

Computergrafik SS 2014

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Vorlesung vom 30.06.2014

Kapitel 21:

3D im Web

Virtual Reality Modelling Language

- 3D-Vektorgrafik für Webseiten
- offizieller Standard des W3C
- in ASCII geschrieben
- exportierbar von CAD-Tools
- verlustfrei skalierbar
- Grafik, Text, Audio, Video
- erlaubt Interaktion
- unterstützt Javascript
- verlangt Plugin im Browser
- verlangt Rechenleistung im Browser

<http://de.wikipedia.org/wiki/VRML>

Geschichte von VRML

April 1994 1st Internat. WWW Conference

Tim Berners-Lee, Mailing List

Okt. 1994 2nd Internat. WWW Conference

VRML 1.0 (statische Szenen)

Dez. 1995 1st VRML Conference

VRML 97

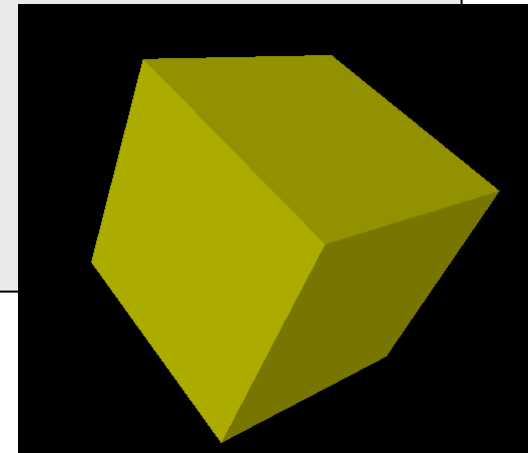
(+ Animation + Sound + Video)

ab 2000: Stillstand

Box

```
# VRML V2.0 utf8

Transform {
  scale      2 2 2
  rotation    0.44 -0.68 -0.57  1.03
  translation 0 0 3
  children [
    Shape {
      geometry Box {size 1 1 1 }
      appearance Appearance {
        material Material {diffuseColor 1 1 0}
      }
    }
  ]
}
```



Webseite mit VRML

```
<HTML>
<HEAD><TITLE>VRML</TITLE></HEAD>
  <BODY>
    <H1>VRML-Beispiel</H1>
    <EMBED SRC      ="cube.wrl"
              WIDTH  =300
              HEIGHT =300>
  </BODY>
</HTML>
```

<http://www-lehre.inf.uos.de/gp/virtuellerstadtbummel-gp.wrl>

X3D

- 3D-Vektorgrafik für Webseiten
- offizieller Standard des W3C
- in ASCII geschrieben **als XML-Anwendung**
- exportierbar von CAD-Tools
- verlustfrei skalierbar
- Grafik, Text, Audio, Video
- erlaubt Interaktion
- unterstützt Javascript
- verlangt Rechenleistung im Browser
- verlangt Plugin im Browser:
<http://www.bitmanagement.com./de/download>

X3D

<http://de.wikipedia.org/wiki/X3D>

<http://x3dgraphics.com/>

<http://www.x3dom.org/>

<http://www.web3d.org/realtime-3d/x3d/what-x3d>

```
# VRML V2.0 utf8
Transform {
  scale      2 2 2
  translation 0 0 3
  rotation    0.44 -0.68 -0.57  1.03
  children [
    Shape {
      geometry Box {size 1 1 1 }
      appearance Appearance {
        material Material {diffuseColor 1 1 0}
      }
    }
  ]
}
```

VRML

versus

X3D

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
  "http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>
    <Transform scale ="2 2 2"
      translation="0 0 3"
      rotation="0.44  -0.68  -0.057  1.03">
      <Shape>
        <Box size="1 1 1"/>
        <Appearance>
          <Material diffuseColor="1 1 0"/>
        </Appearance>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```



```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
"http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>
    <Viewpoint description="start" orientation="1 0 0 -0.174" position="0 5 20"/>
    <Transform translation="0 0 0">
      <Shape>
        <Appearance>
          <Material diffuseColor="0 1 0.5" />
        </Appearance>
        <Box size="2 3.5 2"/>
      </Shape>
    </Transform>
    <Transform translation="0 1 0" rotation="0 0 1 1.57075" >
      <Shape>
        <Cylinder radius="0.2" height ="5.0"/>
        <Appearance>
          <Material diffuseColor = "0 0 1" />
        </Appearance>
      </Shape>
    </Transform>
    <Transform translation="0 3 0">
      <Shape>
        <Sphere radius="1.5"/>
        <Appearance>
          <ImageTexture url="medien/oliver.jpg"/>
        </Appearance>
      </Shape>
    </Transform>
    <Transform translation="0 4.5 0" rotation="1 0 0 -0.1745278" >
      <Shape>
        <Cone bottomRadius="2.0" height ="1"/>
        <Appearance>
          <Material diffuseColor = "1 0 0" />
        </Appearance>
      </Shape>
    </Transform>
  </Scene>
</X3D>

