CZE State Mapping Generalization Efforts

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Late in 2015 we started 16-months initial generalization project intending to do cost saving in civilian scales 1:10 000 and 1:25 000 mapping production. Meanwhile we would like to prepare conditions for long term complex generalization project and extending to scales 1:50 000 and 1:100 000k later on.

We have investigated current State of the Art in this domain in Europe, exploiting EuroSDR research results, various ICA publications and ICA members interviews, local universities, software packages capability and more.

As a result, we got very simplified automated generalization history, mixing approaches, strategies and even producers and agencies from our perspective on the following schema:

Figure 1 Automated generalization approaches in Europe, simplified view

Since number personnel in our state mapping agencies dedicated to generalization research is limited to size below all other successful players, we decided to extend our ArcGIS cartographic line by three step generalization workflow. We believe that this effort allows us to use agile approach similar to Dutch/SwissTopo later in 2017+. Aside of this, we are still open to 1Spatial or similar solution for the "last tactical mile".

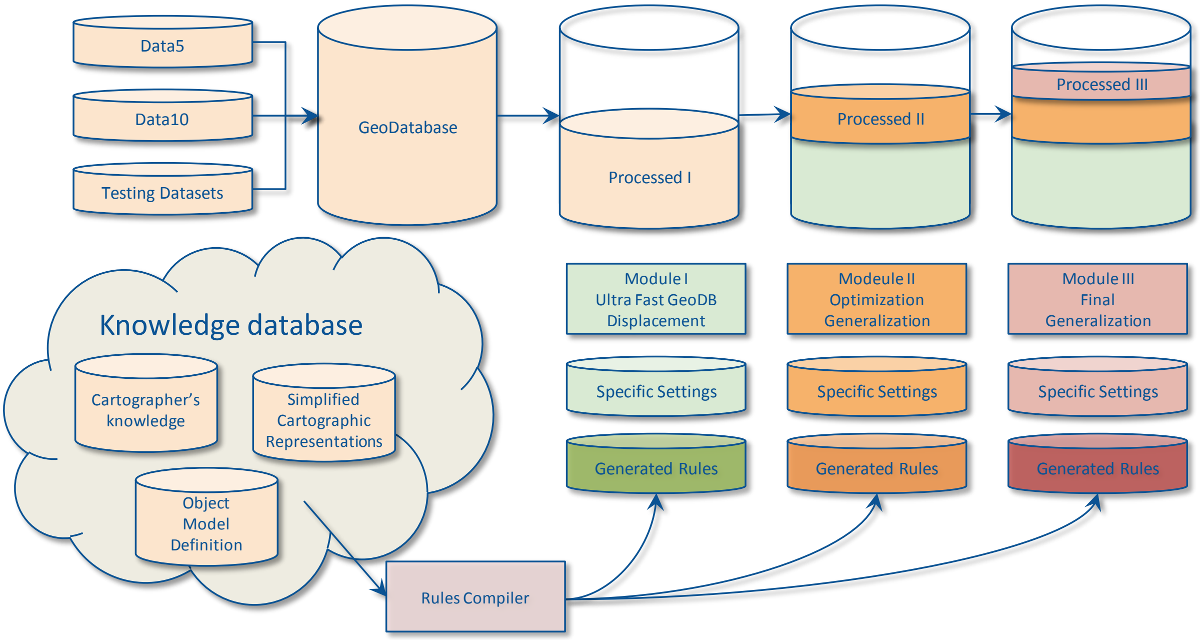


Figure 2 Multiple steps approach for 10k+25k automated generalization

Generalization ontology

We have collected large database of cartographer's knowledge used for civilian state mapping production. After deep search of all manuals and documentation available since the First Military Mapping[1] and interviewed manual cartographers as well. We incorporated it into digital form as a complex semantic web (ontology) with one vocabulary element representing every piece of knowledge, structured from cartographer's perspective as following:

- common rules
- cartographic representation dependent rules
    - 1:10 000
    - 1:25 000

This knowledge base is just fragment of larger generalization database, creating relations between elements when necessary for automation purposes. Another benefit is ability to derive automated processes specific parameters and enable harmonization in our state mapping.

