Serving earth observation data with **GeoServer**: addressing real world requirements

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About Us

- Founded in late 2006

- Expertise
  - Image Processing, GeoSpatial Data Fusion, Web Mashups, Mobile Apps
  - OGC, ISO, INSPIRE Standards

- Supporting/Developing FOSS4G projects
  - MapStore, GeoServer, GeoNetwork, CKAN, GeoNode

- Offer
  - Enterprise Support Services
  - Deployment Warranty
  - Professional Training
  - End-To-End Projects (Integration)

- Clients
  - UN FAO (CIOK, FIGIS, NRL, FORESTRY, ESTG), UN WFP, World Bank, DLR, EUMETSAT, JRC, ARPAT, NATO CMRE, UNESCO, IGAD, UNEP, etc..
  - Private Companies all over the world like BAYER, BASF, DigitalGlobe, MDA, e-GEOS, Halliburton, etc..

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GeoServer

- GeoSpatial enterprise gateway
  - Java Enterprise
  - Management and Dissemination of raster and vector data
- Standards compliant
  - OGC WCS 1.0, 1.1.1 (RI), 2.0.1
  - OGC WFS 1.0, 1.1 (RI), 2.0.0
  - OGC WMS 1.1.1, 1.3.0
  - OGC WPS 1.0.0
  - OGC CSW 2.0.2
  - OGC EO WMS, EO WCS
- Google Earth/Maps support
  - KML, GeoSearch, etc..

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This is GeoServer!

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Let’s take a deep dive: Reference scenario

Cloud Cover

Wavelength

Polarization

Forecast Time

Elevation/Depth

Reference Time

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ImageMosaic plugin as the workhorse for spatiotemporal data

- **ImageMosaic** plugin is the *workhorse* for serving spatiotemporal data
- **Granule/Tile** → The individual raster element composing the mosaic
- **(Granule) Index** → collection of records describing location, spatial coverage and other attributes of each single granule
- **Dimensions/Domains** → used to distinguish individual granules
- Maps to alphanumeric attributes in the index
- **TIME** and **ELEVATION** receive special treatment for WMS and WCS
- **Custom/Additional dimensions** → Everything besides **TIME** & **ELEVATION**
- **REST Interface** for programmatic manipulation
- **Problem**: it is a flat model (single table)

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OGC Services: **WMS support**

**TIME, ELEVATION & Custom dimensions**

http://localhost:8080/geoserver/geosolutions/wms?

&time=2013-03-01T00:00:00.000Z
&elevation=35.0
&DIM_FILEDATE=2013-03-01T00:00:00.000Z
&DIM_UPDATED=2013-04-08T08:18:41.597Z
OGC Services: WCS support

TIME, ELEVATION

http://localhost:8080/geoserver/wcs?request=GetCoverage
&service=WCS&version=2.0.1&coverageId=geosolutions__NO2
&Format=application/x-netcdf
&subset=Long(5,20)
&subset=Lat(40,50)
&subset=elevation(300,1250)
&subset=time("2013-03-01T10:00:00.000Z","2013-03-01T22:00:00.000Z")
OGC Services: WMS/WCS – CQL filtering and sorting

\&CQL\_FILTER=platform=SENTINEL2 → filter WMS on the fly!

\&sortBy=cloudCoverage D

\&sortBy=time A

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OGC Services: Rendering transformations for WMS

- SLD Based transformations
- On-the-fly contouring
- On-the-fly poligonalization
- Current arrows
- Wind Barbs
- Pluggable: add your own
OpenSearch Support: Putting it all together (and finding it)

- Going beyond flat index **ImageMosaic**
- Collections and Granules → **two steps search**
- Use case
  - Lots of satellite imagery
  - Multiple satellites
  - Multiple sensors
  - Deep time and space distribution
- What to do about it?
  - "OpenSearch for EO" to the rescue
- **Geo and Time** Extension to OpenSearch → keywords for time and space
- **Earth Observation** extension → keywords for and EO properties
  - Cloud cover, Snow cover, Off nadir...
**Integrated Model: Single Model with OGC Services Support**

- Based on PostGIS → **ElasticSearch** is on the radar
- Core Elements → Collection, Product, Granule
- Single integrated model
- Exposing imagery catalog as **OpenSearch for discovery**
- Exposing imagery catalog as **WFS for discovery**
  - Different collections in different **FeatureTypes**
  - Simpler (?) Alternative to OpenSearch for discovery
- Exposing Collections as **WCS** ImageMosaic layers
- Exposing Collections as **WMS** ImageMosaic layers
- Support for **CQL_Filter** and **SortBy** → Rich query lang
- 1st discovery then jump to the other OGC services!
- Full Admin REST Interface with automation

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Simple search + Tight integration with mosaic

- http://cloudsdi.geo-solutions.it/geoserver/oseo/search?parentId=SENTINEL2&cloudCover=30
- Output is **RSS** with **description**, **thumb** and **links**
- Links to **metadata**
  - ISO metadata for collection
  - GML O&M for products
- Links to **OGC services (cross linking)**
  - **WMS/WMTS** to see collection/product
  - **WFS** to get “masks” (validity, sea, cloud, snow, ...)
  - **WCS** to extract raster
  - **Direct download** to get original package
- One “feature type” per collection
  - Can be used as the index to a mosaic
  - One mosaic per collection
  - Filter using CQL and sort by attribute on the WMS/WCS service
  - Use all the attributes already searchable by OpenSearch

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The result
That’s all!

Meet me at booth 13

(I am easy to spot!)

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Bonus Track: WMS – heterogeneous CRS mosaic

UTM60N

UTM1N

WGS84

EO OpenScience Conference 2017
Bonus Track: WMS – heterogeneous resolution view

- Sentinel2 bands have variable resolution, e.g., 10m, 20m, 60m
- N separate single band mosaics merged into a single view