```

Box, Cylinder, Sphere, Cone



<http://www-lehre.inf.uos.de/~cg/2014/X3D/figur.x3d>

IndexedFaceSet

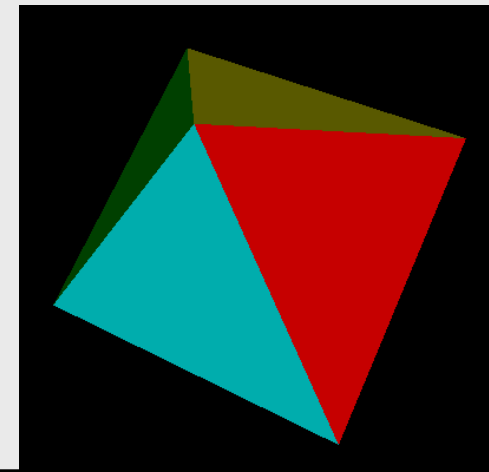
```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
  "http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>
    <Viewpoint orientation="1 0 0 -0.174" position="0 5 20"/>
    <Shape>

      <IndexedFaceSet
        colorPerVertex="false"
        coordIndex='4 0 1 -1 4 1 2 -1 4 2 3 -1 4 3 0 -1 3 2 1 0 -1'>
        <Coordinate point='-1 0 1 1 0 1 1 0 -1 -1 0 -1 0 1.5 0' />
        <Color color="0 1 1 1 0 0 1 1 0 0 1 0 0 0 1" />
      </IndexedFaceSet>

      <Appearance>
        <Material/>
      </Appearance>

    </Shape>

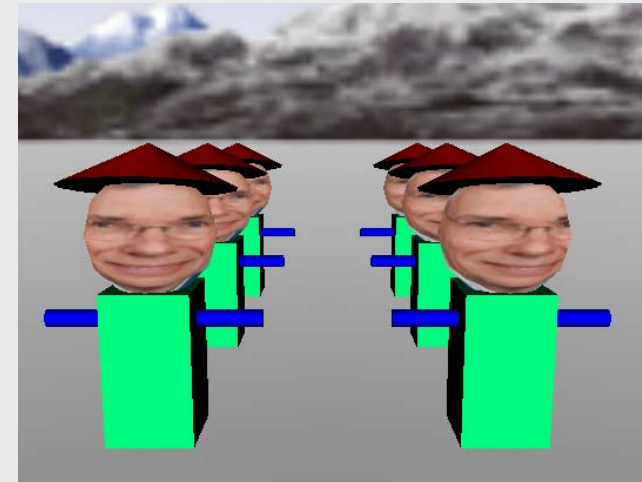
  </Scene>
</X3D>
```



