GeoServer, The Open Source Solution for the interoperable management of geospatial data

Ing. Andrea Aime, GeoSolutions
Ing. Simone Giannecchini, GeoSolutions
Outline

- Who is GeoSolutions?
- Quick intro to GeoServer
- What’s new in the 2.2.x series
- What’s new in the 2.3.x series
- What’s cooking for the 2.4.x series
GeoSolutions

- Founded in Italy in late 2006
- Expertise
  - Image Processing, GeoSpatial Data Fusion
  - Java, Java Enterprise, C++, Python
  - JPEG2000, JPIP, Advanced 2D visualization
- Supporting/Developing FOSS4G projects
  - GeoTools, GeoServer
  - GeoNetwork, GeoBatch, MapStore
  - ImageIO-Ext and more: https://github.com/geosolutions-it
- Focus on Consultancy
  - PAs, NGOs, private companies, etc…
GeoServer quick intro
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 in the pipeline
  - OGC WFS 1.0, 1.1 (RI), 2.0
  - OGC WMS 1.1.1, 1.3
  - OGC WPS 1.0.0
- Google Earth/Maps support
  - KML, GeoSearch, etc..

GeoSolutions
RESTful Configuration

- Programmatic configuration of layers via REST calls
  - Workspaces, Data stores / coverage stores
  - Layers and Styles, Service configurations
  - Freemarker templates (incoming)
- Exposing internal configuration to remote clients
  - Ajax - JavaScript friendly
- Various client libraries available in different languages (Java, Python, Ruby, ...).
- Example, geoserver-manager:
  https://github.com/geosolutions-it/geoserver-manager
WMS

- Dissemination of Maps
  - Fusing raster and vector data seamlessly
  - Rule/scale driven rendering
- WMS 1.1.1 and 1.3 support
- SLD
  - Basic support for SLD 1.1 and SE 1.1
  - Full support for SLD 1.0
- CSS extension for compact styling
- Many rendering extensions available
Rendering
Rendering: real world units

```xml
<Rule>
  <LineSymbolizer uom="http://www.opengeospatial.org/se/units/metre">
    <Stroke>
      <CssParameter name="stroke-width">
        <ogc:Literal>5</ogc:Literal>
      </CssParameter>
    </Stroke>
  </LineSymbolizer>
</Rule>
```
GeoWebCache Integration

- Direct calls to GeoServer rendering engine
- Support for layers modified through WFT-T
- Support for various tile protocols
  - GMap, Gearth
  - OpenLayers, VEarth, Bing
- Speed-up factor 10/100
- Disk quota support

Persistent raster/KML tile cache
KML/KMZ

 TEMPORAL SERIES

 KML EXTRUDE

 KML SUPEROVERLAY
WFS

- Dissemination and filtering of vector data
- WFS 1.0, 1.1 and 2.0 (since 2.2.0)
- Transaction and paging available in all versions
- Simplified filtering via CQL
- Formats:
  - GML 2, 3.1 and 3.2
  - CSV, Excel spreadsheet, GeoRSS, GeoJSON
  - Shapefile (zipped)
  - Any other format supported by ogr2ogr (configurable)
Complex Feature*

- Application/community schemas
- Complex Features
  - Attributes as sub-features
  - Attributes as list of features
  - Tree-like structure
- Mixing in a single tree heterogeneous data sources
WCS

- **Raster data dissemination**
  - Raw raster data useful for analysis, no maps!
  - Support for TIME and ELEVATION (via ImageMosaic plugin)
- **WCS 1.0 and 1.1.1**
- **Output formats**
  - GeoTiff, ArcGrid
  - GDAL based formats under discussion
- **Extensions**
  - ELEVATION as band management
WPS

- WPS 1.0
- Official Extension
- Raster and Vector data support
- High performance processes (raster/vector statistics, raster/vector format conversions and more)
- Integrated WPS
  - Direct access to data sources
  - Automatic publishing of results as new layers
  - Embedding processes into SLD styles (rendering transformation, since 2.2.0)
What’s new in 2.2.x
Virtual services

- Expose different OGC services per workspace
- Styles and layer groups per workspace
- Have different administrators per workspace → multi-tenancy
Referencing news

- Support for NTv2 and NADCON grids → high accuracy datum transformations
- Test and inspect re-projection interactively:

![Reprojection console]

Source CRS
EPSG:4326

Target CRS
EPSG:32632

Show transformation details
Source Geometry (x y, or a WKT geometry)
12 46

Forward Transform (source to target)
Target Point (x y, or a WKT geometry)
732293.358481655 5089424.979644502

Backward Transform (target to source)

GeoSolutions
Impersonation in data access

- Use the current GeoServer user to access DBMS contents
- Tighten security also at the DBMS level
- Useful for high security setups

Use the current GeoServer user to access DBMS contents.
Tighten security also at the DBMS level.
Useful for high security setups.
WMS: PNG8 with alpha

- Support for paletted PNG with alpha transparency
- Best of both worlds: compact but good looking
- Good quality, yet usable in interactive setups
WMS: TIME and ELEVATION

TIME = 20100512T0000000Z
ELEVATION = 0.0

FeatureType Editor

```xml
<Layer queryable="1">
  <Name>it.geosolutions:Pressure_reduced_to_MSL_contour</Name>
  <Title>Pressure_reduced_to_MSL_contour</Title>
  ...
  <LatLonBoundingBox minx="0.04" miny="34.96" maxx="21.96" maxy="49.721"/>
  <BoundingBox SRS="EPSG:4326" minx="0.04" miny="34.96" maxx="21.96" maxy="49.721"/>
  <Dimension name="time" units="ISO8601"/>
  <Dimension name="elevation" units="EPSG:5030"/>
  <Extent name="time" default="current">2010-05-12T00:00:00.000Z</Extent>
  <Extent name="elevation" default="0.0">0.0</Extent>
</Layer>
```
WMS: Rendering Transformations

