



Overview of **OGC Services Architecture**

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Open Geospatial Consortium

Overview of OGC Services Architecture



- Open Standards
- Information Standards
- Service Standards
- Putting it all together



OPEN STANDARDS

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Why Open Standards?



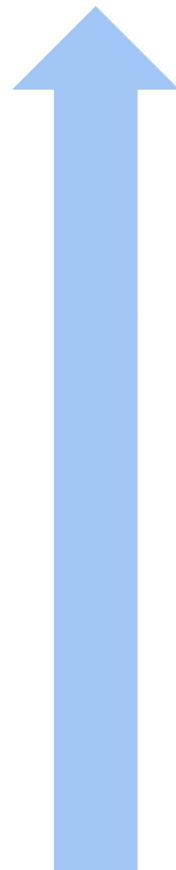
- Rapidly mobilize new capabilities – plug and play
- Lower systems costs
- Encourage market competition
 - Choose based on functionality desired
 - Avoid “lock in” to a proprietary architecture
- Decisions to share information and services become policy decisions

What do we mean by “Open” Standard?



- Freely and publicly available
- Non discriminatory
- No license fees
- Vendor neutral
- Data neutral
- Agreed to by a formal consensus process

Types of OGC Specifications



- Implementation Specifications - Standards
 - Basis for working software; detail the interface structure between software components
- Abstract Specifications
 - Conceptual foundation / reference model for spec development
- Best Practices
 - Describe use of specifications
- Engineering Reports
 - Results from OGC Interoperability Program
- Discussion Papers
 - Forum for public review of concepts



INFORMATION STANDARDS

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OGC Geography Markup Language (GML)



- GML an application of eXtensible Markup Language (XML)
 - XML specified by World Wide Web Consortium (W3C)
 - GML specifies XML Schemas that specify XML encoding of geographic features, their geometry, and their attributes
- GML encodes digital feature data
 - Encodes features, attributes, geometries, collections, etc.
 - Applications require specifying more specific Application XML Schemas
 - GML v3, supports 2 1/2 and 3D geometry as well as complex geometry and topology
- GML 3 is also ISO 19136

Types of Coordinate Reference Systems



CRS	Coordinate System	Characteristics	
Earth curvature modelling	Geocentric	Cartesian or spherical	Proper 3D spatial modeling; spatial applications
	Geographic 3D	ellipsoidal	Locations described relative to ellipsoidal surface
	Geographic 2D	ellipsoidal	Locations described on ellipsoidal surface; for large national/continental geodetic control networks
	Projected	Cartesian	For national mapping; smaller area than Geographic 2D. Carefully controlled mapping distortions
	Engineering	various	Earth curvature ignored; mostly flat-earth model
	Image	Cartesian or oblique Cartesian	Distortions due to earth curvature determined by data acquisition characteristics
	Vertical	gravity-related, depth, barometric	Gravity-related means relative to geoid (~MSL) Depth: complex reference surfaces (tidal)

GML Application Activities



Profiles

- GML Point Profile
- GML Simple Features Profile
- GML GeoShape for use in IETF
- GML in JPEG2000
- GeoRSS: GML Serialization

GML Schemas for NSDI Framework

- Base Transportation
- Roads
- Governmental Units
- Linear Reference Systems
- Dictionaries
- Hydrology

Application Schemas

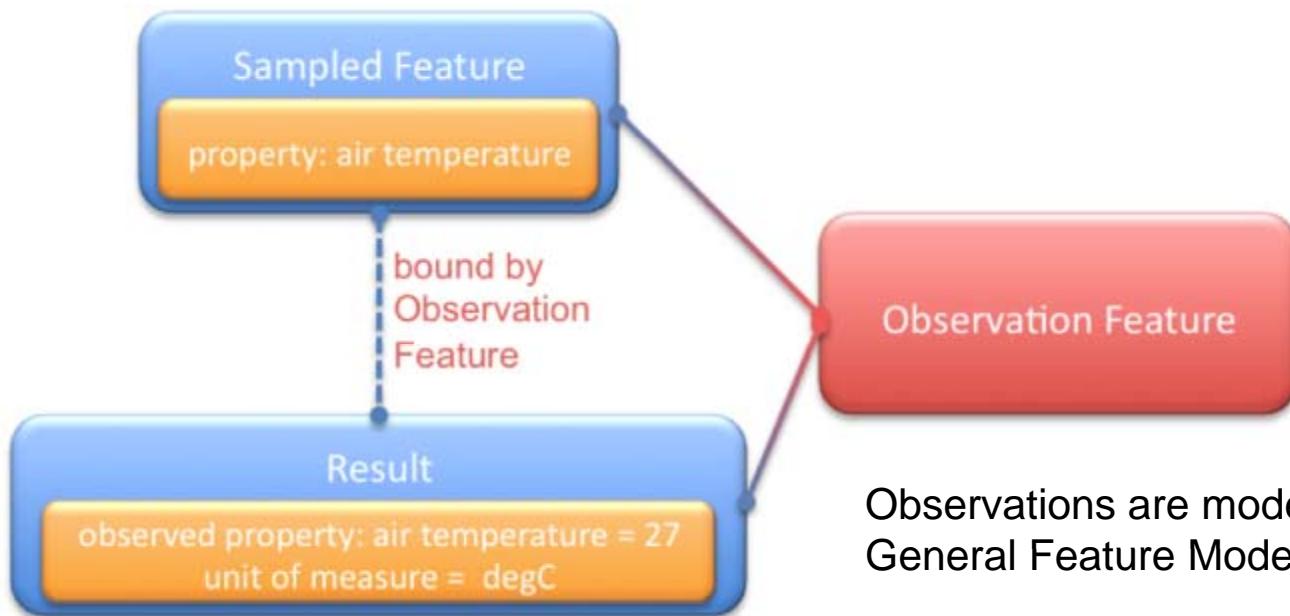
- Climate Science Modelling Language (CSML)
- CityGML
- CleanSeaNet
- NcML/GML (NetCDF and GML)
- TDWG Biodiversity GML
- GeoSciML - Geological Sciences ML
- MarineXML
- Ground Water Modeling Language
- **WaterML**

Further information on OGC Network
<http://www.ogcnetwork.net/node/210>

Observations and Measurements (O&M)

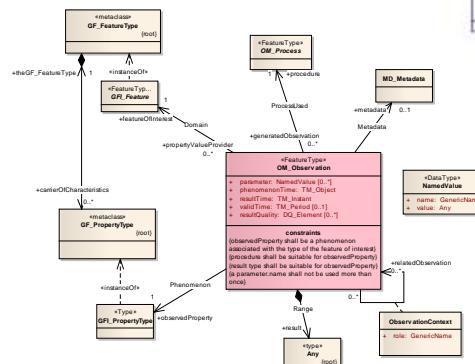
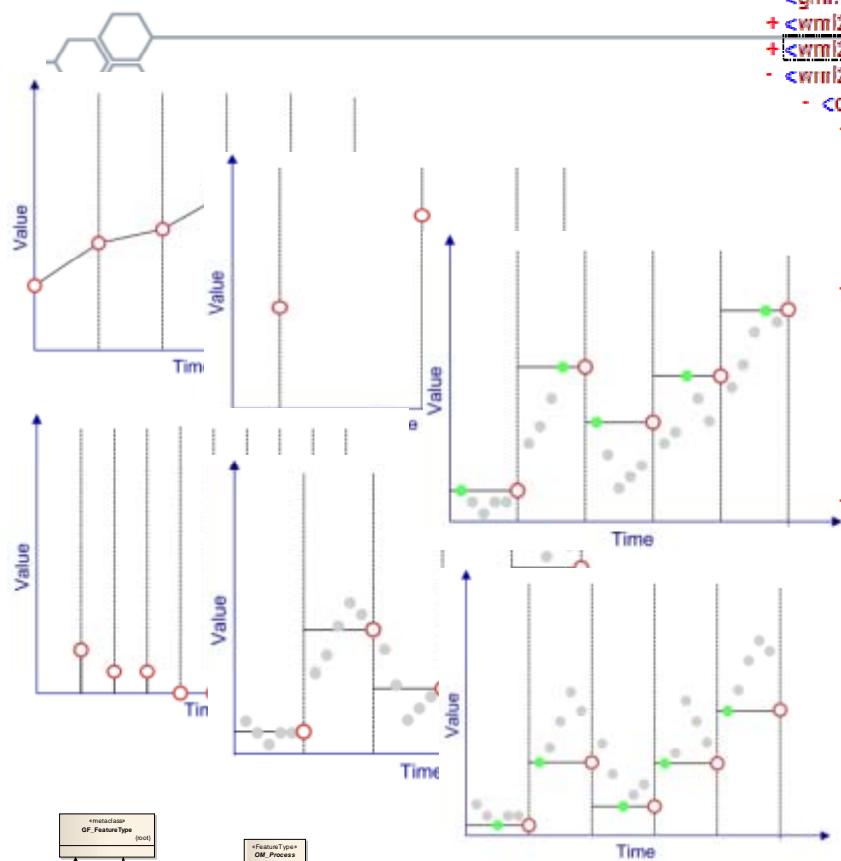


- An **observation** is an event that estimates an **observed property** of a **feature of interest**, using a **procedure**, and generating a **result**
 - Sometimes ‘observed property’ and ‘feature of interest’ are conflated in describing geophysical parameters, e.g. **sea surface temperature**
- Often sampling is used to measure properties of a feature
 - In this case the feature of interest is a ‘**sampling feature**’



Observations are modeled within
General Feature Model [ISO 19109]

