Web3D 2014 CONFERENCE

SRC
A Streamable Format for Generalized Web-based 3D Data Transmission

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Outline

- Motivation
- The SRC Format
- Integration into X3D
- Applications
- Summary

Motivation

- Many Web-aligned **formats** for **3D mesh data** (*WebGL-Loader, X3DOM Binary Geometry, glTF, OpenCTM, …)*

- Still no widely accepted, common solution
- Different strengths / weaknesses

Motivation

- 7 Requirements for a common solution (1-5):
  1. Fast, **direct / zero copy GPU uploads**
  2. Possibility for **progressive** transmission
  3. #Downloads / #Meshes (#Draws) are **decoupled**
  4. Simple integration into **declarative** frameworks
  5. Data **reuse** and **data compositing**

  …

Motivation

- 7 Requirements for a common solution (6-7):

  …

  6. Possibility for different **compression methods**
  7. **GPU-friendly** integration of (compressed) **texture data**

Motivation

Feature	X3DB	glTF	X3DOM Formats
Direct / zero copy GPU Upload	No	Yes	Yes
Progressive	No	No	Yes
Separation #Downloads / #Meshes	No	Yes	No
Dec3D Integration	Yes	No	Yes
Data Compositing	DEF/USE	Per File	Yes
Compression	Yes	Experimental	Quantization
GPU-friendly Texture Encoding	No	No	No

The SRC Format

- SRC = Shape Resource Container
- Structured header + binary file body
  - 3 Words pre-header:
    Format ID, version and encoding, header length
  - Various header encodings (currently: JSON only)

The SRC Format

- Some basic concepts from glTF, additionally:
  - – Support for **progressive** transmission
  - – **Declarative 3D** integration via X3D
  - – Support for **data compositing** via X3D
  - – Support for **quantized mesh data**
  - – Support for binary (compressed) **texture data**

The SRC Format

- **Chunk** layer instead of (glTF) *Buffer* layer:

  Mesh → Accessor → Buffer View → ***Chunk***

- Accessors in SRC: **IndexView / AttributeView**, quantization as basic **compression** via new *decodeOffset / decodeScale* attributes

