Tutorial OGC Services

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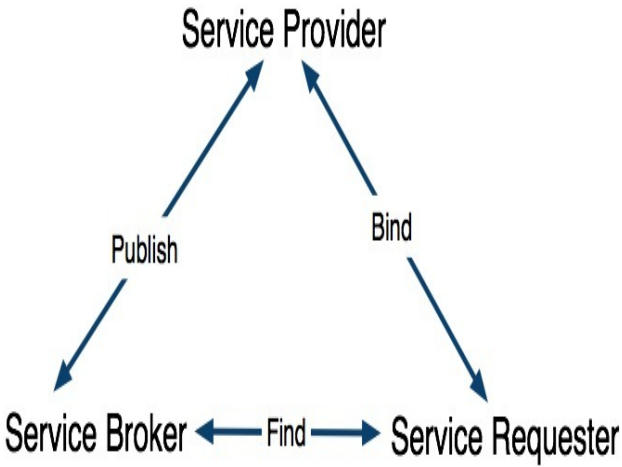
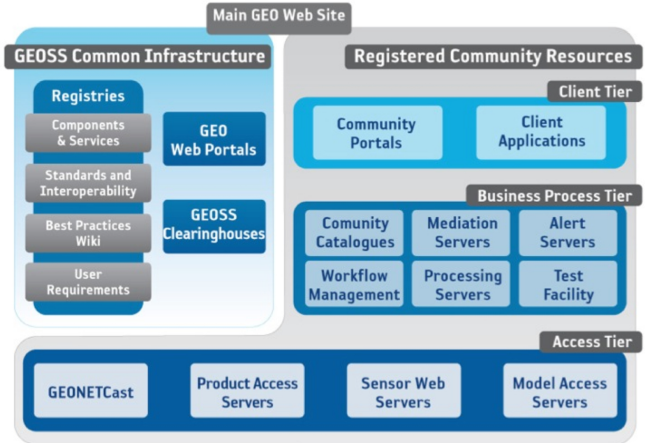
Geospatial Architectures

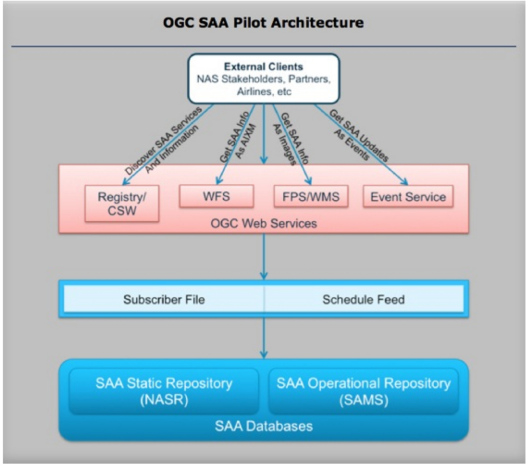
Service Oriented Architectures



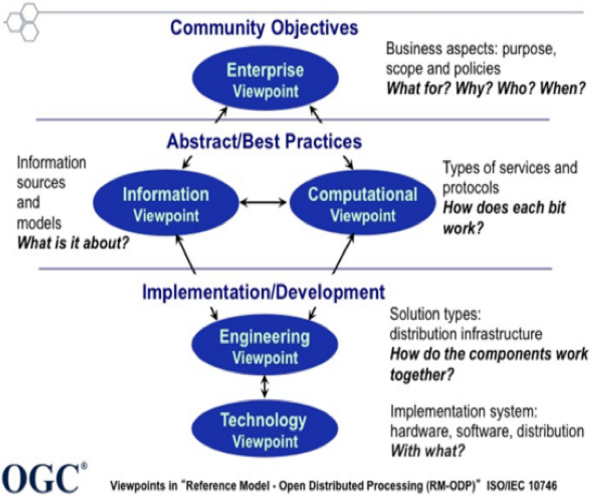
Complex Information Systems



Aviation SAA Pilot



Designing - RM ODP



Enterprise Viewpoint

- stake holders viewpoint
- why the effort in being undertaken
- scope
- objectives
- **defined by: Use Cases**

Information Viewpoint

- **Conceptual models for**
    - Data
    - Metadata
- **Defines Encoding, For example:**
    - WaterML
    - GML
    - SensorML

Computational Viewpoint

Interfaces among service consumers and providers. For example:

- WFS
- WMS
- SOS

Engineering Viewpoint

- Describes Architecture. Which components are needed?
- Explains how services related to each other.
- Services are linked via the interfaces listed in the computational viewpoint.

Other References

- OGC 08-062r7 - OGC Reference Model (2.1).
- OGC 02-112 - Topic 12 - The OpenGIS Service Architecture
- OGC 07-097 - Reference Model for the ORCHESTRA Architecture
- OGC 10-028r1 - GIGAS Methodology for comparative analysis of information and data management systems
- OGC 11-013r6 - OGC Engineering Report: Water Information Services Concept Development Study
- OGC 11-055 - OGC SAA Pilot Study Engineering Report

WEB Map Service (WMS)

This tutorial provides a practical introduction to OGC Web Map Service (WMS) Interface standard.

Goals

- Understand what WMS can be used for
- Understand WMS requests and best practices

Web Map Service (WMS)

The latest version of WMS is 1.3.0 [#ogc-06-042].

A WMS Server:

- Provides information about what maps a service can produce
- Produces a Map
- Answers queries about content of a Map

WMS Usage

- Image of any geocoded information

WMS Operations

- GetCapabilities
- GetMap
- GetFeatureInfo

WMS GetCapabilities Request

Request example:

```
http://ri.opengeospatial.org:8680/degree-wms-130/services?
service=WMS&
version=1.3.0&
request=GetCapabilities
```

Link to getCapabilities

WMS GetCapabilities Response

- How to invoke GetMap
- Types of exceptions
- List of layers

WMS GetMap Request

Request example:

```
http://ri.opengeospatial.org:8680/degree-wms-130/services?
service=WMS&
version=1.3.0&
request=GetMap&
format=image/png&
width=300&
height=300&
crs=EPSG:4326&
layers=cite:BasicPolygons,cite:Forests&
STYLES=default,default
BBOX=-2,-1,2,6&
```

Link to GetMap

WMS GetFeatureInfo Request

Request example:

```
http://ri.opengeospatial.org:8680/degree-wms-130/services?
service=WMS&
version=1.3.0&
request=getfeatureinfo&
format=text/html&
crs=EPSG:4326&
layers=cite:BasicPolygons&
query_layers=cite:BasicPolygons&
BBOX=-2,-1,2,6&
width=300&
height=300&
i=1&
j=1
```

Link to GetFeatureInfo

Tutorial OGC Catalog

- Metadata
- Search
- Catalog
- FGDC
- ISO
- Profiles
- CSW Operations
- OpenSearch

Resource

- A thing
- Anything which is worth uniquely identifying (over the Web)
- Can be data

Metadata

- Data about a resource
- Data about data

Metadata

This is the metadata for this.

What is Missing ?

