


Footprint Annotation For XML Schemas of Geospatial Web Services





Outline:

- ◆ Problem Statement
- ◆ Annotate the Schema
- ◆ Create the Footprint
- ◆ Examples & Challenges
- ◆ Conclusion



Problem: Given a query window and some attributes, find objects in XML files

- ◆ Challenge: find objects that appear similar, but are described differently
- ◆ For queries, use metadata and real data for filtering



◆ Determine the MBR of the object ID(s)

- lat, long
- address, addressDetail
- geometry

- one file may have multiple objects
- lat/lon ideal, address needs geocoding

◆ Extract non-spatial attributes

- description, name, color

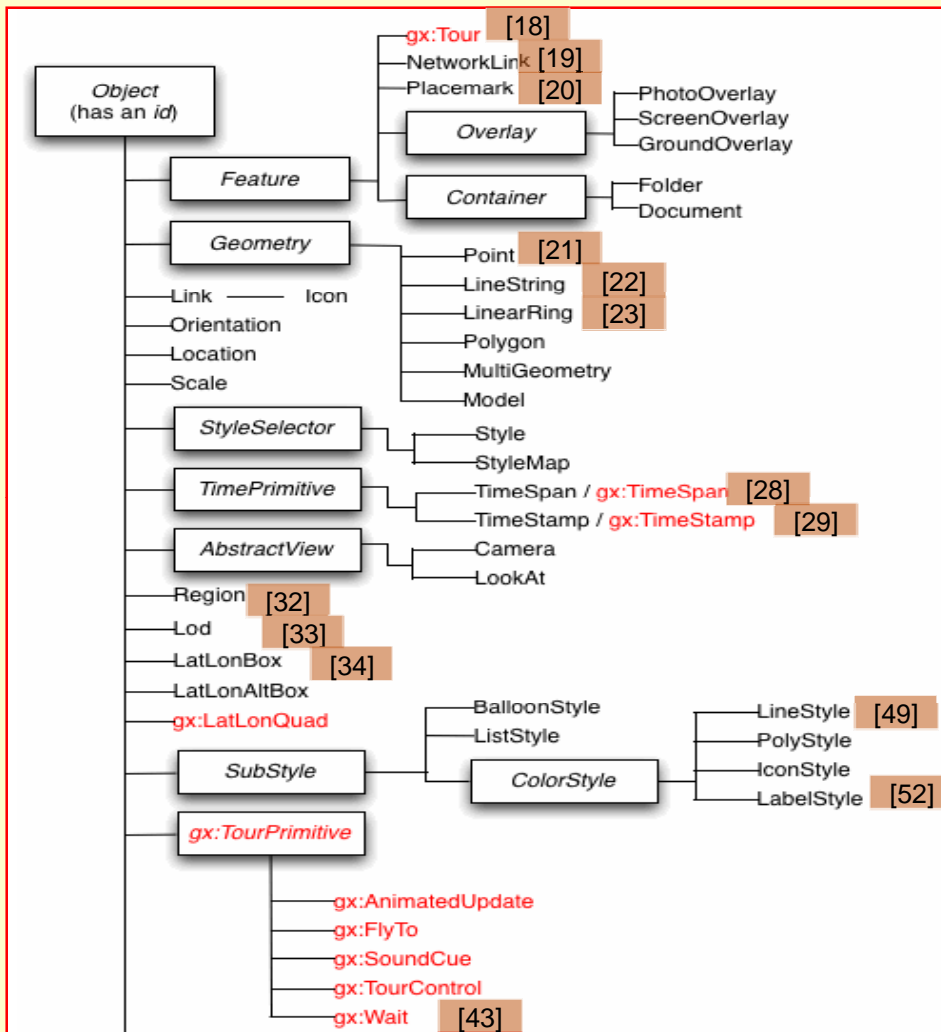
◆ Calculate the footprint

1. Select the XML schema to serve as the object model
2. Associate each node with a unique control ID
3. From the application file, map each feature element to a notation label
4. Build a vector(s) using the control IDs

Example: 2 files **describing the** **Washington Monument.** **Files conform to the** **KML Schema**

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Placemark>
    <name>Washington DC Monuments</name>
    <description>
      Attached to the ground. Intelligently places
      itself at the height of the underlying terrain.
    </description>
    <Point>
      <coordinates>-77.0822035425683, -
      111.42228990140251,0</coordinates>
    </Point>
  </Placemark>
</kml>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Placemark>
    <name>Washington Monument</name>
    <visibility>1</visibility>
    <description>Floats a defined distance above
    the ground.</description>
    <LookAt>
      <longitude>-122.084075</longitude>
      <latitude>37.4220033612141</latitude>
      <altitude>45</altitude>
      <heading>0</heading>
      <tilt>90</tilt>
      <range>100</range>
      <altitudeMode>relativeToGround</altitudeM
ode>
    </LookAt>
    <Point>
      <coordinates>-77.08220354, -
      111.42228990 </coordinates>
    </Point>
  </Placemark>
</kml>
```