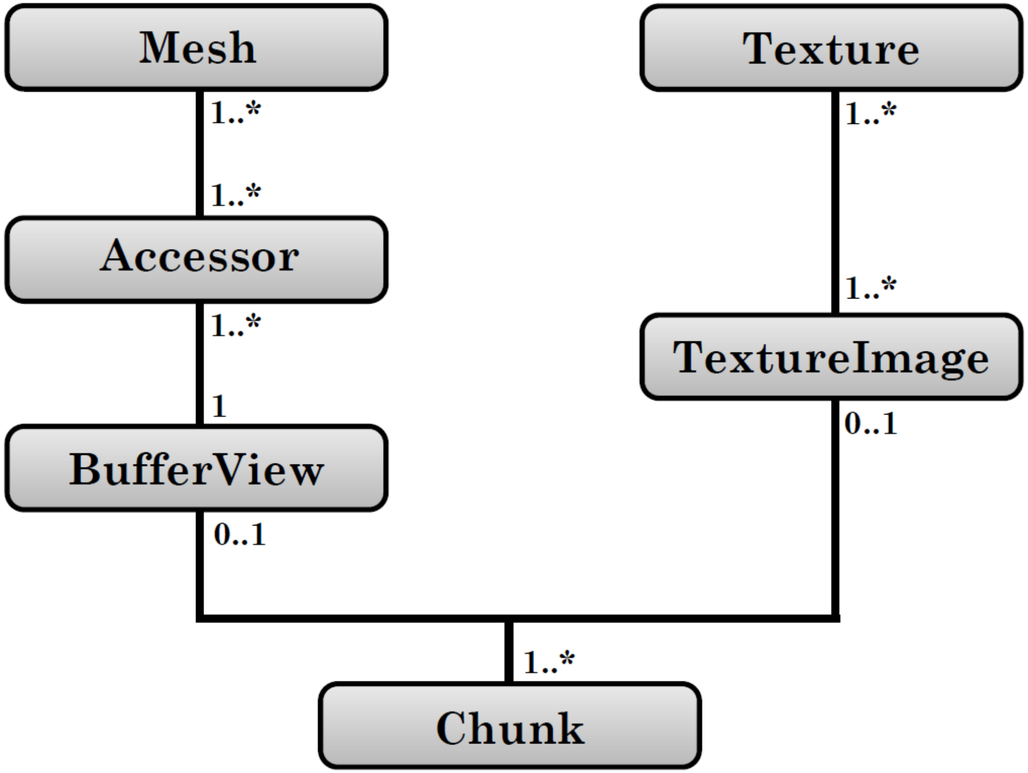
The SRC Format

- Similar concepts for (compressed) **Textures**

  Texture → TextureImage → Chunk

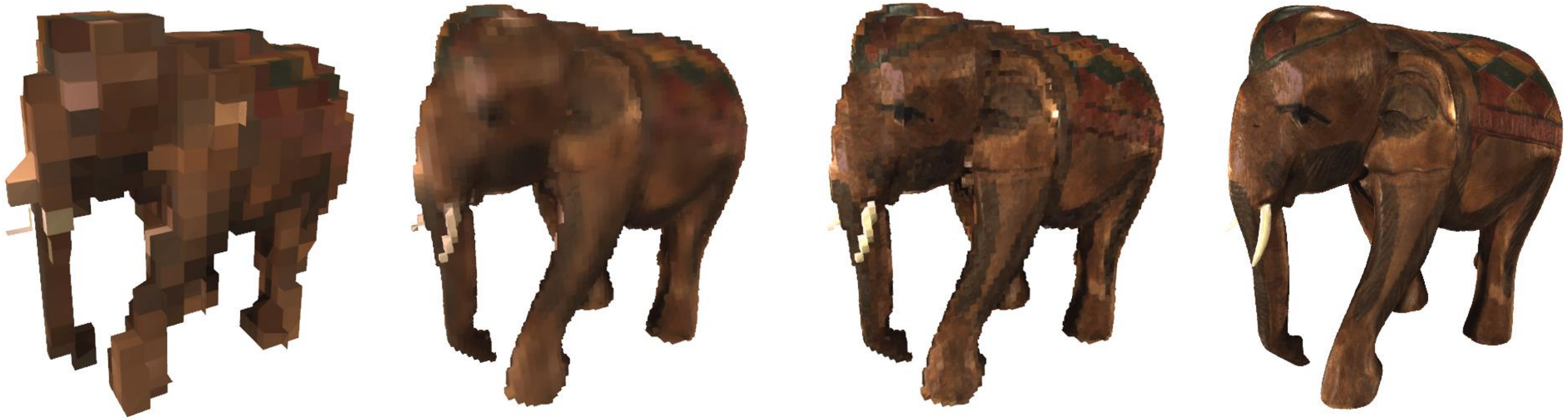
- Compressed Textures: Separated transmission of MIP pyramid, 1 TextureImage = 1 MIP level

The SRC Format



The SRC Format

- Chunks enable **interleaved** transmission …
  - … of mesh data (e.g., vertex data and indices)
  - … of mesh and texture data



Integration into X3D

X3DOM *BinaryGeometry* node:

```
<Shape>
        <Appearance>
                <Material diffuseColor=’0.6 0.6 0.6’
                          shininess=’0.00234375’/>
                <ImageTexture url=’"duck.png"’/>
        </Appearance>
        <BinaryGeometry vertexCount=’12636’
           position=’13.44 86.94 -3.70’ size=’165.47 154.04 115.25’
           primType=’"TRIANGLES"’ index=’binGeo/indexBin.bin’
           coord=’binGeo/coordBin.bin+8’ normal=’binGeo/normalBin.bin+4’
           texCoord=’binGeo/texCoordBin.bin+4’
           coordType=’Int16’ normalType=’Int8’ texCoordType=’Uint16’/>
</Shape>
```

