Metaverse and the Future of glTF

Nathaniel Hunter (Infinite World), Neil Trevett (NVIDIA), Leonard Daly (Daly Realism), Brent Scannell (Autodesk), Dwight Rodgers (Adobe), Pawel Nikiel (CG Trader)
Today’s Presenters

Neil Trevett (NVIDIA)

Nathaniel Hunter (Infinite World)

Brent Scannell (Autodesk)

Leonard Daly (Daly Realism)

Dwight Rodgers (Adobe)

Pawel Nikiel (CG Trader)
Metaverse Origin

June 1992
The Metaverse is still “new”
Metaverse Explanation

It’s not a destination...
or a platform...
or an app...

It’s a metaphor
Metaverse / Internet Comparison

The Internet
~1.16B sites

The Metaverse
hundreds of worlds/spaces
Metaverse Rules

Tony Parisi’s Metaverse Rules

Rule #1: There is only one Metaverse.

Rule #2: The Metaverse is for everyone.

Rule #3: Nobody controls the Metaverse.

Rule #4: The Metaverse is open.

Rule #5: The Metaverse is hardware-independent.

Rule #6: The Metaverse is a Network.

Rule #7: The Metaverse is the Internet.

https://medium.com/meta-verses/the-seven-rules-of-the-metaverse-7d4e06fa864c
Web3

- Web1 - Worldwide Web
- Web2 - User generated web
- Web3 - Decentralized Internet
## The difference between...

<table>
<thead>
<tr>
<th>WEB3</th>
<th>METAVERSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The decentralized internet built on distributed technologies</td>
<td>A shorthand for virtual worlds or spaces</td>
</tr>
<tr>
<td>- Blockchain</td>
<td>- users can interact with each other</td>
</tr>
<tr>
<td>- DAO’s</td>
<td>- engage with apps and services in a far more immersive way.</td>
</tr>
<tr>
<td>- centralized on servers owned by individuals or corporations</td>
<td></td>
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</tbody>
</table>
What the Metaverse ISN’T today

- It isn’t any single platform or experience
- It’s not ALL on the Blockchain
- It isn’t just games
- Experiences are NOT all interoperable
- There are no guidelines or standards for content
- It isn’t finished, figured out or finalized
What we’ll focus on today

- The high level glTF roadmap
- A deeper dive into glTF topics
- Geospatial and WC3 tie-ins
- How glTF can help with interoperability & consistency
- The Metaverse Standards Forum hosted by Khronos
A BRIEF OVERVIEW OF ASSET JOURNEY

Paweł Nikiel (CGTrader)
TRANSITION

CONTROLLED ECOSYSTEM

DCCS
- Blender
- 3ds Max
- SolidWorks
- Etc.

FLEXIBILITY

FORMATS
- USD
- FBX
- JT
- Etc.

EXPECTATIONS

BEST POSSIBLE RESULTS

- If user input is available -> allow interactions
- If bandwidth is a factor -> minimize
- If performance is a factor -> optimize
- If hardware / network is not limiting -> reach uncanny visual quality

CONSISTENCY

- Asset creation guidelines
- Assets validation tools
- Viewer certification program
- Predictable format
GLTF in the Metaverse: Referencing, Interactivity, and Anchoring

Dwight Rodgers (Adobe)
Incorporation by Reference
Why?
Caching parts for reuse
Personalization & Interactive content
Structure

Scene

Bike 1

Shop

Bike 2
Structure

Scene

Bike 1

Frame 1

Bike 2

Frame 2

Shop

Racks

Tire 1

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Structure

Scene

Bike 1

Frame 1

Tire 1

Bike 2

Frame 2

... Racks

... Shop

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Structure

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## GLXF

<table>
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<th>.gltf</th>
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<tr>
<td>Node graph and transforms</td>
<td>Scenes</td>
</tr>
<tr>
<td></td>
<td>Cameras</td>
</tr>
<tr>
<td></td>
<td>Extensions</td>
</tr>
</tbody>
</table>
GLXF

• Asset list (URIs)
• Incorporates node-hierarchies or scenes from listed assets

GLTF

• Meshes
• Materials
• Texture Samplers
• Binary data
• Animation data

(note that GLTFs can share texture image references already)
Extensibility on GLXF