```

<name>01</name>
<visibility>02</visibility>
  <open>03</open>
  <atom:author>04</atom:author>
  <atom:link>05</atom:link>
  <address>06</address>
  <xal:AddressDetails>07</xal:AddressDetails>
  <phoneNumber>08</phoneNumber>
  <Snippet maxLines="2">09</Snippet>
  <description>10</description>
  <AbstractView>11</AbstractView>
  <TimePrimitive>12</TimePrimitive>
  <styleUrl>13</styleUrl>
  <StyleSelector>14</StyleSelector>
  <Region>15</Region>
  <Metadata>16</Metadata>
  <ExtendedData>17</ExtendedData>
  
```

KML Object Model

FootPrint:



```
<?xml version="1.0" encoding="UTF-8"?>  
<kml xmlns="http://www.opengis.net/kml/2.2">  
  <Placemark>  
    <name>Washington DC Monuments</name>  
    <description>  
      Attached to the ground. Intelligently places  
      itself at the  
      height of the underlying terrain.  
    </description>  
    <Point>  
      <coordinates>-77.0822035425683,-  
111.42228990140251,0</coordinates>  
    </Point>  
  </Placemark>  
</kml>
```

<u>fID</u>	<u>oid</u>	<u>Pl</u>	<u>n</u>	<u>d</u>	<u>p</u>	<u>coord</u>
XX	77	20	01	10	21	53

FootPrint:



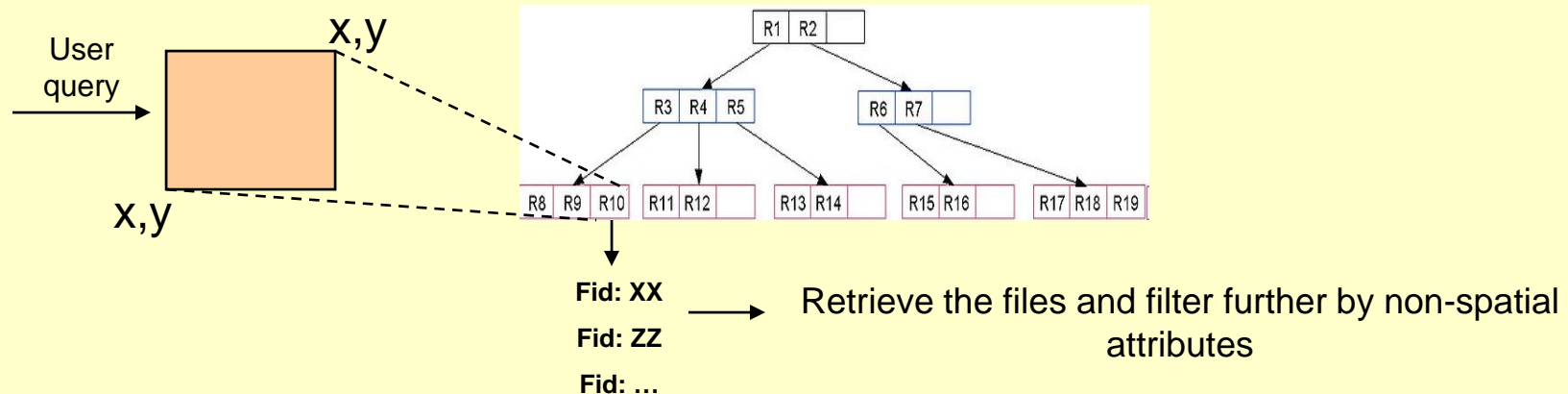
```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Placemark>
    <name>Washington Monument</name>
    <visibility>1</visibility>
    <description>Floats a defined distance above
the ground.</description>
    <LookAt>
      <longitude>-122.084075</longitude>
      <latitude>37.4220033612141</latitude>
      <altitude>45</altitude>
    </LookAt>
    <Point>
      <coordinates>-77.08220354, -
111.42228990 </coordinates>
    </Point>
  </Placemark>
</kml>
```

<u>fID</u>	<u>oid</u>	<u>Pl</u>	<u>n</u>	<u>v</u>	<u>d</u>	<u>Lkt</u>	<u>lon</u>	<u>lat</u>	<u>p</u>	<u>coord</u>
ZZ	99	20	01	02	10	53	99	20	21	53

FootPrint:

XX	77	2001	10	21	53
ZZ	99	20010210	53	99	202153

- ◆ Save the footprint vectors in a spatial index. Use the coordinates of the feature as the MBR.
- ◆ Save the non-spatial attributes (all or just a subset of the interesting ones).
- ◆ Alternatively, just save the files.
- ◆ To query, use spatial operators on MBRs: **Disjoint, Touches, Within, Overlaps**
- ◆ **Refine**






GML Class Hierarchy

- Geographic features: *feature.xsd*
- 1D or 2D geometries: *GeometryBasic0d1d*, *GeometryBasic2d*
- Terrain relationships: *topology.xsd*
- Temporal schemas
- Coverages (aerial photographs, digital elevation models).

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- Challenges:
 - Footprints are built at the object level.
 - Size of footprint grows with size of XML Schema and the number of objects p/ file.
 - For large schemas, footprint size will need some optimization to keep it as small as possible (e.g., limit the feature universe).



Conclusions

A. Create footprints to describe XML Schemas

***B. Use the footprints along with MBR window
and non-spatial attributes to find interesting
objects***

***C. Need to incorporate ontology for feature
classification (helps with data filtering)***