<http://www-lehre.inf.uos.de/~cg/2014/X3D/pyramid.x3d>

Hintergrund

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
  "http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>
    <Viewpoint orientation="1 0 0 -0.174" position="0 5 20"/>
    <Background
      skyColor = "0.0 0.1 0.5 1.0 1.0 1.0"
      skyAngle = "1.571"
      groundColor = "0.15 0.15 0.15 0.75 0.75 0.75"
      groundAngle = "1.571"
      frontUrl="medien/mountain.png"
      backUrl = "medien/mountain.png"
      leftUrl = "medien/mountain.png"
      rightUrl="medien/mountain.png" />
    <Transform translation="0 0 0">
      <Inline url="gruppe.x3d"/>
    </Transform>
  </Scene>
</X3D>
```



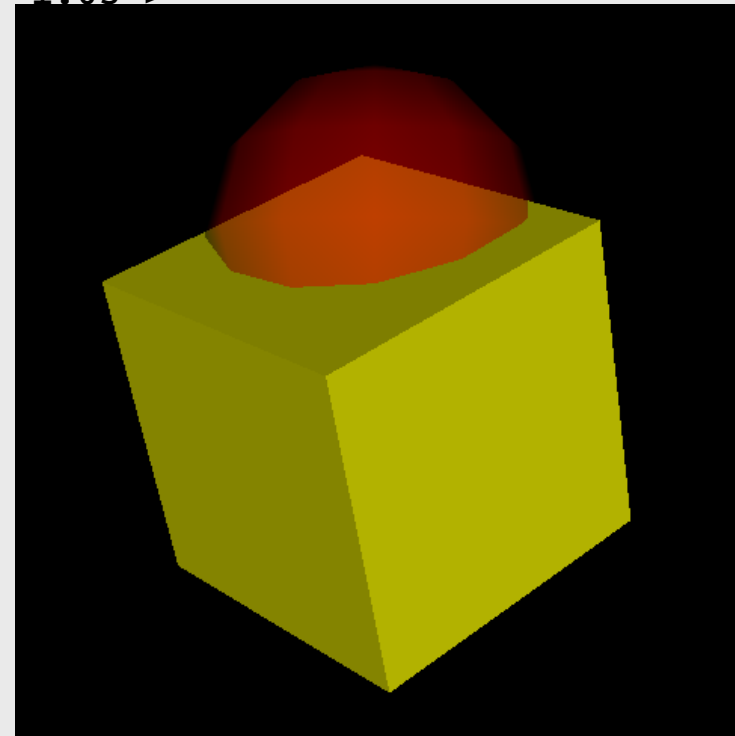
Transparenz

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
  "http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>

    <Transform rotation="0.44  -0.68  -0.057  1.03">
      <Shape>
        <Appearance>
          <Material diffuseColor="1 1 0"/>
        </Appearance>
        <Box size="2 2 2"/>
      </Shape>
    </Transform>

    <Transform translation= "0 1 0">
      <Shape>
        <Sphere radius="1"/>
        <Appearance>
          <Material diffuseColor="1 0 0"
            transparency="0.5"/>
        </Appearance>
      </Shape>
    </Transform>

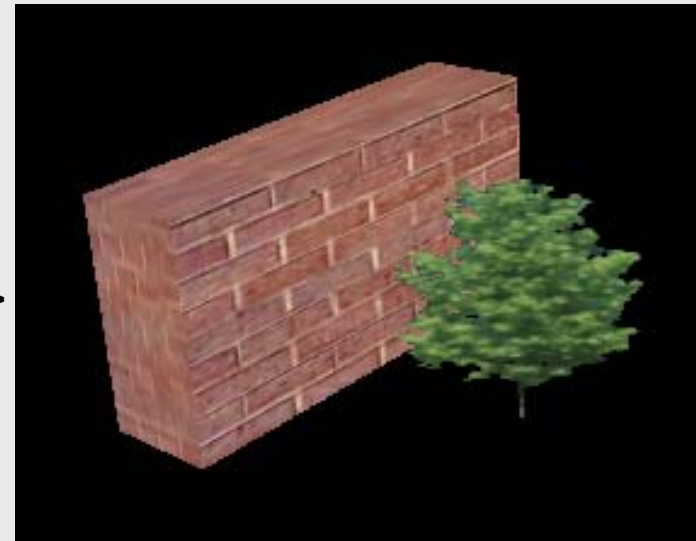
  </Scene>
</X3D>
```



<http://www-lehre.inf.uos.de/~cg/2014/X3D/transparenz.x3d>

Billboard

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
"http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>
    <Viewpoint orientation="1 0 0 -0.174" position="0 5 20"/>
    <Billboard axisOfRotation="0 1 0">
      <Shape>
        <IndexedFaceSet coordIndex="0 1 2 3 -1">
          <Coordinate point =
            "2 -2 0
             2 2 0
            -2 2 0
            -2 -2 0"/>
        </IndexedFaceSet>
        <Appearance>
          <ImageTexture url="medien/baum.gif" />
        </Appearance>
      </Shape>
    </Billboard>
    <Transform translation="0 0 -4">
      <Shape>
        <Box size="8 4 2" />
        <Appearance>
          <ImageTexture url="medien/ziegel.gif" />
        </Appearance>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```



