

OGC Observations and Measurements Serialization

Matthew B. Jones

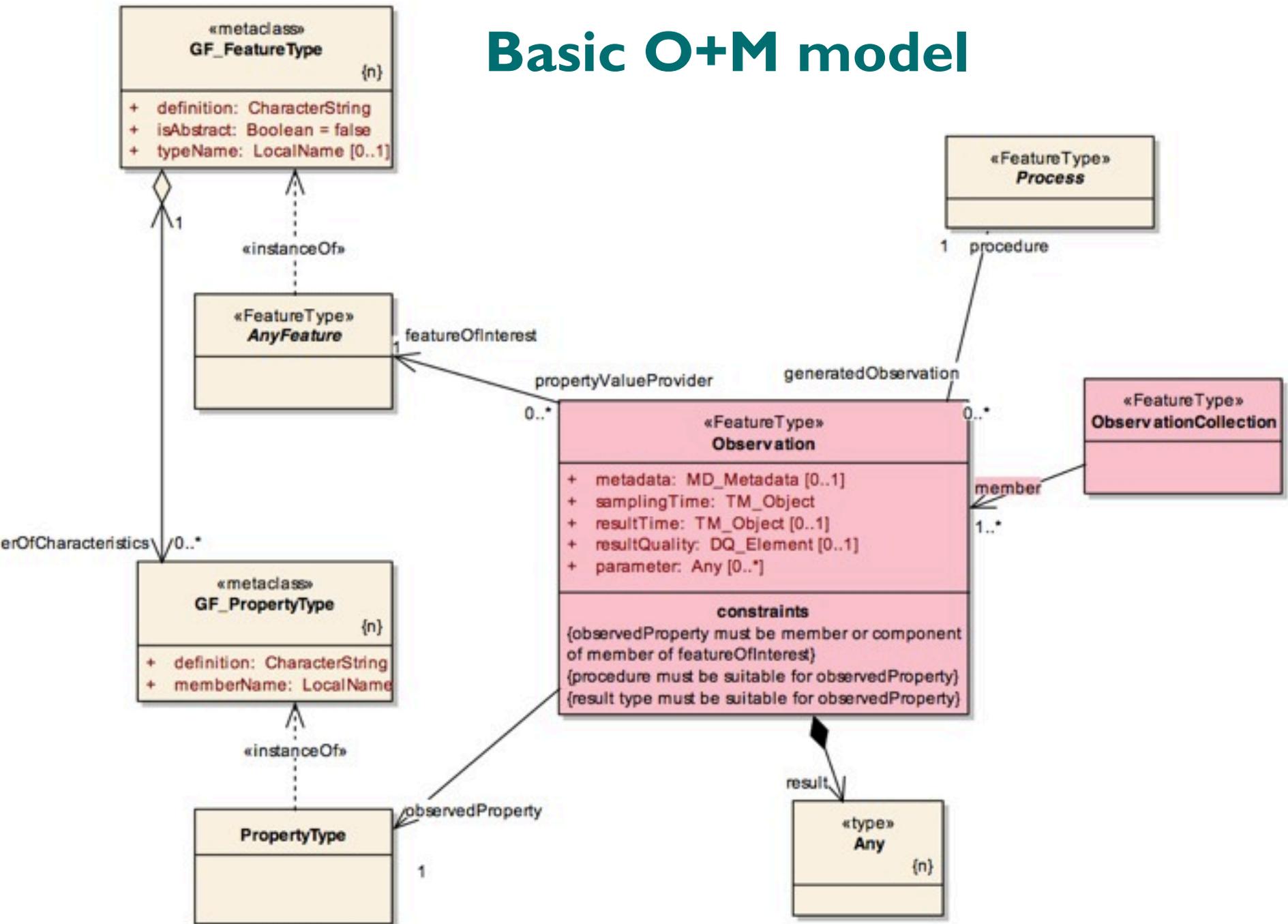
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Basic O+M model