Nutrition Facts

Serving Size 172 g

Amount Per Serving

Calories 200	Calories from Fat 8
	% Daily Value*
Total Fat 1g	1%
Saturated Fat 0g	1%
Trans Fat	
Cholesterol 0mg	0%
Sodium 7mg	0%
Total Carbohydrate 36g	12%
Dietary Fiber 11g	45%
Sugars 6g	
Protein 13g	

Vitamin A	1%	• Vitamin C	1%
Calcium	4%	• Iron	24%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

NutritionData.com

What is Missing ?

Metadata - Who

- Who collected the data?
- Who processed the data?
- Who wrote the metadata?
- Who to contact for questions?
- Who to contact to order?
- Who owns the data?

Metadata - What

- What are the data about?
- What project were they collected under?
- What are the constraints on their use?
- What is the quality?
- What are appropriate uses?
- What parameters were measured?
- What format are the data in?

Metadata - Why

- Why were the data collected?

Metadata - Why

- Why were the data collected?

Where

- Where were the data collected?
- Where were the data processed?
- Where are the data located?

When

- When were the data collected?
- When were the data processed?

How

- How were the data collected?
- How were the data processed?
- How do I access the data?
- How do I order the data?
- How much do the data cost?
- How was the quality assessed?

Metadata requires update

1980	2005
British Honduras	Belize
West Germany	Germany

Metadata Value

- Organizations: captures the knowhow of an organization
- Developers: help share reliable information
- Users: helps discover data

Search

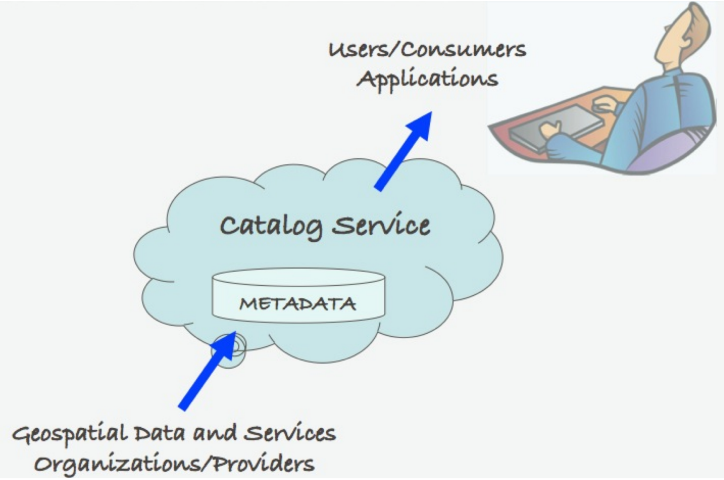
Discovery & evaluation of resources through (summary) metadata

Catalog

- Organized, detailed, descriptive list of items
- arranged systematically (so they can be found)

Catalog

Catalog Service



Registry

System for maintaining a register or authoritative list of names / values / types / relationships (so they can be referenced)

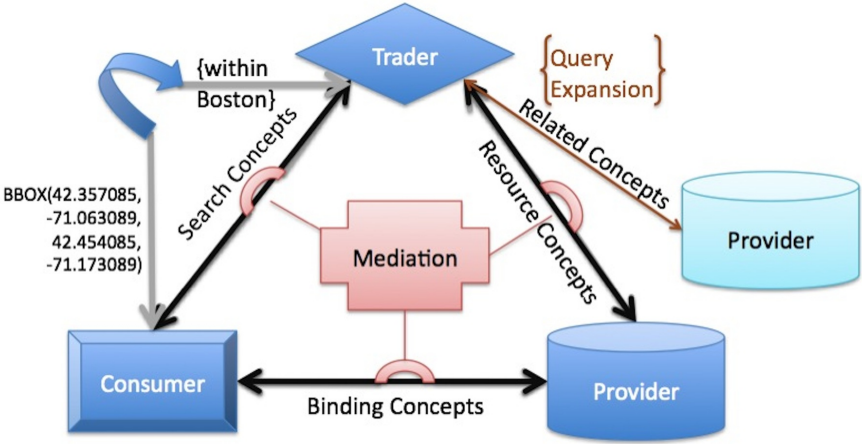
Repository or Archive

Place for storage of resources (so they can be retrieved)

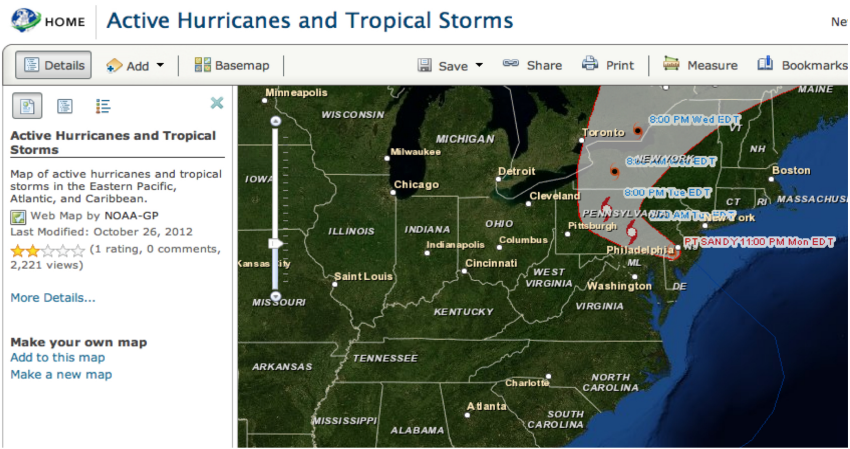
Trader

- Intermediary in a service oriented architecture
- Connects providers with consumers)

Discovery using SOA



Example: Geospatial Platform



Metadata for Hurricane Map

Active Hurricanes and Tropical Storms

Map of active hurricanes and tropical storms in the Eastern Pacific, Atlantic, and Caribbean.

Web Map by NOAA-GP

Last Modified: October 26, 2012

(1 rating, 2,222 views)

Sign In to rate this item.

Open

Description

This map contains the following layers:

Watches, Warnings and Advisories

A warning is issued when a hazardous weather or hydrologic event is occurring, imminent or likely. A warning means weather conditions pose a threat to life or property.
People in the path of the storm need to take protective action.

A watch is used when the risk of a hazardous weather or hydrologic event has increased significantly, but its occurrence, location or timing is still uncertain

Comments (0)

Metadata for Hurricane Map

Access and Use Constraints

The services in this map are not operational and therefore may not be available 24x7.