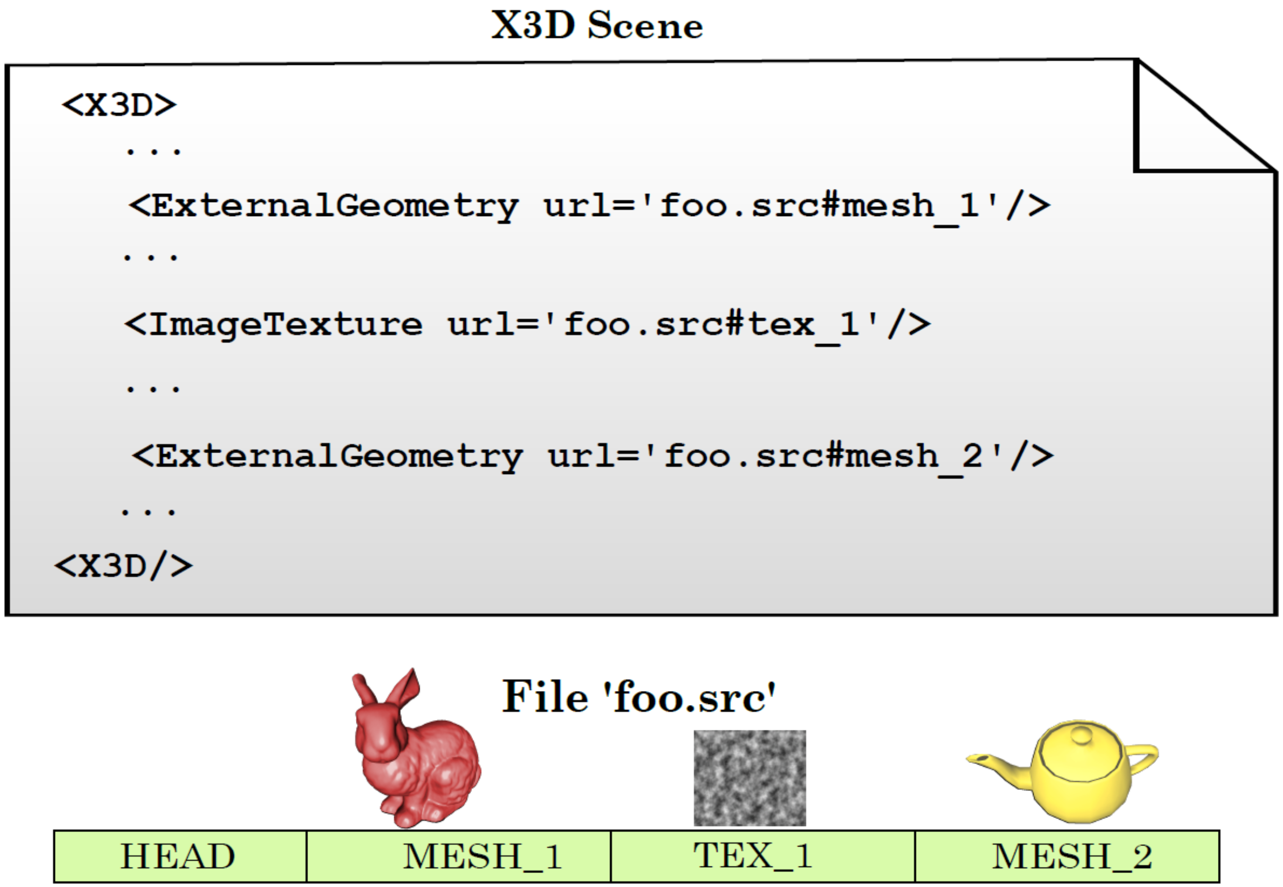
Integration into X3D

ExternalGeometry node:

```
<Shape>
        <Appearance>
                <Material diffuseColor=’0.6 0.6 0.6’
                           shininess=’0.00234375’/>
                <ImageTexture url=’"duck.png"’/>
        </Appearance>
        <ExternalGeometry url=’"duck.src"’/>
</Shape>
```