Example O+M Serialization Structure

- ObservationCollection
 - GML bounding box
 - Observation
 - SamplingTime
 - Procedure
 - ObservedProperty
 - FeatureOfInterest
 - Result

A simple weather observation

35.1, 6.5, 085.0, 950, 32.0, clear

Result using swe:Record

```
<?xml version="1.0" encoding="UTF-8"?>
<om:Observation gml:id="COTest3" xmlns:om="http://www.opengis.net/om/1.0"
xmlns:swe="http://www.opengis.net/swe/1.0.1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml" xsi:schemaLocation="http://www.opengis.net/om/1.0
<gml:description>Complex Observation test instance</gml:description>
<gml:name>Complex Observation test 3</gml:name>
<om:samplingTime>
  <gml:TimeInstant gml:id="ot1t">
    <gml:timePosition>2005-01-11T17:22:25.00</gml:timePosition>
  </gml:TimeInstant>
</om:samplingTime>
<om:procedure xlink:href="http://www.flakey.org/register/process/weatherStation3"/>
<om:observedProperty xlink:href="urn:ogc:def:phenomenon:SEEGrid:weather1"/>
<om:featureOfInterest xlink:href="http://www.ga.gov.au/bin/gazd01?rec=293604"
xlink:role="urn:cgi:featureType:SEEGRID:framework:locality"/>
<om:result>
  <swe:Record RS="weatherRecordDefinition.xml">
    <swe:field><swe:Item>35.1</swe:Item></swe:field>
    <swe:field><swe:Item>6.5</swe:Item></swe:field>
    <swe:field><swe:Item>085.0</swe:Item></swe:field>
    <swe:field><swe:Item>950.</swe:Item></swe:field>
    <swe:field><swe:Item>32.0</swe:Item></swe:field>
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      <swe:field><swe:Item>clear</swe:Item></swe:field>
    </swe:Record>
  </om:result>
</om:Observation>
```

Simple Categorical Observation

2005-01-11T17:22:25.00, Banana

```
<?xml version="1.0" encoding="UTF-8"?>
<om:Observation gml:id="obsTest2" xmlns:om="http://www.opengis.net/om/1.0"
xmlns:sml="http://www.opengis.net/sensorML/1.0.1" xmlns:swe="http://www.opengis.net/swe/1.0.1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xsi:schemaLocation="http://www.opengis.net/om/1.0 ../om.xsd http://www.opengis.net/sensorML/1.0.1
http://schemas.opengis.net/sensorML/1.0.1/sensorML.xsd">
  <gml:description>Observation test instance: fruit identification</gml:description>
  <gml:name>Observation test 2</gml:name>
  <om:samplingTime>
    <gml:TimeInstant gml:id="ot2t">
      <gml:timePosition>2005-01-11T17:22:25.00</gml:timePosition>
    </gml:TimeInstant>
  </om:samplingTime>
  <om:procedure>
    <sml:ProcessModel>
      <sml:method xlink:href="http://www.flakey.org/register/party/abc99"/>
    </sml:ProcessModel>
  </om:procedure>
  <om:observedProperty xlink:href="urn:ogc:def:phenomenon:OGC:Species"/>
  <om:featureOfInterest xlink:href="http://wfs.flakey.org?request=getFeature&featureid=fruit37f "/>
  <om:result xsi:type="swe:ScopedNameType"
codeSpace="http://en.wikipedia.org/wiki/List_of_fruits">Banana</om:result>
</om:Observation>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<om:Observation gml:id="obsTest2" xmlns:om="http://www.opengis.net/om/1.0"
xmlns:sml="http://www.opengis.net/sensorML/1.0.1" xmlns:swe="http://www.opengis.net/swe/1.0.1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xsi:schemaLocation="http://www.opengis.net/om/1.0 ../om.xsd http://www.opengis.net/sensorML/1.0.1
http://schemas.opengis.net/sensorML/1.0.1/sensorML.xsd">
  <gml:description>Observation test instance: fruit identification</gml:description>
  <gml:name>Observation test 2</gml:name>
  <om:samplingTime>
    <gml:TimeInstant gml:id="ot2t">
      <gml:timePosition>2005-01-11T17:22:25.00</gml:timePosition>
    </gml:TimeInstant>
  </om:samplingTime>
  <om:procedure>
    <sml:ProcessModel>
      <sml:method xlink:href="http://www.flakey.org/register/party/abc99"/>
    </sml:ProcessModel>
  </om:procedure>
  <om:observedProperty xlink:href="urn:ogc:def:phenomenon:OGC:Species"/>
  <om:featureOfInterest xlink:href="http://wfs.flakey.org?request=getFeature&featureid=fruit37f "/>
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xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xsi:schemaLocation="http://www.opengis.net/om/1.0 ../om.xsd http://www.opengis.net/sensorML/1.0.1
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  <gml:name>Observation test 2</gml:name>
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  <om:procedure>
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    </sml:ProcessModel>
  </om:procedure>
  <om:observedProperty xlink:href="urn:ogc:def:phenomenon:OGC:Species"/>
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    </gml:TimeInstant>
  </om:samplingTime>
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    </sml:ProcessModel>
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codeSpace="http://en.wikipedia.org/wiki/List_of_fruits">Banana</om:result>
</om:Observation>
```