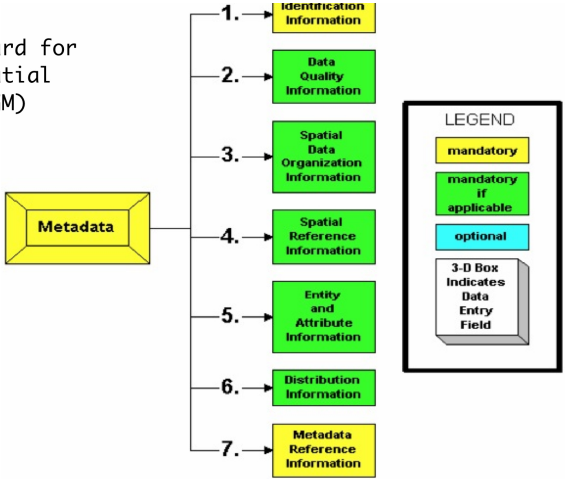
Map Contents

Atlantic and Caribbean:
http://gis.srh.noaa.gov/ArcGIS/rest/services/AtStormViewer/MapServer
Eastern Pacific:
http://gis.srh.noaa.gov/ArcGIS/rest/services/EpStormViewer/MapServer
Imagery with Labels:
http://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer
Imagery with Labels:
http://services.arcgisonline.com/ArcGIS/rest/services/Reference/World_Boundaries_and_Places/

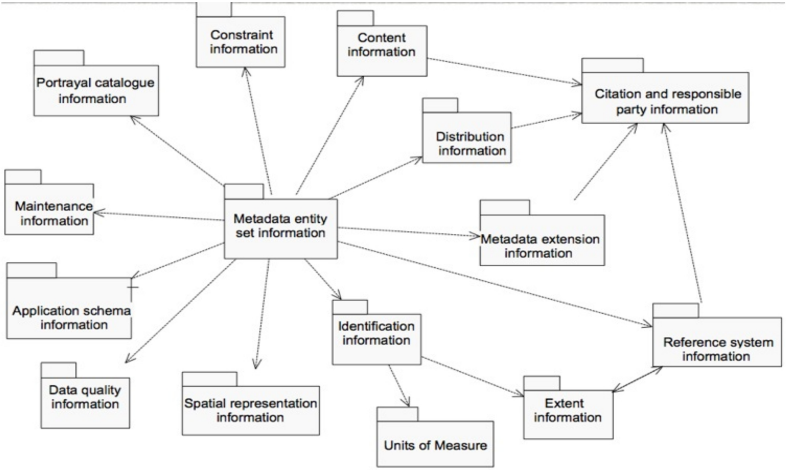
Tags	hurricane forecast, tropical storms
Credits	National Weather Service, National Hurricane Center
Size	184 KB
Extent	Left: -95.05 Right: -50.8 Top: 44.73 Bottom: 16.44

FGDC

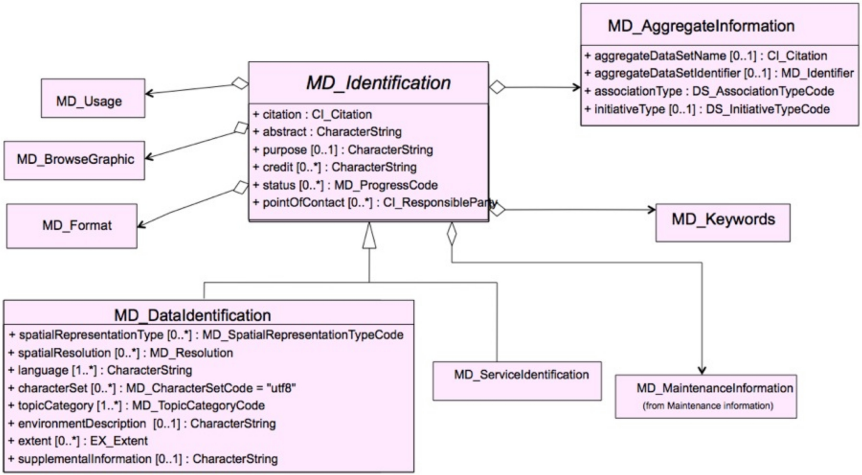
Content Standard for
Digital Geospatial
Metadata (CSDGM)



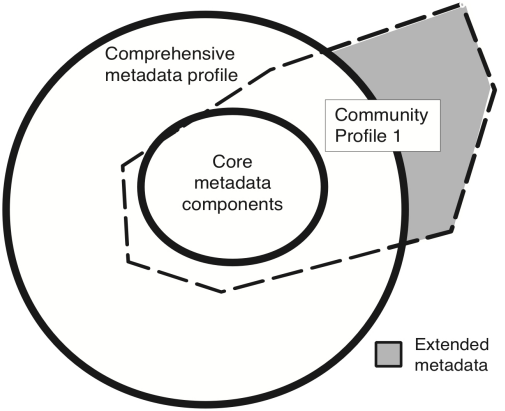
ISO 19115 Geographic Information



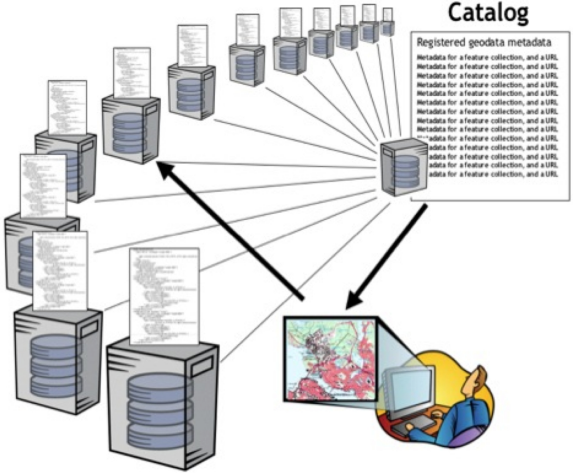
ISO 19115 Geographic Information



Profiles


Comprehensive
metadata profile
Community
Profile 1
Core
metadata
components
Extended
metadata

Catalog Service



Catalog Services

- CSW
- ISO 19119 Metadata Profile
- Z39.50 Profile
- OASIS ebRIM Profile
- OpenSearch

GEOSS Registry

GROUP ON EARTH OBSERVATIONS

GEOSS Registry System

Home | About | Registration Holdings | Search | Registration | API Interface | Standards Registry

Component and Service Registry - Registration Holdings

These two charts were automatically generated on *Feb 3, 2012* at 2:00AM EDT. You might want to check out the public search interface to know the most current data holdings information.

Please note that only approved Components and Service Instances are listed here. You may login to the secure publication portal to search all Components and Service Instances including pending records. After login, you can also request for approval of pending Components or Service Instances records you registered.

Click to see all the Components | Click to see Data-CORE Information | Click to see all the Services

Component List

Click on the heading to sort the column.

List	Component Name	Agriculture	Biodiversity	Climate	Disasters	Ecosystems	Energy	Health	Water	Weather	Details
1.	20m digital elevation model of Italy										Details
2.	52?North SOS Client										Details
3.	52?North Sensor Observation Service										Details
4.	ACQWA										Details
5.	AEMET Current observations available										Details
6.	AEMET Meteorological Data Server										Details

Example Requests

GEOSS Geonetwork

CSW Operations

- GetCapabilities
- DescribeRecord
- GetRecordById
- GetRecords

CSW GetCapabilities

Example Request:

```
http://geossregistries.info:9002/geonetwork/srv/en/csw?
  Request=GetCapabilities&Service=CSW&Version=2.0.2
```

Link to GetCapabilities

CSW DescribeRecord

Example Request:

```
http://geossregistries.info:9002/geonetwork/srv/en/csw?
  Request=DescribeRecord&
  Service=CSW&Version=2.0.2&
  NAMESPACE=xmlns(rim=urn:oasis:names:tc:ebxml-regrep:xsd:rim:3.0)
```

