GeoServer,

the open source server for interoperable spatial data handling

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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

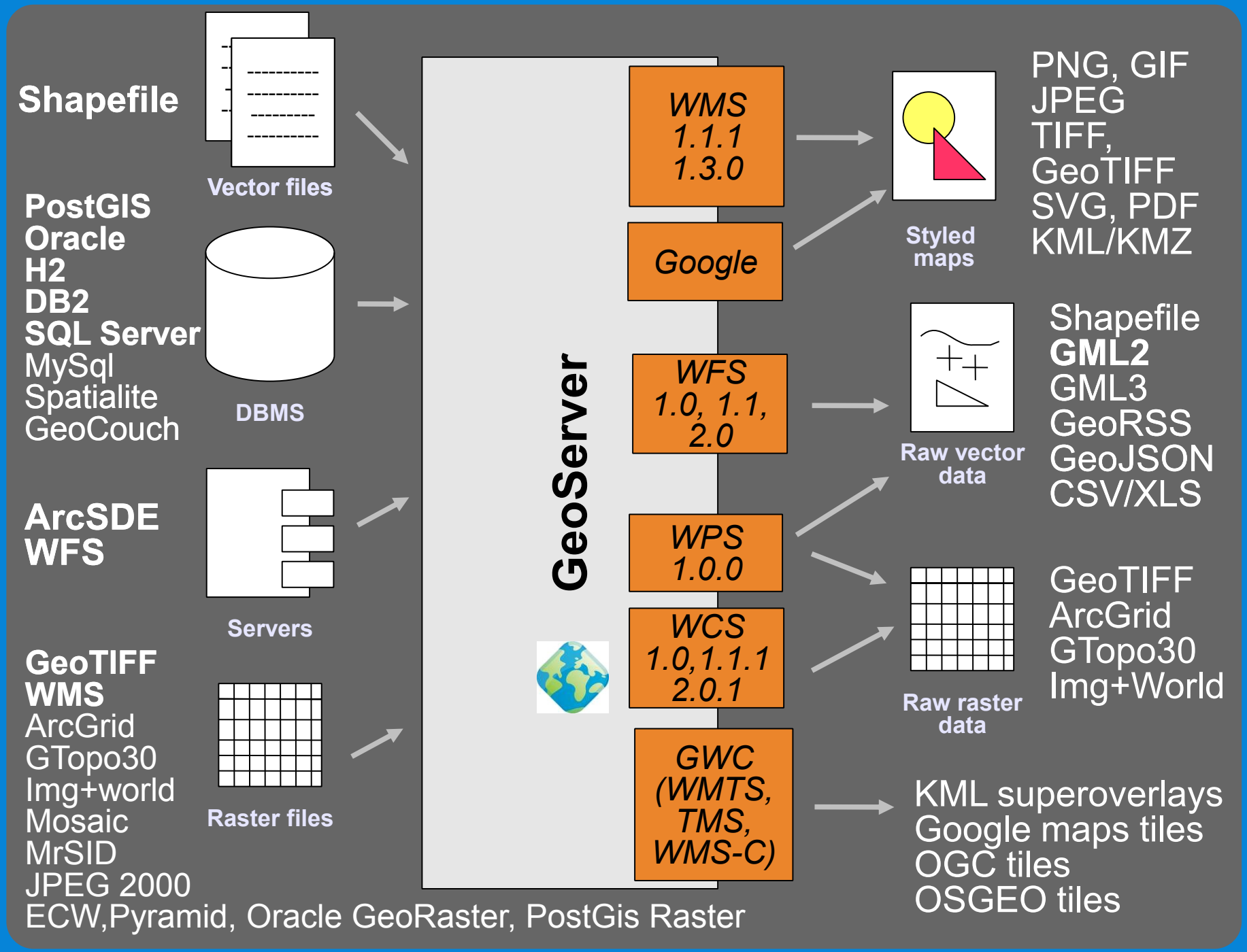
- Founded in Italy in late 2006
- Expertise
  - Image Processing, GeoSpatial Data Fusion
  - Java, Java Enterprise, C++, Python
  - JPEG2000, JPIP, Advanced 2D visualization
- Supporting/Developing FOSS4G projects
  - GeoTools, GeoServer
  - GeoNetwork, GeoBatch, MapStore
  - ImageIO-Ext and more: https://github.com/geosolutions-it
- Focus on Consultancy
  - PAs, NGOs, private companies, etc…

GeoServer quick intro

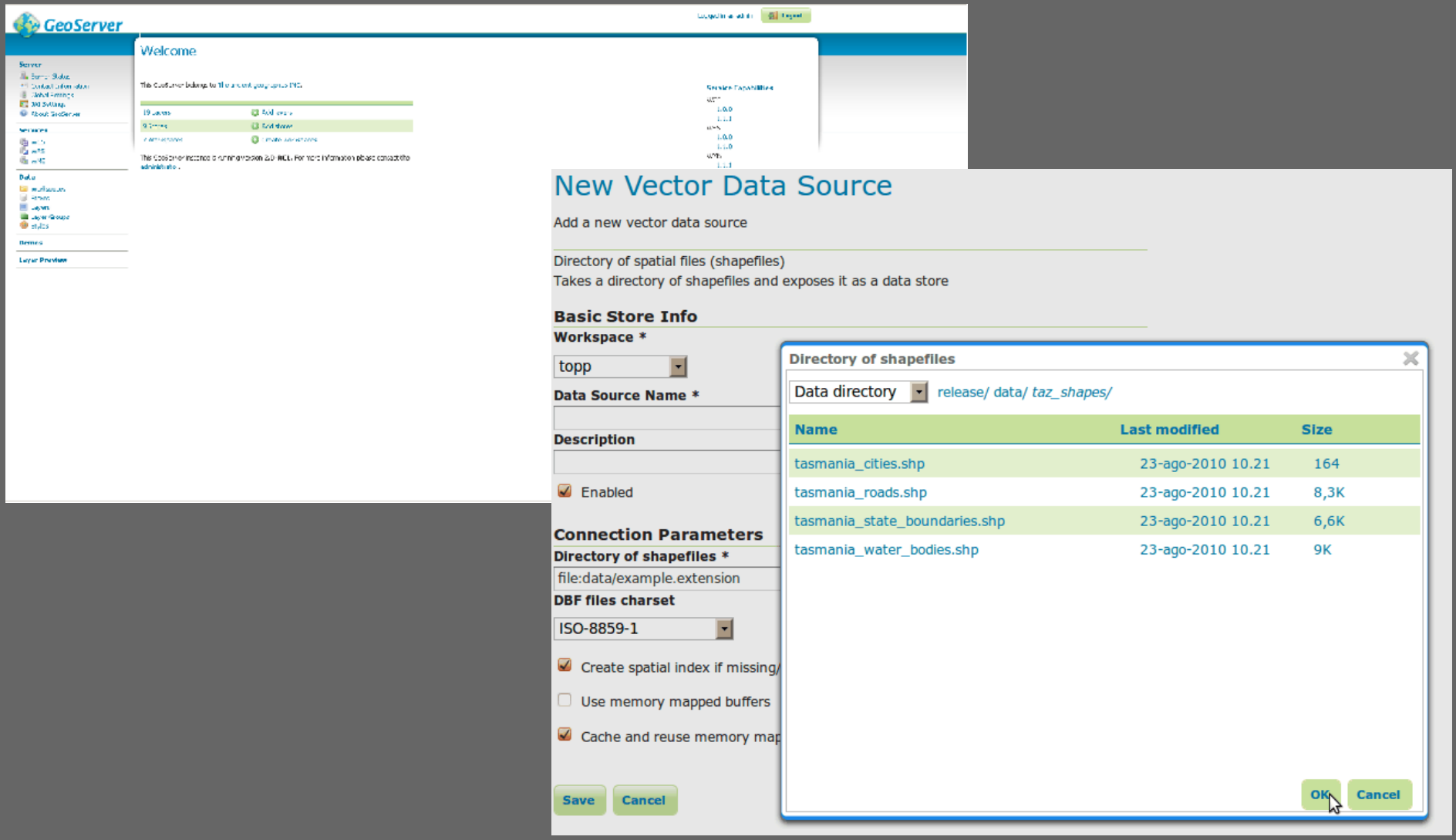
GeoServer

- GeoSpatial enterprise gateway
  - Java Enterprise
  - Management and Dissemination raster and vector data
- Standards compliant
  - OGC WCS 1.0, 1.1.1 (RI), 2.0 in th 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..

Formats and Protocols



Administration GUI



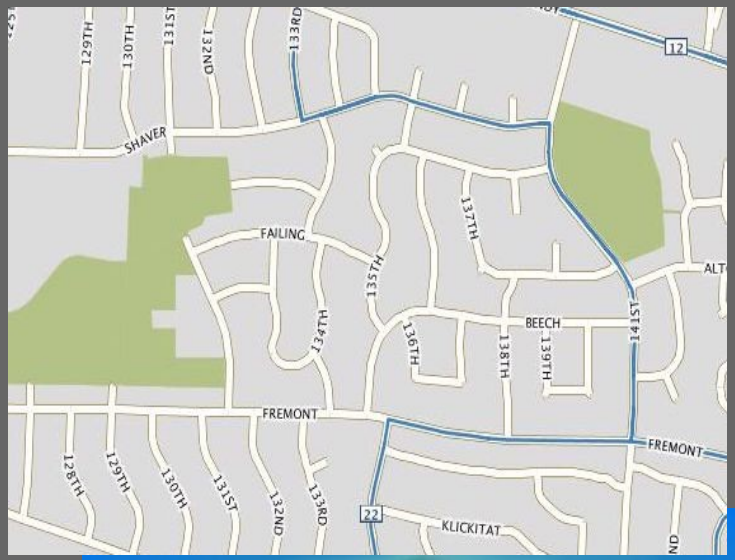
RESTful Configuration

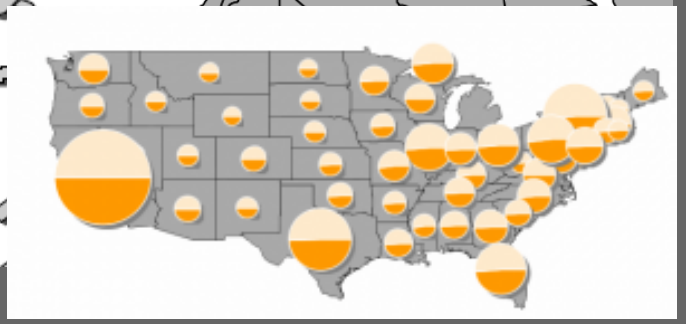
- Programmatic configuration of layers via REST calls
  - Workspaces, Data stores / coverage stores
  - Layers and Styles, Service configurations
  - Freemarker templates (incoming)
- Exposing internal configuration to remote clients
  - Ajax - JavaScript friendly
- Various client libraries available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