- On-the-fly data transformations
- Calling spatial analysis processes from SLD docs
- Optimized for performance
- Examples: on the fly contour lines, heat maps, point clustering, point interpolation, GCP based image rectification
Improved GWC integration

- Custom gridset definition
- Per layer caching configuration
WFS: 2.0 and XSLT

- WFS 2.0
  - GML 3.2
  - Paging (back-ported to other versions)
  - Joins (scalar, temporal, spatial) between feature types
  - Stored queries
- XSLT output format:
  - GML 2.X/3.X
  - Custom XSL sheet
  - XSLT engine
  - Output formats: txt, Custom xml, HTML, KML
WPS: asynchronous calls

- Asynchronous WPS support for long running processes

Client | WPS protocol handler | WPS executor

- Execute
- Status poll
- Status poll
- Status?
- Results
- Internal submit
- Update status
- Update status
- Write results

GeoSolutions
Security: Authentication

- Pluggable user sources, available out of the box:
  - LDAP, DBMS
- Pluggable authentication mechanisms, available out of the box:
  - BASIC/DIGEST HTTP, CAS
- Possible to integrate with other mechanisms and in-house solutions
- Available since 2.2.0, before only basic HTTP auth + simple text file for users
What’s new in 2.3.x
Database configuration backend

- Pluggable configuration backends
- In-memory implementation + XML storage (current one)
- Database based implementation (as a community module)
- Pluggable, add your own (any takers for a NoSQL elastic implementation?)
Improved clustering for GWC in 1.4.x:
- Metastore removed
- Disk quota can work off a central DBMS
- Distributed locks, avoid concurrent computation of same tile at the same time

Active/active clustering of GWC now possible
CSW 2.0.2

- Wow, catalogue services in GeoServer!
- Catalog Service for the Web 2.0.2
- Pluggable record backend
- Pluggable record type support
- Not a replacement for a full-fledged GeoNetwork (not at the moment, at least)

CSW protocol handler

- Dublin core support
- ebRIM support
- ISO support

- GeoServer config backend
- Simple DC backend
- Vendor specific bridge

Record type plugins
Record sources
CSW 2.0.2

- Current implementation
  - Demo backend with Dublin Core record support, passes CITE certifications tests
  - ISO + Dublin core backend reporting layers in the GeoServer configuration, in development
  - ebRIM (Earth Observation profile) implementation plus proxy to a in-house, vendor specific catalog (proxy front-end model)

- Currently a community module
  - will be graduated to extension once the ISO backend over the GeoServer own config is completed
WCS 2.0

- WCS 2.0 implementation with extensions:
  - Range subsetting
  - Scaling and interpolation
  - CRS (reprojection)
  - GeoTiff & NetCDF encoding
- Earth Observation profile support
  - Temporal series
  - Exposing mosaic structure
  - EO metadata describing sensors
- NetCDF support as both input and output
- Sponsors
  - DLR (German spatial agency)
  - EUMETSAT (European operational satellite agency for monitoring weather, climate and the environment)
Other Enhancements

- LayerGroups
- WPS Process Selection
- WMS Addition Dimensions
- Monitoring Extension
- Extensive JSONP Support
- Security Subsystem Improvements
What’s cooking for 2.4.x
Earth Observation profile support
- Temporal series
- Exposing mosaic structure
- EO metadata describing sensors

**MERI SS__RR_2P**

```xml
<DIMENSION name="time" ...>

1
MERI SS__RR_2P_outlines

1..*
MERI SS__RR_2P_bands

1..*
MERI SS__RR_2P_geopar

1..*
MERI SS__RR_2P_flagname
```

- queryable (?) - SHALL contain a TIME dimension with no default
- optional - queryable (XML, con time ISO8601)
- 10 predefined styles (white, yellow, orange, red, magenta, blue, cyan, green, brown, black)
- optional - queryable
- support Dimension in case we have available things like polarization, wavelength and so on
- optional - queryable
- support a LEGENDURL with a colorap
- optional - queryable
- 10 predefined styles (white, yellow, orange, red, magenta, blue, cyan, green, brown, black
Spatiotemporal Raster Management

- **NetCDF support**
  - Improve existing NetCDF/CF input format, support CF convention and make sure the samples provided by DLR/EUMETSAT can be read
  - Expose NetCDF internal data as a set of 2D slices
  - Write new NetCDF/CF output format for GeoServer

Input multidimensional NetCDF file that contains multiple forecasts at multiple elevations (optional) for various geophysical parameters.

For each single 2D slice contained in the multidimensional NetCDF file we have an entry to index it for successive stitching.
Spatiotemporal Raster Management

- Add REST support to expose a image mosaic internal structure
  - Dimensions
  - Granules

**Dimensions: list, edit, create, remove**
- /workspaces/<ws>/coveragestores/<cs>/coverages/<mosaic>/dimensions
- /workspaces/<ws>/coveragestores/<cs>/coverages/<mosaic>/dimensions/<dimension>[.format]
- TODO paging and query of dimension domain

**Granules: list, edit, create, remove**
- /workspaces/<ws>/coveragestores/<cs>/coverages/<mosaic>/index
- /workspaces/<ws>/coveragestores/<cs>/coverages/<mosaic>/index/pageN
- /workspaces/<ws>/coveragestores/<cs>/coverages/<mosaic>/index/pageN/granuleM
The End

Questions?

andrea.aime@geo-solutions.it

simone.gianneccchini@geo-solutions.it