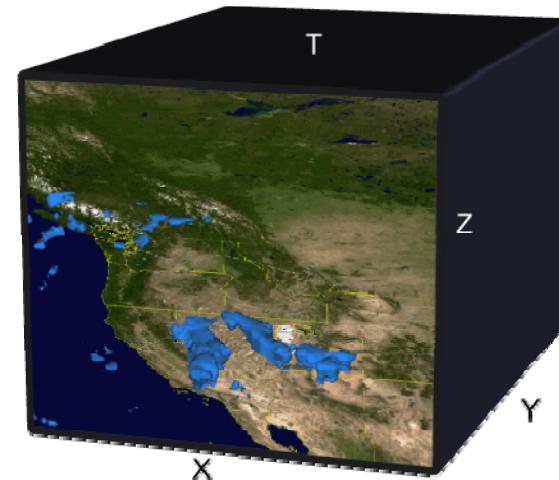
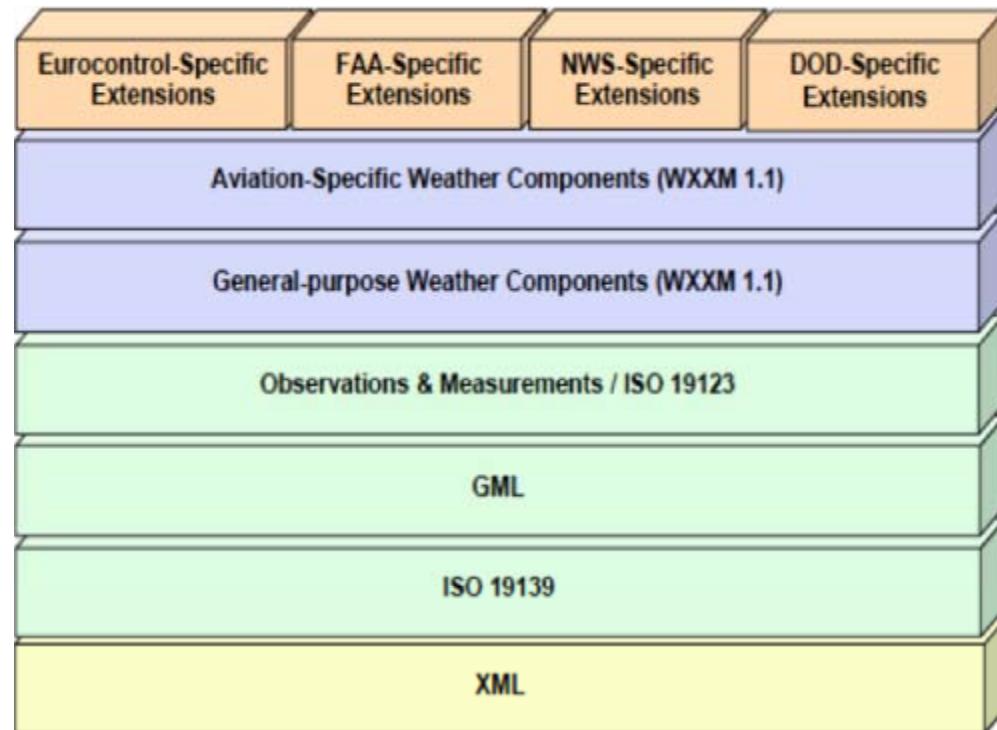
WaterML



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xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xr
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+ <wml:2:metadata>
+ <wml:2:temporalExtent>
- <wml:2:observationMember>
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Weather Information Exchange Model (WXXM)

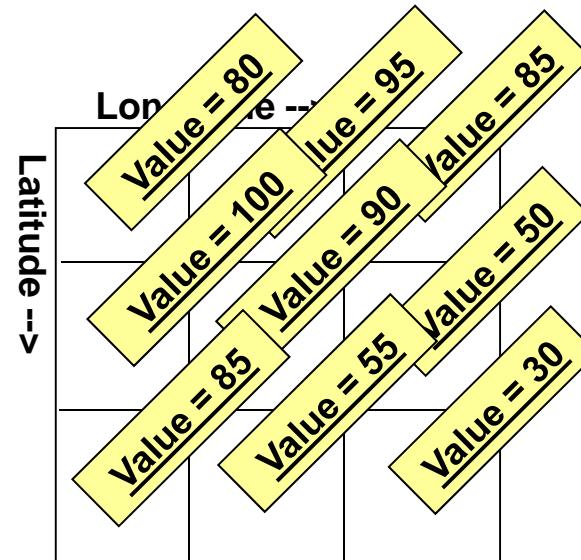


Coverages



“A coverage is a feature that associates positions within a bounded space to feature attribute values”

- That is to say -- a collection of features that share a common regular geometry
- Examples
 - Raster image
 - Polygon overlay
 - Digital elevation matrix



Coverage Encodings



OGC Specifications

- GeoJP2
- GML
- GML in JPEG2000 (GMLJP2)
- SWE Common
- **Network Common Data Format (NetCDF)**

Other Specifications

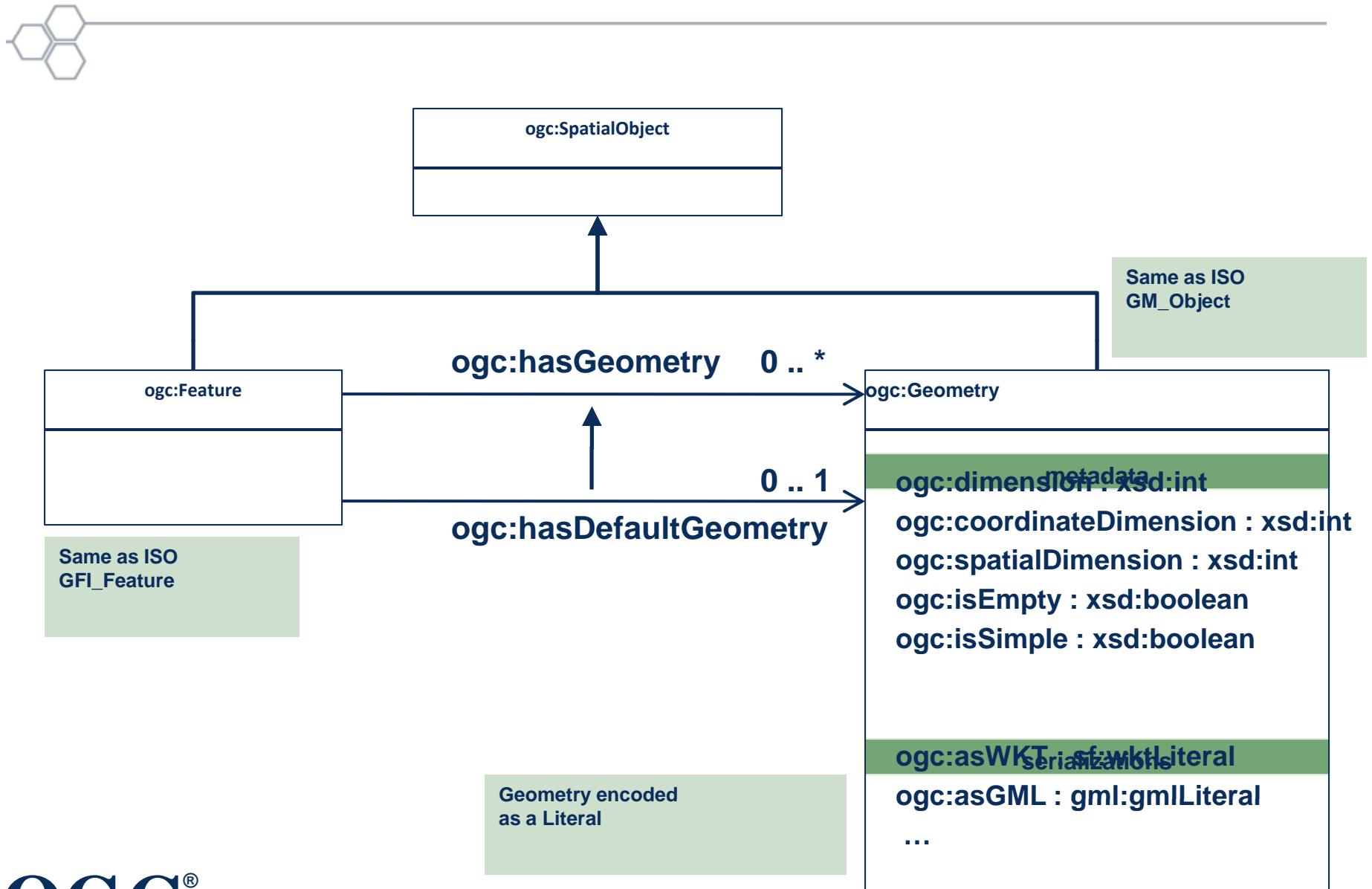
- GeoTIFF
- National Imagery Transfer Format / BIIF
- HDF and HDF-EOS

Metadata



- Metadata is data about data
- Dataset metadata
 - characterize geographic data; enables in most efficient manner; facilitates data discovery, retrieval and reuse; fitness for use
 - datasets, aggregations of datasets, individual geographic features,
 - core metadata - subset of the full set of elements
 - OGC adopted ISO 19115
- Service Metadata
 - "Get Capabilities" operation common to all OWS1 services, returns a "capabilities document" describing the service.
 - OGC AS Topic 12 (identical with ISO 19119)
- Registry Information Model (RIM)
 - all metadata and data types are registry objects.
 - ebRIM applied for registries in OGC

