- Security features

X3D Ecosystem

X3D: A Presentation Layer

Data Import	Add Behavior	Publish on Web
Bring data from any domain into X3D format	Enhance with scene description, interactivity, and animation using time, touch, and space sensors	Use open-source implementations - X3DOM, X_ite to deploy on the web

Open-Source Engines

X_ITE

Modern Javascript Engine with WebGL renderer, optimized for both desktop and mobile performance with comprehensive X3D standard support.

X3DOM

Javascript Engine that enables X3D integration directly into HTML5 DOM, making 3D content as easy to use as regular HTML elements.
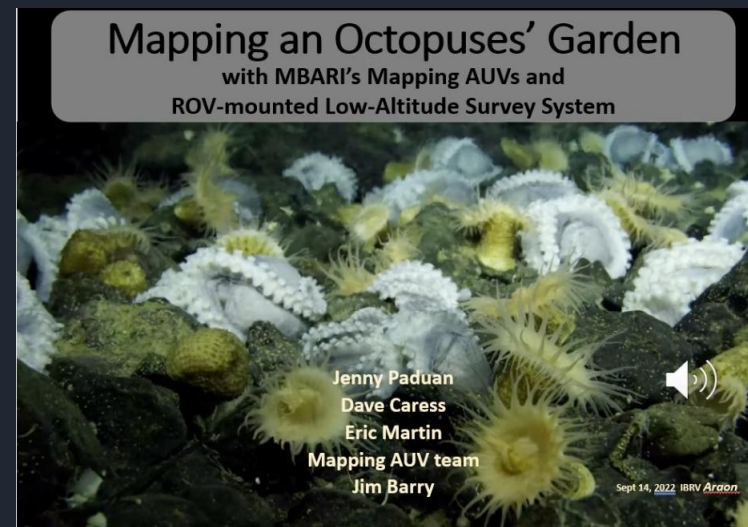
Castle Game Engine

Open-source cross-platform 3D game engine with robust X3D support, featuring powerful tools for game creation and interactive applications.
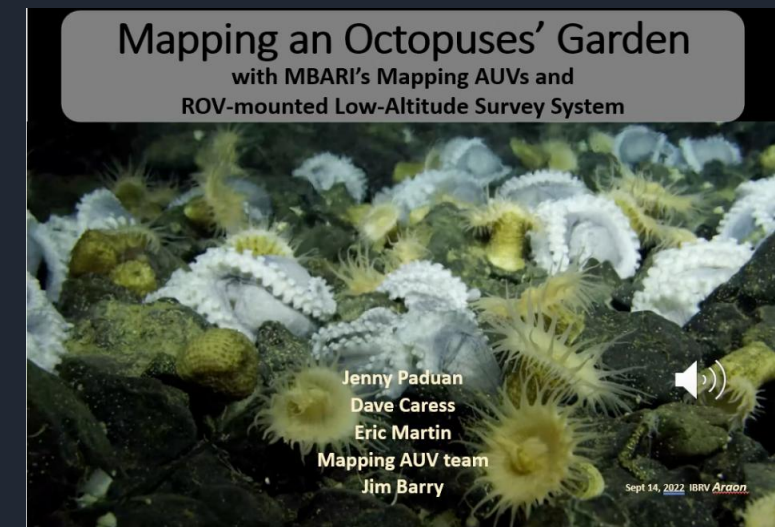
X3DOM is widely adopted, downloaded 49,076 in 2 weeks.

X3D Use Cases

Versar: Environmental impact assessments, infrastructure planning, and resource management

MBARI: Mapping of the Seafloor

3dMD: Health care and Wearables

Mapping an Octopuses' Garden
with MBARI's Mapping AUVs and
ROV-mounted Low-Altitude Survey System

Jenny Paduan
Dave Caress
Eric Martin
Mapping AUV team
Jim Barry

Sept 14, 2022 IBRV *Aragon*

Mapping an Octopuses' Garden
with MBARI's Mapping AUVs and
ROV-mounted Low-Altitude Survey System

Jenny Paduan
Dave Caress
Eric Martin
Mapping AUV team
Jim Barry

Sept 14, 2022 IBRV *Aragon*

X3D provides the tools needed to create meaningful interactive visualizations that help stakeholders understand complex spatial relationships