.glxf + geospatial extension

.glxf + interactivity extension

.glxf + interactivity extension + geospatial extension
Feedback wanted soon!
Interactivity
Interactivity

= 3D Model

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Interactivity

= 3D Model + Website

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Interactivity

3D Model + Website + JavaScript
But this is the Metaverse
Interactivity in the GLTF ecosystem

Content + Interactivity
for composing and 3rd party viewers
or other devices
Interactivity in the GLTF ecosystem

Content + Interactivity
for composing and 3rd party viewers
or other devices

- Safety
- Performance
- Control
- Time to market

Feedback Wanted

Expressive power
Come see our BoF next Thursday
Again, feedback wanted!
XR Anchors
XR Anchors

How should a GLTF tell us where it wants to be?
Face Anchors
Multiple Anchor Points - one GLTF?
Multiple Faces?
World Anchors?

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What if I can’t see the anchor?
Because we’re looking the other way
Multiple anchorings?
Doors?
Equipment?
Anchoring and Interactivity?

**On Anchor Found**
Type: Face

**Show**
Subject: Cat Face

**On Anchor Lost**
Type: Face

**Hide**
Subject: Cat Face
Feedback Wanted
Geospatial in the Metaverse

Leonard Daly
3D Systems Consultant
Daly Realism
Geospatial is Foundational to the Metaverse

Earth from Space, NASA, Earth Observatory
Geospatial Is Foundational

Video & screen grabs from OGC’s YouTube video: Gaming and Simulation Compilation
Geospatial Data

- Data quantity is a major issue
- Even physically small scenes can be > 2GB
- May include mesh models and point cloud data
Managing Data Flow

- **glTF Experience Format**
  - “Using glTF for Geospatial, Metaverse, and Beyond” - Wednesday, 1:30pm PDT
  - Conceptually compatible with Esri’s “I3S” and Cesium’s “3D Tiles Next”

- Use geometry compression
- Use compressed image textures (KTX)

- Define HLOD
- Partition scene
- Leaf nodes are glTF files
Positioning Objects

• Where are objects positioned?
GeoPose

• Open Geospatial Consortium’s (draft) specification for location and orientation
Anchors

- W3C IW
- OpenXR
- glTF

Use logos for above:
- W3C, IW
- OpenXR
- glTF
- OGC

Streets of Shanghai at night
(c) 2013, Mstyslav Chernov. CC-BY-SA

Streets of Shanghai at night
(c) 2013, Mstyslav Chernov. CC-BY-SA
Geospatial Solutions Directly Solve Metaverse Problems
Contacts

- “Using glTF for Geospatial, Metaverse, and Beyond” BOF (Wednesday, 1:30pm PDT)
- Khronos Group - https://khronos.org
- Leonard Daly - https://www.linkedin.com/in/leonarddaly/
The Metaverse Standards Forum and glTF

Neil Trevett, NVIDIA
Fostering Metaverse Interoperability

**What will the metaverse be?**
Some mix of the connectivity of the web with the immersiveness of spatial computing

Diverse technologies will need to work together in novel ways – driving the need for a constellation of interoperability standards

Synthetic visual reality, practical XR optics, real-time environment scanning and semantic understanding, end-user 3D content creation tooling, accurate physical simulations, effective remote social interactions, servers scaling to millions of simultaneous users, streaming of vast geospatial data sets, real-world geo-anchoring with persistence, universal digital twins, online personas and social connections, realistic avatars, universally sharable consumer assets, security, privacy, interoperable run-times, online economies and currencies, IOT sensor networks, pervasive low-latency wireless connectivity … and many more …

**Metaverse Standards Forum Mission**
Identify TODAY’S interoperability pain points and coordinate pragmatic action to help solve them through standardization

Standards enable pervasive deployment of proven technologies to build market opportunities for all

Open interoperability standard specifications and conformance tests
The Vision

A Venue for Cooperation between Standards Organizations and Companies to Foster the Development of Interoperability Standards for an Open and Inclusive Metaverse

Forum was initiated by Khronos, and is being hosted by Khronos for fast organizational bootstrap
Metaverse Standards Forum