GeoSPARQL Vocabulary: Basic Classes and Relations



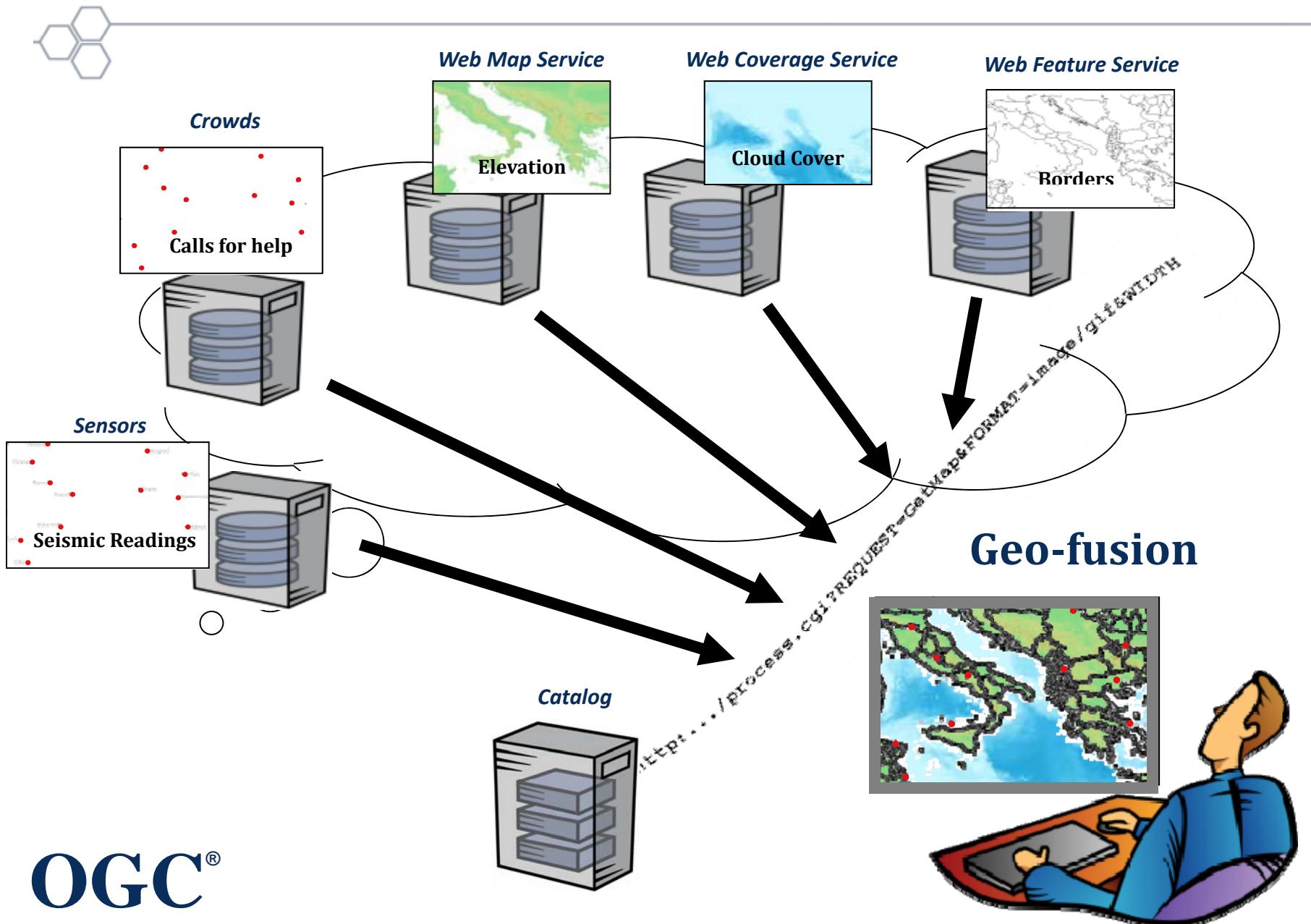


SERVICE STANDARDS

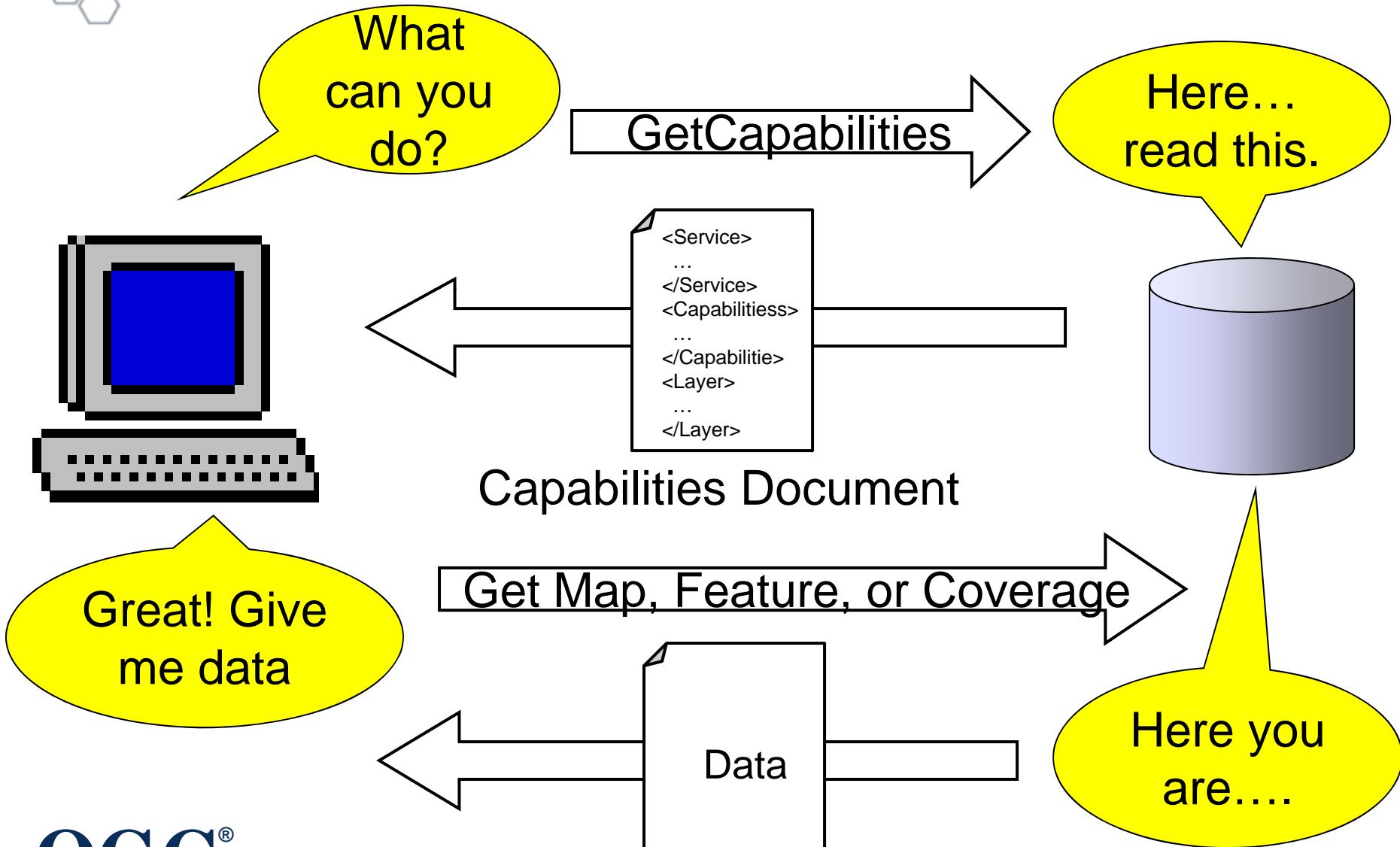
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Publish, Discover, Access, Fuse



OGC Web Services (“W*S”) Pattern



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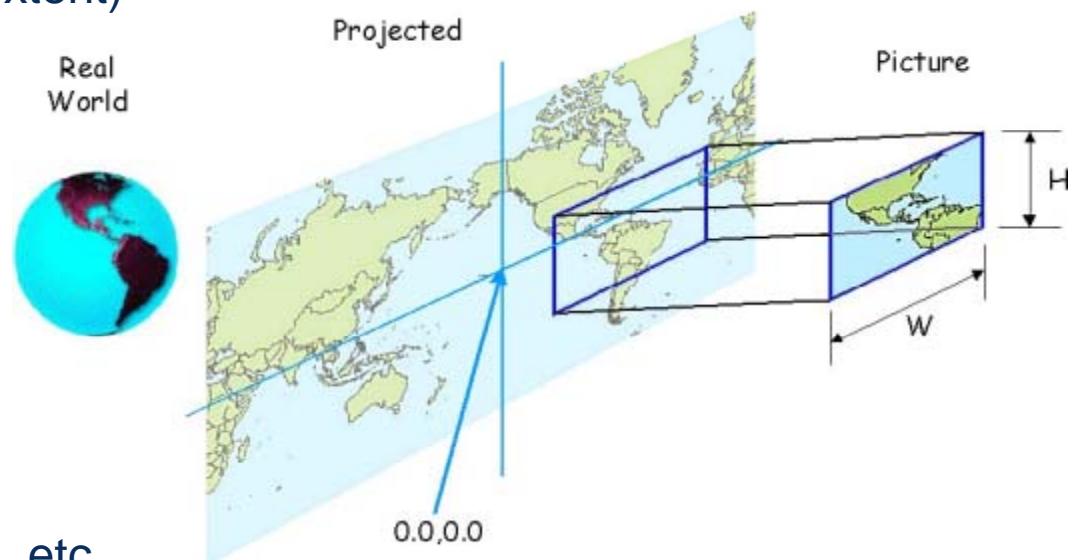
OGC Web Map Service



- Spatial Context
 - Spatial Reference System (EPSG)
 - Corners of map (geographic extent)
 - Image width & height

- List of “layers”
 - Layer name
 - Symbolization style

- Return Format
 - GIF | JPEG | WebCGM | SVG, etc.
 - Background info (color, transparency)
 - Exception Type = InImage | Encoded/Parseable



OGC WMS – GetMap Operation

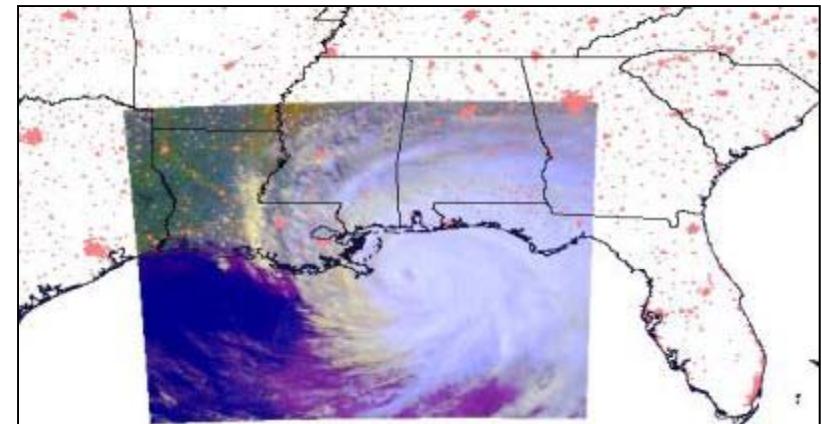


REQUEST1:

- http://amapco.com/mapserver.cgi?VERSION=1.1.0&REQUEST=GetMap&SRS=EPSG:4326&BBOX=-97.105,24.913,78.794,36.358&WIDTH=560&HEIGHT=350&LAYER=AVHRR-09-27&STYLES=&FORMAT=image/png&EXCEPTIONS=application/vnd.ogc.se_inimage

REQUEST2:

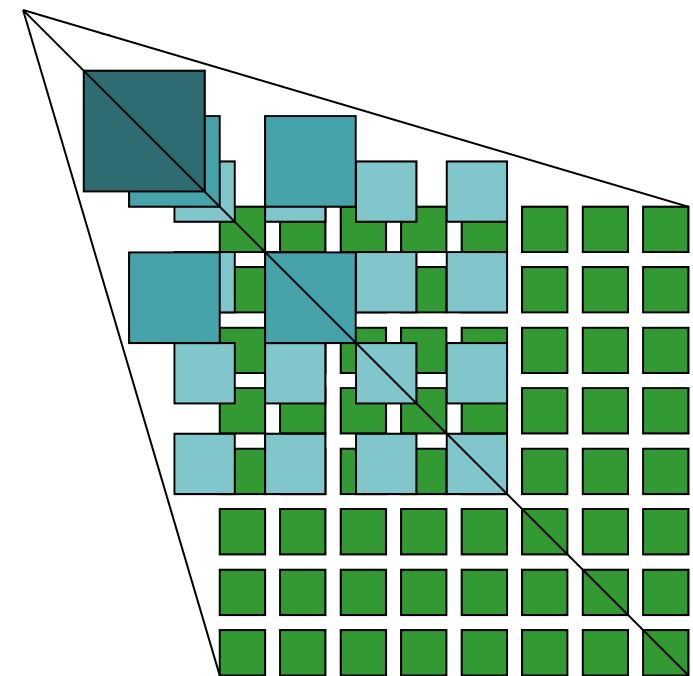
- http://b-maps.com/map.cgi?VERSION=1.1.0&REQUEST=GetMap&SRS=EPSG:4326&BBOX=-97.105,24.913,78.794,36.358&WIDTH=560&HEIGHT=350&LAYER=BUILTUPA_1M,COASTL_1M,POLBNDL_1M&FORMAT=image/png&STYLES=style1,style2,style3&TRANSPARENT=TRUE&EXCEPTIONS=application/vnd.ogc.se_inimage



WMS-Tiling (WMTS) builds on WMS



- WMTS designed for high performance: anticipates high volume of identical requests
 - Pre-render data as tiles
 - Supports caching
- WMS request by bbox & h/w vs. WMTS request by Tiles
 - TileMatrixSet (CRS)
 - TileCol
 - TileRow
- Bindings:
 - KVP, SOAP/WSDL, RESTful



Web Feature Service (WFS)

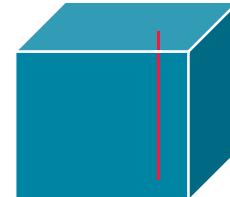
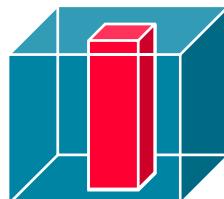
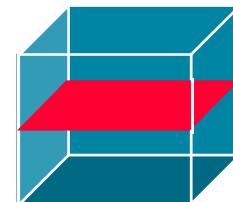
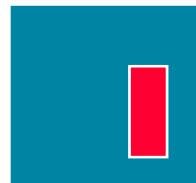


- Access Vector Data using Web standards: HTTP, SOAP
- request components
 - service binding URL
 - geographic bounding box
 - coordinate reference system (CRS)
 - complex “filter” (much like a SQL query)

OGC Web Coverage Service (WCS)



- Service for Coverage offerings
 - Domain: grids; polygons, points, etc.
 - Range components: vector- or scalar-valued
- Operations similar to WFS - tuned to Coverages
 - GetCapabilities: Inquire about a WCS server
 - DescribeCoverage: Fetch details about a coverage
 - GetCoverage: Fetch data from a coverage
- Subsetting



The Big Picture of WCS 2.0



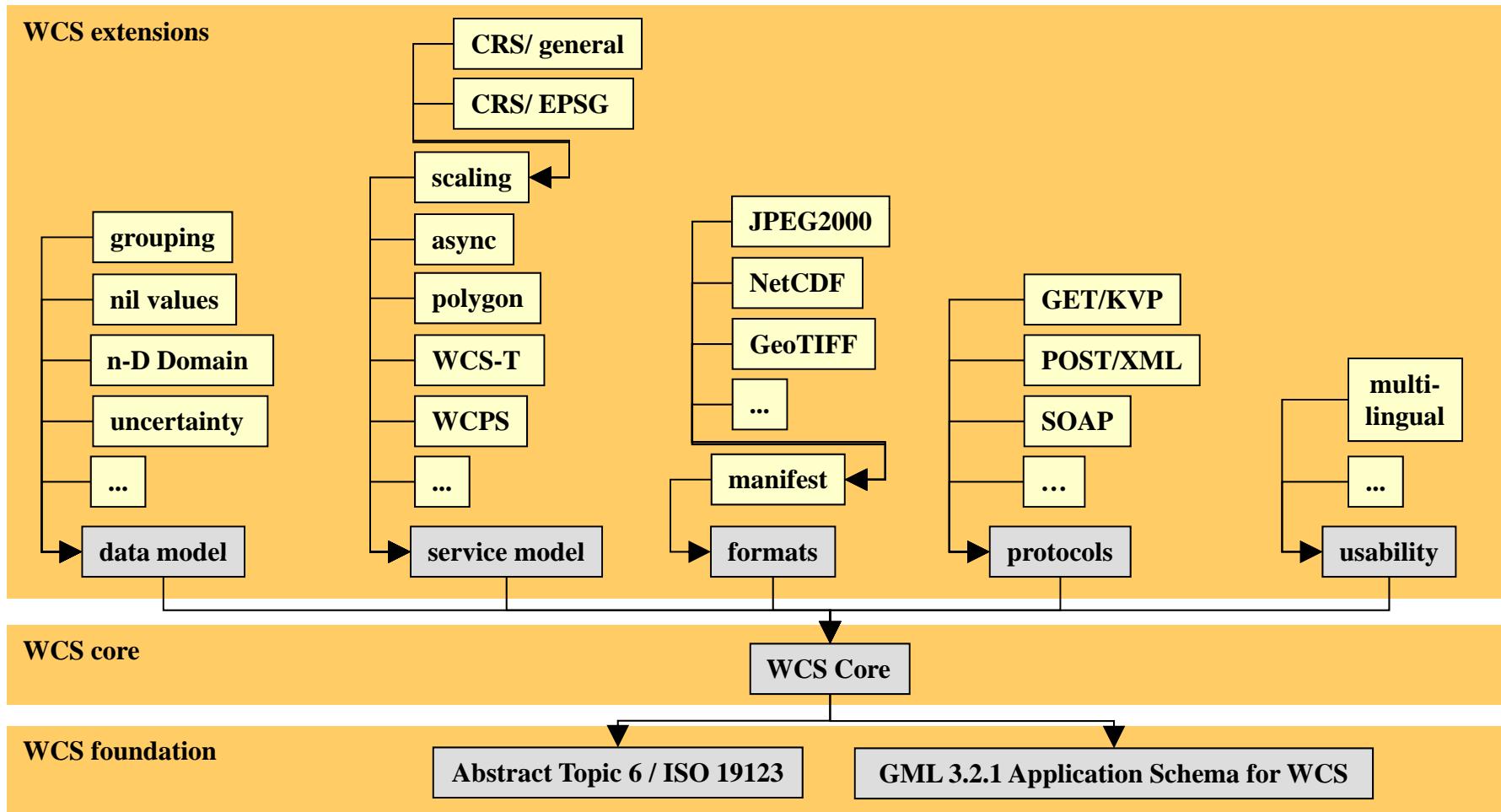
- Uses Core and Extension approach
- Extensions for KVP, POST, SOAP; NetCDF

Legend:

abstract extension
(not advertised)

concrete extension
(advertised)

→ inheritance

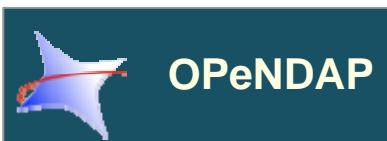


OWS-9 Testbed Innovations Thread

- OWS-9 Kickoff Workshop occurring this week -



- WMTS Harmonization
 - Align diverse web map tiling APIs
 - Scalable interoperability architectures
 - Map Tiling Methods Harmonization Engineering Report
 - WMTS change requests
 - WMTS service
- Coverage Access and Data Quality
 - NITF, LIDAR, and DAP/OPeNDAP with WCS 2.0
 - Data quality in WMS, WMTS and KML
 - GMLJP2-wrapped LIDAR HRE Data
 - WCS and GMLJP2 change requests
 - WCS 2.0 for coverage access
 - Coverage Access Engineering Report
 - OWS Context Document