Link to DescribeRecord

CSW GetRecordById

Example Request:

```
http://geossregistries.info:1090/GEOSSCSW202/discovery?
   Service=CSW&Request=GetRecordById&
   Id=urn:uuid:85fd419c-081b-4e69-8998-d1003b5d4489:1.4,
   urn:uuid:a9ad5a4b-1589-4876-a149-904fc5a9fef0:1.8
```

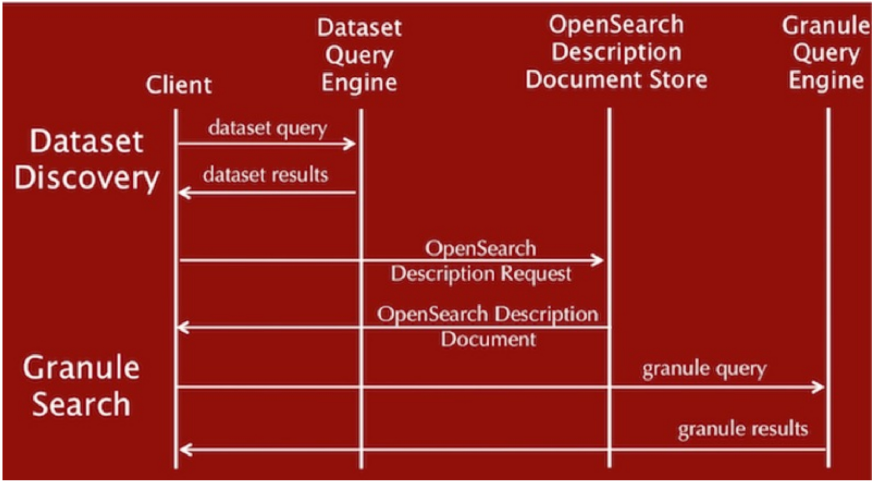
Link to GetRecordById

CSW GetRecords

Example Request:

```
http://geossregistries.info:9002/geonetwork/srv/en/csw?
   Service=CSW&Request=GetRecords&version=2.0.2%20&
   constraintLanguage=CQL_TEXT&
   typeNames=gmd:MD_Metadata&
   namespace=xmlns%28gmd%3Dhttp%3A%2F%2Fwww.isotc211.org%2F2005%2Fgmd%29&
   resultType=results
```

OpenSearch


Client
Dataset Query Engine
OpenSearch Description Document Store
Granule Query Engine
Dataset Discovery
dataset query
dataset results
OpenSearch Description Request
OpenSearch Description Document
Granule Search
granule query
granule results

OpenSearch

```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSearchDescription
     xmlns="http://a9.com/-/spec/opensearch/1.1/">
  <ShortName>Mirador Dataset Search</ShortName>
  <Description>Use Mirador Dataset Search to obtain a
  list of Earth Science Data Sets</Description>
  <Tags>Mirador Dataset Search</Tags>
  <Contact>mirador-disc@listserv.gsfc.nasa.gov</Contact>
  ...
```

OpenSearch

```
<Url type="application/atom+xml"
        template="http://mirador.gsfc.nasa.gov/cgi-bin/
           mirador/collectionlist.pl?
        keyword={searchTerms}&
        page=1&
        count={count}&
        osLocation={geo:box}&
        startTime={time:start}&
        endTime={time:end}&
        format=atom"/>
```

OpenSearchGeo

```
http://example.com/?
q=pizza&
bbox=-111.032,42.943,-119.856,43.039&
format=rss
```

OpenSearchGeo

```
http://example.com/?
q=pizza&
lat=43.25&lon=-123.45
&radius=10000&
format=rss
```

OpenSearchGeo

```
http://example.com/?
q=pizza&
l=boston&
format=rss
```

Example Tool: GeoNetwork

Credits

- NOAA NCDDC Metadata training materials

SWE Introduction

SWE definition

Set of OGC standards that work together to better:

- discover
- access
- control
- use sensor data.

SWE scope

Let's call all these **Sensor Systems** or *Systems*

- Detectors
- Sensors
- Sensor Networks
- Platforms

SWE motivation

- Systems are disconnected
- Systems are heterogeneous
- Systems produce massive amount of data

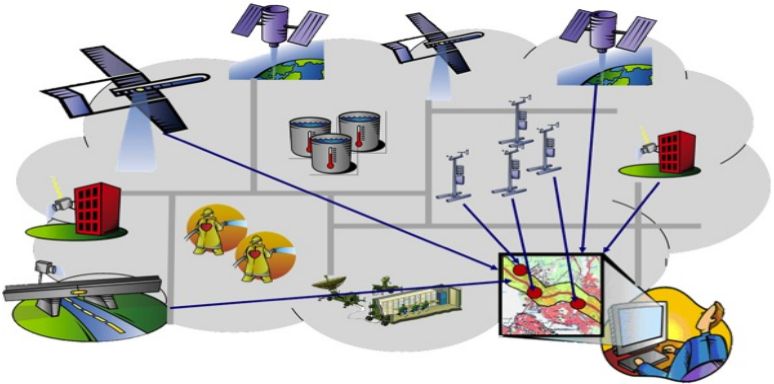
Systems are disconnected

Systems are heterogeneous

Systems produce lots of data

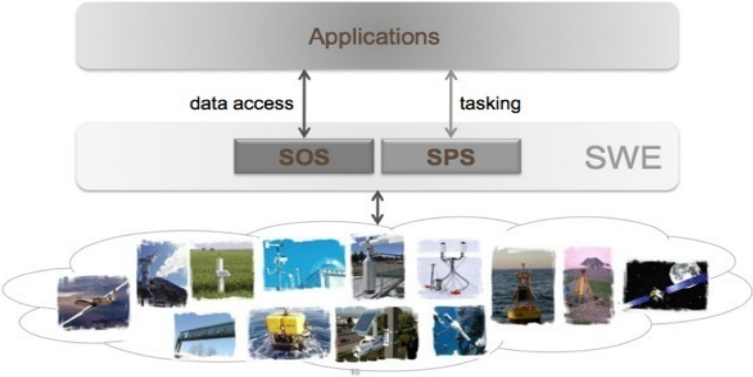
640 terabytes of operational data on just one Atlantic crossing

User connected to sensor systems



SWE requirements

SWE solution



SWE encoding standards

- Observations and Measurements (O&M)
- SensorML
- SWECommon
- PUCK

SWE interface standards

- Sensor Observation Service
- Sensor Planning Service
- PUCK

SWECommon

SWECommon provides

- primitive data types (boolean, categories, text, quantities ..)
- aggregate data types (records, arrays, matrices)
- specialized data types (curves, time dependent)
- Structure to encode quality information
- Structure to provide semantic annotations

SWECommon relation with other encoding standards

- In SensorML inputs and outputs are express via SWECommon
- In O&M the result can be expressed with SWECommon

SWECommon XML Example

Namespace declaration:

```
<?xml version="1.0" encoding="UTF-8"?>
<swe:DataStream id="EXAMPLE_01"
   xmlns:swe="http://www.opengis.net/swe/2.0"
   xmlns:gml="http://www.opengis.net/gml/3.2"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:xlink="http://www.w3.org/1999/xlink"
   xsi:schemaLocation=
         "http://www.opengis.net/swe/2.0 http://schemas.opengis.net/sweCommon/2.0/swe.xsd">
```