Compound observedProperty

```
<om:ObservationCollection ...>
  <gml:boundedBy>
    <gml:Envelope>
      <gml:lowerCorner>-110.8292007446289 40.8843994140625</gml:lowerCorner>
      <gml:upperCorner>-110.8292007446289 40.8843994140625</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <om:member>
    <om:Observation>
      <om:samplingTime>
        <gml:TimePeriod xsi:type="gml:TimePeriodType">
          <gml:beginPosition>2003-04-03T20:00:00-05:00</gml:beginPosition>
          <gml:endPosition>2003-04-03T20:00:00-05:00</gml:endPosition>
        </gml:TimePeriod>
      </om:samplingTime>
      <om:procedure xlink:href="http://.../observation.owl#TemperatureSensor_46"/>
      <om:observedProperty>
        <swe:CompositePhenomenon gml:id="cpid0" dimension="2">
          <gml:name>resultComponents</gml:name>
          <swe:component xlink:href="urn:ogc:data:time:iso8601"/>
          <swe:component xlink:href="http://.../weather.owl#_AirTemperature"/>
        </swe:CompositePhenomenon>
      </om:observedProperty>
      <om:featureOfInterest>
        <gml:FeatureCollection>
          <gml:featureMember>
            <sa:SamplingPoint gml:id="FreezingRain_562">
              <gml:name>FreezingRain_562</gml:name>
              <sa:position>
                <gml:Point>
                  <gml:pos srsName="urn:ogc:def:crs:EPSG:4326">-110.8292007446289
                    40.8843994140625</gml:pos>
                </gml:Point>
              </sa:position>
            </sa:SamplingPoint>
          </gml:featureMember>
        </gml:FeatureCollection>
      </om:featureOfInterest>
      ...
    </om:Observation>
  </om:member>
```