- Faster HTML parsing (esp. for large models)
- Other formats could also be used this way

Integration into X3D



X3D Scene

```
<X3D>
   ...
   <ExternalGeometry url='foo.src#mesh_1'/>
   ...
   <ImageTexture url='foo.src#tex_1'/>
   ...
   <ExternalGeometry url='foo.src#mesh_2'/>
   ...
<X3D/>
```

File 'foo.src'

HEAD	MESH_1	TEX_1	MESH_2

Integration into X3D

Mesh data compositing with *Source* node:

```
<Shape>
        <Appearance>
                <Material diffuseColor=’0.6 0.6 0.6’
                          shininess=’0.00234375’/>
                <ImageTexture url=’"duck.png"’/>
        </Appearance>
        <ExternalGeometry url=’"duck.src"’>
                <Source name=’color’
                        url=’"duckAltColors.src#mesh_1.color"’/>
        </ExternalGeometry>
</Shape>
```

→ Details see paper ☺

Integration into X3D

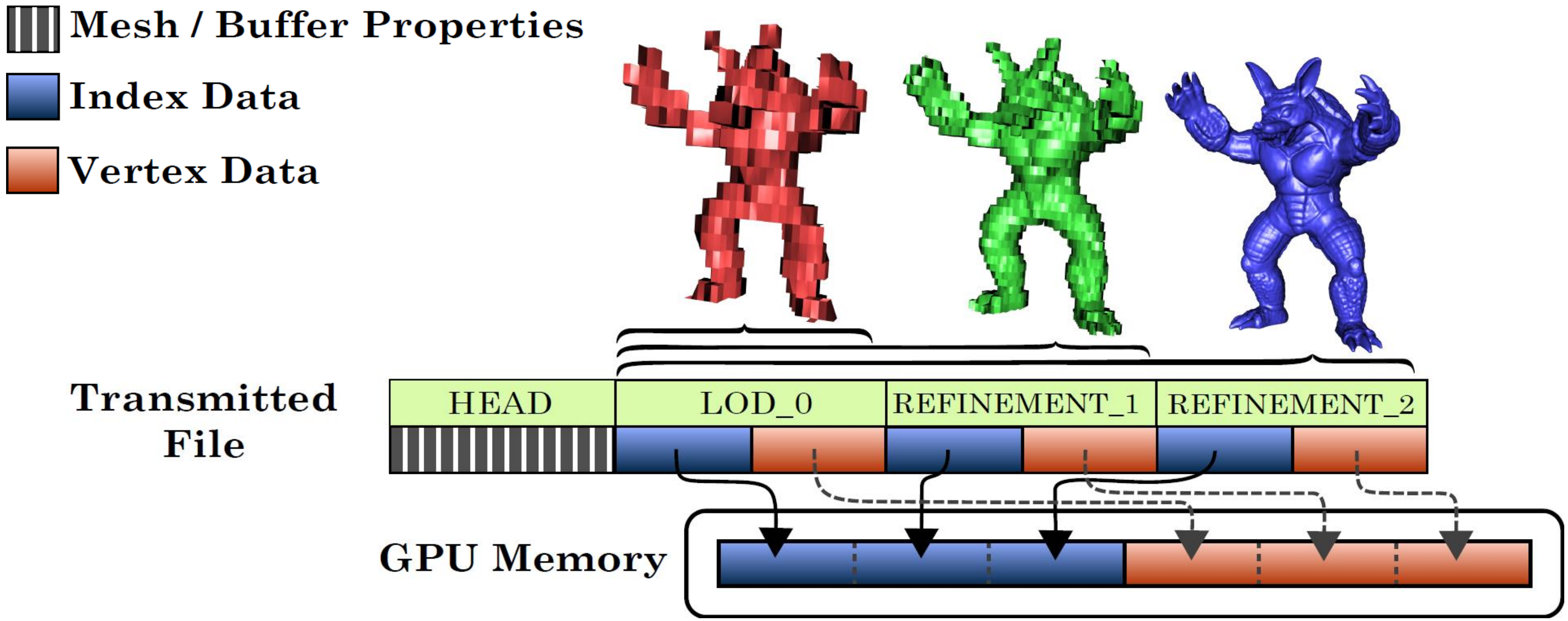
ExternalShape node:

```
<ExternalShape url=’"duck.src"’
 bboxCenter=’13.44 86.94 -3.70’
 bboxSize=’165.47 154 115.25’/>
```