Web3D® Consortium

30-year legacy of 3D Graphics

Standards Development

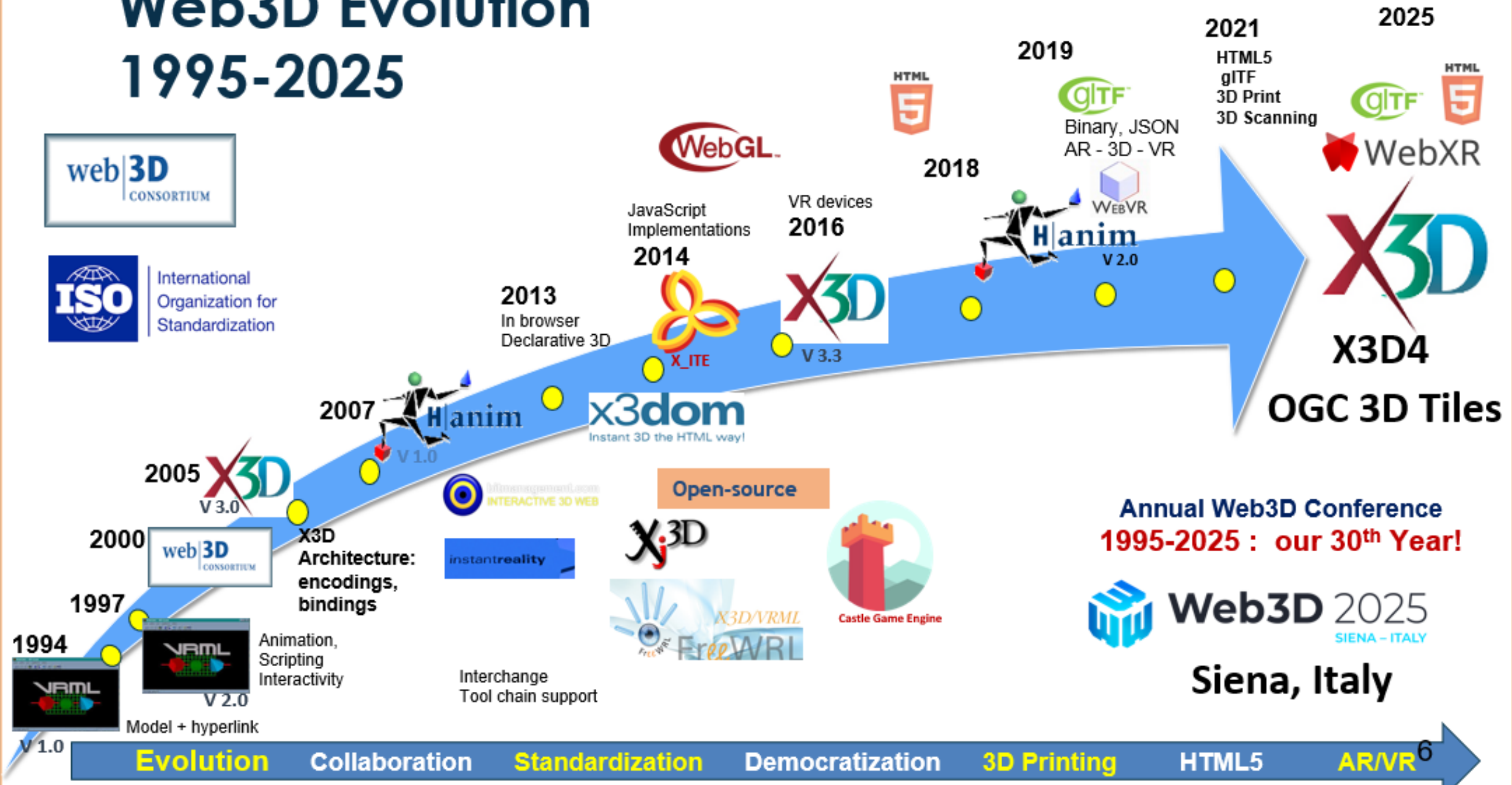Community and Collaboration

Education and Outreach

Technical Advancements

Join us at our 30th anniversary celebration at Web3D 2025 in Siena, Italy

ISO X3D + ISO gITF

ISO X3Dv4 includes ISO gITF2!