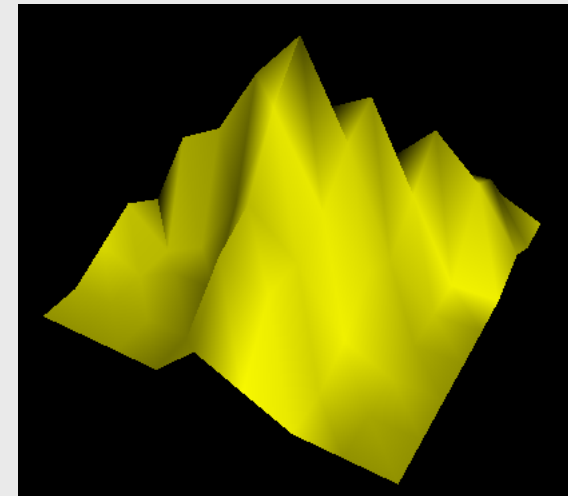
<http://www-lehre.inf.uos.de/~cg/2014/X3D/billboard.x3d>

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
  "http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Scene>
    <Viewpoint orientation="1 0 0 -0.174" position="3 5 20"/>
    <Shape>
      <Appearance>
        <Material diffuseColor="1 1 0"/>
      </Appearance>
      <ElevationGrid
        xDimension="9"
        zDimension="9"
        creaseAngle="1.57"
        solid="false"
        height="0.0 0.0 0.5 1.0 0.5 0.0 0.0 0.0 0.0
              0.0 0.0 0.0 0.0 2.5 0.5 0.0 0.0 0.0
              0.0 0.0 0.5 0.5 3.0 1.0 0.5 0.0 1.0
              0.0 0.0 0.5 2.0 4.5 2.5 1.0 1.5 0.5
              1.0 2.5 3.0 4.5 5.5 3.5 3.0 1.0 0.0
              0.5 2.0 2.0 2.5 3.5 4.0 2.0 0.5 0.0
              0.0 0.0 0.5 1.5 1.0 2.0 3.0 1.5 0.0
              0.0 0.0 0.0 0.0 0.0 0.0 2.0 1.5 0.5
              0.0 0.0 0.0 0.0 0.0 0.0 0.5 0.0 0.0"/>
      </Shape>
    </Scene>
  </X3D>

```

Elevation Grid



<http://www-lehre.inf.uos.de/~cg/2014/X3D/elevation-grid.x3d>

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
"http://www.web3d.org/specifications/x3d-3.0.dtd">
```

Sensor

```
<X3D>
```

```
<Scene>
```

```
<Viewpoint orientation="1 0 0 -0.174" position="0 5 20"/>
```

```
<Transform DEF="Figur"> <Inline url="figur.x3d"/> </Transform>
```

```
<TouchSensor DEF="Klick" description="Bitte klicken !"/>
```

```
<TimeSensor DEF="Zeit" cycleInterval="5" loop="false"/>
```

```
<OrientationInterpolator DEF="Drehen"
```

```
key      ='0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9'
```

```
keyValue='1 0 0 0 1 0 0 3.14 1 0 0 6.28
          0 1 0 0 0 1 0 3.14 0 1 0 6.28
          0 0 1 0 0 0 1 3.14 0 0 1 6.28' />
```

```
<ROUTE fromNode="Klick" fromField="touchTime"
toNode="Zeit" toField="startTime" />
```

```
<ROUTE fromNode="Zeit" fromField="fraction_changed"
toNode="Drehen" toField="set_fraction"/>
```

```
<ROUTE fromNode="Drehen" fromField="value_changed"
toNode="Figur" toField="set_rotation" />
```

```
</Scene>
```

```
</X3D>
```



<http://www-lehre.inf.uos.de/~cg/2014/X3D/sensor.x3d>

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.3//EN"
"http://www.web3d.org/specifications/x3d-3.3.dtd">
<X3D>
```

Audio