- Even smaller HTML layout
- Inherits bbox fields from *X3DBoundedNode*
  → load SRC on demand
- No material data in SRC header → use X3D defaults

Applications

- Progressive mesh data representation



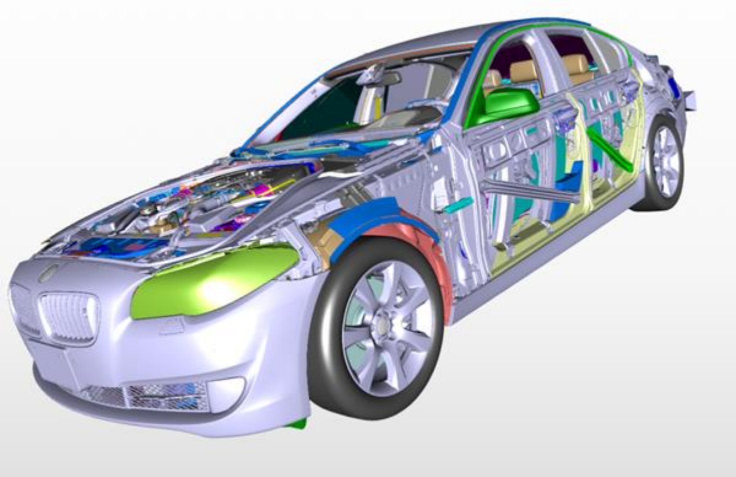
Applications

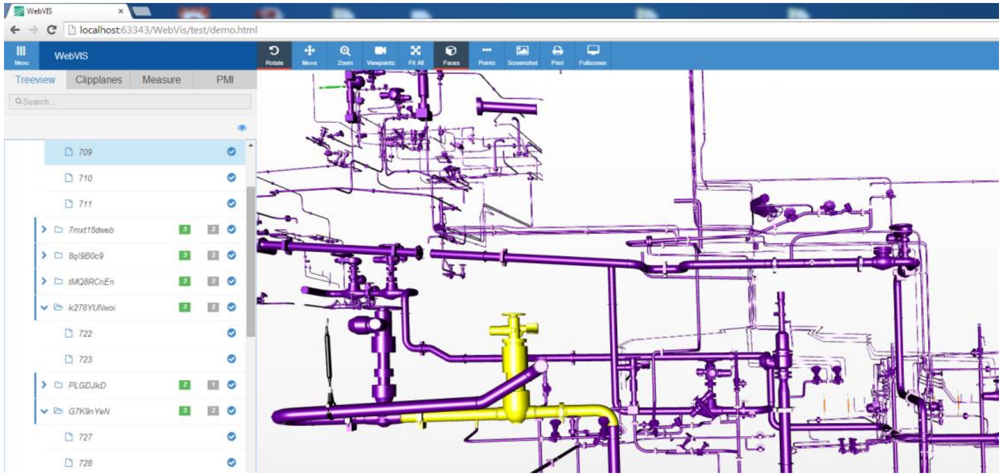
- Siena Cathedral Virtual Walkthrough

  - Texture data much larger than mesh data
  - Textures 241 MB as PNG, 78 MB compressed
  - Direct GPU upload reduces waiting time

Applications

- Automotive & Energy CAD visualization





  - – More than 10,000 identifiable objects
  - – #Downloads crucial! (SRC: 1 Request per object)
  - – Size of HTML page crucial! (*ExternalShape* helps)

Summary

- SRC (Shape Resource Container) = structured header + binary file body
- Container format for mesh data and textures
- Simple, yet flexible, integration into X3D

Summary

Feature	X3DB	glTF	X3DOM Formats	SRC
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Thanks for your attention!

Questions?