WMS

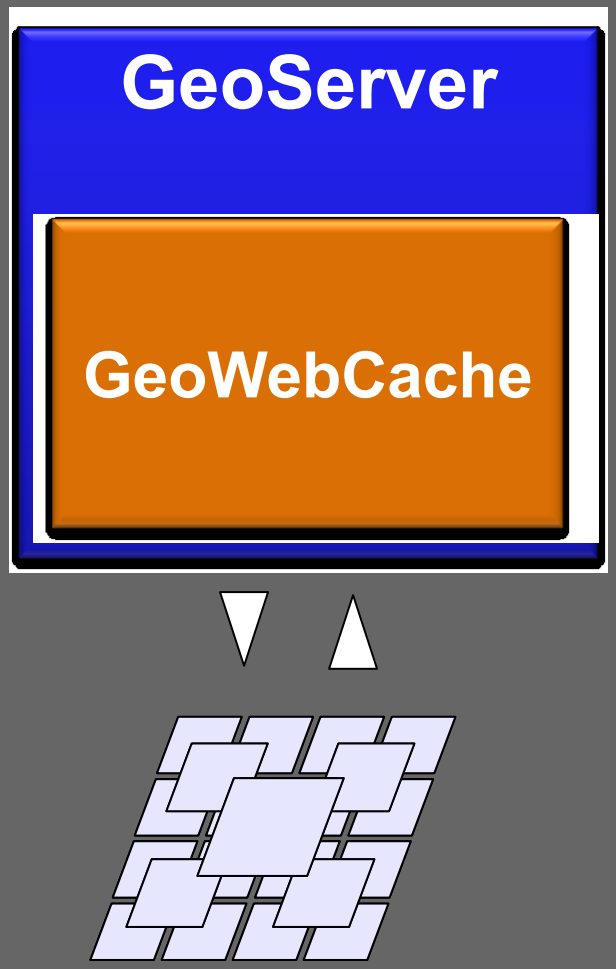
- Dissemination of Maps
  - Fusing raster and vector data seamlessly
  - Rule/scale driven rendering
- WMS 1.1.1 and 1.3 support
- SLD
  - Basic support for SLD 1.1 and SE 1.1
  - Full support for SLD 1.0
- CSS extension for compact styling
- Many rendering extensions available

Rendering



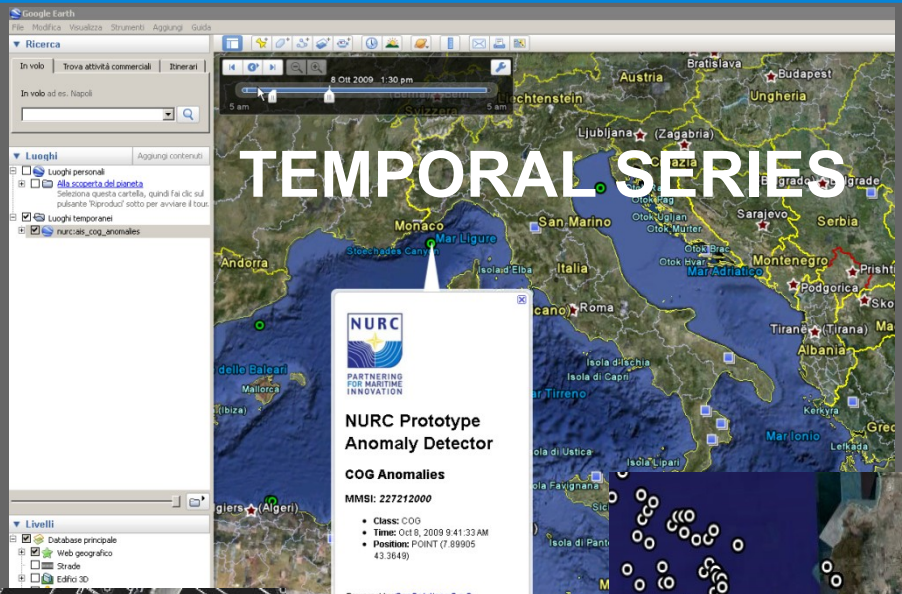


GeoWebCache Integration



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

KML/KMZ



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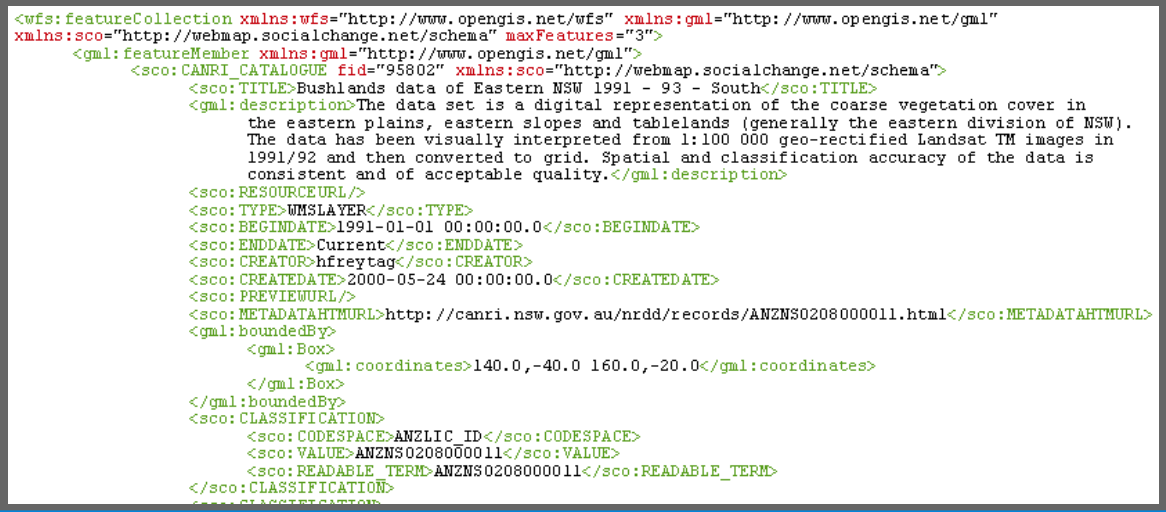
WFS

- 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 hererogeneous data sources