Web3D Consortium Specification

- Interactive 3D scenes on the Web in real-time
- Wide range of 3D graphics features
- Multiple coordinate projections
- Double-precision data types

Khronos Specification

- Efficient transmission format for 3D scenes
- Optimized for runtime performance
- Physically-based rendering materials
- Lightweight 3D model delivery

These complementary standards create a robust ecosystem for web-based 3D visualization, each addressing different aspects of the technical challenge.
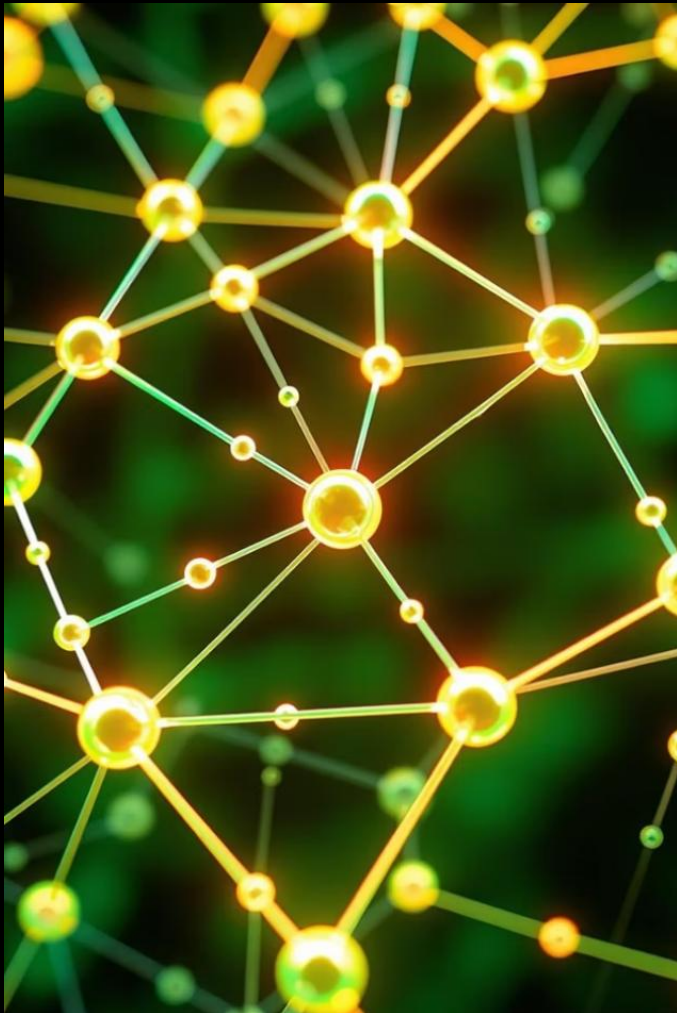
ISO X3Dv4 includes ISO glTF2!

A milestone achievement in 3D web standardization

Unifying the power of comprehensive scene graphs with efficient asset delivery

X3D External References and gIX

1 Existing X3D Capabilities

X3D has supported anchors + inline functionality since version 1.0, enabling sophisticated scene composition

2 Enhanced External References

glTF + links: X3D External reference system provides comprehensive linking capabilities

3 Streamlined Profile

A new subset of the "Interchange" profile that includes only Core, Networking, and Grouping components

Key question: How do we best link to glTF, USD or other data types through inline Geometry?

Lightweight X3D External References Profile
Optimized for Interoperability

A new profile that is a subset of the "Interchange" profile and only includes components:

Core Component
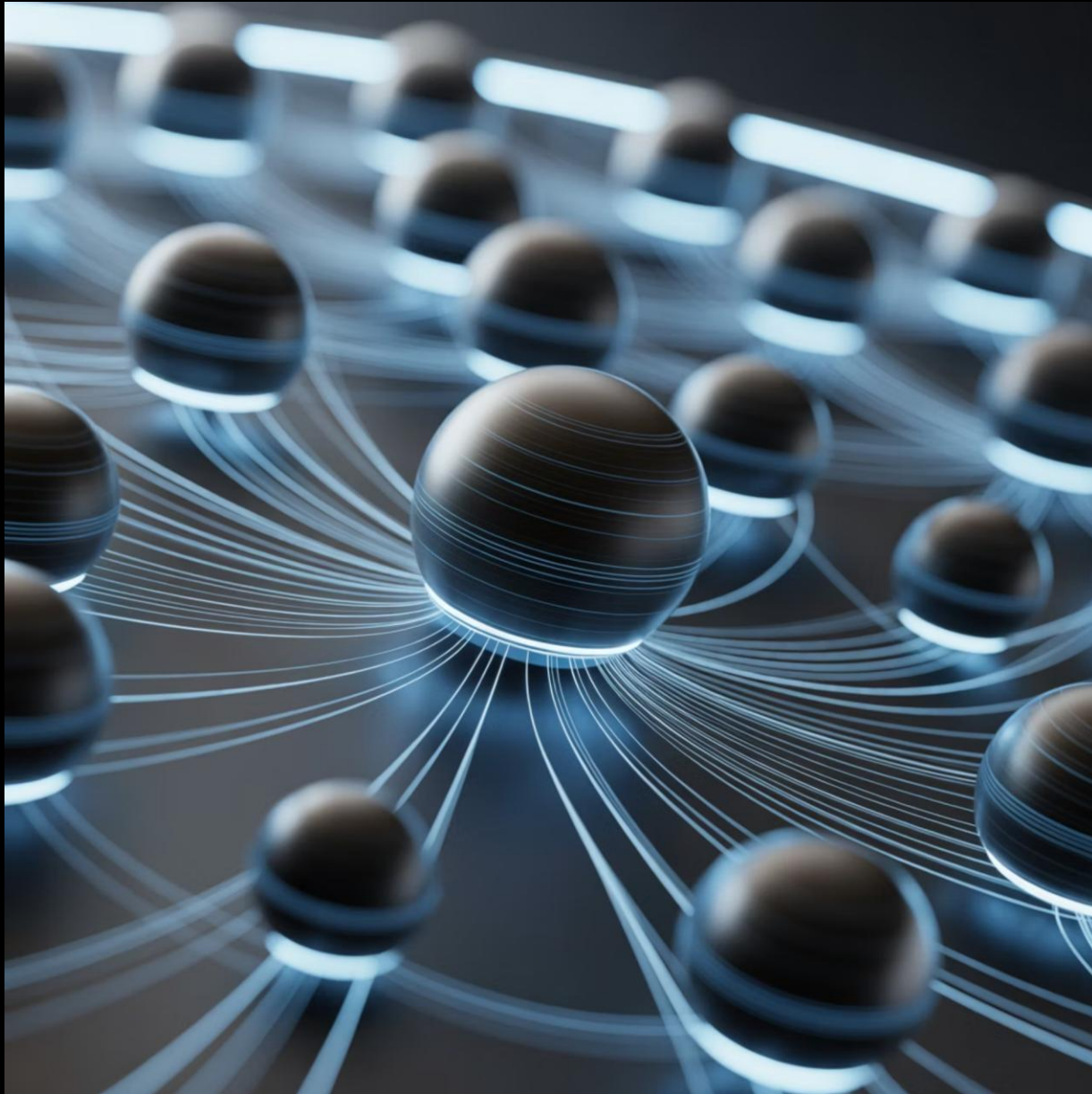Essential metadata support for documentation, search, and semantic meaning

Networking Component
Powerful linking capabilities to connect assets and worlds

Grouping Component
Hierarchical organization of scene elements with transformation support

X3D Networking Components

Anchor
Creates interactive regions that, when activated, navigate to specified URLs – enabling spatial hyperlinking

Inline
Loads external X3D or compatible files and incorporates them into the current scene graph

LoadSensor
Monitors the loading status of Inline nodes and other resources, enabling developers to create responsive experiences

X3D Core Components
Metadata Support

Robust Metadata Types

- MetadataBoolean
- MetadataDouble
- MetadataFloat
- MetadataInteger

Hierarchical Organization

- MetadataSet
- Nested structures
- Flexible organization

Context & Documentation

- MetadataString
- WorldInfo
- Scene-level metadata

The Core component provides comprehensive metadata capabilities essential for documentation, search, and interoperability across different 3D formats and platforms

DATA

NAME

NAME

VALUE

VALUE

X3D Composition Example

External References in Practice

X3D's flexible referencing system allows seamless integration of multiple file formats within a single scene graph, maintaining hierarchical relationships and transformations

```
<X3D>
    <Transform>
        <Inline url='http://example.com/car.x3d" />
        <Inline url='http://example.com/car.glb" />
        <Inline url='http://example.com/car.usd" />
        <Inline url='http://example.com/car.jt" />
    </Transform>
</X3D>
```

This approach enables developers to leverage the strengths of each format while maintaining a coherent scene structure