[1] First Austrian military mapping, http://mapire.eu/en/map/firstsurvey/

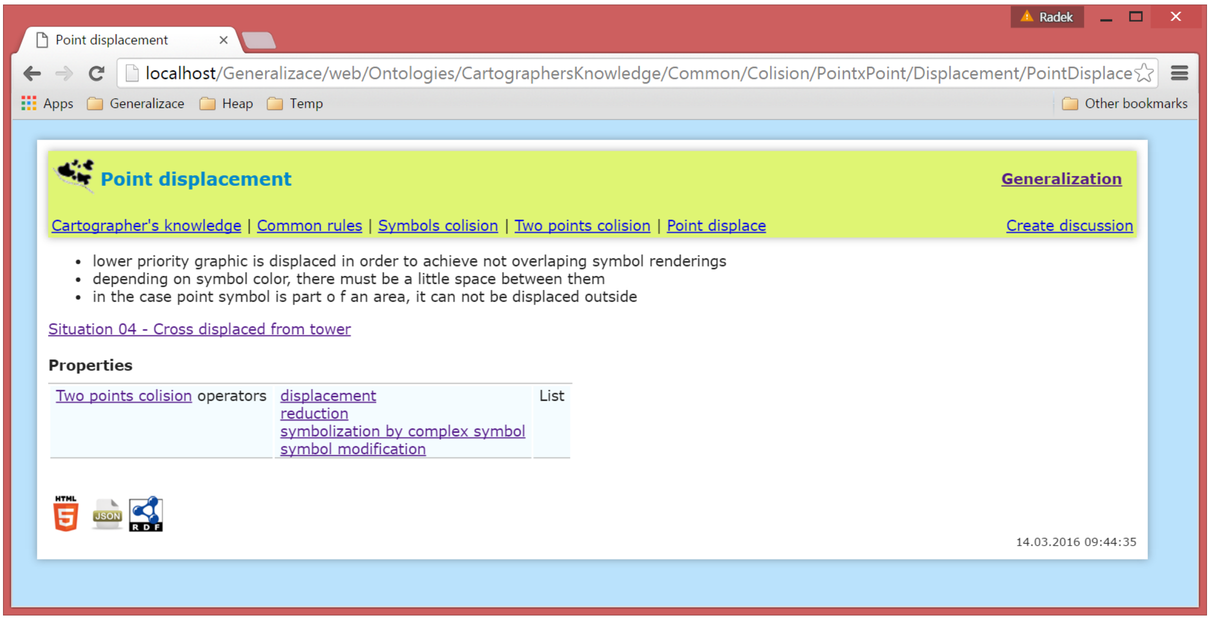
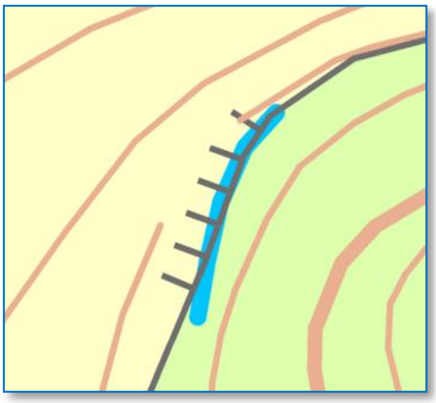


Figure 3 Simple cartographer's knowledge element captured in a hierarchical database[2]
Note in lower left corner that database is available in JSON and RDF formats

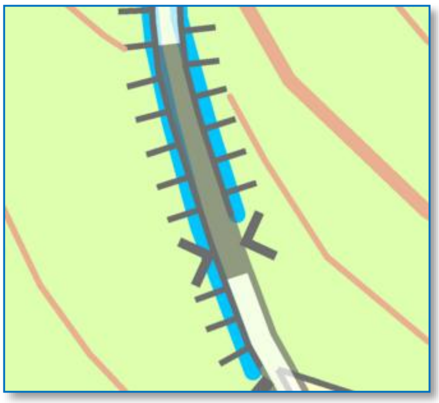
Why ontology?