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<wfs:featureCollection xmlns:wfs="http://www.opengis.net/wfs" xmlns:gml="http://www.opengis.net/gml"
xmlns:sco="http://webmap.socialchange.net/schema" maxFeatures="3">
      <gml:featureMember xmlns:gml="http://www.opengis.net/gml">
            <sco:CANRI_CATALOGUE fid="95802" xmlns:sco="http://webmap.socialchange.net/schema">
                  <sco:TITLE>Bushlands data of Eastern NSW 1991 - 93 - South</sco:TITLE>
                  <gml:description>The data set is a digital representation of the coarse vegetation cover in
                        the eastern plains, eastern slopes and tablelands (generally the eastern division of NSW).
                        The data has been visually interpreted from 1:100 000 geo-rectified Landsat TM images in
                        1991/92 and then converted to grid. Spatial and classification accuracy of the data is
                        consistent and of acceptable quality.</gml:description>
                  <sco:RESOURCEURL/>
                  <sco:TYPE>WMSLAYER</sco:TYPE>
                  <sco:BEGINDATE>1991-01-01 00:00:00.0</sco:BEGINDATE>
                  <sco:ENDDATE>Current</sco:ENDDATE>
                  <sco:CREATOR>hfreytag</sco:CREATOR>
                  <sco:CREATEDATE>2000-05-24 00:00:00.0</sco:CREATEDATE>
                  <sco:PREVIEWURL/>
                  <sco:METADATAHTMURL>http://canri.nsw.gov.au/nrdd/records/ANZNS0208000011.html</sco:METADATAHTMURL>
                  <gml:boundedBy>
                        <gml:Box>
                              <gml:coordinates>140.0,-40.0 160.0,-20.0</gml:coordinates>
                        </gml:Box>
                  </gml:boundedBy>
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                        <sco:CODESPACE>ANZLIC_ID</sco:CODESPACE>
                        <sco:VALUE>ANZNS0208000011</sco:VALUE>
                        <sco:READABLE_TERM>ANZNS0208000011</sco:READABLE_TERM>
                  </sco:CLASSIFICATION>
```

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

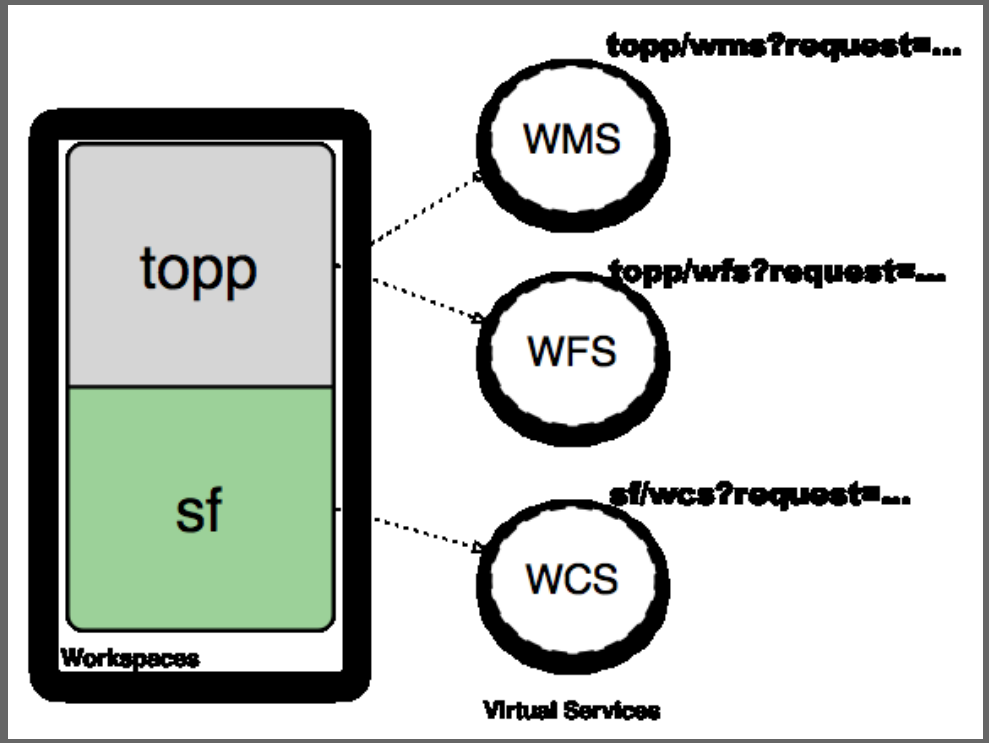
WPS

- 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

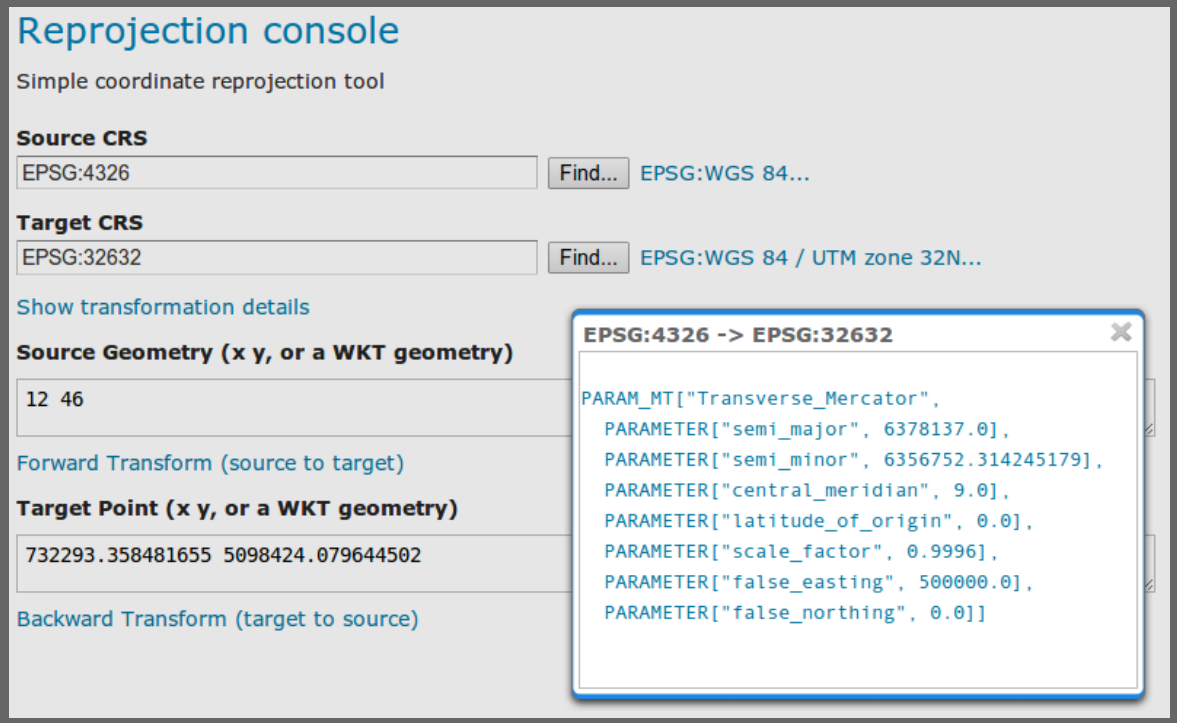
Virtual services

- 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:



More Projections

Robinson

Winkel Tripel

Mollweide

Winkel Tripel

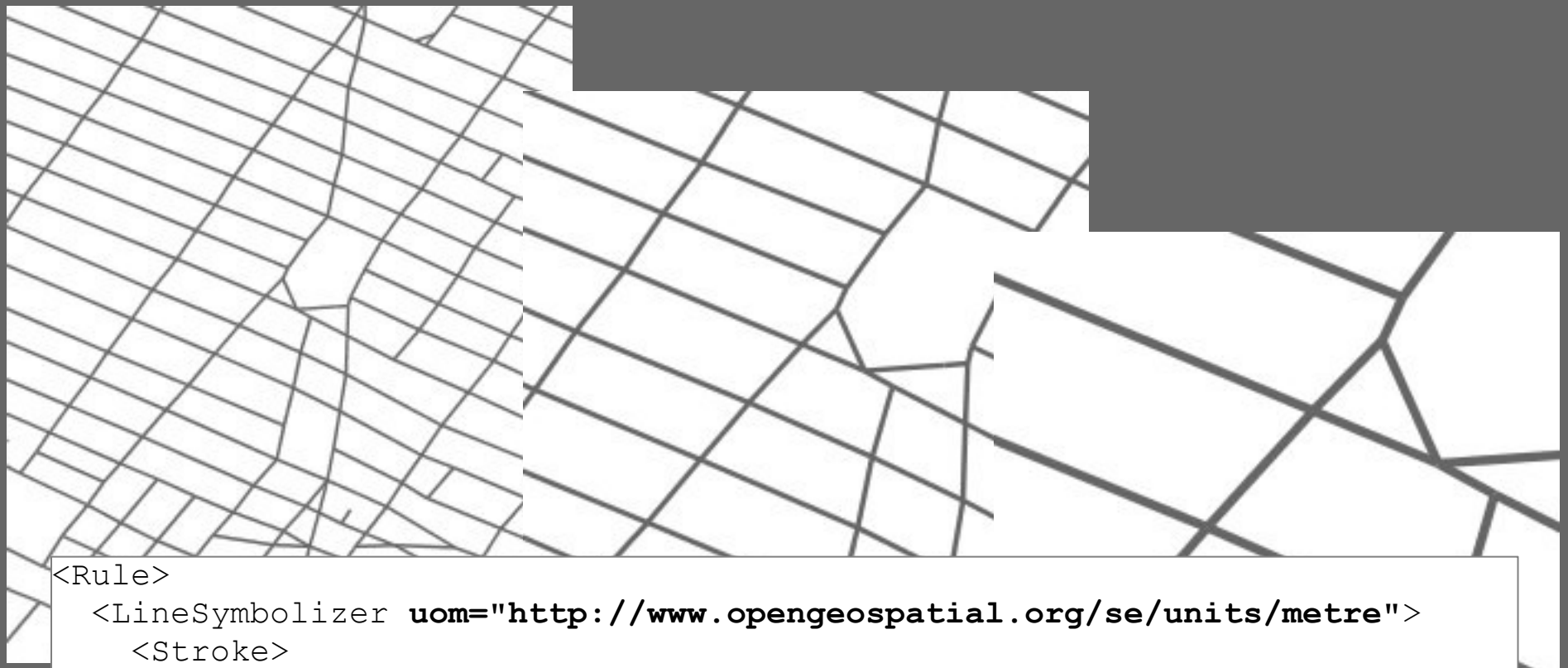
Eckert IV

Advanced Projection Handling

Management of dateline Change and map-wrapping

Cutting un-reprojectable geometries

Rendering: real world units



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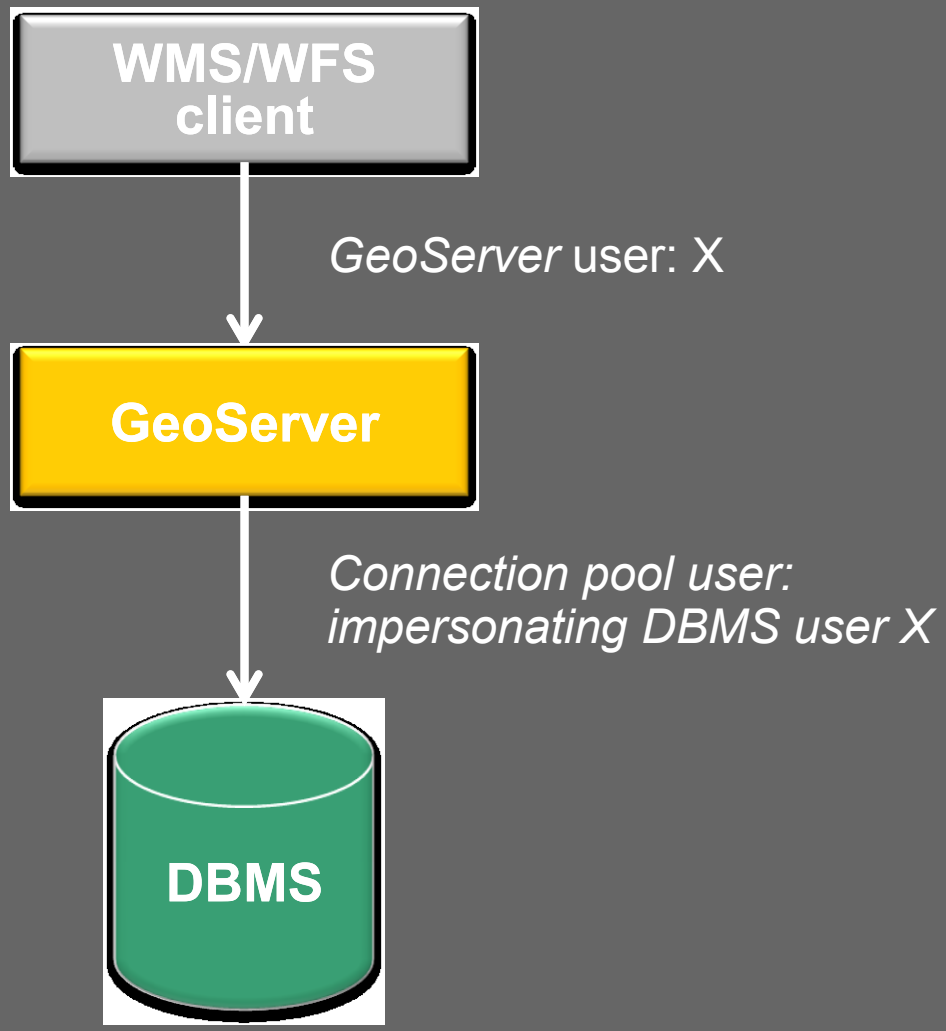
        <ogc:Literal>5</ogc:Literal>
      </CssParameter>
    </Stroke>
  </LineSymbolizer>
</Rule>
```

