Geological data Visualization, Interpretation, and Integration on the Base of GIS and LOD

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# Introduction

Geological data are accumulated, analyzed and converted into cartographic works (usually, maps), generalizing current data. The maps are the main result of geologists’ scientific research, but they cannot account the current state of the geological process. Understanding this issue, researchers created dynamic GIS based interactive resources (see a short review in [gladkov]) accounting seismic and volcanic events, allowing one to query the databases for the phenomena, constructing a cartographic work on request with the filtered data. However, the similar phenomena can be observed at different locations, as well as various conclusion can be drawn from the whole body of the analyzed observation.

The knowledge revealing natural laws of good quality are obtained on the base of mathematical models application to the known geological data. Nowadays technologies implementing computer simulation services are implemented as web processing services (WPS), e.g. [paramonov]. In order to support research activity, data integration between databases, cartographic services and should be implemented.

Since 2001, Semantic Web (SW) data publishing techniques are developing in the direction of information systems integration within internet and local area network. The technologies integrate the systems, whish design and implementation principles are varying drastically. The data to be published and acquired are accompanied with their metadata, allowing to develop of correct interpretation within the integration. A number of data format, processing procedures and interfaces have been developed, namely Resource Description Framework (RDF), Knowledge Graphs (KG), and SPARQL [bakg]. The flexibility of tools allow one to implement integration on various levels: databases, federated queries and document data [cherkashin].

The aim of the research is to raise the level of integration by introduction of the Linked Open Data (LOD) SW technologies into existing services of geological data publishing. This will allow to develop

requirements of the software (integrating LOD and GIS)

1. Web technologies. (Resulting in usage of leaflet-like software, i.e. web-GIS)
2. Service-oriented to lower coupling and higher integration within a module.
3. Integration should allow (weak) coupling with sematic data servers.

# Related works

In [iwaniak] a comprehensive review of projects is presented, notifying that there are too few number of projects integrating GIS and LOD data. Authors present an approach utilizing a desktop GIS to manage LOD datasets. The research is oriented on processing imported LOD data by the desktop GIS. Practical problems were solved, e.g., asserting new spacial relations between objects figured out by GIS modules. In later work [iwaniak2] of the authors’ collective the spatial relations are accounted by means special SPARQL UPDATE queries and WFS, a subsystem driven by experts is used to fix answers to user questions as RDF triples. The techniques of LOD data enrichment were refined to build new prototype recommender system, a subontology was developed to denote relationships between spacial objects and their LOD data in municipal economy domain. In [abid] a problem of publishing DBPedia objects referenced by spacial coordinates is considered. The publishing is carried out with three stages: mapping the coordinate to an object (a city) by Google Maps API v3; construct a SPARQL query finding celebrities, who born in the city; show the list of the results as HTML table with LOD references.

LinkedGeoData [lgd]

Ontologies WGS84 Basic Geo and GeoSPARQL allow one to interpret the spacial attributes for LOD objects [].

In conclusion, we note that the above mentioned projects deal with DBPedia and alike resources related to OpenstreetMap topological basis.

# Discussion

Spacial data inference within domain SPARQUL queries (are there any inference in SPARQL).

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