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<om:ObservationCollection ...>
  <gml:boundedBy>
    <gml:Envelope>
      <gml:lowerCorner>-110.8292007446289 40.8843994140625</gml:lowerCorner>
      <gml:upperCorner>-110.8292007446289 40.8843994140625</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <om:member>
    <om:Observation>
      <om:samplingTime>
        <gml:TimePeriod xsi:type="gml:TimePeriodType">
          <gml:beginPosition>2003-04-03T20:00:00-05:00</gml:beginPosition>
          <gml:endPosition>2003-04-03T20:00:00-05:00</gml:endPosition>
        </gml:TimePeriod>
      </om:samplingTime>
      <om:procedure xlink:href="http://.../observation.owl#TemperatureSensor_46"/>
      <om:observedProperty>
        <swe:CompositePhenomenon gml:id="cpid0" dimension="2">
          <gml:name>resultComponents</gml:name>
          <swe:component xlink:href="urn:ogc:data:time:iso8601"/>
          <swe:component xlink:href="http://.../weather.owl#_AirTemperature"/>
        </swe:CompositePhenomenon>
      </om:observedProperty>
      <om:featureOfInterest>
        <gml:FeatureCollection>
          <gml:featureMember>
            <sa:SamplingPoint gml:id="FreezingRain_562">
              <gml:name>FreezingRain_562</gml:name>
              <sa:position>
                <gml:Point>
                  <gml:pos srsName="urn:ogc:def:crs:EPSG:4326">-110.8292007446289
                    40.8843994140625</gml:pos>
                </gml:Point>
              </sa:position>
            </sa:SamplingPoint>
          </gml:featureMember>
        </gml:FeatureCollection>
      </om:featureOfInterest>
      ...
    </om:Observation>
  </om:member>
```

Compound observedProperty

```
<om:ObservationCollection ...>
  <gml:boundedBy>
    <gml:Envelope>
      <gml:lowerCorner>-110.8292007446289 40.8843994140625</gml:lowerCorner>
      <gml:upperCorner>-110.8292007446289 40.8843994140625</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <om:member>
    <om:Observation>
      <om:samplingTime>
        <gml:TimePeriod xsi:type="gml:TimePeriodType">
          <gml:beginPosition>2003-04-03T20:00:00-05:00</gml:beginPosition>
          <gml:endPosition>2003-04-03T20:00:00-05:00</gml:endPosition>
        </gml:TimePeriod>
      </om:samplingTime>
      <om:procedure xlink:href="http://.../observation.owl#TemperatureSensor_46"/>
      <om:observedProperty>
        <swe:CompositePhenomenon gml:id="cpid0" dimension="2">
          <gml:name>resultComponents</gml:name>
          <swe:component xlink:href="urn:ogc:data:time:iso8601"/>
          <swe:component xlink:href="http://.../weather.owl#_AirTemperature"/>
        </swe:CompositePhenomenon>
      </om:observedProperty>
      <om:featureOfInterest>
        <gml:FeatureCollection>
          <gml:featureMember>
            <sa:SamplingPoint gml:id="FreezingRain_562">
              <gml:name>FreezingRain_562</gml:name>
              <sa:position>
                <gml:Point>
                  <gml:pos srsName="urn:ogc:def:crs:EPSG:4326">-110.8292007446289
                    40.8843994140625</gml:pos>
                </gml:Point>
              </sa:position>
            </sa:SamplingPoint>
          </gml:featureMember>
        </gml:FeatureCollection>
      </om:featureOfInterest>
      ...
    </om:Observation>
  </om:member>
```

Compound observedProperty

```
<om:ObservationCollection ...>
  <gml:boundedBy>
    <gml:Envelope>
      <gml:lowerCorner>-110.8292007446289 40.8843994140625</gml:lowerCorner>
      <gml:upperCorner>-110.8292007446289 40.8843994140625</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <om:member>
    <om:Observation>
      <om:samplingTime>
        <gml:TimePeriod xsi:type="gml:TimePeriodType">
          <gml:beginPosition>2003-04-03T20:00:00-05:00</gml:beginPosition>
          <gml:endPosition>2003-04-03T20:00:00-05:00</gml:endPosition>
        </gml:TimePeriod>
      </om:samplingTime>
      <om:procedure xlink:href="http://.../observation.owl#TemperatureSensor_46"/>
      <om:observedProperty>
        <swe:CompositePhenomenon gml:id="cpid0" dimension="2">
          <gml:name>resultComponents</gml:name>
          <swe:component xlink:href="urn:ogc:data:time:iso8601"/>
          <swe:component xlink:href="http://.../weather.owl#_AirTemperature"/>
        </swe:CompositePhenomenon>
      </om:observedProperty>
      <om:featureOfInterest>
        <gml:FeatureCollection>
          <gml:featureMember>
            <sa:SamplingPoint gml:id="FreezingRain_562">
              <gml:name>FreezingRain_562</gml:name>
              <sa:position>
                <gml:Point>
                  <gml:pos srsName="urn:ogc:def:crs:EPSG:4326">-110.8292007446289
                    40.8843994140625</gml:pos>
                </gml:Point>
              </sa:position>
            </sa:SamplingPoint>
          </gml:featureMember>
        </gml:FeatureCollection>
      </om:featureOfInterest>
      ...
    </om:Observation>
  </om:member>
```

Compound observedProperty