X3D for the Metaverse

Building Bridges Between Worlds

Links Between Worlds
Anchors and URLs for world-to-world navigation

Asset Integration
Inline and URL for seamless asset incorporation
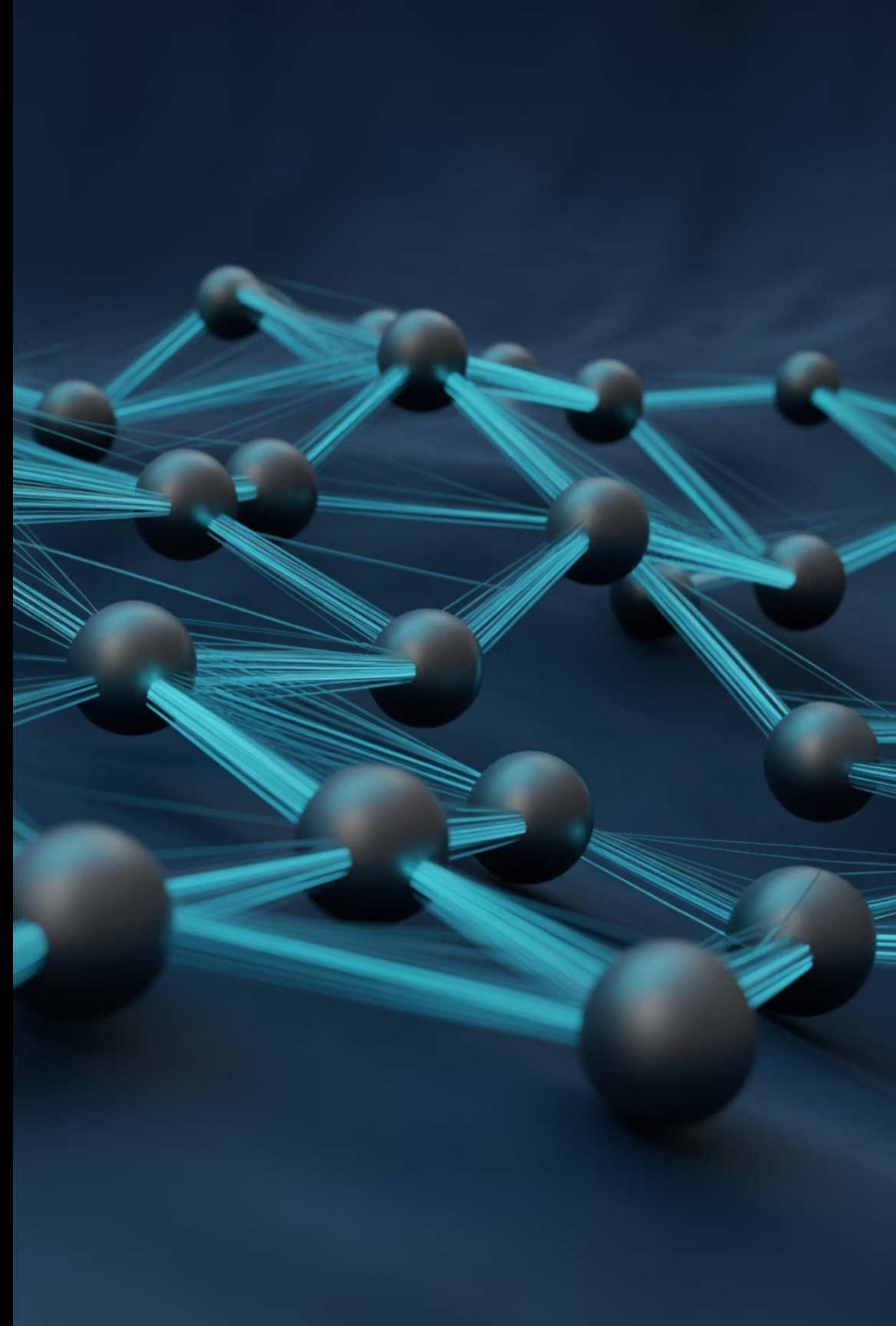
Specialized Profiles
Creating capabilities where gITF doesn't offer solutions

Next Steps
Developing comprehensive world linking standards

X3D's proven networking capabilities provide the foundation for creating an interconnected metaverse of 3D worlds with standardized navigation and asset sharing

Technology Comparison

Rich Frameworks for 2D and 3D Web

Feature	2D Web App	3D Web App
Frameworks	React, Angular, Vue, Next.js	Three.js, X3DOM, X_ITE
Navigation	2D Page Navigation	6D Camera, WebXR Input
Multi-User	Live sync UA	Live sync UA
Persistency	Online 2D Documents	Online 3D Documents
Device Classes	Desktop, Mobile, (XR)	Desktop, Mobile, XR
Security	SSO, OAuth	SSO, OAuth
GPU Access	WebGL, WebGPU	WebGL, WebGPU

The critical question remains:

Why is the open web not the preferred platform for 3D experiences today?