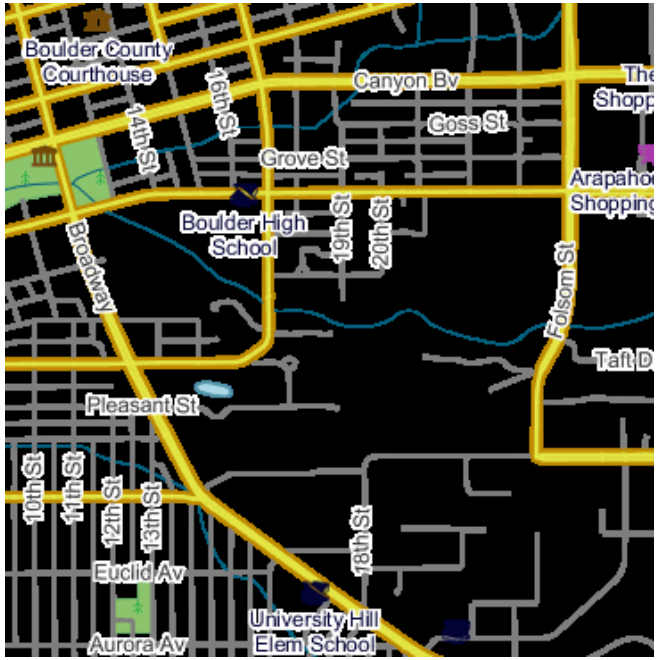
Impersonation in data access

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



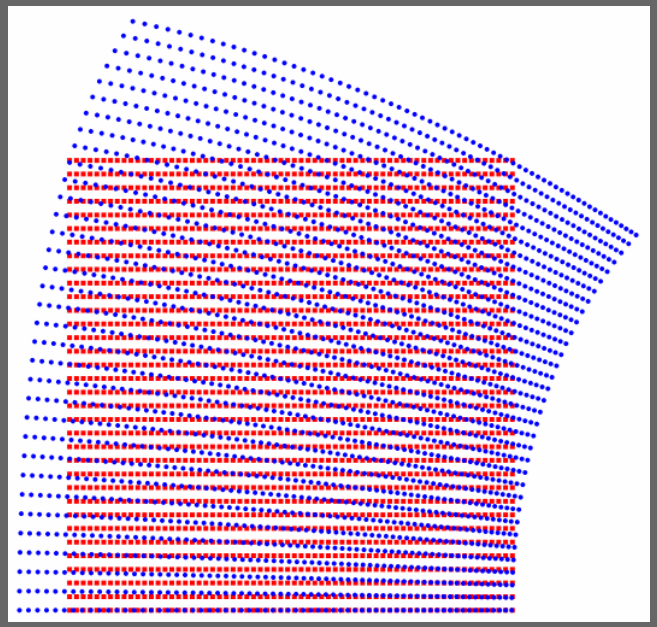
WMS: PNG8 with alpha

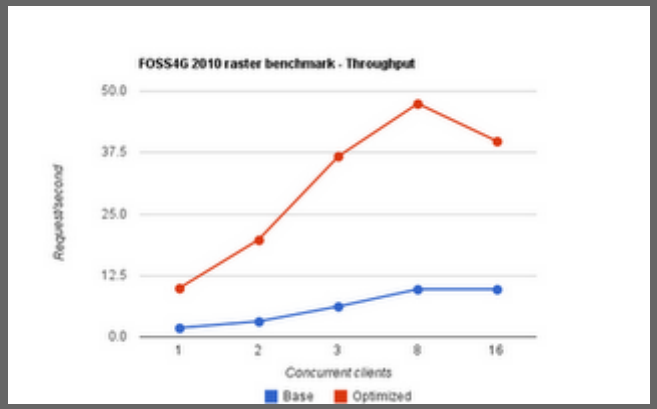
- Support for paletted PNG with alpha transparency
- Best of both worlds: compact but good looking
- Good quality, yet usable in interactive setups



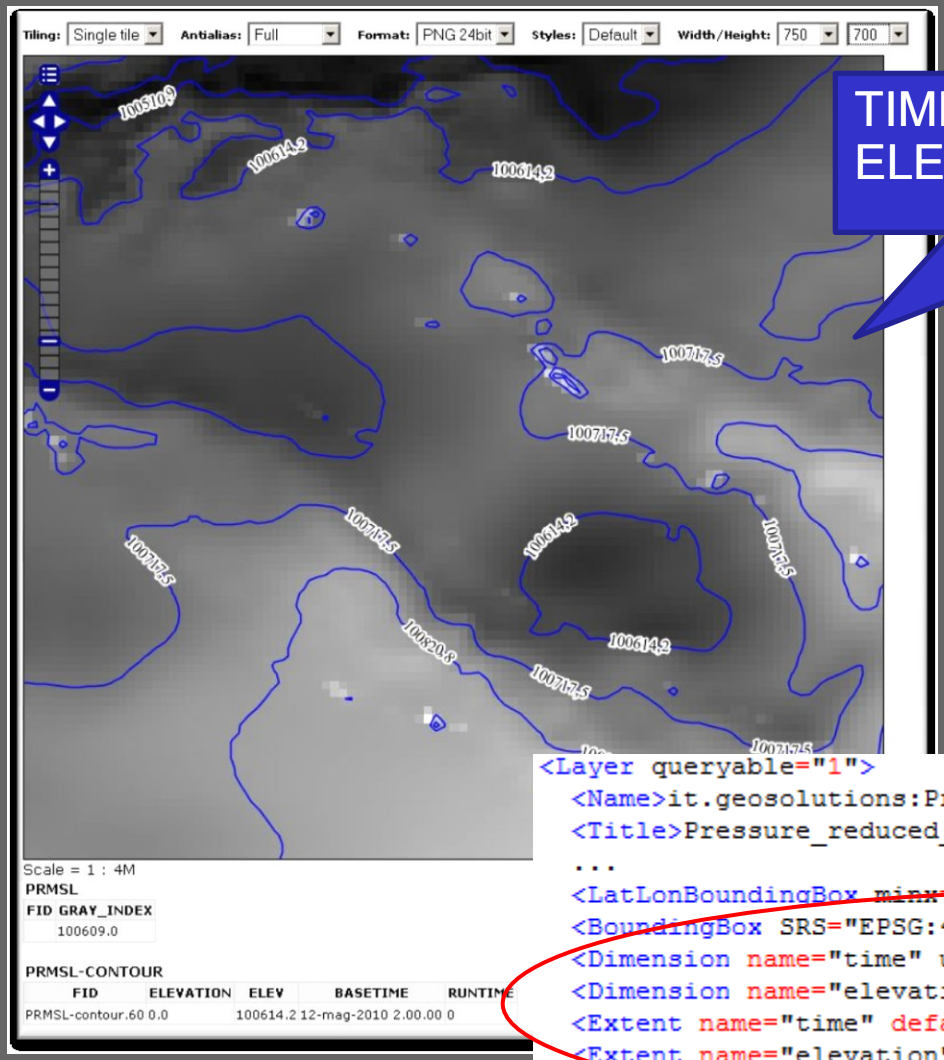
Improved Raster Reprojection

- Raster reprojection → complex process
- Idea:
  - *try to approximate the overall transformation with a simpler one, either a single affine transformation or a piecewise composition of them (grid warp)*
- Ability to specify threshold for error acceptance
- Iterative approach (local optimization)
- Trade off between speed and precision





WMS: TIME and ELEVATION



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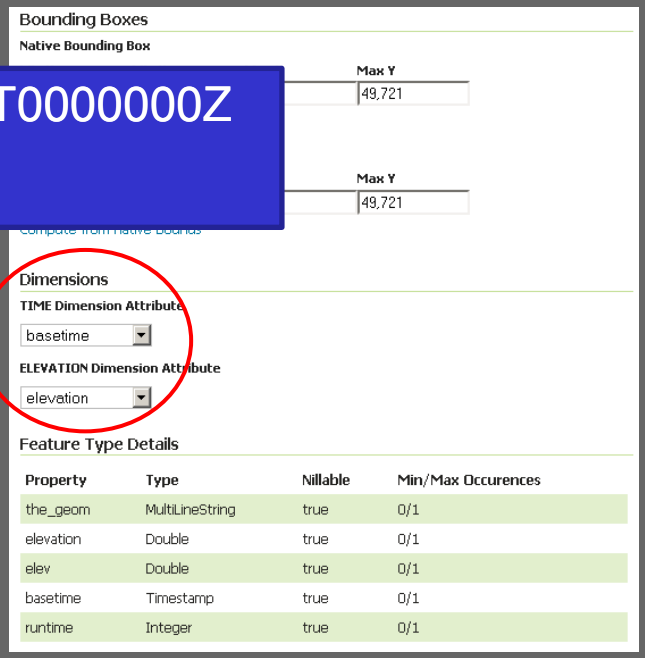
ELEVATION = 0.0