CREAF

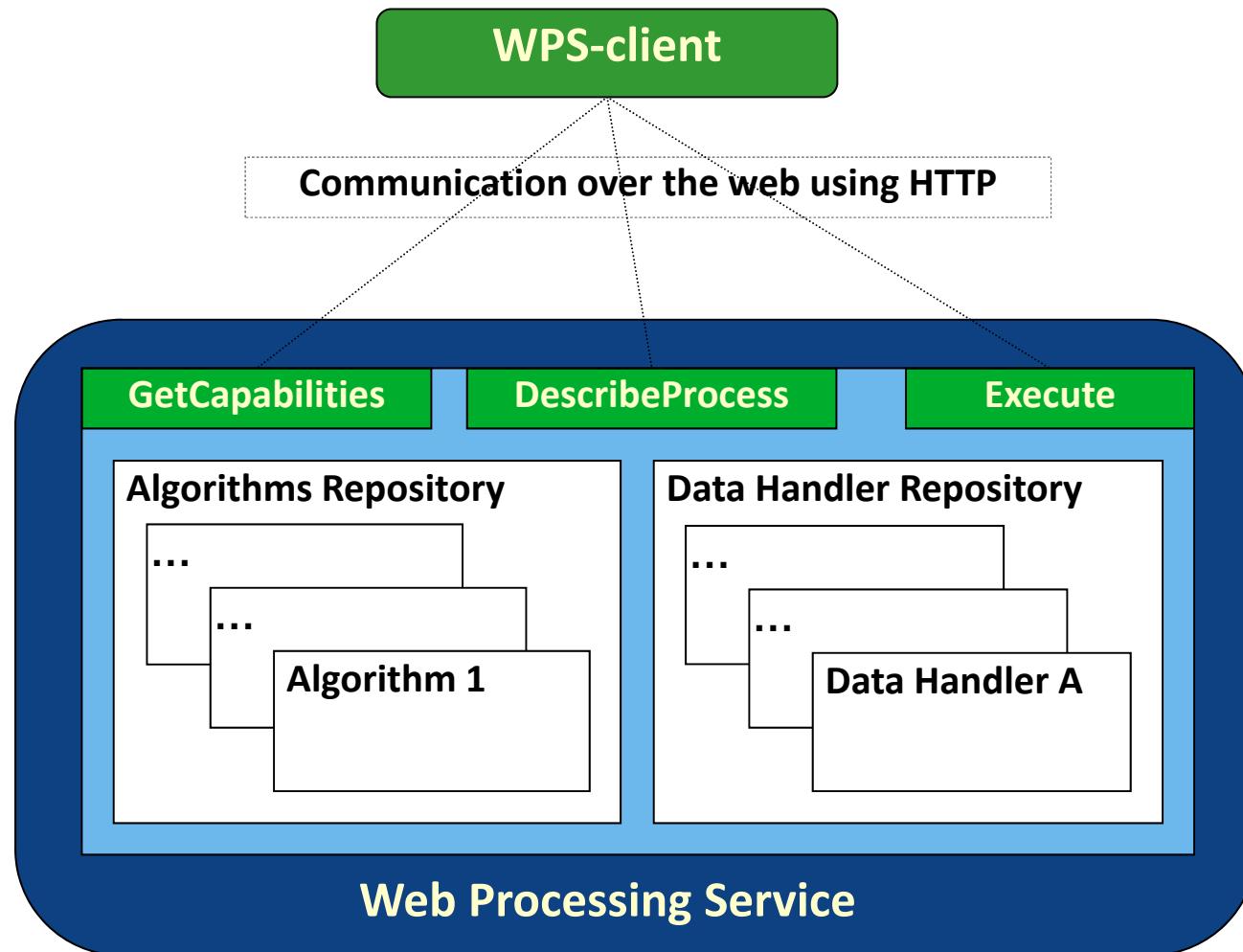


Geo-Processing

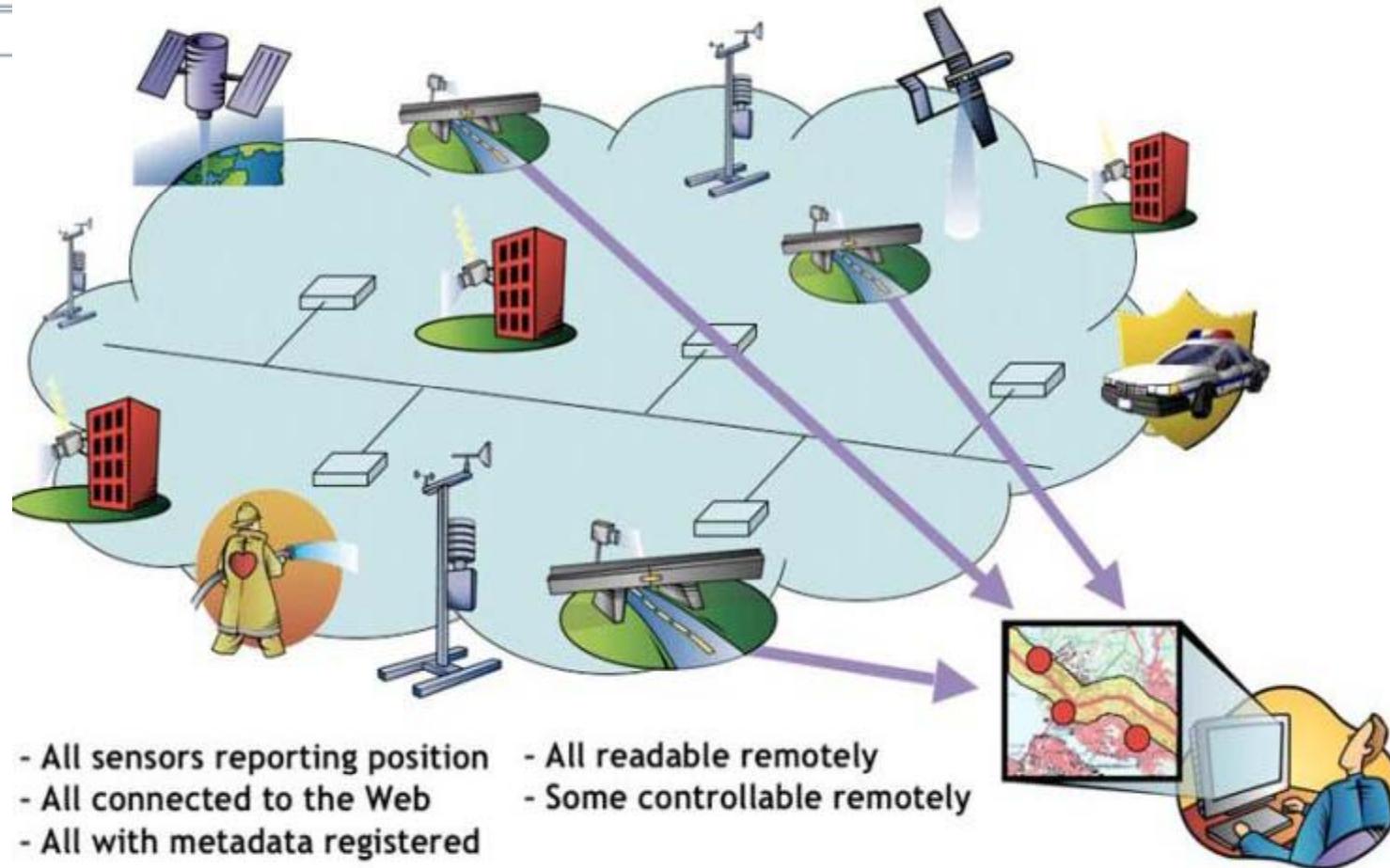


- Hundreds of types of algorithms for geodata
- How can we scale to interoperable geo-processing?
- OGC Web Processing Service (WPS)
 - Interface that facilitates the publishing of geospatial processes, and the discovery of and binding to those processes by clients
 - Processes include any algorithm, calculation or model that operates on spatially referenced data.
 - WPS may offer calculations as simple as subtracting one set of spatially referenced numbers from another) or as complicated as a global climate change model.

OGC Web Processing Service (WPS)



OGC Sensor Web Enablement



Enables discovery and tasking of sensor assets, and application of sensor observations for enhanced situational awareness, much like HTML, and HTTP enabled the WWW

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SWE Information Models and Schema



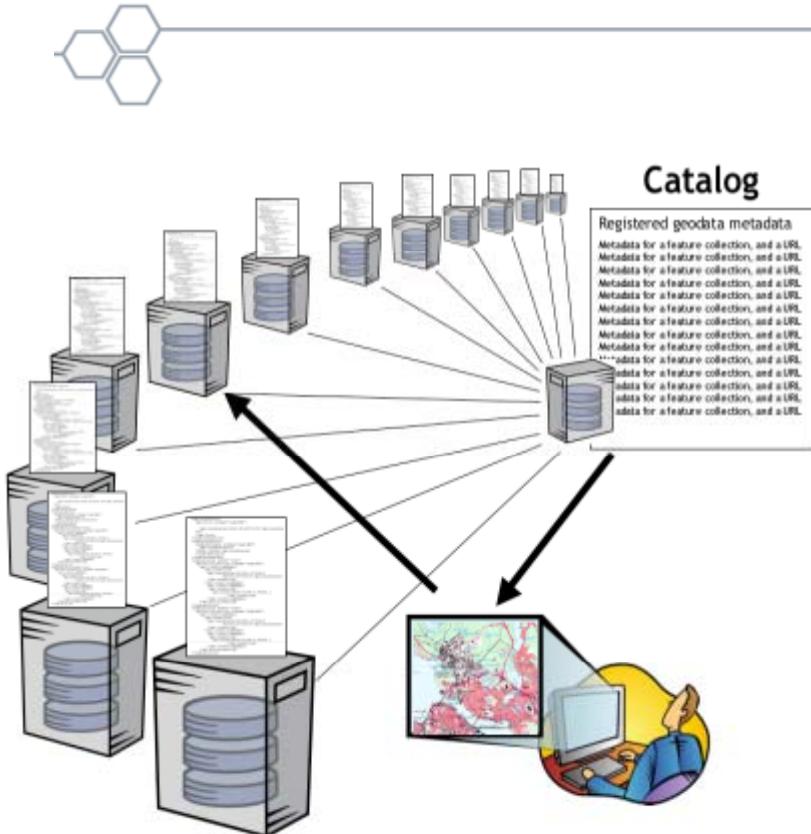
- **Observations and Measurements (O&M)** – Core models and schema for observations
- **Sensor Model Language (SensorML) for In-situ and Remote Sensors** - Core models and schema for observation processes: support for sensor components, georegistration, response models, post measurement processing
- **SWE Common** - low level data models for exchanging sensor related data. Structure, encode and transmit sensor datasets in a self describing and semantically enabled way.

SWE Web Services



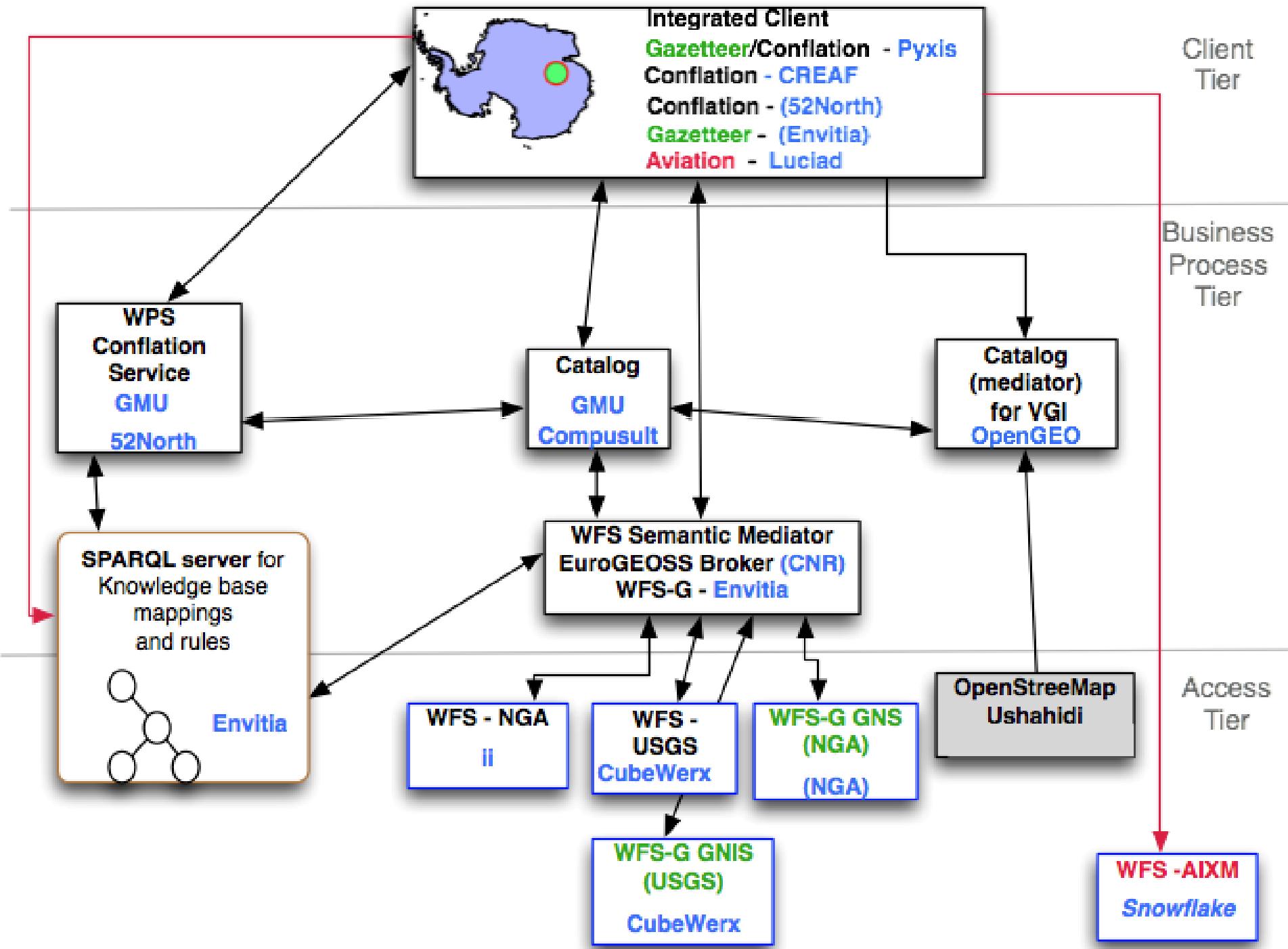
- **Sensor Observation Service** - Access Observations for a sensor or sensor constellation, and optionally, the associated sensor and platform data
- **Sensor Alert Service** – Subscribe to alerts based upon sensor observations
- **Sensor Planning Service** – Request collection feasibility and task sensor system for desired observations
- **Web Notification Service** – Manage message dialogue between client and Web service(s) for long duration (asynchronous) processes
- **Sensor Registries** – Discover sensors and sensor observations