```
<om:ObservationCollection ...>  
  <gml:boundedBy>  
    <gml:Envelope>  
      <gml:lowerCorner>-110.8292007446289 40.8843994140625</gml:lowerCorner>  
      <gml:upperCorner>-110.8292007446289 40.8843994140625</gml:upperCorner>  
    </gml:Envelope>  
  </gml:boundedBy>  
<om:member>  
  <om:Observation>
```

```
    <om:samplingTime>  
      <gml:TimePeriod xsi:type="gml:TimePeriodType">  
        <gml:beginPosition>2003-04-03T20:00:00-05:00</gml:beginPosition>  
        <gml:endPosition>2003-04-03T20:00:00-05:00</gml:endPosition>  
      </gml:TimePeriod>  
    </om:samplingTime>
```

```
    <om:procedure xlink:href="http://.../observation.owl#TemperatureSensor_46"/>
```

```
    <om:observedProperty>  
      <swe:CompositePhenomenon gml:id="cpid0" dimension="2">  
        <gml:name>resultComponents</gml:name>  
        <swe:component xlink:href="urn:ogc:data:time:iso8601"/>  
        <swe:component xlink:href="http://.../weather.owl#_AirTemperature"/>  
      </swe:CompositePhenomenon>  
    </om:observedProperty>
```

```
    <om:featureOfInterest>  
      <gml:FeatureCollection>  
        <gml:featureMember>  
          <sa:SamplingPoint gml:id="FreezingRain_562">  
            <gml:name>FreezingRain_562</gml:name>  
            <sa:position>  
              <gml:Point>  
                <gml:pos srsName="urn:ogc:def:crs:EPSG:4326">-110.8292007446289  
                  40.8843994140625</gml:pos>  
              </gml:Point>  
            </sa:position>  
          </sa:SamplingPoint>  
        </gml:featureMember>  
      </gml:FeatureCollection>  
    </om:featureOfInterest>
```

...

```
  </om:Observation>  
</om:member>
```

Results using swe:SimpleDataRecord

```
<om:member>
  <om:Observation>
    ...

    <om:result>
      <swe:DataArray>
        <swe:elementCount>
          <swe:Count><swe:value>1</swe:value></swe:Count>
        </swe:elementCount>
        <swe:elementType name="Components">
          <swe:SimpleDataRecord>
            <swe:field name="Time">
              <swe:Time definition="urn:ogc:data:time:iso8601"/>
            </swe:field>
            <swe:field name="feature">
              <swe:Text definition="urn:ogc:data:feature"/>
            </swe:field>
            <swe:field name="weather.owl#_AirTemperature">
              <swe:Quantity definition="http://.../weather.owl#_AirTemperature">
                <swe:uom code="http://.../observation.owl#fahrenheit"/>
              </swe:Quantity>
            </swe:field>
          </swe:SimpleDataRecord>
        </swe:elementType>
        <swe:encoding>
          <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator="@@"/>
        </swe:encoding>
        <swe:values>2003-04-03T20:00:00-05,FreezingRain_562,2.0@@</swe:values>
      </swe:DataArray>
    </om:result>
  </om:Observation>
</om:member>
```

Results using swe:SimpleDataRecord

```
<om:member>
  <om:Observation>
    ...