FeatureType Editor

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<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>
```

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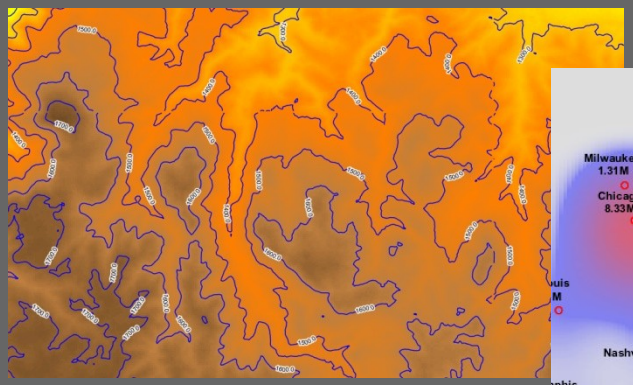
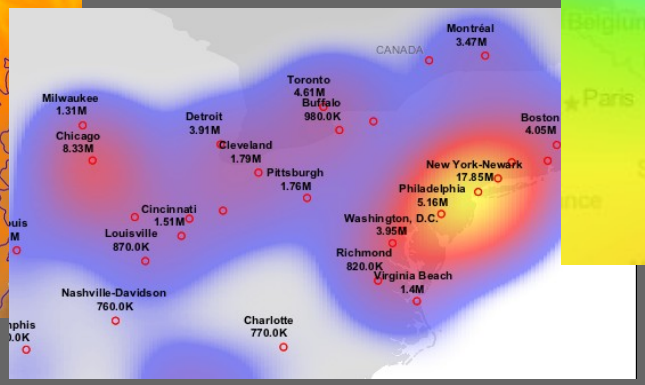
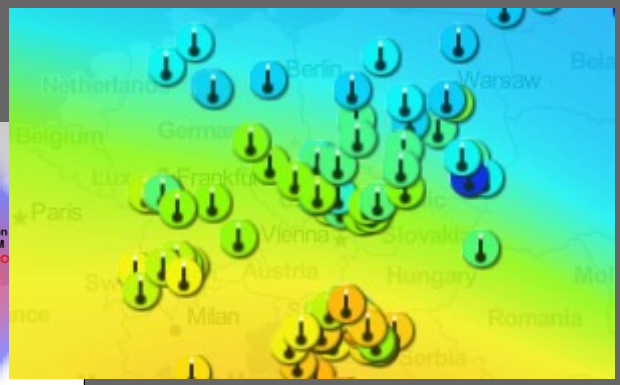
WMS: Rendering Transformations

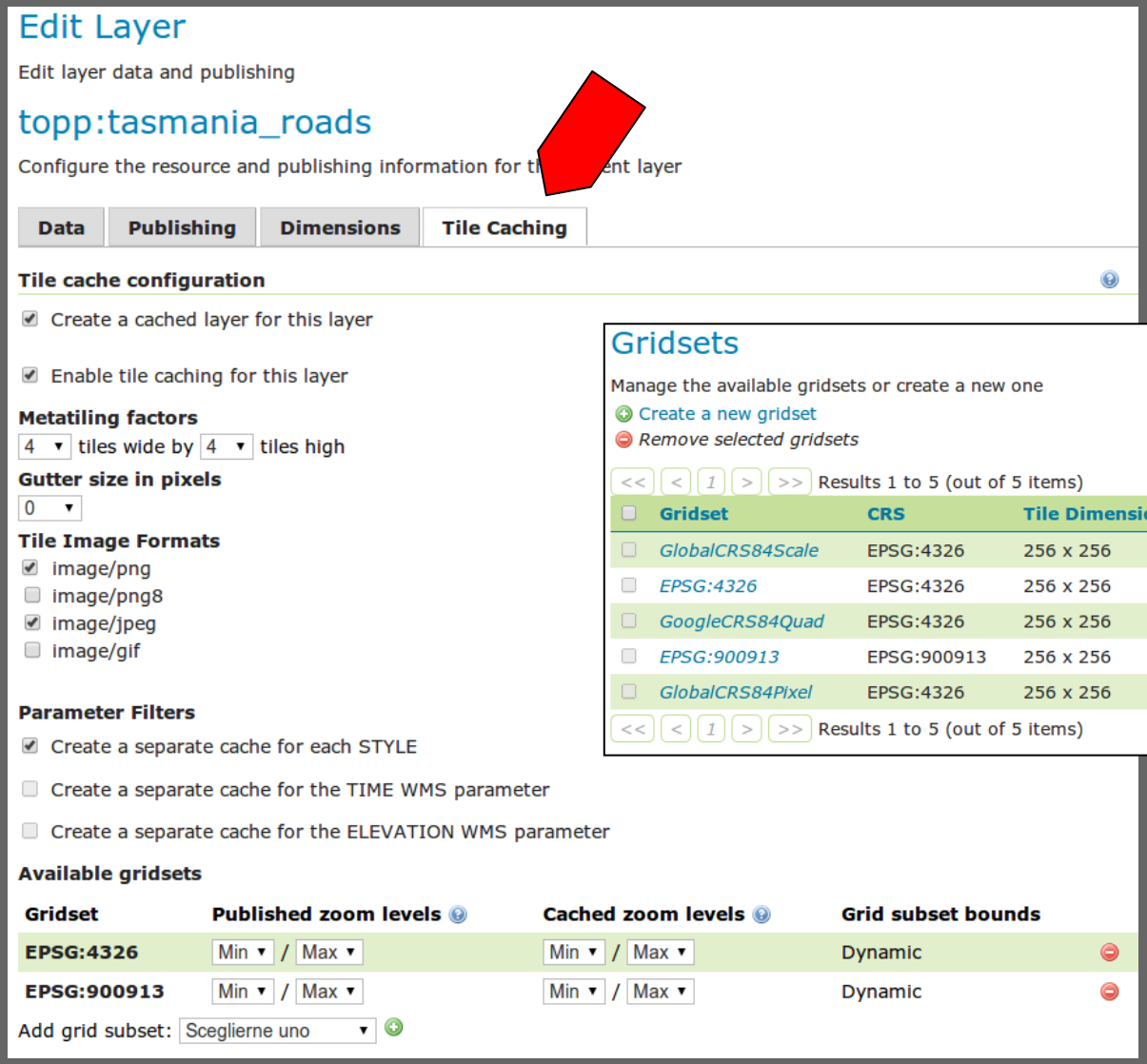
- On-the-fly data transformations
- Calling spatial analysis processes from SLD docs
- Optimized for performance
- Examples: on the fly contour lines, heat maps, point clustering, point interpolation, GCP based image rectification







Improved GWC integration



- Custom gridset definition
- Per layer caching configuration

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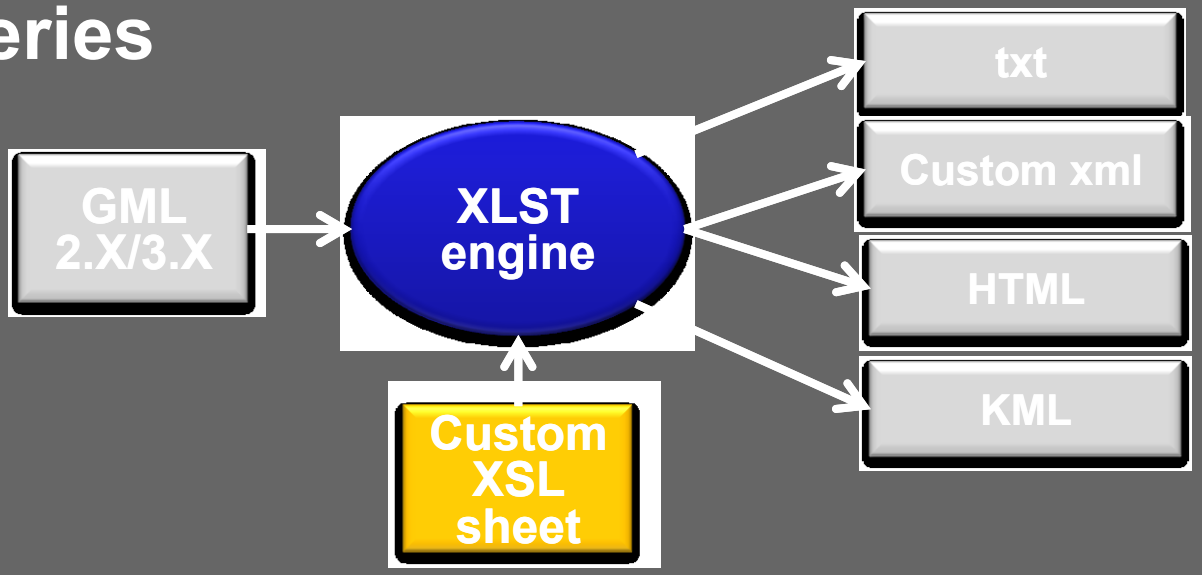
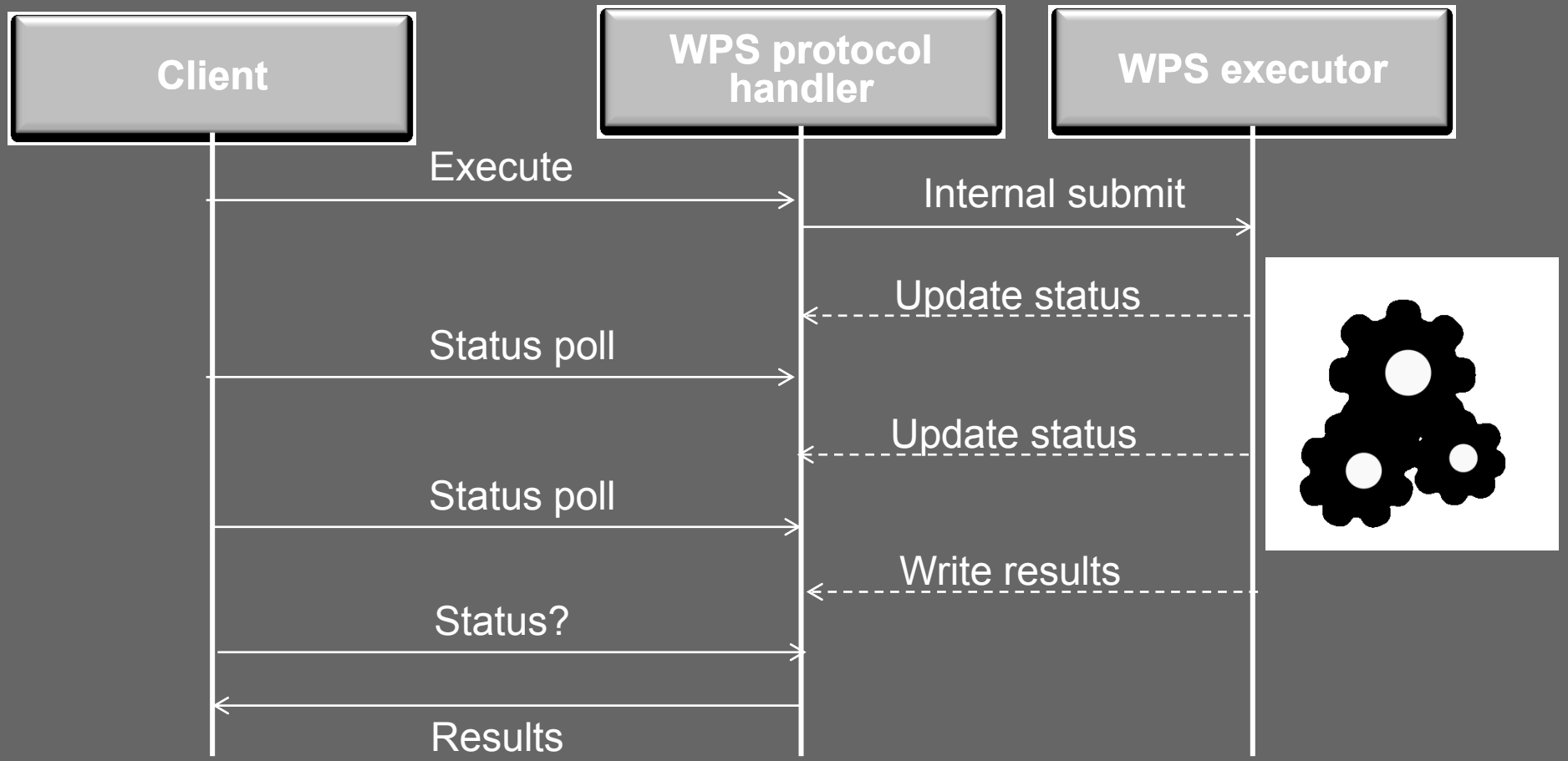
WFS: 2.0 and XSLT

- WFS 2.0
  - GML 3.2
  - Paging (back-ported to other versions)
  - Joins (scalar, temporal, spatial) between feature types
  - Stored queries
- XSLT output format:



WPS: asynchronous calls

- Asynchronous WPS support for long running processes



Security: Authentication

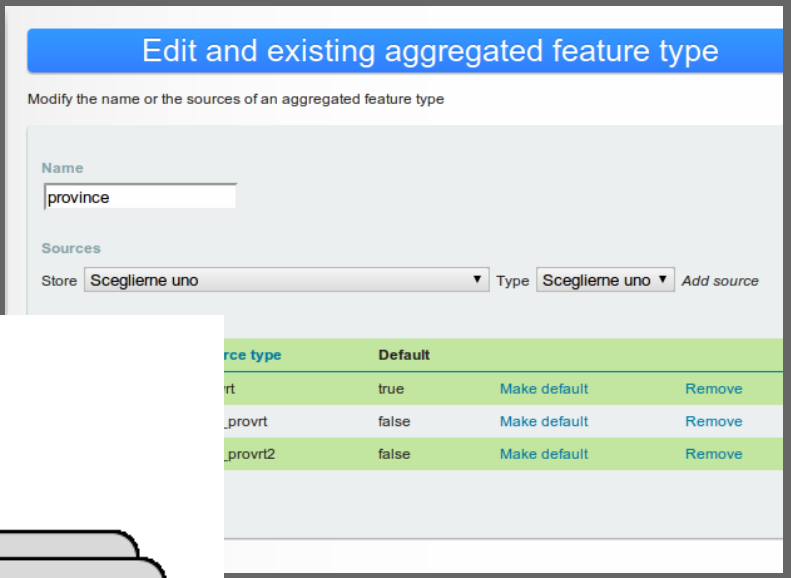
- Pluggable user sources, available out of the box:
  - LDAP, DBMS
- Pluggable authentication mechanisms, available out of the box:
  - BASIC/DIGEST HTTP, CAS
- Possible to integrate with other mechanisms and in-house solutions
- Available since 2.2.0, before only basic HTTP auth + simple text file for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

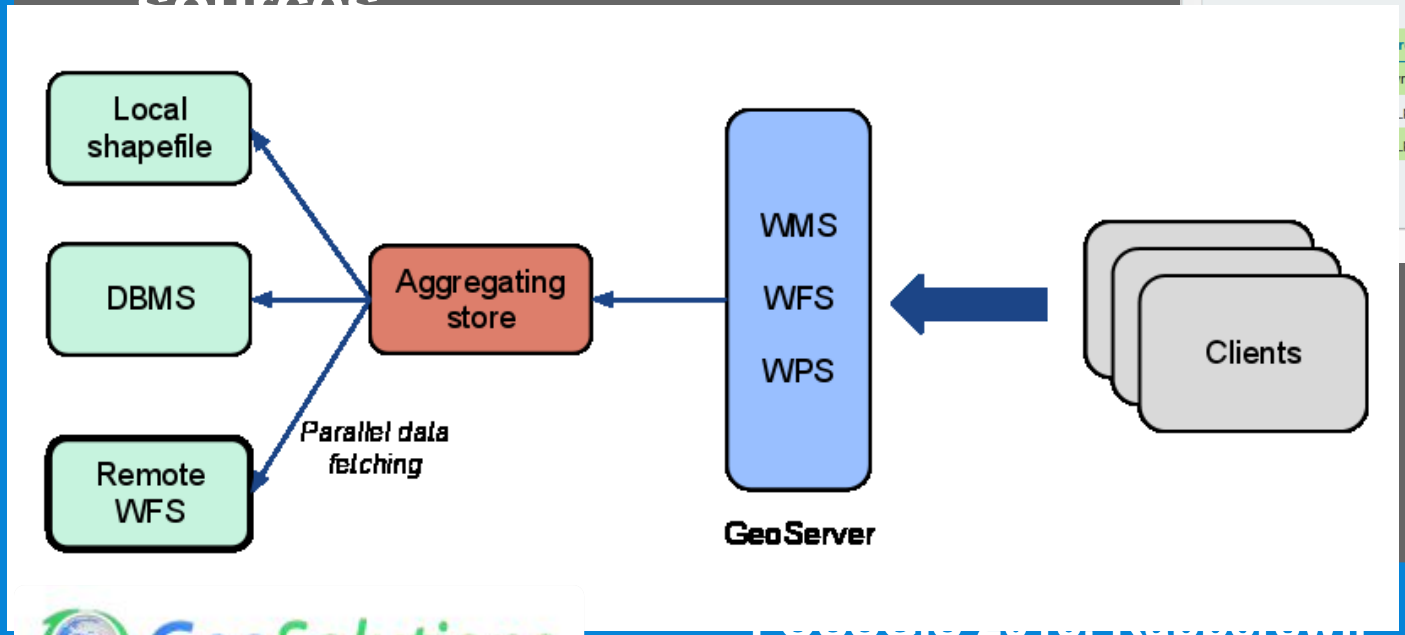
Image Server*

- Turning GeoServer into an Image Server
  - Serving pure Imagery
  - No geo-reference need/available/(would make sense!)
- Special Coordinate Reference Systems defined
  - Interoperability with WMS clients
  - Respecting EPSG conventions
    - EPSG:404000
    - See here
- Improved support for data with bad/missing geo-reference!

Aggregating data store

- N layers, remote or local, sharing the same structure
- Aggregating store puts them together dynamically, the client wil think there is just one layer