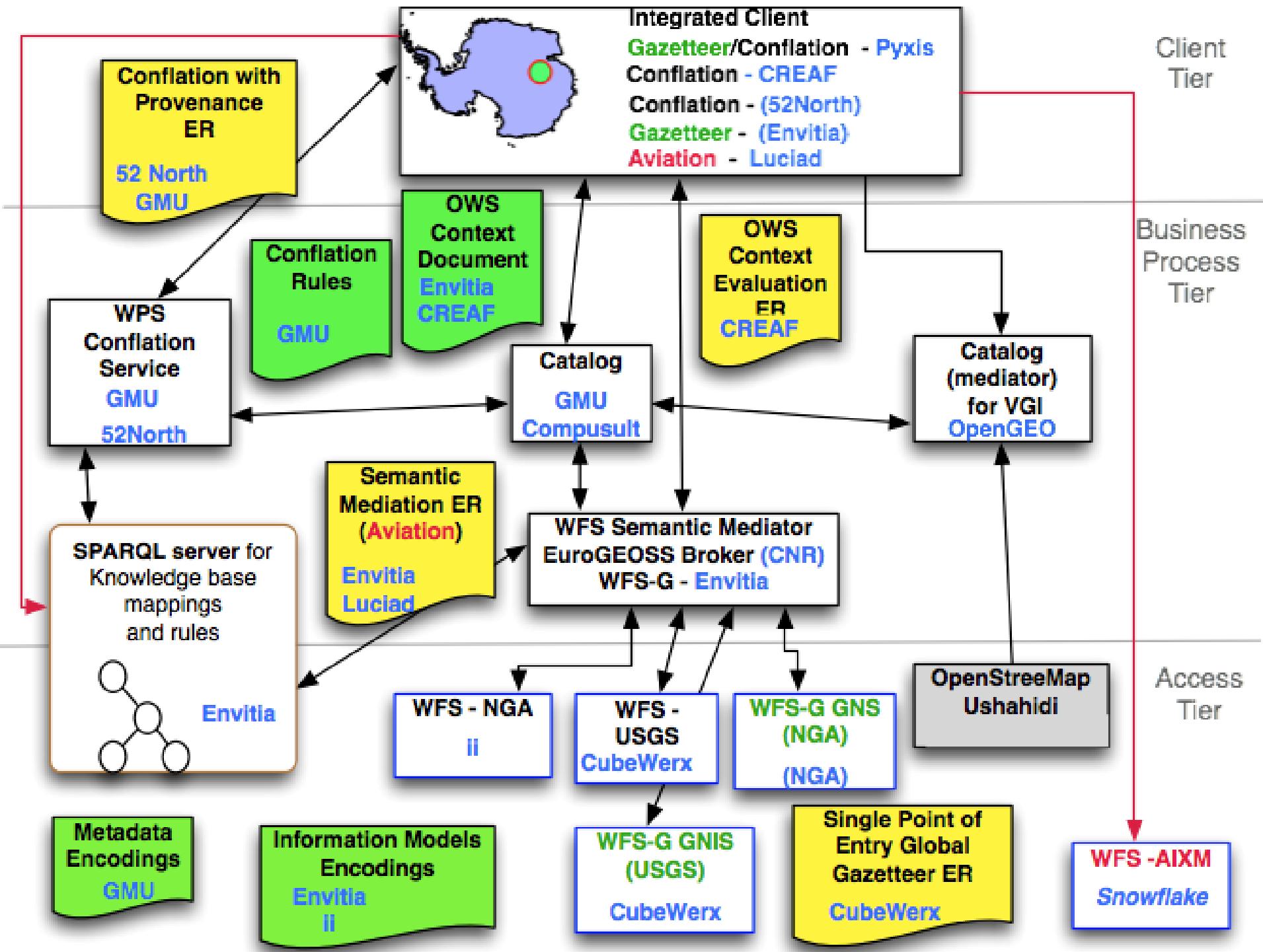
Search/Discovery of Geospatial Data



- OGC Catalog Service
 - Catalog Service for the Web (CSW)
 - ISO 19119 Metadata Profile
 - OASIS ebRIM Profile
 - OpenSearch
 - Request components
 - service binding URL
 - geographic bounding box
 - coordinate reference system (CRS)
 - complex “filter” (much like a SQL query)

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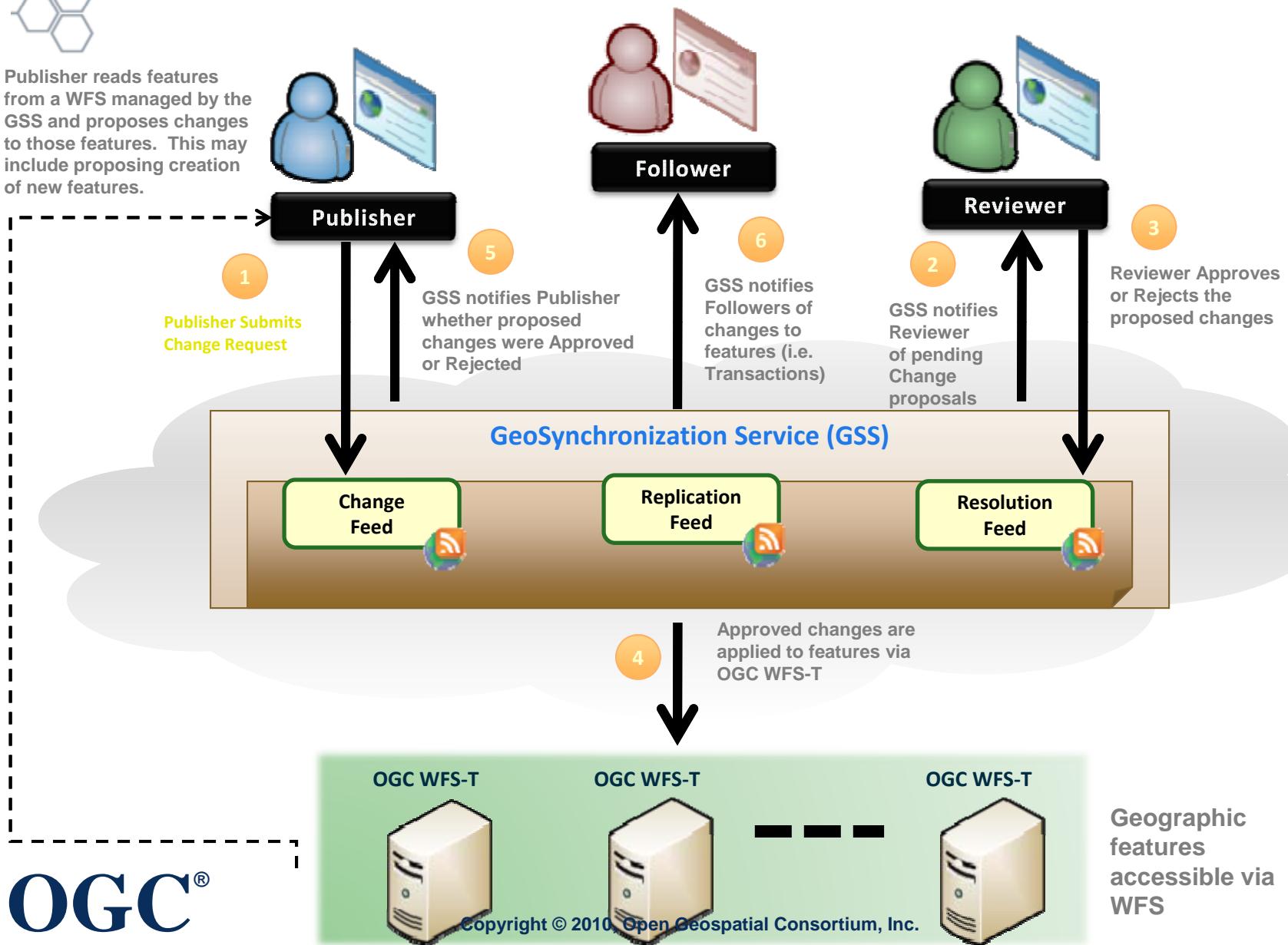




GeoSynchronization Services



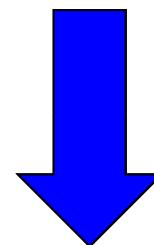
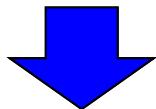
Publisher reads features from a WFS managed by the GSS and proposes changes to those features. This may include proposing creation of new features.