```
<Scene>
```

```
  <Transform>
```

```
    <Shape>
```

```
      <Box/>
```

```
      <Appearance>
```

```
        <Material diffuseColor ="1 0 0" />
```

```
      </Appearance>
```

```
    </Shape>
```

```
  </Transform>
```

```
  <Sound
```

```
    location="0 0 0"
```

```
    direction="0 0 1"
```

```
    maxFront="100"
```

```
    minFront="10">
```

```
      <AudioClip
```

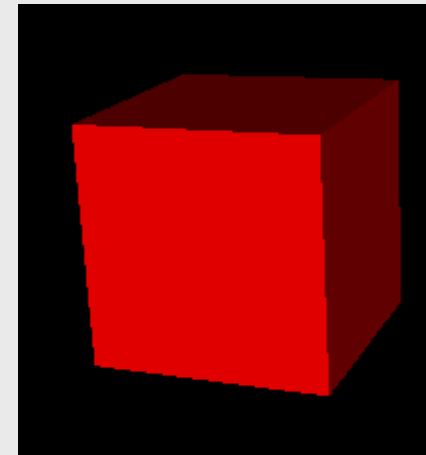
```
        loop="true"
```

```
        url="medien/loop.wav"/>
```

```
    </Sound>
```

```
</Scene>
```

```
</X3D>
```



<http://www-lehre.inf.uos.de/~cg/2014/X3D/audio.x3d>

Video

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN"
  "http://www.web3d.org/specifications/x3d-3.0.dtd">
<X3D>
  <Viewpoint description="start" position="0 0 20"/>
  <Scene>
    <Transform translation="0 0 0">
      <Shape>
        <Box size="16 9 0.2"/>
        <Appearance>
          <MovieTexture DEF="Film"
            url="medien/happy-feet.mov" />
        </Appearance>
      </Shape>
    </Transform>
    <Transform translation="0 -6 0">
      <Shape>
        <Box size="16 1 0.2"/>
        <Appearance>
          <Material diffuseColor="0.04 0.38 0.75"/>
        </Appearance>
      </Shape>
      <TouchSensor DEF="Knopf" description="Bitte klicken !"/>
    </Transform>
    <ROUTE fromField='touchTime' fromNode="Knopf"
      toField='startTime' toNode="Film"/>
  </Scene>
</X3D>
```



Google SketchUp

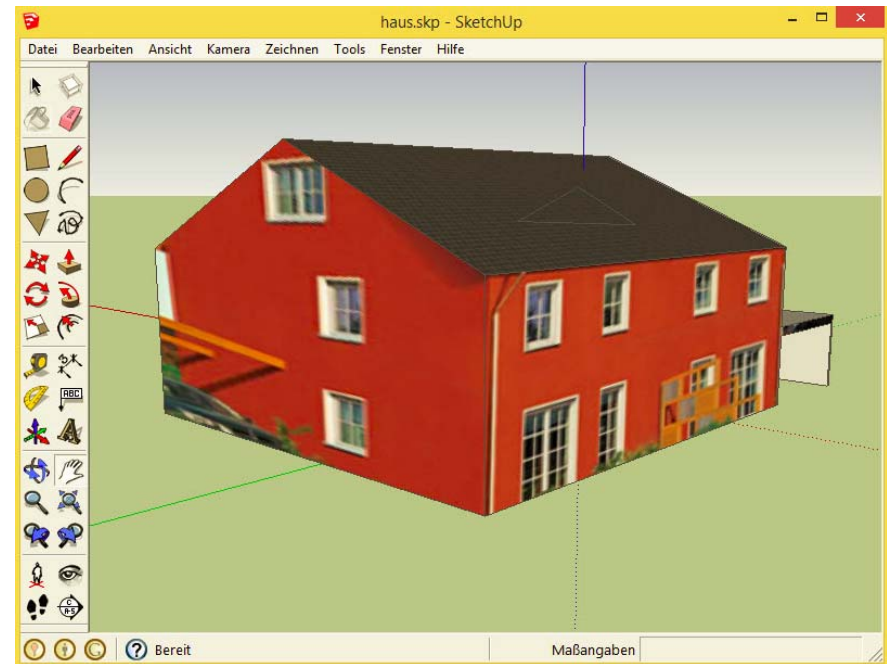
2000: @last software

2006: Google

Schwerpunkte:

- Architektur
- Modellieren in 3D
- Zusammenspiel mit Google Earth

<http://www.sketchup.com/de/download>



Google Earth

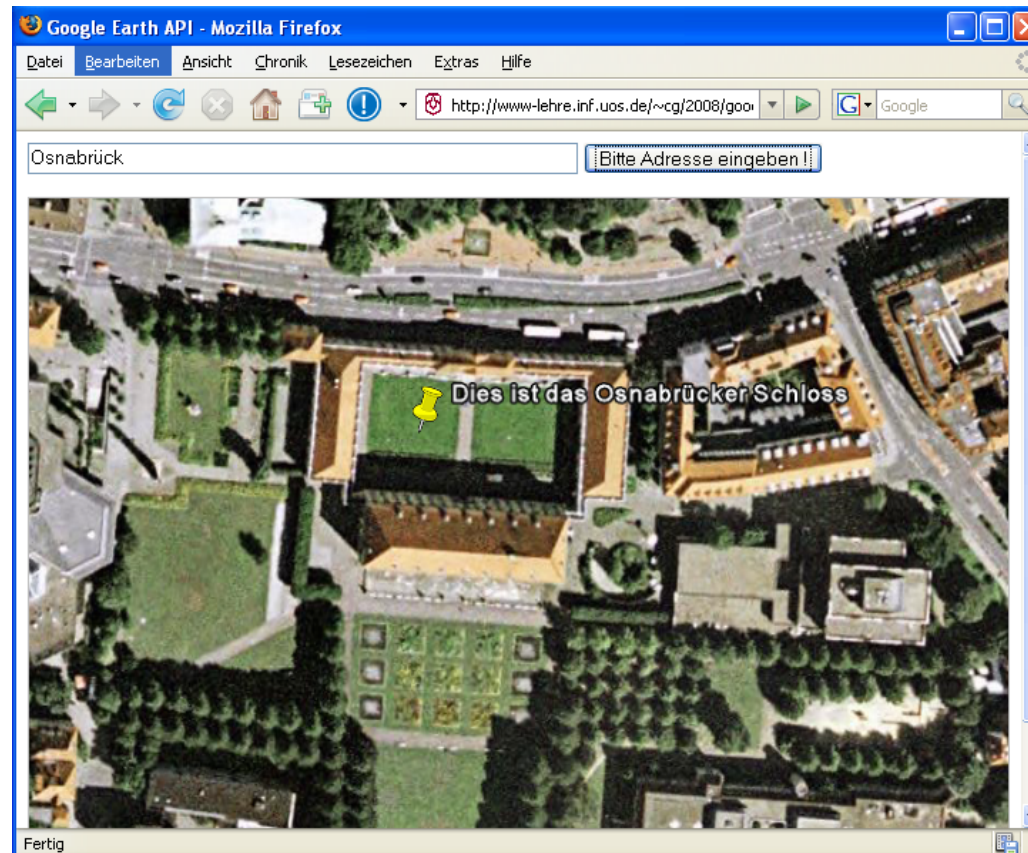


Keyhole Markup Language (KML)

```
<?xml version="1.0" encoding="UTF-8"?>
  <kml xmlns="http://earth.google.com/kml/2.2">
    <Placemark>
      <name>Osnabrücker Schloss</name>
      <description>
        Dies ist der Innenhof des Osnabrücker Schlosses
      </description>
      <Point>
        <coordinates>
          8.044, 52.2716,0
        </coordinates>
      </Point>
    </Placemark>
  </kml>
```

<http://www-lehre.inf.uos.de/~cg/2014/google/kml.html>

Google Earth API



<http://www-lehre.inf.uos.de/~cg/2014/google/alles.html>


```

<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
<Document>
  <Placemark>
    <name>Schloss</name>
    <description>Hier steht das Schloss</description>

    <Style>
      <LineStyle>
        <color>ff00ff00</color>
        <width>6</width>
      </LineStyle>
    </Style>

    <LineString>
      <coordinates>
        8.0432,52.271,0
        8.0452,52.271,0
        8.0452,52.272,0
        8.0432,52.272,0
        8.0432,52.271,0
      </coordinates>
    </LineString>

  </Placemark>
</Document>
</kml>

```

KML



Microsoft Photosynth



<http://labs.live.com/photosynth>