- Launched on June 21st 2022
- Open to all, no participation fee, no NDA, no IP framework
- Coordinated cooperation between industry and Standards Developing Organizations (SDOs)

**Requirements**
- Resources
- Expertise
- Use cases
- Project funding

**Standards Organizations**
- Coordinated requirements for current or new standards

**Metaverse Companies**
- Open to any company or SDO
- NOT another SDO!
- All standardization at existing SDOs
- Focus on pragmatic, actionable short-term opportunities to enhance metaverse interoperability

**Agreed industry-wide terminology**

**Standards usage recommendations and guidelines**

**Interoperability prototypes, hackathons, plugfests and tooling projects**

**Accelerated development of standards under existing SDO governance and IP Policies**
Over 1200 Members and Counting

Wide diversity of organizations, including...

Platforms
Meta, Microsoft, Sony, Google, Baidu, Huawei, General Motors, RedHat

Tools and Engines
Epic, Unity, Adobe, AutoDesk, Otoy, Maxon, Cesium, Blackshark.ai, Croquet, Lamina1, Ready Player Me, Manticore, Avataar

XR
HTC, Magic Leap, Nreal, Panasonic, Tobii

Hardware
NVIDIA, Intel, AMD, Qualcomm, Samsung, MediaTek, Oppo, Lenovo, ZTE, LG

Wireless Carriers
China Telecom, T-Mobile, Verizon

3D Commerce
Alibaba, Wayfair, IKEA, Avataar, VNTANA

Universities and Institutes
Stanford, John Hopkins, Yale (XRP), Queens University Belfast, University Salford, New York Institute Technology, APMG

Advocacy
Standards Developing Organizations in the Forum so far

- VFX and Animation
- Scheduling
- Consumer
- Concept Management
- Information Models
- XR and Networking
- Run time APIs and file formats
- Business
- Geospatial Standards
- Connecting physical and digital worlds
- Open Metaverse
- IOT and Digital Twins
- Volumetric Format Association
- Avatars
- X3D
- Web Standards
- XRSI Privacy and Safety Framework

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Organizing for Effective Forum Action

1. Gather interoperability Topics from all members
   Online input from all members on actionable topics that need improvement today!

2. Organize Topics into Domains
   Consensus on where is member interest AND the Forum has quorum to add industry value

3. Create Domain Working Groups
   Focused discussions with smaller group size and chairs elected from membership

4. Working Group Projects
   Self organizing focus on specific project execution

5. Publish Project Work Products
   Examples
   - Standards Registry
   - Guidelines and recommendations
   - Open-source tooling
   - Plugfest resources and reports
   - Requirements to pass to Standards Developing Organizations

... Close to 200 topics suggested and counting...
   ... some examples so far

Database of metaverse standards
Taking 3D assets between worlds
Asset LODs
glTF / USD interoperability
Avatar customization / animation
3D Apparel and Fashion
Cloth Simulation
Metaverse traversal
Geospatial ontologies
Geospatial streaming
Decentralized User ID
Ethical framework
User privacy
Child safety
Payment frameworks
Metaverse Pharmacy
Etc. etc..

Topics naturally falling into Domains

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Domain Working Groups and Projects will be formed and start work in 3Q22
Example Asset Interoperability Testbed Project

- **Goals**
  - Confirm asset behaviours and attributes satisfy use cases
  - Test publishing and transmission pipeline
  - Exercise interoperable behaviours in multiple runtimes

- All engine and platform vendors invited to participate
- Cooperative shared open-source and assets

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**Tools create assets using open standards**

**Run time engines ingest and process assets**

- USD-based tools
  - Author assets and publish into glTF

- Web-based Configurator
  - Material variants

- Runtime Demos
  - Open door, start engine
  - Drive course with physics simulation
Broadening glTF Industry Engagement

The Metaverse Standards Forum significantly broadens industry input and engagement in glTF for the Metaverse.

- glTF Advisory Panel for contributions and feedback under the Khronos IP Framework
- glTF Public GitHub for extension proposals and discussions

Any company welcome to join!

https://metaverse-standards.org/
Question and Answer

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