OGC Open GeoSMS



- **Innovation:** Location encoding for SMS
- **Activities:** Sahana, Ushahidi, Frontline SMS and the UN ITU
- **Applications:** Disaster monitoring (debris flow and earthquakes), emergency response, transportation planning, taxi services and many more.

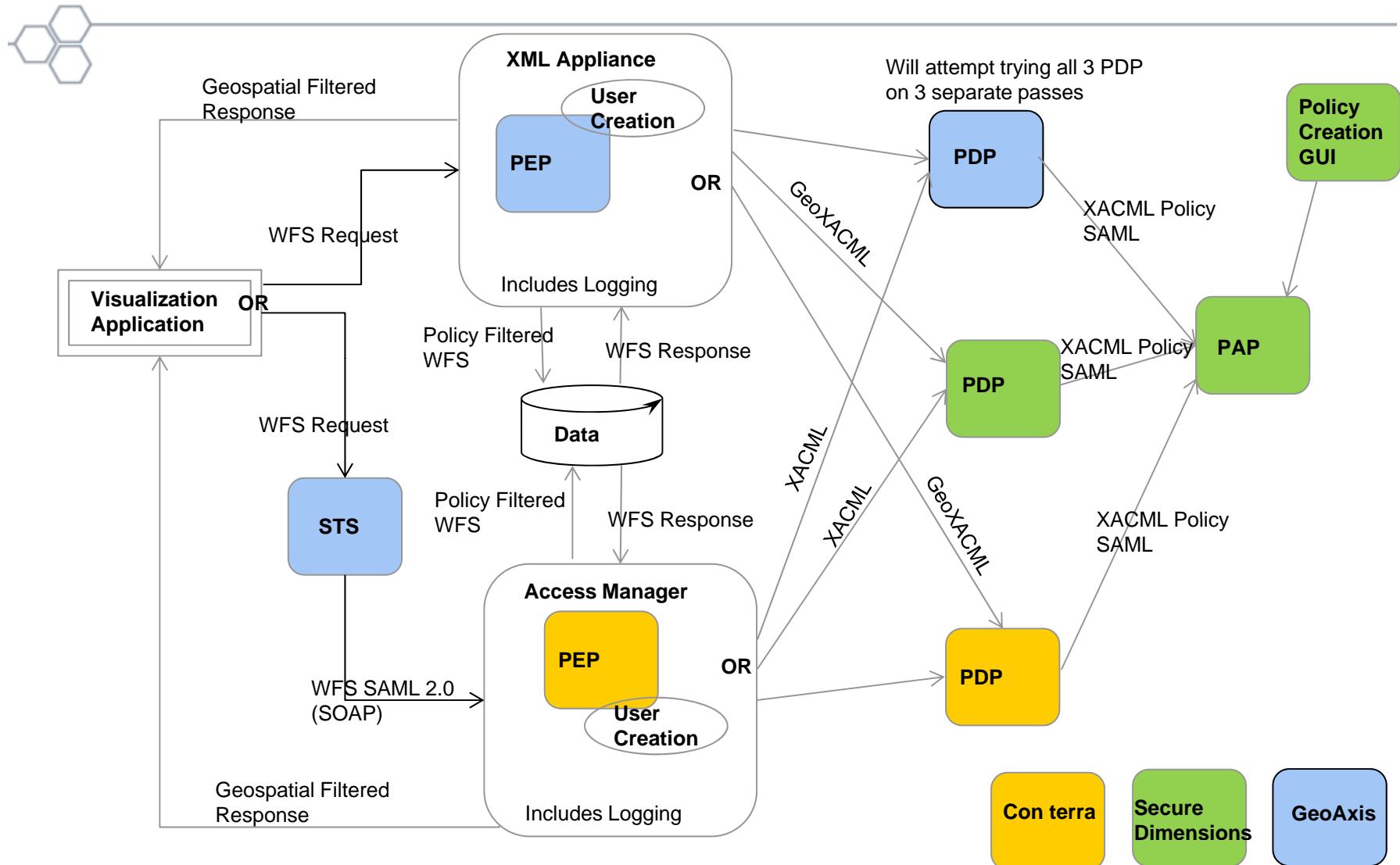


OGC and Security



- The OGC does not develop authentication, authorization and security standards
- We define best practices and extensions to existing standards from other standards organizations, such as OASIS
 - XACML (OASIS): access control policy language in XML and a processing model to interpret the policies
 - GeoXACML (OGC): geographic access control rules for distributed geographic content.

Security in OWS-9 Testbed



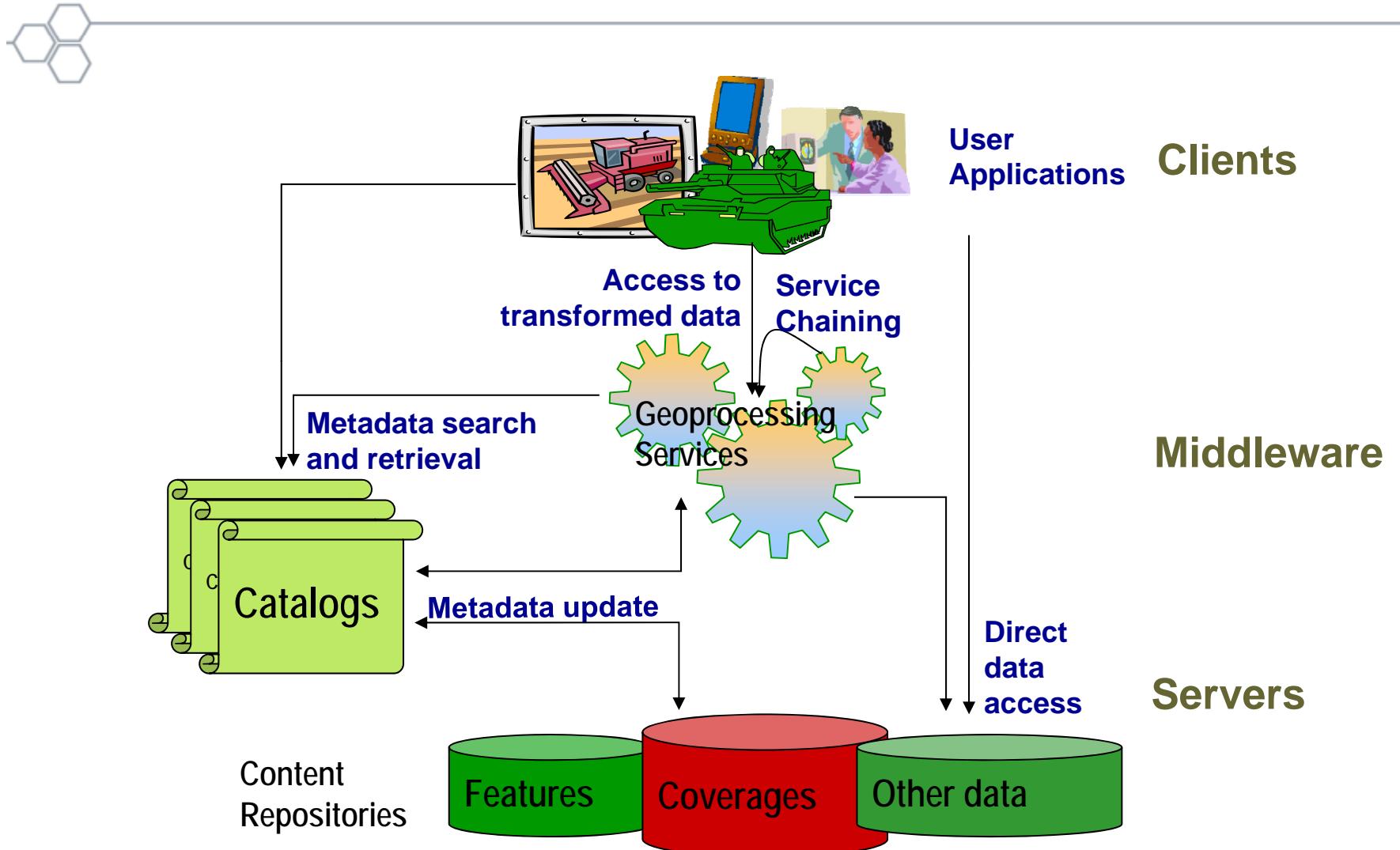


PUTTING SERVICES TOGETHER

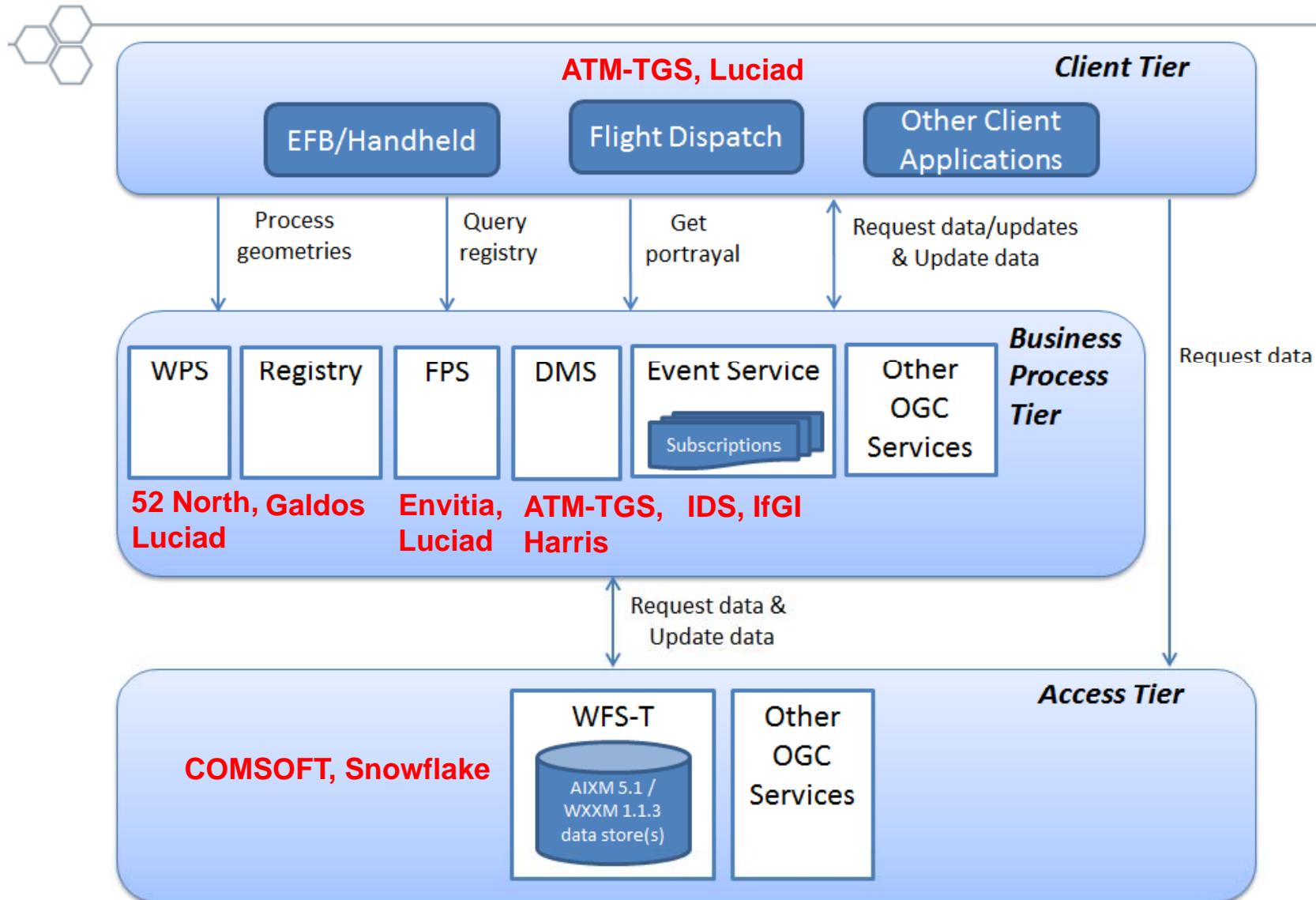
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Interoperability “Stack” - Service Viewpoint