Original reasons for using ontology to store configuration and rules was our paining lesson identified while moving from Soviet Style Military Mapping into the NATO Standards. Additionally we were influenced by ICA generalization ontology effort as well. Thus we decided to store information in ontology based vocabulary since very beginning due to expectation that later in the project we will be able to exploit formalized relations between entities and perhaps SPARQL powerful engine as well.

Imagine parallelization operation on the pictures below. This is the cartographer's perspective. He see four variants, each of them with his special name to be referred about. But automated generalization analyst, for him there are just two variants: first is snapping one geometry to another, second one is snapping it to some offset feature.

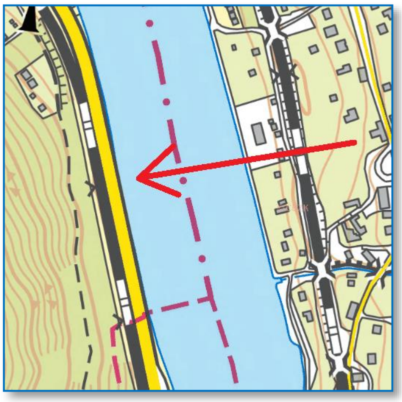


Geometries snapping

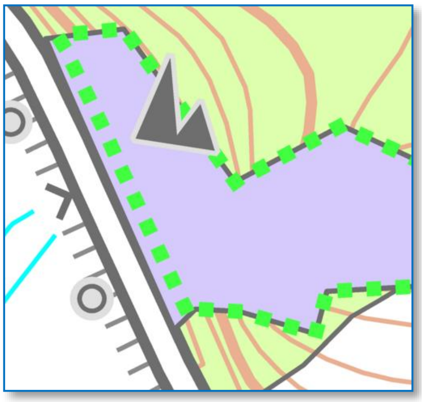


Rendering edges inner alignment

[2] Only this page translated to EN, database is in CZ



Rendering edges outer alignment



Rendering alignment with threshold

If we map these via ontology vocabulary, we receive base ready to make relations for automated processing.

Another example of promising ontology advantage is mapping between generalization operators and software registries on the pictures below.