- Parallel data fetching
- Can be configured to tolerates temporarily unreachable data sources





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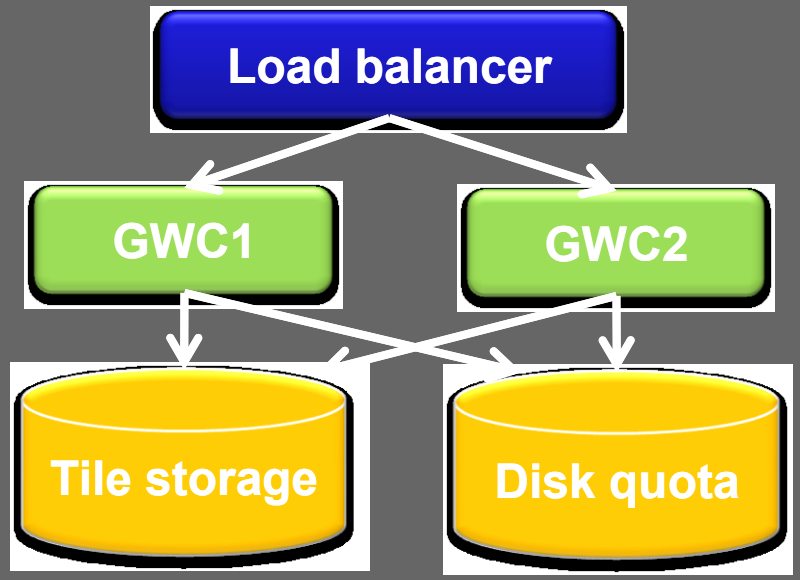
What's new in 2.3.x

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?)

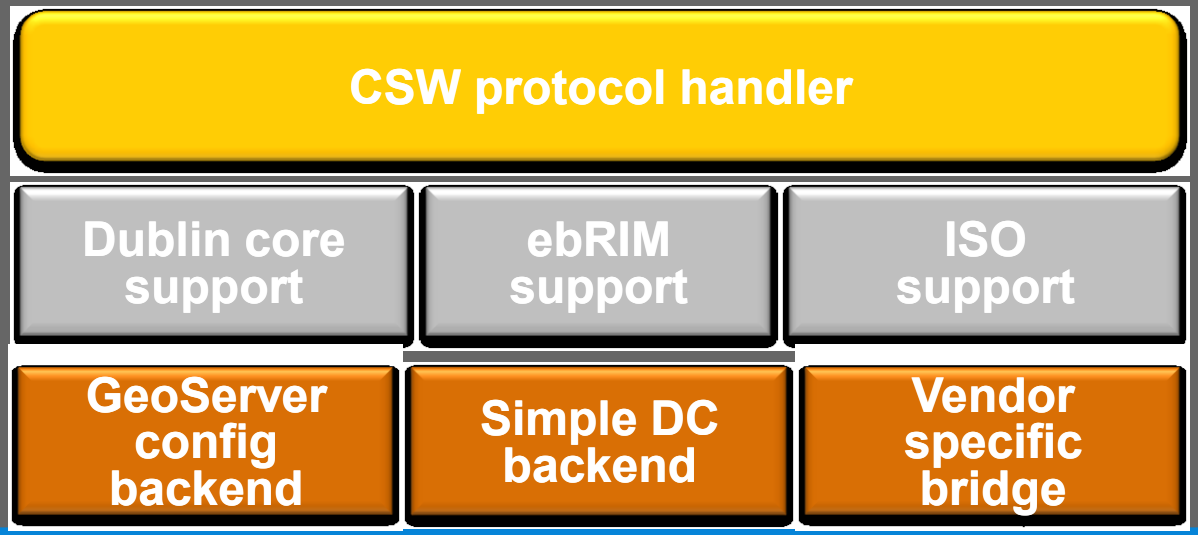
GWC clustering

- 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)



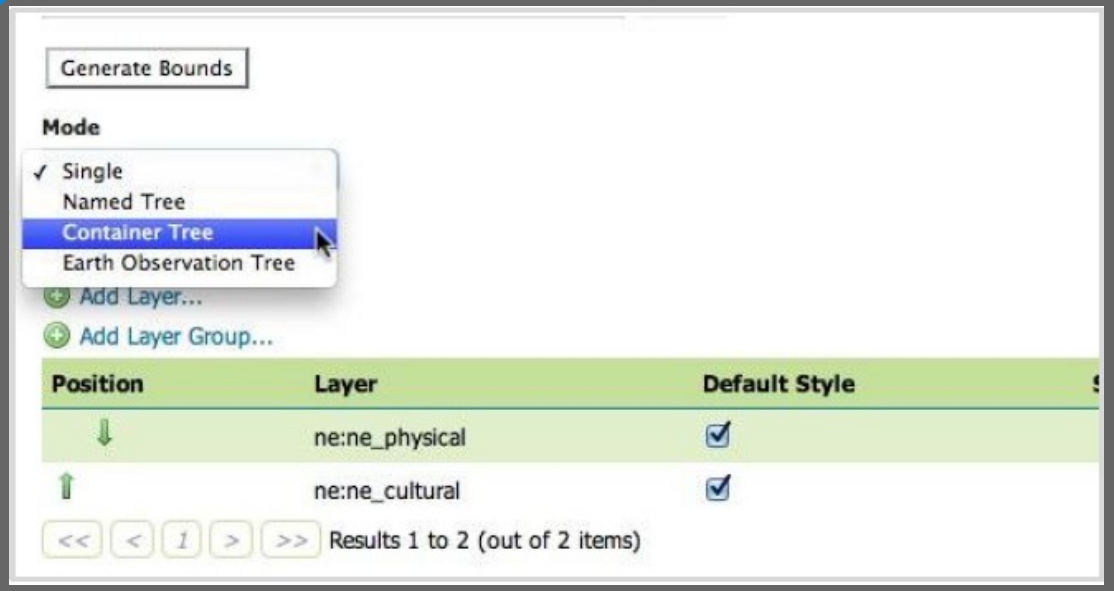
CSW 2.0.2

- 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

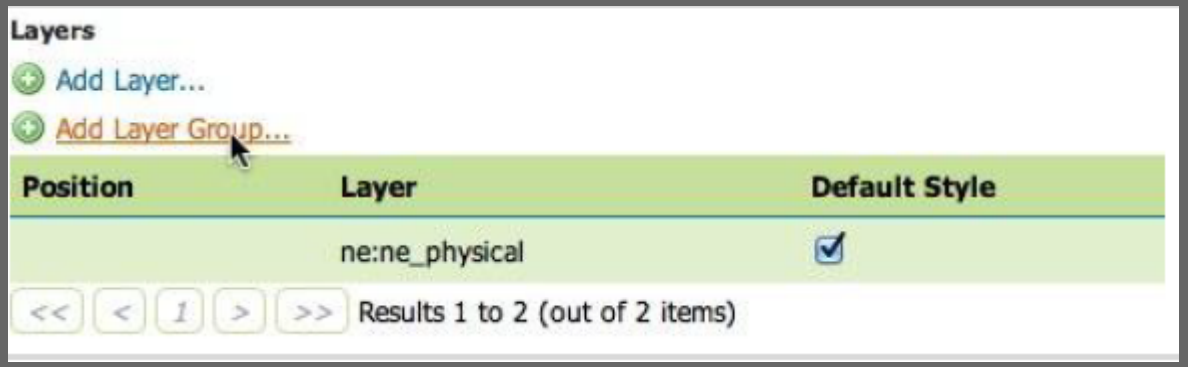
- WCS 2.0 implementation with extensions:
  - Range subsetting
  - Scaling and interpolation
  - CRS (reprojection)
  - GeoTiff & NetCDF encoding
- Earth Observation profile support
  - Temporal series
  - Exposing mosaic structure
  - EO metadata describing sensors
- NetCDF support as both input and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

Layer Groups



Capabilities Tree

Nesting



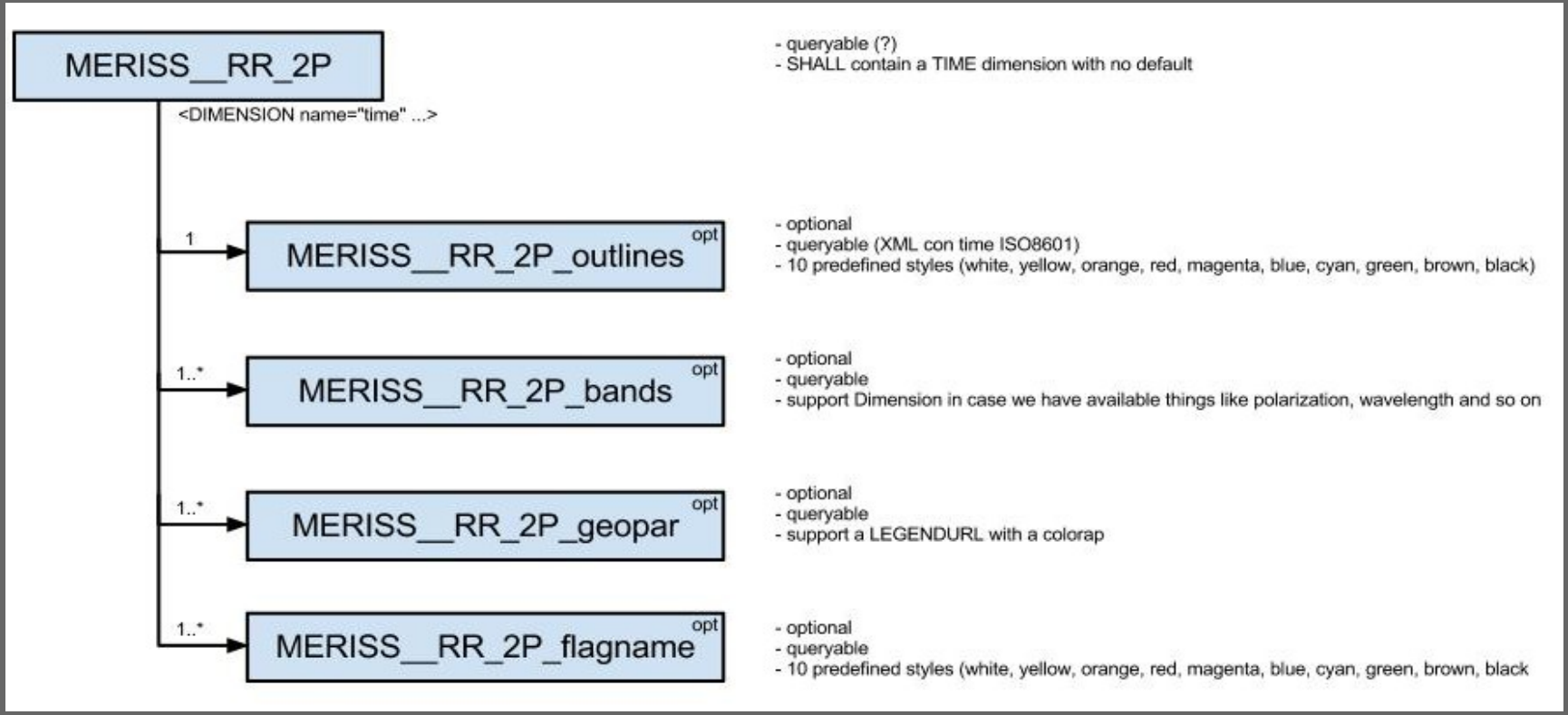