The Web of Worlds (WoW) Vision

Web

Site is HTTP endpoint

2D > 2D > 2D > 2D

Traditional web navigation
between pages

Metaverse

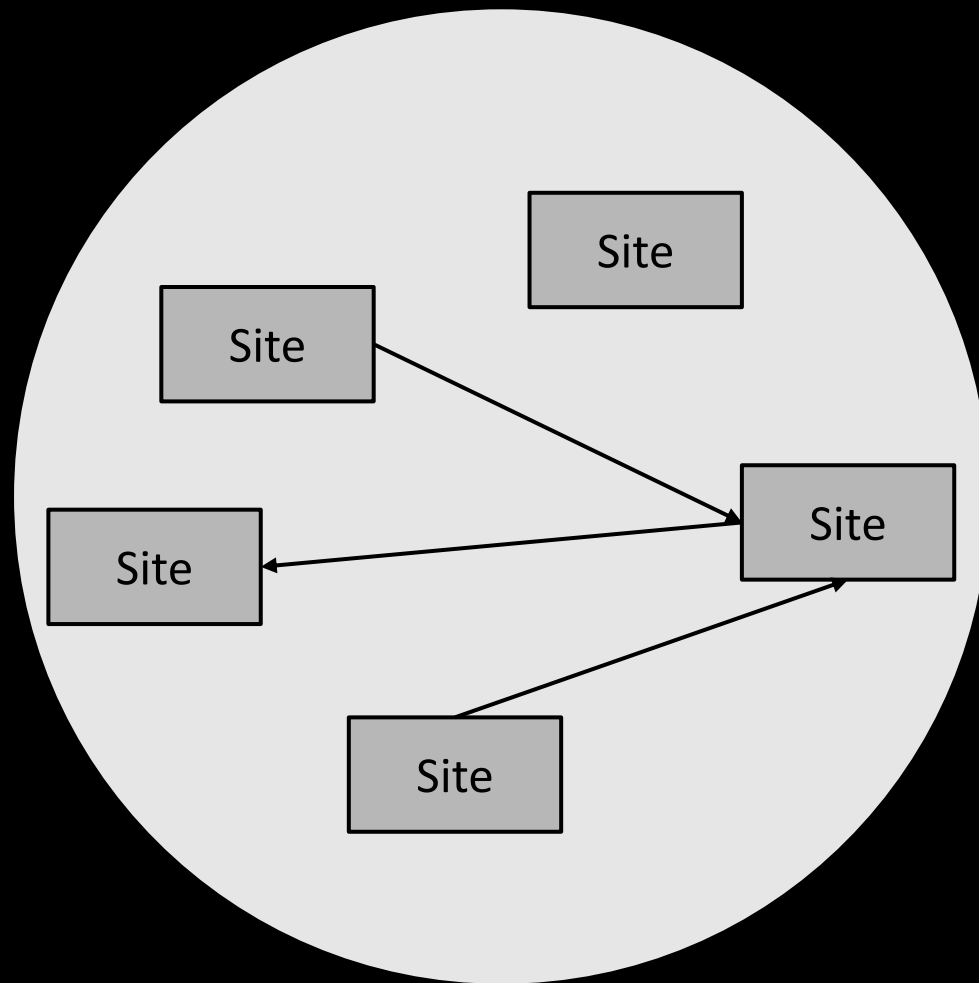World is API & HTTP endpoint

3D > 3D > 3D > 3D

Spatial-first experience
connecting virtual worlds

The Web of Worlds creates a new paradigm where users navigate
seamlessly between interconnected 3D environments, maintaining
context and identity across spatial experiences

