Industrial Metaverse on the web

3D Web Interoperability for the Metaverse BOF
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Johannes Behr, CPO, Threedy
Threedy GmbH
Pioneers of visual computing - building on 25 years of research!

Christian Stein
CEO

Dr. Johannes Behr
CPO

Maik Thöner
CTO

Sascha Räsch
CS & QA

Stefan Domdey
VP Sales

Andreas Holz
CFO

25 years of research

Founded in Q3/2020

50 heads by Q2/2023

Internationally experienced team

References

Partner
Exploding demand for industrial 3D to bring Digital Twins & Industrial Metaverse to life!
Customers accelerate Digital Transformation with growing # of tailor-made Digital Products to accelerate Time to Market for physical products
Digital Product on the web

Hyperconnectivity
- Progressive data & apps
- Desktop, mobile & XR
- Multi-user, Multi-channel
- Distributed data governance

Interoperability
- Dynamic, user generated content
- Rich user experience
- Mobile first
- Databases & APIs

Static content
- Discrete data
- Single user
- Server compute
- Blocking transmission

But current 3D technology won't deliver on the 3D data omnipresence!

3D Technology Today
- Discrete & closed files
- Coupled transfer & processing
- Server vs. client compute
- Data size & format explosion
- Costly conversion as band-aid fix
Digital Product scalability 😞

“Pilot Purgatory” leads to exploding TCOs

1998, CeBIT, Fraunhofer IGD, BMW
=> “AR-Service is Killer App!”

Status 2023:
• No Standard Solution
• TCO/Cost per Case to high!
Standard 3D Software Architectures

Download & Local Compute vs. Pixel Streaming

3D Data

Explicit Server Compute

(GPU) Server

2D Pixel Streaming

Traffic Data conversions

TCO

3D Data Download

Explicit Client Compute

100%
instant3Dhub: Web-Scale Visual Computing Middleware
Service infrastructure to automate & distribute computation
instant3Dhub: “Google Maps for 3D Data”
API-based Company-wide Visual Computing Enablement

Data integration via live-links to harmonize single source(s) of truth e.g., PLM or Digital Twin backends

First data-driven Visual Computing middleware for fully automated distributed computation & progressive streaming

Packaged Standard Apps & Custom App built on service APIs

Any Data  Any Device  Any Size
3D Data and Visual Computing
Virtualization
as perfect fit
to enable
Digital Products
in modern software infrastructures.
Dynamically compose 3D data of
- any format (e.g., USD, gltf, X3D, OpenJT, step...)
- provisioned by different gateways (e.g., Omniverse, MS Graph, S3, Teamcenter ..)
- for standard and custom apps (e.g., Web, UNREAL, ..)

Unreal integration (Unreal 5.1, GPU Raytracing)
- Omniverse Live Links. USD data
- S3 Live Links, OpenJT data
• “Visualization-as-a-Service” infrastructure backbone
• #1 Use Case: Engineering review & collaboration
• > 2,000 daily users for core applications

• Company-wide End2End 3D enablement
• Various use cases along product lifecycle
• DARC: #1 AR solution for engineering & backbone for XR Application mesh

• Digital twin for worldwide field service
• 1.7k users accessing > 150k product instances
• Deep integration of live 3D & product data
Learnings and Findings
3D Data Formats: Shape Properties and Composability

<table>
<thead>
<tr>
<th>Shape (e.g. Mesh, Nurbs, BRep)</th>
<th>Multi-Class</th>
<th>Single-Class</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD</td>
<td>e.g. gltf</td>
<td>e.g. Collada</td>
<td>gltfc</td>
</tr>
<tr>
<td>X3D</td>
<td></td>
<td>e.g. step242</td>
<td></td>
</tr>
</tbody>
</table>

Link Types:
- Target Formats
- Full domain
- Multi-Type
- Single-Type
- None
### 3D Data Formats: Data fragment addressing

<table>
<thead>
<tr>
<th>Use-Case</th>
<th>Pattern</th>
<th>Existing Fragment Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial View Selection</td>
<td><code>#initialView=&quot;foo&quot;</code></td>
<td>X3D</td>
</tr>
<tr>
<td>Animation Selection (autoplay ?)</td>
<td><code>#autoplay=&quot;foo, bar&quot;</code></td>
<td></td>
</tr>
<tr>
<td>Selection of Scene Nodes</td>
<td><code>#includeNodes=&quot;foo, bar&quot;</code></td>
<td>PLMXML</td>
</tr>
<tr>
<td></td>
<td><code>#excludeNodes=&quot;foo, bar&quot;</code></td>
<td></td>
</tr>
<tr>
<td>Selection on Spatial Dimension</td>
<td><code>#xyzwhd=100,100,50,10,10,100</code></td>
<td>W3C Media Fragments</td>
</tr>
<tr>
<td>Selection on Temporal Dimension</td>
<td><code>#t=10,20</code></td>
<td>W3C Media Fragments</td>
</tr>
<tr>
<td>Material/Appearance selection</td>
<td><code>#material=&quot;gold&quot;</code></td>
<td></td>
</tr>
</tbody>
</table>
Fragment Example 1/3: Spatial Selection

- Multi-Resource Data
  - Structure => Parts (X3D => STEP)
- Use-case: 3D-Room selection in DMU Session
  - datagateway.local/most/3423423#xyzwhz=100,100,100,20,20,20
Fragment Example 2/3: Scene Graph Selection

- Multi-Resource Data
  - Variant => Structure => Segment selection (STEP-XML -> STEP-XML -> KBL)

- Use Case: Service-Twin provides setup for scanned VIN (Vehicle identification number)
  - example.com/variant/434#includeNode="2343,3424,2224"
Fragment Example 3/3: Animation Trigger

- Multi-Resource Data
  - Variant => Structure => Animation selection (STEP-XML -> JT -> JT)
- Use Case: AR session with service twin
  - example.com/variant/393483/repair453#autoplay="step1"
What’s next?

- Allow gltfc with any format?
- Do we need “W3C model fragment” standard?
Rethink industrial 3D

https://www.threedy.io
johannes.behr@threedy.io