SWECommon XML Example

Element Count:

```
<swe:elementCount>
   <swe:Count>
      <swe:value>10</swe:value>
   </swe:Count>
</swe:elementCount>
```

SWECommon XML Example

Data Record and definition of first field (Time):

```
<swe:elementType name="weather_data">
   <swe:DataRecord>
      <!-- -->
      <swe:field name="time">
         <swe:Time definition=
               "http://www.opengis.net/def/property/OGC/0/SamplingTime">
            <swe:label>Sampling Time</swe:label>
            <swe:uom xlink:href=
               "http://www.opengis.net/def/uom/ISO-8601/0/Gregorian"/>
         </swe:Time>
      </swe:field>
```

SWECommon XML Example

Definition of second field (Temperature):

```
<swe:field name="temperature">
   <swe:Quantity definition=
         "http://mmisw.org/ont/cf/parameter/air_temperature">
      <swe:label>Air Temperature</swe:label>
      <swe:uom xlink:href="Cel"/>
      <swe:constraint>
         <swe:AllowedValues>
            <swe:value>1</swe:value>
            <swe:value>2</swe:value>
                      <swe:value>3</swe:value>
            <swe:interval>-50 +50</swe:interval>
            <swe:significantFigures>2</swe:significantFigures>
         </swe:AllowedValues>
      </swe:constraint>
   </swe:Quantity>
</swe:field>
```

SWECommon XML Example

Definition of third field (Pressure):

```
<swe:field name="pressure">
   <swe:Quantity definition=
         "http://mmisw.org/ont/cf/parameter/air_pressure">
      <swe:label>Atmospheric Pressure</swe:label>
      <swe:quality>
         <swe:Quantity definition=
               "http://sweet.jpl.nasa.gov/2.0/sciUncertainty.owl#Accuracy">
            <swe:uom code="%"/>
            <swe:value>10</swe:value>
         </swe:Quantity>
      </swe:quality>
      <swe:uom code="mbar"/>
   </swe:Quantity>
</swe:field>
```

SWECommon XML Example

Definition of fourth and fifth fields (Wind Vector):

```
      <swe:field name="windSpeed">
         <swe:Quantity definition=
                  "http://mmisw.org/ont/cf/parameter/wind_speed">
            <swe:uom code="km/h"/>
         </swe:Quantity>
      </swe:field>
      <!-- -->
      <swe:field name="windDirection">
         <swe:Quantity definition=
                 "http://mmisw.org/ont/cf/parameter/wind_to_direction">
            <swe:uom code="deg"/>
         </swe:Quantity>
      </swe:field>
      <!-- -->
   </swe:DataRecord>
</swe:elementType>
```

SWECommon XML Example

Definition of the encoding and the data:

```
   <swe:encoding>
      <swe:TextEncoding tokenSeparator=","
            blockSeparator="&#32;"
            decimalSeparator="."/>
   </swe:encoding>
   <swe:values>
      2009-01-01T10:00:25Z,25.3,1098,5,56
      2009-01-01T10:00:35Z,25.4,1098,15,59
      2009-01-01T10:00:45Z,25.4,1098,12,42
      ...
   </swe:values>
</swe:DataStream>
```

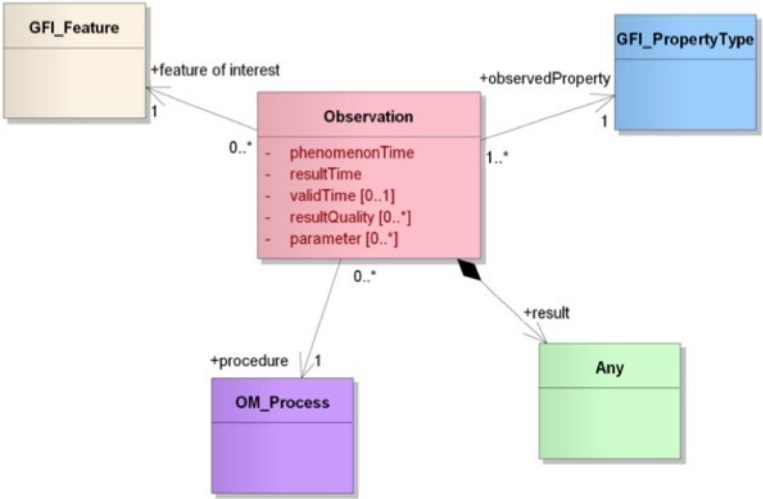
Observations and Measurements (O&M)

This tutorial provides an introduction to the OGC Encoding Standard Observations and Meaurementes

O&M

- An observation is an *event* that
- estimates an *observed property*
- of a *feature of interest*,
- using a *procedure*, and
- generating a *result*

O&M UML


GFI_Feature
+feature of interest
1
0..*
Observation
- phenomenonTime
- resultTime
- validTime [0..1]
- resultQuality [0..*]
- parameter [0..*]
+observedProperty
1
1..*
GFI_PropertyType
0..*
+procedure
1
OM_Process
+result
Any

O&M XML Example

Lets walk through an example from Geonovum

O&M XML Header

```
<?xml version="1.0" encoding="windows-1250"?>
     <om:Measurement gml:id="obsTest"
        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
          ../extensions/observationSpecialization_override.xsd">
```

O&M XML Time

```
<om:samplingTime>
  <gml:TimeInstant>
    <gml:timePosition>2008-10-14T00:09:53+02:00</gml:timePosition>
  </gml:TimeInstant>
</om:samplingTime>
```

O&M XML Procedure

```
<om:procedure
   xlink:href=
         "urn:ogc:object:feature:OSIRIS-HWS:
            a1ef1094-c201-4f9f-8f2e-0ff97bf65f03"/>
```

O&M XML Observed Property

```
<om:observedProperty
   xlink:href="urn:x-ogc:def:property:OGC::RelativeHumidity"/>
```

O&M XML Feature of Interest

```
   <om:featureOfInterest>
         <sa:SamplingPoint
      gml:id=
         "urn:ogc:object:feature:OSIRIS-HWS:
            a1ef1094-c201-4f9f-8f2e-0ff97bf65f03"
      xsi:type="ns:SamplingPointType"
         xmlns:ns="http://www.opengis.net/sampling/1.0"
      xmlns:gml="http://www.opengis.net/gml">
    <gml:name>roof of the ifgi</gml:name>
    <sa:sampledFeature
      xlink:href="urn:ogc:object:feature:
         OSIRIS-HWS:hygrometera1ef1094-c201-4f9f-8f2e-0ff97bf65f03"/>
    <sa:position>
      <gml:Point srsName="urn:ogc:def:crs:EPSG:4326">
        <gml:pos>52.07349 9.42125</gml:pos>
      </gml:Point>
    </sa:position>
  </sa:SamplingPoint>
</om:featureOfInterest>
```