    <om:result>
      <swe:DataArray>
        <swe:elementCount>
          <swe:Count><swe:value>1</swe:value></swe:Count>
        </swe:elementCount>
        <swe:elementType name="Components">
          <swe:SimpleDataRecord>
            <swe:field name="Time">
              <swe:Time definition="urn:ogc:data:time:iso8601"/>
            </swe:field>
            <swe:field name="feature">
              <swe:Text definition="urn:ogc:data:feature"/>
            </swe:field>
            <swe:field name="weather.owl#_AirTemperature">
              <swe:Quantity definition="http://.../weather.owl#_AirTemperature">
                <swe:uom code="http://.../observation.owl#fahrenheit"/>
              </swe:Quantity>
            </swe:field>
          </swe:SimpleDataRecord>
        </swe:elementType>
        <swe:encoding>
          <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator="@@"/>
        </swe:encoding>
        <swe:values>2003-04-03T20:00:00-05,FreezingRain_562,2.0@@</swe:values>
      </swe:DataArray>
    </om:result>
  </om:Observation>
</om:member>
```

Results using swe:SimpleDataRecord

```
<om:member>
  <om:Observation>
    ...

    <om:result>
      <swe:DataArray>
        <swe:elementCount>
          <swe:Count><swe:value>1</swe:value></swe:Count>
        </swe:elementCount>
        <swe:elementType name="Components">
          <swe:SimpleDataRecord>
            <swe:field name="Time">
              <swe:Time definition="urn:ogc:data:time:iso8601"/>
            </swe:field>
            <swe:field name="feature">
              <swe:Text definition="urn:ogc:data:feature"/>
            </swe:field>
            <swe:field name="weather.owl#_AirTemperature">
              <swe:Quantity definition="http://.../weather.owl#_AirTemperature">
                <swe:uom code="http://.../observation.owl#fahrenheit"/>
              </swe:Quantity>
            </swe:field>
          </swe:SimpleDataRecord>
        </swe:elementType>
        <swe:encoding>
          <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator="@@"/>
        </swe:encoding>
        <swe:values>2003-04-03T20:00:00-05,FreezingRain_562,2.0@@</swe:values>
      </swe:DataArray>
    </om:result>
  </om:Observation>
</om:member>
```

Results using swe:SimpleDataRecord

```
<om:member>
  <om:Observation>
    ...

    <om:result>
      <swe:DataArray>
        <swe:elementCount>
          <swe:Count><swe:value>1</swe:value></swe:Count>
        </swe:elementCount>
        <swe:elementType name="Components">
          <swe:SimpleDataRecord>
            <swe:field name="Time">
              <swe:Time definition="urn:ogc:data:time:iso8601"/>
            </swe:field>
            <swe:field name="feature">
              <swe:Text definition="urn:ogc:data:feature"/>
            </swe:field>
            <swe:field name="weather.owl#_AirTemperature">
              <swe:Quantity definition="http://.../weather.owl#_AirTemperature">
                <swe:uom code="http://.../observation.owl#fahrenheit"/>
              </swe:Quantity>
            </swe:field>
          </swe:SimpleDataRecord>
        </swe:elementType>
        <swe:encoding>
          <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator="@@"/>
        </swe:encoding>
        <swe:values>2003-04-03T20:00:00-05,FreezingRain_562,2.0@@</swe:values>
      </swe:DataArray>
    </om:result>
  </om:Observation>
</om:member>
```

Results using swe:SimpleDataRecord

```
<om:member>
  <om:Observation>
    ...