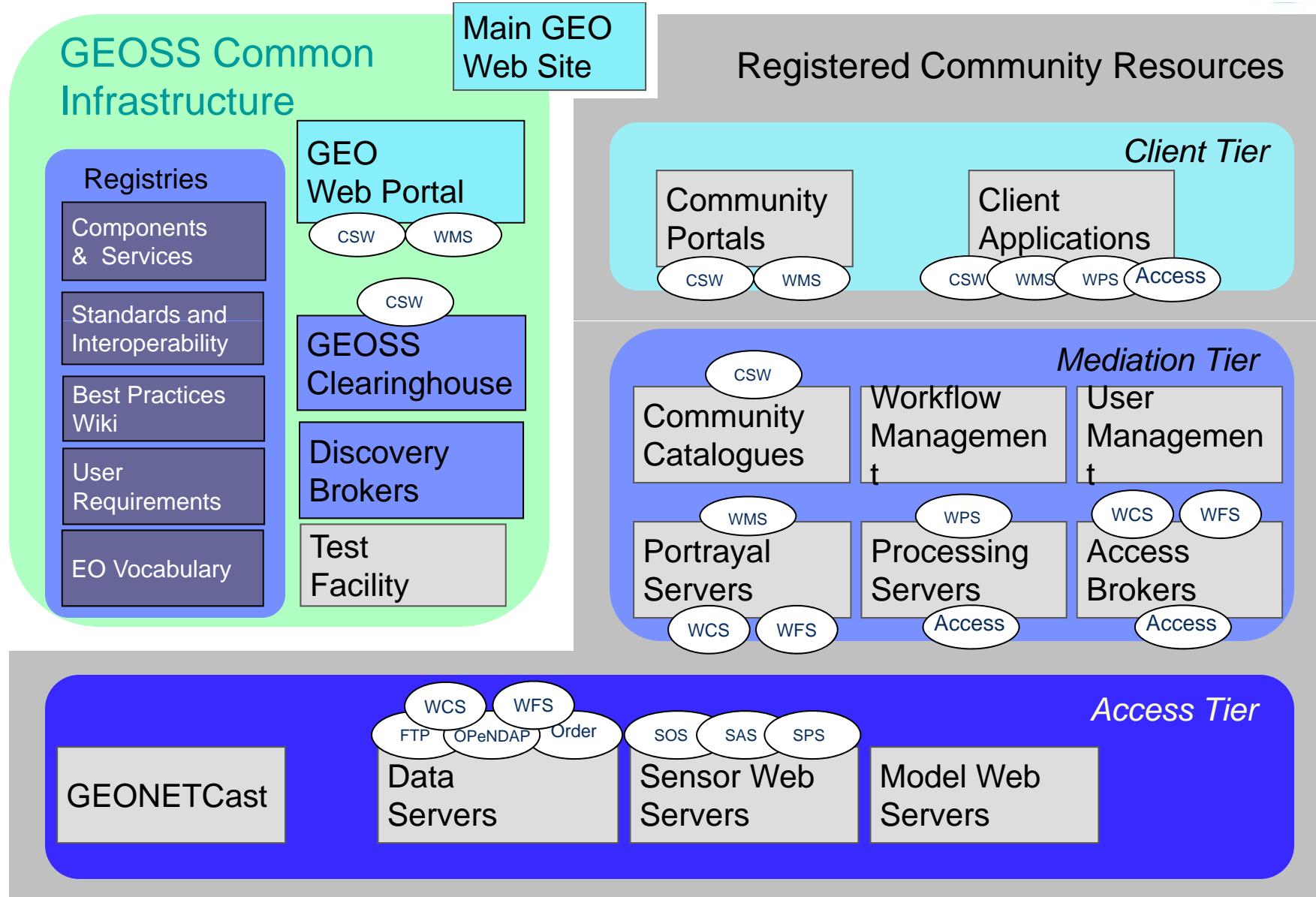


Aviation Information in OWS-9 Testbed



Engineering Components:

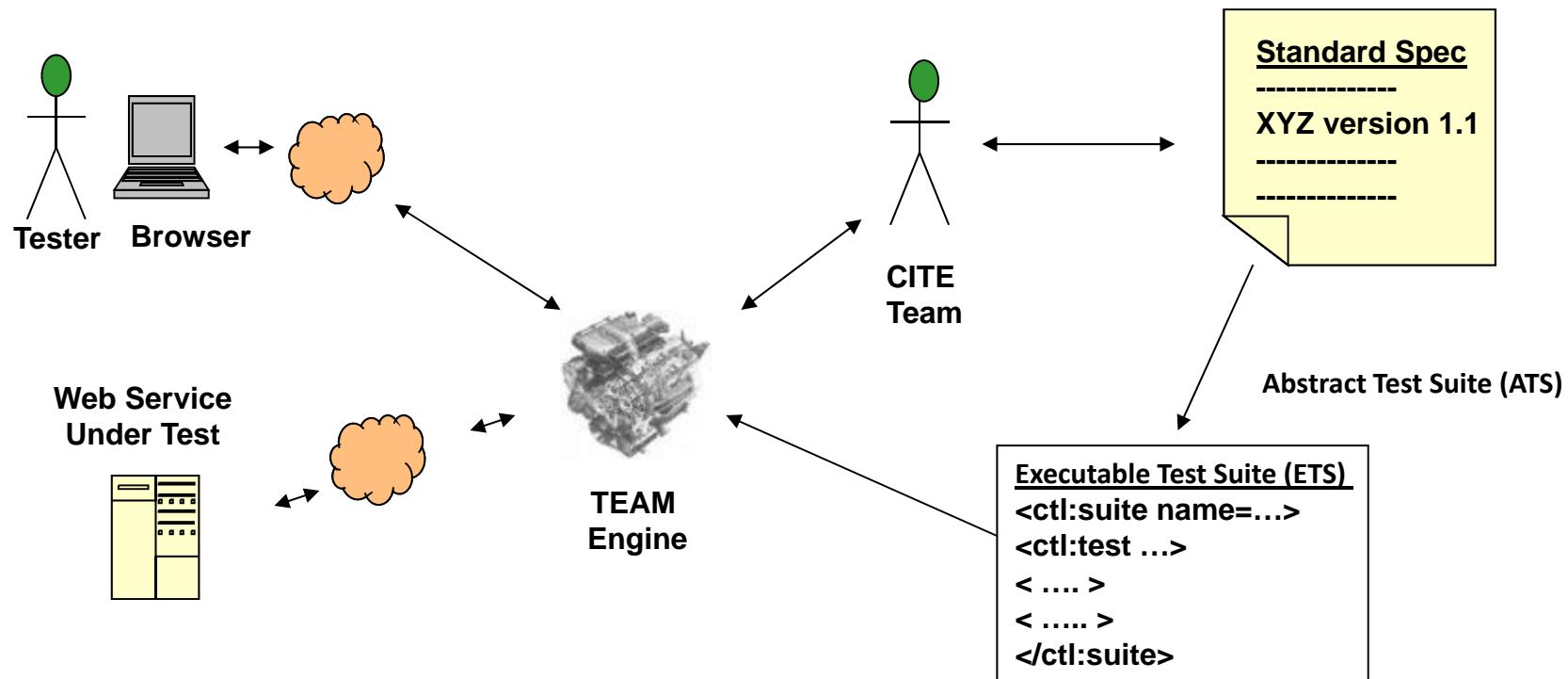
Host data; Interact thru Services



OGC Compliance Testing



Determines whether a product implementation of a particular specification fulfills all mandatory elements of the spec



Compliance Program – Great Success



- More than 650 implementing products in the market

ESRI		KSIC(Korea Geospatial Information & Communication Co., LTD.)		Oracle Corporation	
Product Name	OGC Spec	Product Name	OGC Spec	Product Name	OGC Spec
ArcGIS 8.1	IntraMap/Web v5.6 GML 3.0, WCS 1.1	IntraMap/Web 6.0	WMS 1.3.0 (compliant)	Oracle Application Server MapViewer, 10g Release 2 (10.1.2)	WMS 1.1.1 (server compliant)
ArcGIS Server 9.3	lat/lon GmbH	Product Name	OGC Spec	Oracle Locator 11g, SFS(TF) 1.1 (compliant)	
ArcGIS Server 9.3.1	degree Sensor Observation Service	SOS 1.0.0 (compliant)	3.0		
ArcGIS Server 9.3.2	Rolta India Ltd.	Product Name	OGC Spec		ver compliant)
ArcGIS Server 9.3.3	Rolta OnPoint 6.4	WMS 1.3.0 (server compliant), CAT 2.0.2, WFS 1.0.0 (server compliant)			ver compliant)

For Details on OGC Standards...



- OGC Standards
 - Freely available
 - www.opengeospatial.org/standards
- OGC Reference Model (ORM)
 - Overview of OGC Standards Baseline
 - Resource for defining architectures for specific applications
 - www.opengeospatial.org/standards/orm



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