O&M XML Observed Property

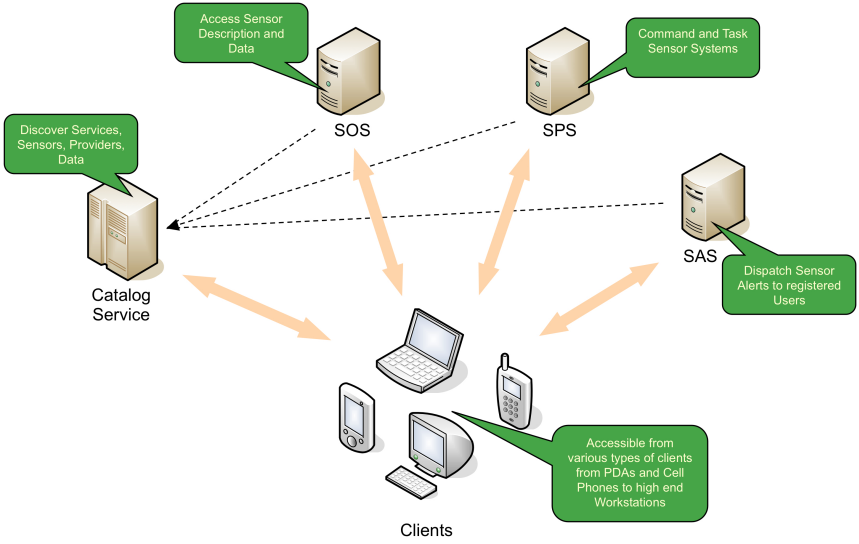
```
   <om:result uom="%"
      xlink:href="urn:x-ogc:def:uom:OGC:percent" >41
   </om:result>
</om:Measurement>
```

SWE Services

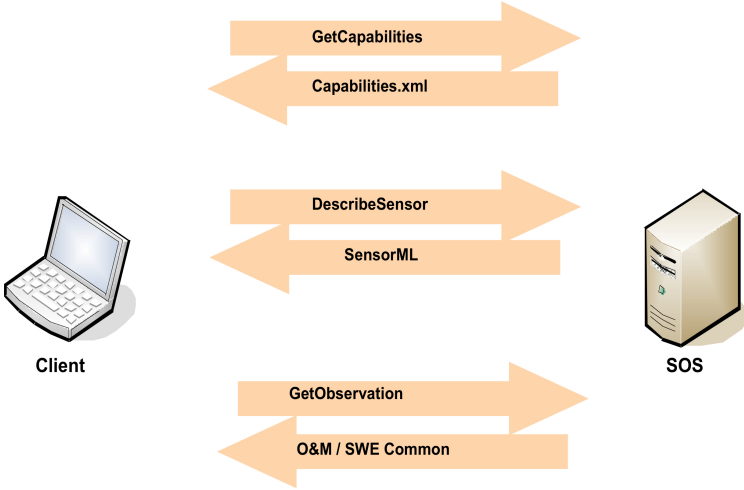
SWE Services

- **Sensor Observation Service** – Access observations and descriptions for sensor systems
- **Sensor Alert Service** – Subscribe to alerts based upon sensor observations
- **Sensor Planning Service** – Request collection feasibility and task sensor system for desired observations
- **Web Notification Service** – Manage message dialogue between client services for long duration (asynchronous) processes
- **Sensor Registries** – Discover sensors and sensor observations

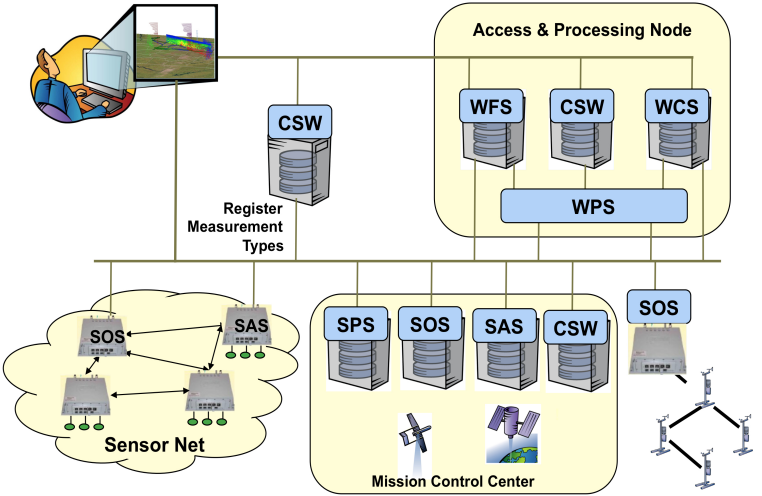
SWE Services


Access Sensor Description and Data
SOS
Command and Task Sensor Systems
SPS
Discover Services, Sensors, Providers, Data
Catalog Service
SAS
Dispatch Sensor Alerts to registered Users
Accessible from various types of clients from PDAs and Cell Phones to high end Workstations
Clients

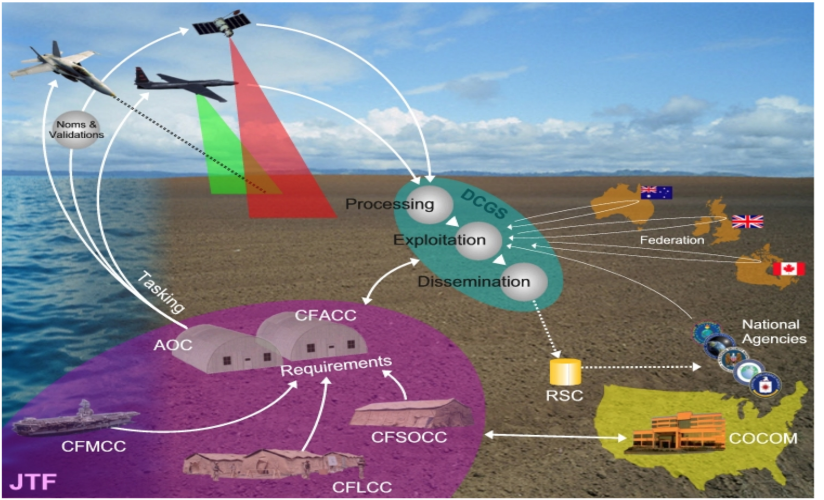
SOS Operations



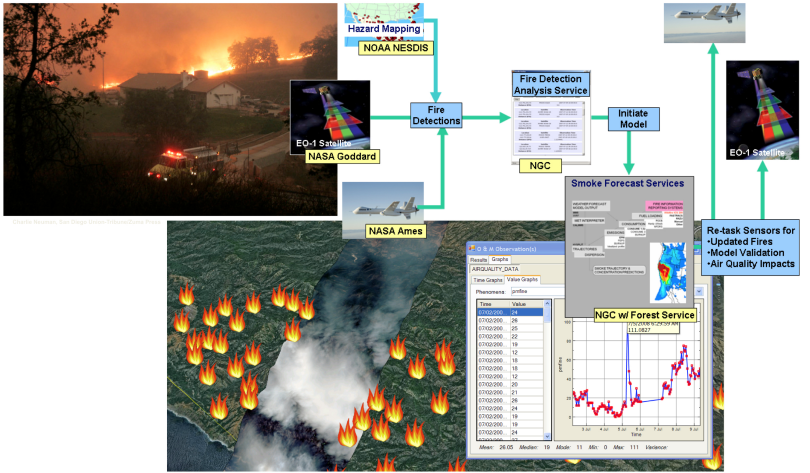
SWE and Geo-processing Workflow



SWE in Defense



SWE in Air Quality



KML

This tutorial provides an introduction to KML

KML is used for

- Annotate the Earth
- Specify icons and labels to identify locations on the surface of the planet
- Create different camera positions to define unique views for KML features
- Define image overlays to attach to the ground or screen
- Define styles to specify KML feature appearance