The Web of Worlds (WoW) Vision

WoW API and Aspect Schema
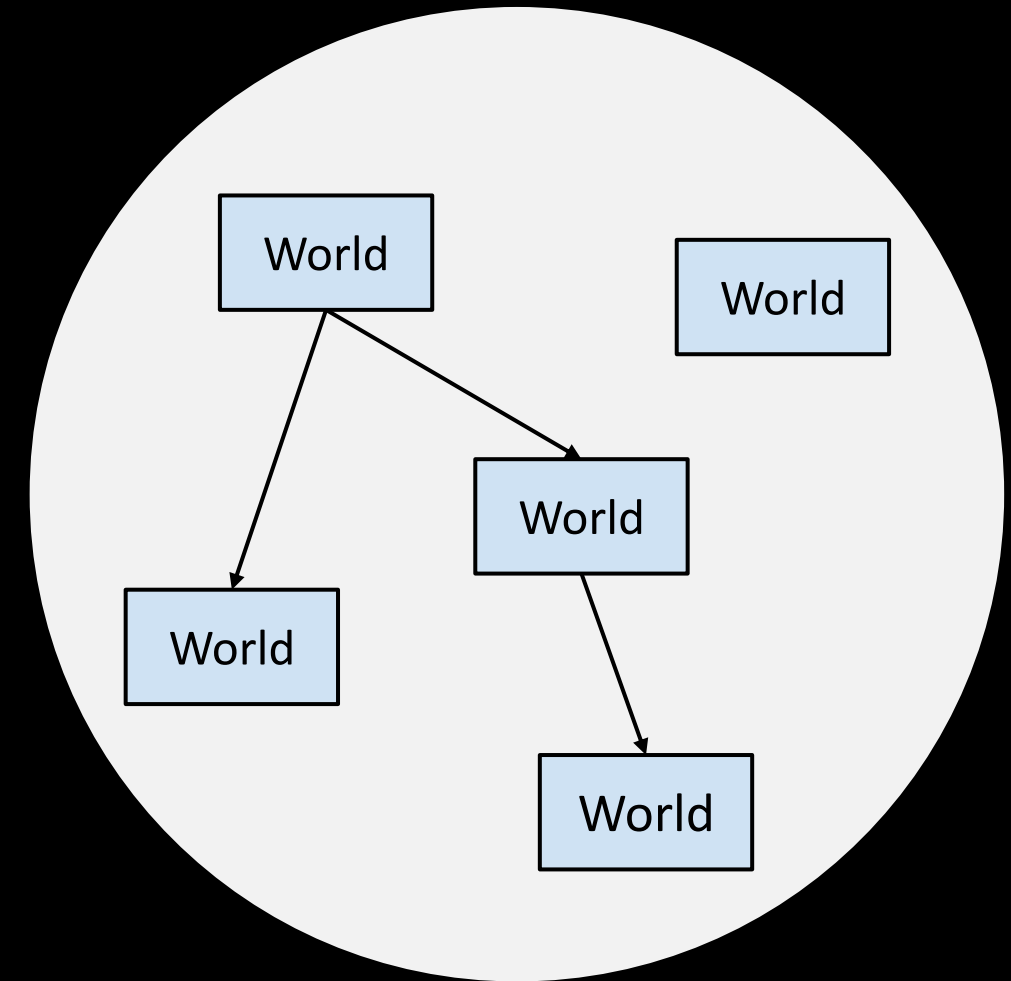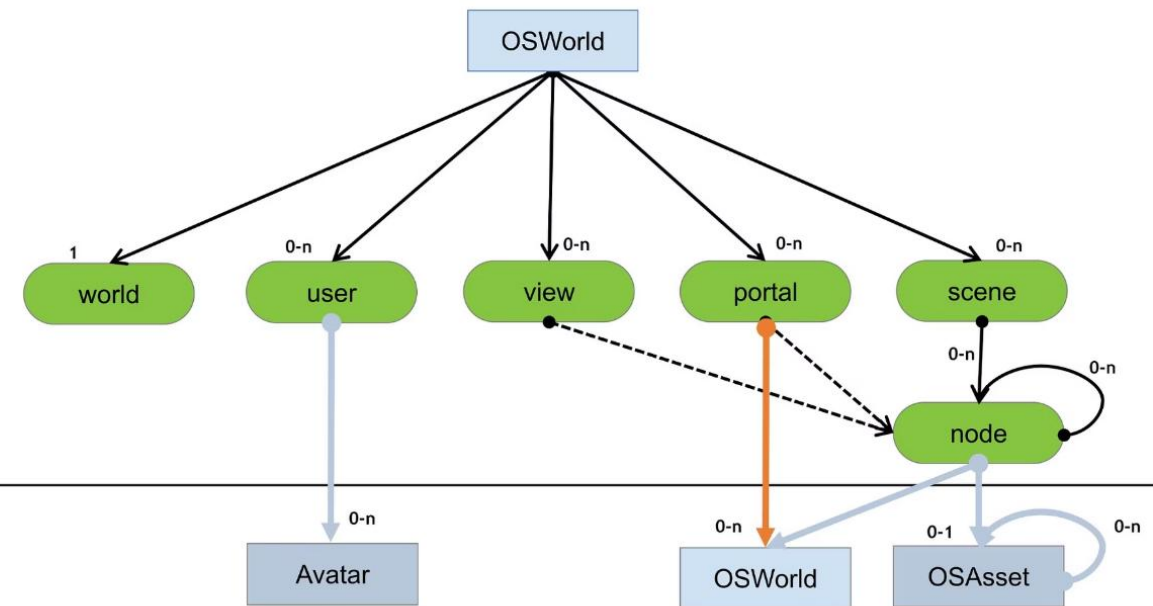
https://github.com/WebOfWorlds/WOWAPI