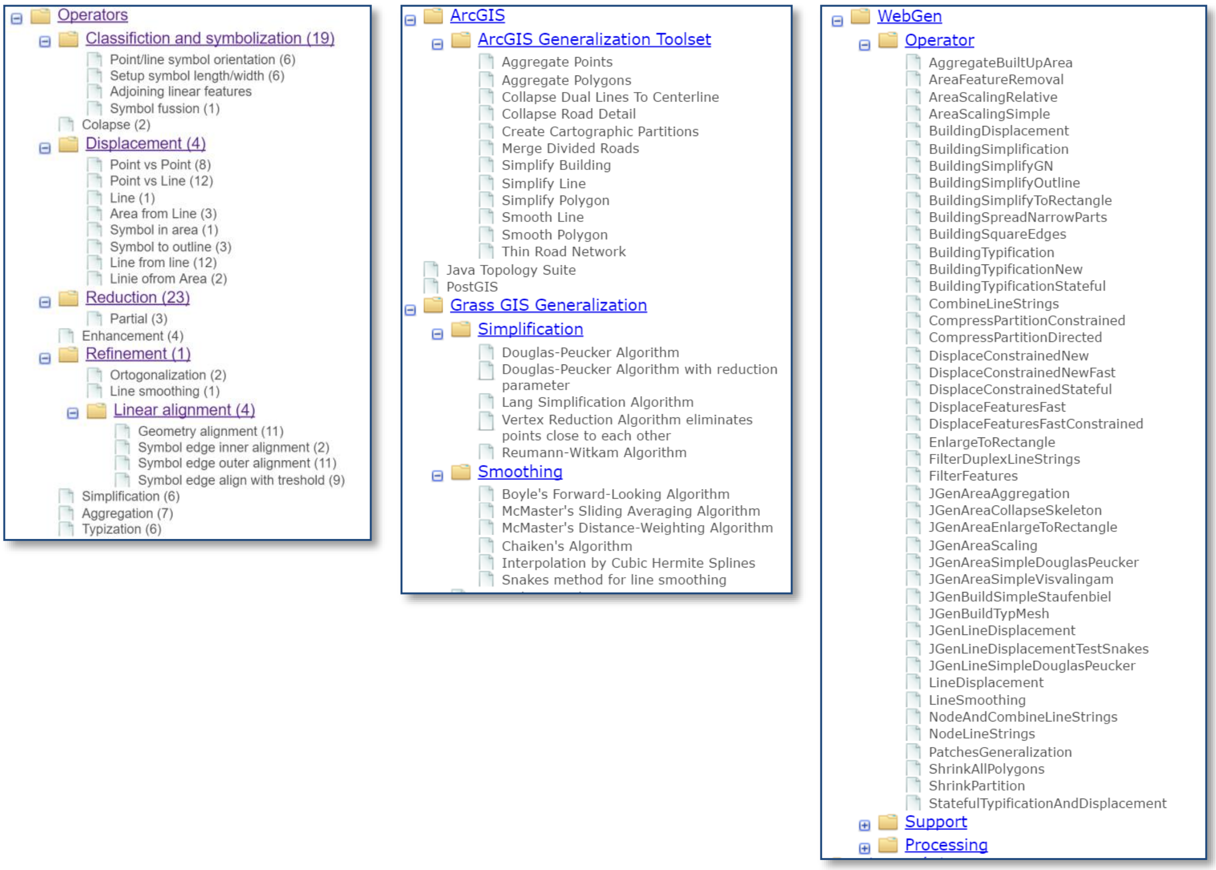


Figure 4 Multiple representation of generalization operators in ontology tree

Web Processing Services in use

Followed SwissTopo recommendation, we are developing against automated test cases. In our case, each of the prototype functionality in different environments is published via Web Processing Service as a unique WPS operation.

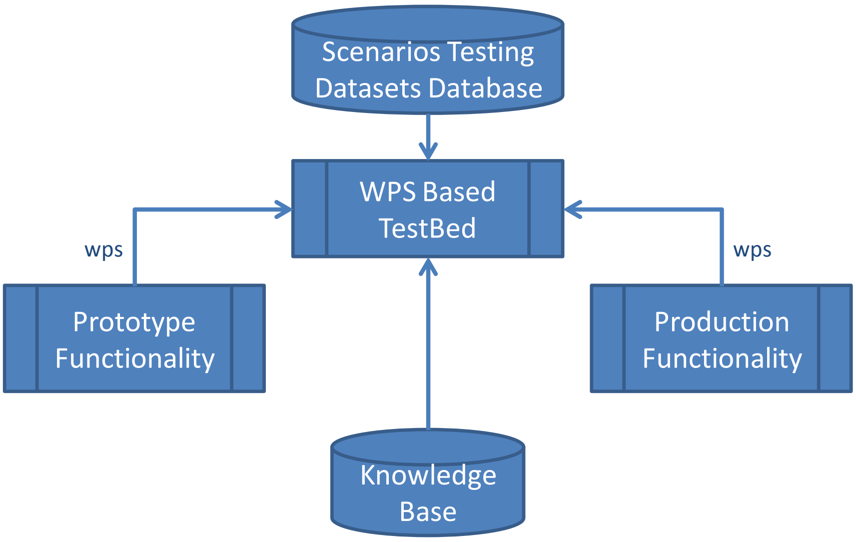


Figure 5 WPS Based TesBed

Once functionality is accepted as a prototype, it is upgraded to production version and published again. During this process, WPS testing helps to keep the quality. It allows us to fragment development team on granularity requested as well.

While WPS technology is very well suit to connect functionality on different machines, operating systems and programming languages, it is not ready to hand over with large datasets. Until now we are streaming to one single production environment, avoiding WPS. In case we still have a need to connect different systems, we will enhance WPS by database data handlers and use them rather than expanding data to GML, send over network, store to GeoDB and do opposite with operation results.

Conclusion

All of the activities above lead us to believe that for scales 10k+25k we are able to setup critical automated generalization processes with high cost save. Infrastructure built will enable us to follow Swiss/Dutch agile approach and be still open to more sophisticated commercial/academic solutions

Acknowledgement

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