KML is used for

- Write HTML descriptions of KML features, including hyperlinks and embedded images
- Organize KML features into hierarchies
- Locate and update retrieved KML documents from local or remote network locations
- Define the location and orientation of textured 3D objects

KML Example

```
<kml xmlns="http://www.opengis.net/kml/2.2">
    <Document>
       <name>Document.kml</name> <open>1</open>
       <Style id="exampleStyleDocument">
           <LabelStyle>
           <color>ff0000cc</color>
           </LabelStyle>
         </Style>
```

KML Example

```
<Placemark>
    <name>Document Feature 1</name>
    <styleUrl>#exampleStyleDocument</styleUrl>
    <Point>
       <coordinates>-122.371,37.816,0</coordinates>
    </Point>
</Placemark>
```

KML Example

```
        <Placemark>
            <name>Document Feature 2</name>
            <styleUrl>#exampleStyleDocument</styleUrl>
            <Point>
               <coordinates>-122.370,37.817,0</coordinates>
            </Point>
        </Placemark>
   </Document>
</kml>
```

WPS

This tutorial provides an introduction to the OGC Web processing Service (WPS) Interface Standard.

Geoprocessing

A GIS operation used to manipulate GIS data.

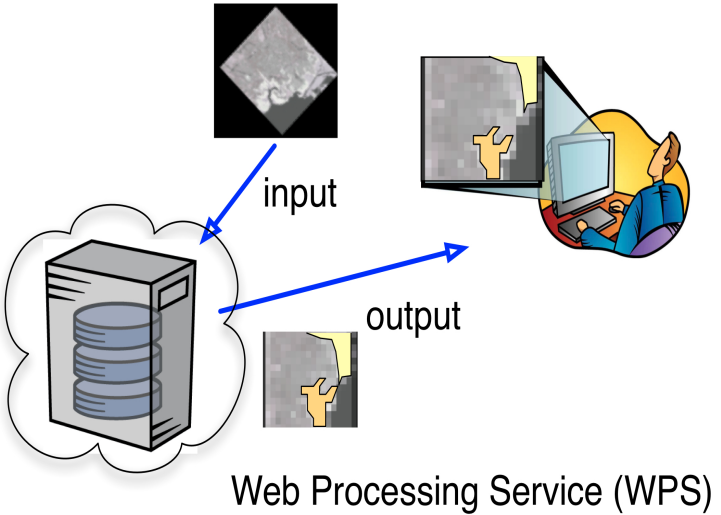
Examples?

Data Processing

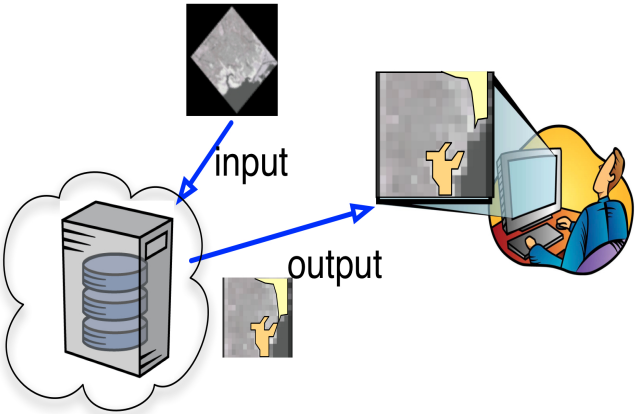
Types of Operations

- Feature Overlay
- Feature Selection
- Topology processing
- Raster processing
- Data Conversion
- Feature Analysis

Web Processing Service

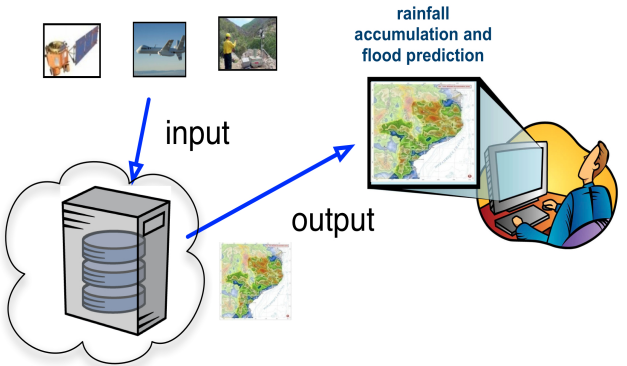


Classification



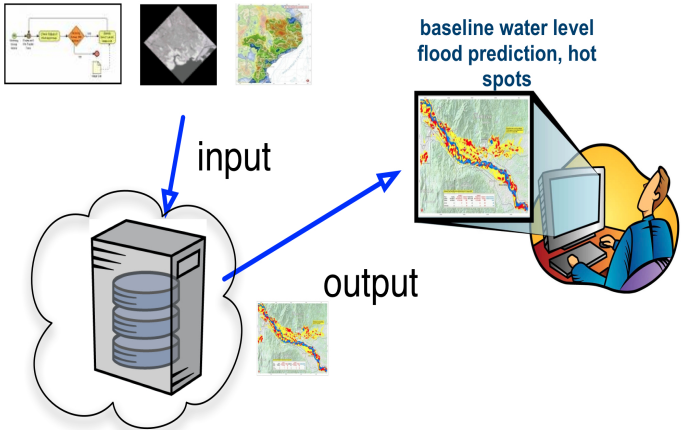
Web Processing Service (WPS) - Classification

Model Run



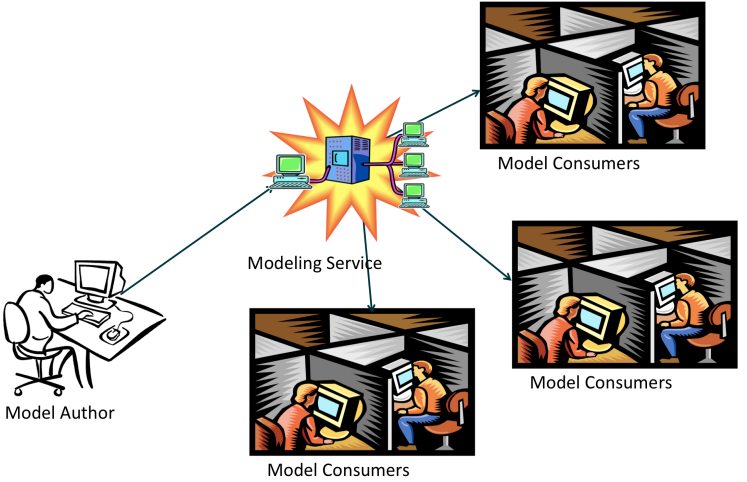
Web Processing Service (WPS) - Model Running

Workflows



Web Processing Service (WPS) - Workflows

Reusability



Operations

- *GetCapabilities* returns information about the service
- *DescribeProcess* returns details of a specific process including its inputs and outputs
- *Execute* returns, for a specific process, the output(s) of a process

Parameters DescribeProcess

- service
- request
- describeProcess
- identifier

Input

- URL
- GML
- Image
- Data

Output

- URL
- GML
- Image
- Another service

Open Layers Demo

http://openlayers.org/dev/examples/wps.html

- inspect process types
- run a buffer operation

52North Demo

http://geoprocessing.demo.52north.org:8080/wps/test.html

- run the default buffer operation
- what can I input to the process?