    <om:result>
      <swe:DataArray>
        <swe:elementCount>
          <swe:Count><swe:value>1</swe:value></swe:Count>
        </swe:elementCount>
        <swe:elementType name="Components">
          <swe:SimpleDataRecord>
            <swe:field name="Time">
              <swe:Time definition="urn:ogc:data:time:iso8601"/>
            </swe:field>
            <swe:field name="feature">
              <swe:Text definition="urn:ogc:data:feature"/>
            </swe:field>
            <swe:field name="weather.owl#_AirTemperature">
              <swe:Quantity definition="http://.../weather.owl#_AirTemperature">
                <swe:uom code="http://.../observation.owl#fahrenheit"/>
              </swe:Quantity>
            </swe:field>
          </swe:SimpleDataRecord>
        </swe:elementType>
        <swe:encoding>
          <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator="@@"/>
        </swe:encoding>
        <swe:values>2003-04-03T20:00:00-05,FreezingRain_562,2.0@@</swe:values>
      </swe:DataArray>
    </om:result>
  </om:Observation>
</om:member>
```

Out-of-band results

```
<?xml version="1.0" encoding="UTF-8"?>
<om:Observation gml:id="OPTest1"
xmlns:om="http://www.opengis.net/om/1.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
xsi:schemaLocation="http://www.opengis.net/om/1.0 ../om.xsd">
  <gml:description>Observation instance with remote result</gml:description>
  <gml:name>Observation Pointer 1</gml:name>
  <om:samplingTime>
    <gml:TimePeriod gml:id="op1t">
      <gml:beginPosition>2005-01-11T17:22:25.00</gml:beginPosition>
      <gml:endPosition>2005-01-11T18:22:25.00</gml:endPosition>
    </gml:TimePeriod>
  </om:samplingTime>
  <om:procedure xlink:href="urn:ogc:object:feature:Sensor:3eti:abc45"/>
  <om:observedProperty xlink:href="urn:ogc:def:phenomenon:OGC:RelativeHumidity"/>
  <om:featureOfInterest xlink:href="http://my.modest.org/wfs%26request=getFeature%26;featureid=789002"
xlink:role="urn:ogc:def:featureType:NWS:station"/>
  <om:result xlink:href="http://my.modest.org/results%3f798002%26property=RH" xlink:role="application/xmpp"
xsi:type="gml:ReferenceType"/>
</om:Observation>
```

Out-of-band results

```
<?xml version="1.0" encoding="UTF-8"?>
<om:Observation gml:id="OPTest1"
xmlns:om="http://www.opengis.net/om/1.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
xsi:schemaLocation="http://www.opengis.net/om/1.0 ../om.xsd">
  <gml:description>Observation instance with remote result</gml:description>
  <gml:name>Observation Pointer 1</gml:name>
  <om:samplingTime>
    <gml:TimePeriod gml:id="op1t">
      <gml:beginPosition>2005-01-11T17:22:25.00</gml:beginPosition>
      <gml:endPosition>2005-01-11T18:22:25.00</gml:endPosition>
    </gml:TimePeriod>
  </om:samplingTime>
  <om:procedure xlink:href="urn:ogc:object:feature:Sensor:3eti:abc45"/>
  <om:observedProperty xlink:href="urn:ogc:def:phenomenon:OGC:RelativeHumidity"/>
  <om:featureOfInterest xlink:href="http://my.modest.org/wfs%26request=getFeature%26;featureid=789002"
xlink:role="urn:ogc:def:featureType:NWS:station"/>
  <om:result xlink:href="http://my.modest.org/results%3f798002%26property=RH" xlink:role="application/xmpp"
xsi:type="gml:ReferenceType"/>
</om:Observation>
```

Notes on the syntax

- Compatible with OGC GML
- Flexible result encoding
 - Inline, in XML, plus parsed encodings
 - Out-of-band, via URI refs
- Really verbose
- Incredibly complex
 - difficult to build fully conformant parsers
- Supports wide range of observations
 - categorical, scalar, vector, grid
- Good linkage to semantic types

References

- Observations and Measurements documentation
 - <http://www.opengeospatial.org/standards/om>