


http://www.cgg.cvut.cz

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## VRML Extensions




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## Content

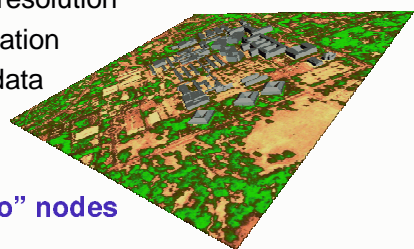
1. GeoVRML
2. NurbsVRML
3. Web3D Working Groups
4. X3D

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## Part 1: GeoVRML 1.0



- Coordinate systems
- Multi-resolution
- Navigation
- Metadata



**10 "Geo" nodes**

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## GeoVRML: Coordinates

**12 coordinate systems:**

- Geodetic (GDC) - latitude/longitude/elev.
- Geocentric (Earth)
- UTM, LCC, etc.

GeoCoordinate

↓ geoOrigin

GeoOrigin

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## GeoVRML: Coordinates contd.

**Precision:**  
Float => String

**Conversion:**

- coordinate systems
- "old" VRML nodes

GeoLocation

↓ children

VRML nodes

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## GeoVRML: Multi-resolution

**GeoLOD { }** (quad-tree)

root

→

2	3
1	4

Level *n*                      Level *n*+1

**GeoInline { }** - load/unload children  
`SFBool load TRUE`

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## GeoVRML: Navigation

### GeoViewpoint { }

- navigation speed dependent on height
- no terrain tracking :-)

Other "Geo" nodes:

### GeoPositionInterpolator { }

### GeoTouchSensor { }



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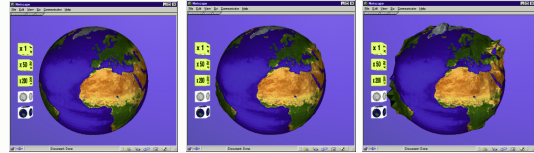
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## GeoVRML: Data

### GeoElevationGrid { } - elevation exaggeration

50x

200x



### GeoMetadata { } - 14 predefined keywords



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## GeoVRML: Example

```

GeoViewpoint {
  geoSystem [ "GDC" ]      description "London"
  orientation 1 0 0 -1.57   position "51.5122 -0.065 10000000"
}
Shape {
  appearance Appearance {
    texture ImageTexture { url "images/earth.jpg" }
  }
  geometry GeoElevationGrid {
    geoSystem [ "GDC" ]      geoGridOrigin "-90 -180 0"
    xDimension 6             zDimension 6
    xSpacing "72"           zSpacing "36"
    creaseAngle 1.05
    height [ 0 0 0 0 0, 0 0 0 0 0, 0 0 0 0 0,
            0 0 0 0 0, 0 0 0 0 0, 0 0 0 0 0 ]
  }
}
    
```



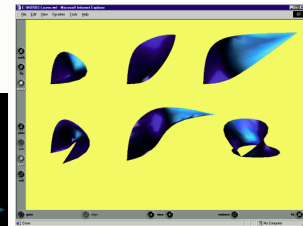
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## Part 2: NurbsVRML

- Non Uniform Rational B-Spline
- Trimmed surfaces
- Animations
- FFD



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## NurbsVRML: Modeling

### NurbsSurface { }, NurbsCurve { }

- Grid of control vertices (CV)
- Weights for CV

### TrimmedSurface { }

- Surface with holes
- Curve contoured surfaces

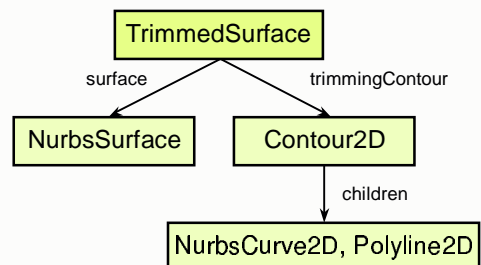


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## NurbsVRML: Trimmed surfaces



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## NurbsVRML: Tessellation

Tessellation - Object  $\times$  Screen space

*Criteria:* fixed, chord length, angle, fine near silhouette

### Automatic LOD

*Criteria:* fps, triangles/object, triangles/frame, CPU power distance to viewer, screen area, etc.



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## NurbsVRML: Animations

NurbsPositionInterpolator { }

- Interpolated position on the NURBS surface

CoordinateDeformer { }

- Free form deformation
- Parameterized 3D volume (u, v, w)
- Applicable to any child geometry



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## Part 3: Web3D Consortium

About 15 Working Groups:

- **source:** reference browser
- **h-anim:** humanoid animation
- **web3d-mpeg:** integration with MPEG
- **dis:** distributed interactive simulation
- **kbinput:** `StringSensor { }`



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## Working Groups contd.

- **vrml-streams:** streaming scene graph & data (see also [www.viewpoint.com](http://www.viewpoint.com))
- **media:** universal media (like *fonts*)



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## Part 4: X3D = Next VRML version

- The next generation **Open Web3D** standard
- Concerted action by key VRML browser **companies** (*Blaxxun, ParallelGraphics, Nexternet, OpenWorlds*)
- Extensible **Architecture** (small core plus flexibility)
- Full **compatibility** with VRML 97 (saving existing content)
- Influence to other industry **standards** (MPEG-4, XML)

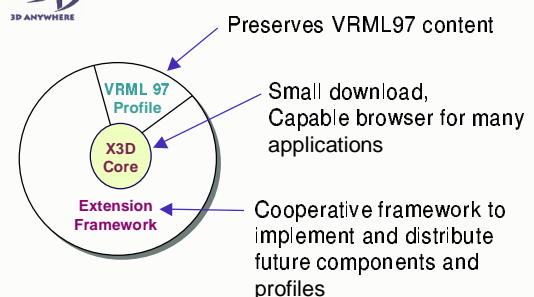


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## Architecture



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## Profiles & Components

### Two profiles:

- Core - light renderers (Java applets)
- Base - full functionality

### Components:

Rendering, Geometry, GeoVRML, Language, Texture, Navigation, Nurbs, Scripting, Sensor, etc.



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## Features

- XML notation
- Interfaces to scripting languages
- Consortium registers new components (OpenGL strategy)
- Open source reference browser implementation



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## Specification

- 1) Abstract specification  
object oriented
- 2) Three notations
  - UTF-8 (like VRML 97)
  - XML
  - Binary (like MPEG-4)
- 3) Scene authoring interface  
Java, ECMAScript, DOM



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## Information Sources

1. GeoVRML Specification  
[www.geovrml.org](http://www.geovrml.org)
2. NurbsVRML Specification  
[www.web3d.org/technicalinfo/specifications/vrml97am1/fdam](http://www.web3d.org/technicalinfo/specifications/vrml97am1/fdam)
3. Web 3D Consortium  
[www.web3d.org](http://www.web3d.org)



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**The end**

Thank you for your attention

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