OpenSpatialWorld

- OpenAPI specification

- World, User, View, Portal, and Node JSON Schemas

OpenSpatialAsset

- OpenAPI specification

- Asset JSON Schema

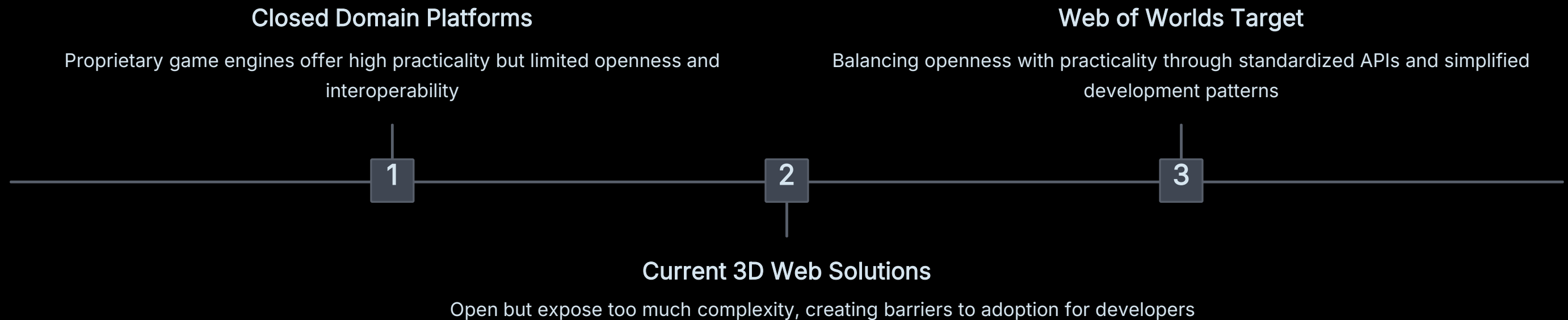Information exposed by the **OpenSpatialWorld** Web-API

Optional shared **Avatar** and **OpenSpatialAsset** web links to agnostic endpoints

Visual representation of the Web of Worlds API architecture

The WoW API provides a standardized approach to creating, connecting, and interacting with 3D worlds across the web

Complexity vs. Practicality

Finding the Right Balance

Closed Domain Platforms

Proprietary game engines offer high practicality but limited openness and interoperability

Web of Worlds Target

Balancing openness with practicality through standardized APIs and simplified development patterns

1   2   3

Current 3D Web Solutions

Open but expose too much complexity, creating barriers to adoption for developers

The key challenge is reducing the exposed complexity while maintaining the openness and interoperability that makes the web powerful

Join us at our 30th anniversary celebration at Web3D 2025 in Siena, Italy

11:00 – 12:30 - Wednesday September 10.2026
Workshop 4 – *3D Web Interoperability for the Metavers*e
Coordinators: Johannes Behr and Nicholas Polys

This workshop will discuss the progress and directions of the 3D Web Interoperability Domain Group from the Metaverse Standards Forum. Web of Worlds – This project to link virtual worlds highlights a compelling analogy between the World Wide Web—a unified system of URL-addressable, interconnected interactive experiences—and what we envision as a cohesive metaverse platform. This envisioned platform comprises numerous addressable and interconnected spatial experiences, or virtual worlds, collectively forming what we call the "Web of Worlds." Just as websites create a networked digital ecosystem, these spatial-first experiences would interconnect to create a seamless virtual world.
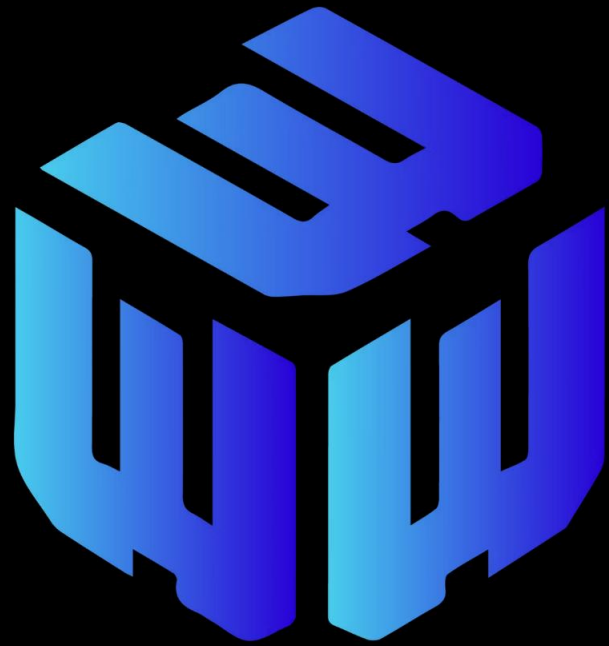
Thank You!

web|3D
CONSORTIUM

Join us in shaping the future of 3D on the web
Visit web3d.org to learn more and get involved