Other Enhancements

- WPS Process Selection
- WMS Additional Dimensions
- More INSPIRE
- Monitoring Extension
- Extensive JSONP Support
- Security Subsystem Improvements

What's cooking for 2.4.x (plus wish list ☺)

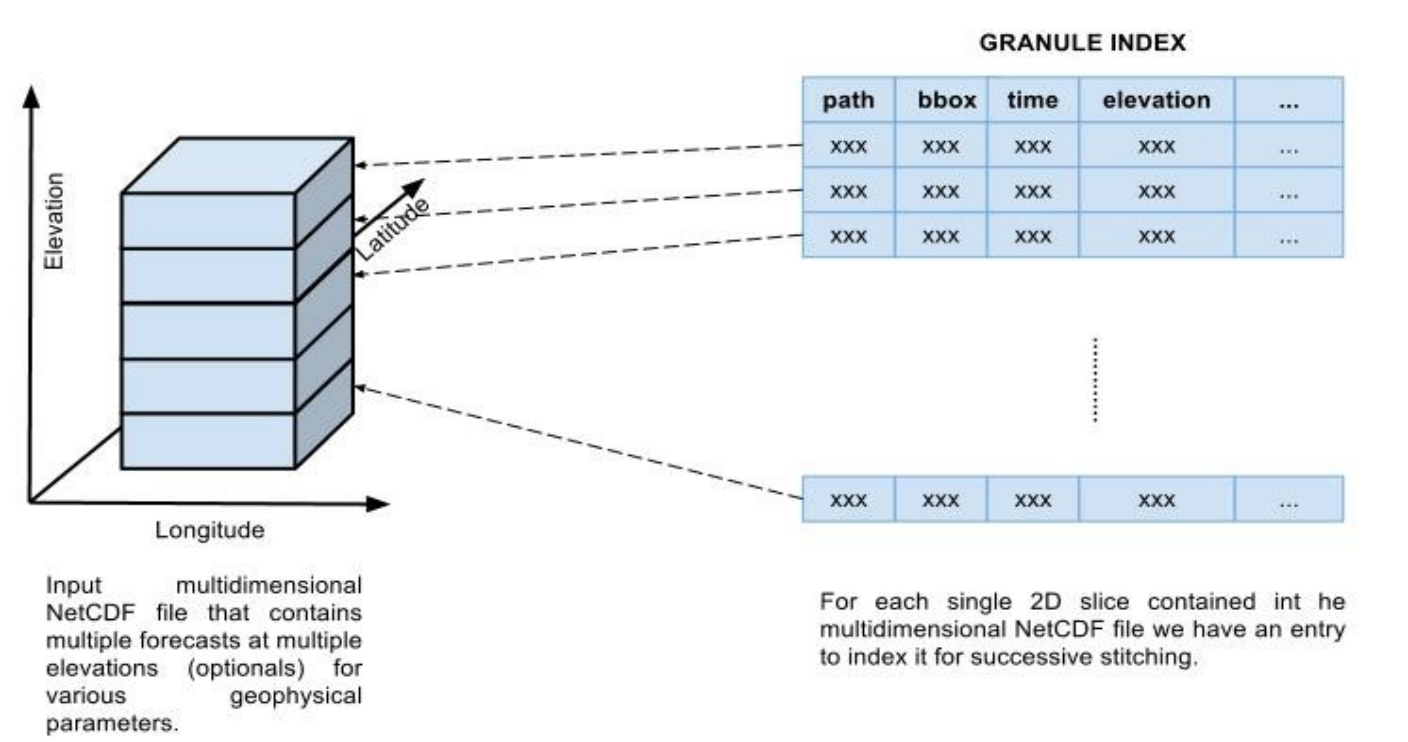
WMS EO

- Earth Observation profile support
  - Temporal series
  - Exposing mosaic structure
  - EO metadata describing sensors



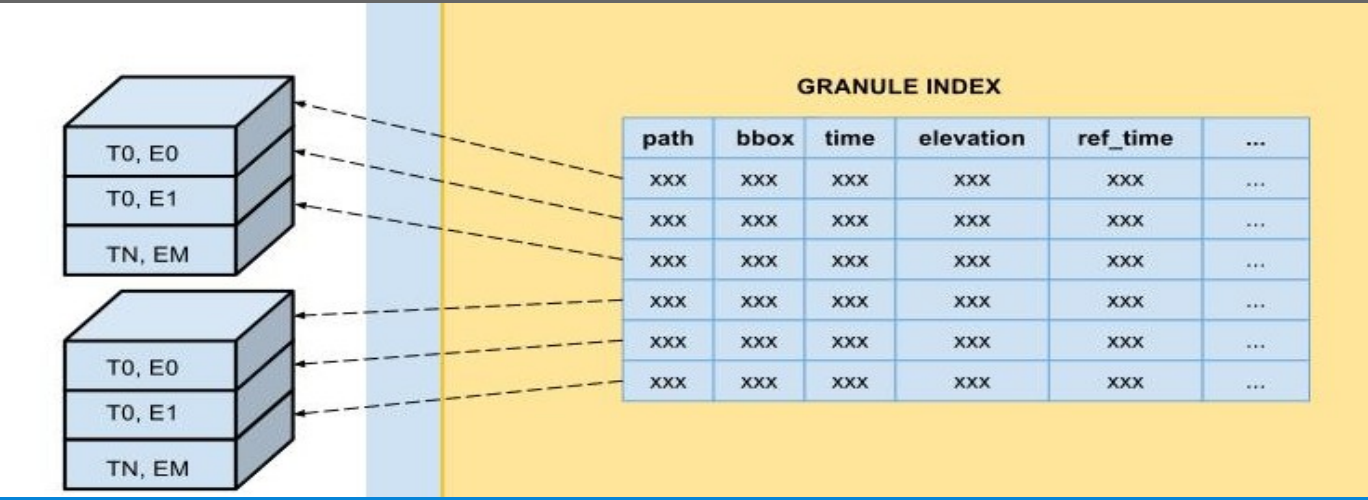
Spatiotemporal Raster Management

- **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



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



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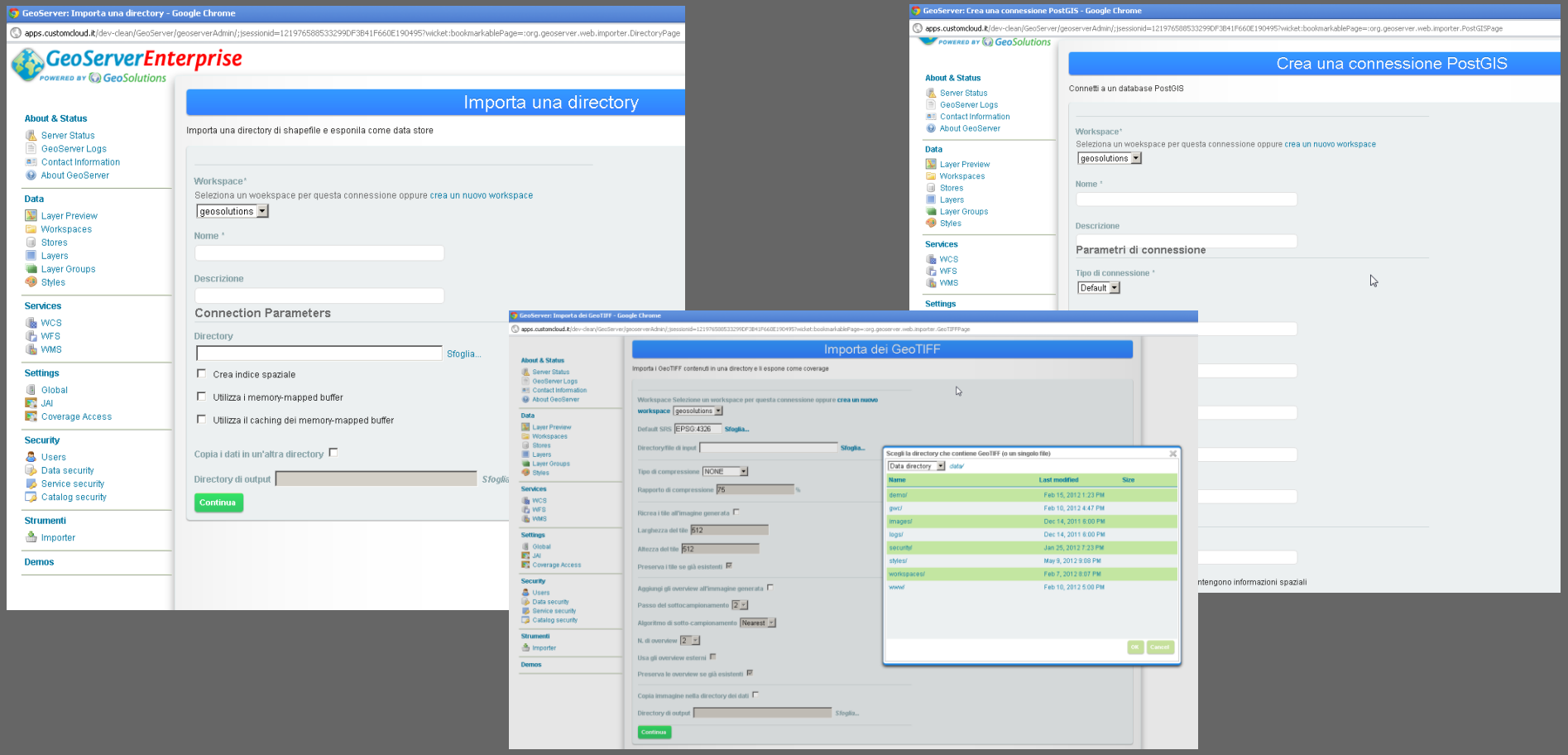
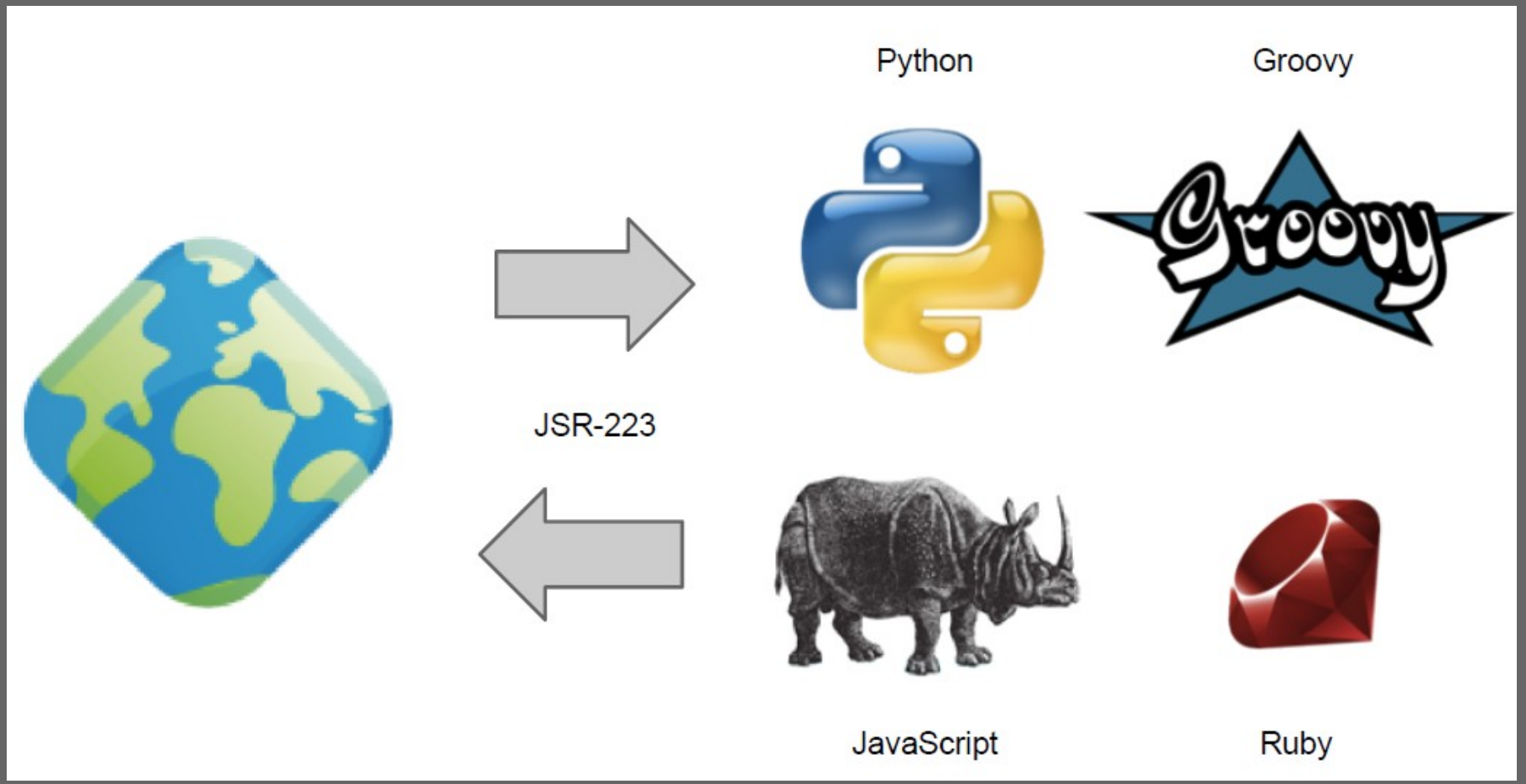
Importer

- Graphical Workflow for preprocessing data
- Copy over, optimize, publish and style



Scripting Processing (WPS)



More…

- QGIS Integration
- Vector Data Attribute Remapping
- Advanced Authorization Subsystem
- Circular Arc Support

The End

Questions?

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