52North Demo

Use another feature collection as input.

For example this getFeature request

Web Feature Service (WFS) Tutorial

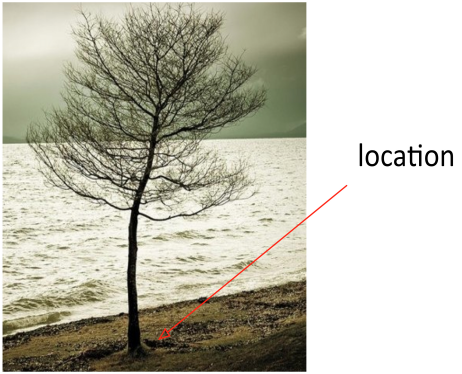
This tutorial provides an introduction to WFS.

Feature

Feature has Properties

location

Geospatial Feature



Generalization

Class = Feature Type = Tree

Properties of Tree:

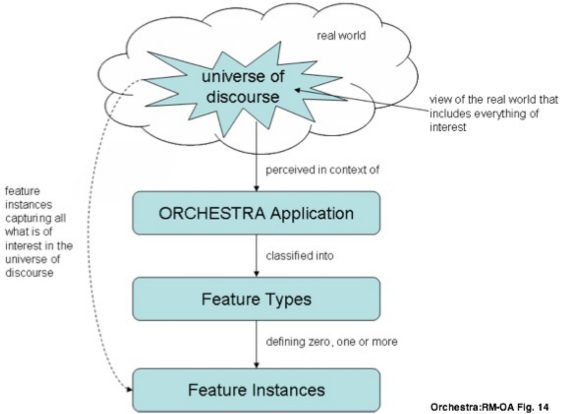
- Height
- Location

All my Trees will have a height and location.

Feature Instance

My favorite tree in Cartagena is the one in front of the hotel Colombia.
Height = 5 mt
Location: Latitude, Longitude
10.407793,-75.551262

Features Modeling



Orchestra:RM-OA Fig. 14

Geographic Markup Languaae (GML)

```
<Bridge>
  <span>100</span>
  <height>200</height>
  <gml:centerLineOf>
    <gml:LineString>
       <gml:pos>100 200</gml:pos>
       <gml:pos>200 200</gml:pos>
    </gml:LineString>
  </gml:centerLineOf>
</Bridge>
```

Feature Instance of Type Bridge

```
<Bridge>
  <span>100</span>
  <height>200</height>
  <gml:centerLineOf>
    <gml:LineString>
       <gml:pos>100 200</gml:pos>
       <gml:pos>200 200</gml:pos>
    </gml:LineString>
  </gml:centerLineOf>
</Bridge>
```

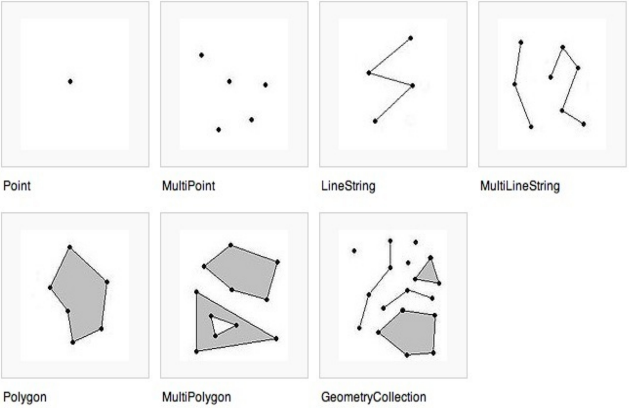
Feature Types are defined in GML

```
<xs:complexType name="BridgeType">
     <xs:complexContent>
          <xs:extension base="gml:AbstractFeatureType">
              <xs:sequence>
              <xs:element name="span"  type="xs:integer"/>
              <xs:element name="height" type="xs:integer"/>
                 <xs:element ref="gml:centerLineOf"/>
               </xs:sequence>
            </xs:extension>
     </xs:complexContent>
 </xs:complexType>
```

GML Provides

- Defines an abstract feature model
- Provides XML Schemas
- Provides primitives:
    - Geometry
    - Feature Types
    - Coordinate Reference Systems

GML Geometries



How can I model a radio station?

How can I model a radio station?

Point - when looking at a country map

How can I model a radio station?

Polygon - location of the building

How can I model a radio station?

Multipolygon - Area of Transmition

Communities develop their own Application Schemas

- AIXM – Aviation
- CAAML – Canadian avalanches
- CityGML – 3D city models
- CSML – Climate Science Modelling
- DAFIF – Defense aviation
- GeoSciML - Geoscience
- ...

Web Feature Service (WFS)

- Service (Protocol)
- Do the following with Geographic Features:
    - publish
    - access
    - manipulate

WFS Operations

- *getCapabilities* - summary of the service
- *DescribeFeatureType* - structure of the feature types
- *GetFeature* - get the feature instance
- *Transaction* - create, update and delete geographic features
- *Lock Feature* - Protects feature record when updating it.

GeoServer Demo

- GeoServer is the reference implementation for WFS 1.1.0.
- Open and free software
- Java-based

GeoServer Demo

- http://localhost:8080/geoserver/web/
- click on Demos
- Explore Operations

Example GetCapabilities Request

Request example:

```
http://localhost:8080/geoserver/topp/ows?
service=WFS&
version=1.0.0&
request=GetCapabilities
```

Link to GetCapabilities

Example DescribeFeature Request

Request example:

```
http://localhost:8080/geoserver/topp/ows?
 service=WFS&
 version=1.1.0&
 request=DescribeFeatureType&
 typeName=topp:tasmania_water_bodies
```

Link to DescribeFeature

Example GetFeature Request

Request example:

```
http://localhost:8080/geoserver/topp/ows?
service=WFS&version=1.1.0&request=getFeature&
TypeName=topp:tasmania_water_bodies
```

Link to getFeature request

Query based on values of properties

Lakes with area > 1067000000 cm.

```
http://localhost:8080/geoserver/topp/ows?
  service=WFS&version=1.1.0&request=getFeature&
  TypeName=topp:tasmania_water_bodies&
  FILTER=
     <Filter xmlns="http://www.opengis.net/ogc">
       <PropertyIsGreaterThan>
         <PropertyName>AREA</PropertyName>
         <Literal>1067000000</Literal>
       </PropertyIsGreaterThan>
     </Filter>
```

Link to GetFeature with filter

Client - Server Demo

- Open uDIG
- **Connect with geoserver:**

  http://localhost:8080/geoserver/topp/ows

References

OGC Standards

http://www.opengeospatial.org/standards

GML Application Profiles

http://www.ogcnetwork.net/gmlprofiles

GeoServer

http://docs.geoserver.org/stable/en/user/data/vector/index.html

uDIG

http://udig.refractions.net