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Spatio-temporal Semantic Modeling of Historical Content

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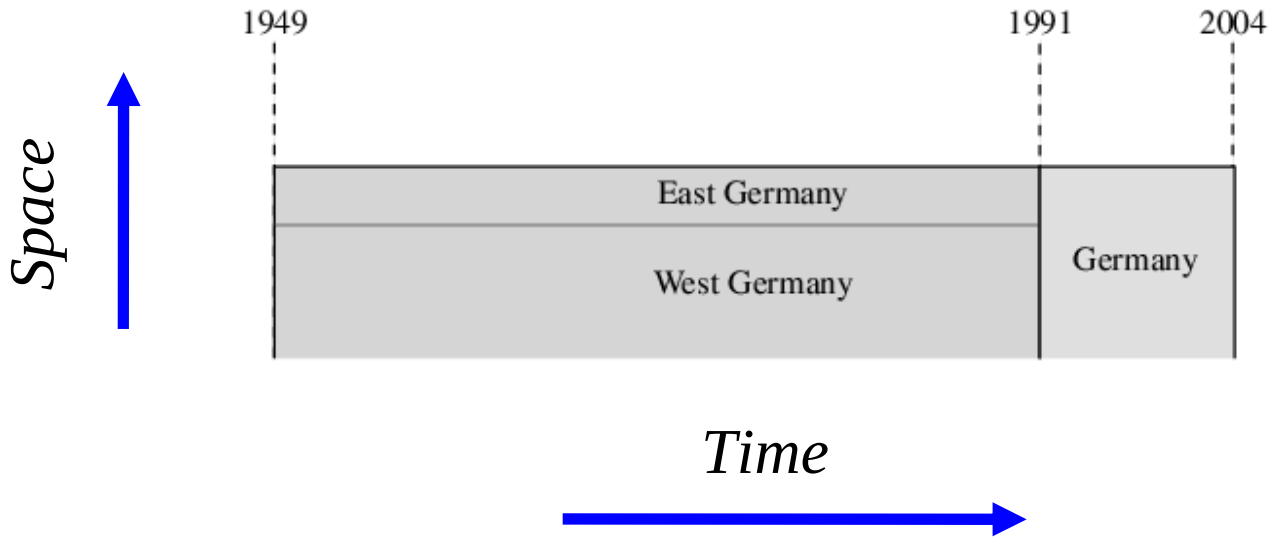
- **Research problem** is how to use changing and historical location names and concepts in indexing and retrieving cultural heritage data.
- **Geospatial regions** like countries and counties have split, merged and changed their names over time
  - annotation and query concepts are not necessarily matching.
- **Goal** is to provide a spatiotemporal model of ontological change to solve the mapping problem between query and annotation concepts.
- **Result** is a method for reasoning over geospatial changes in time.

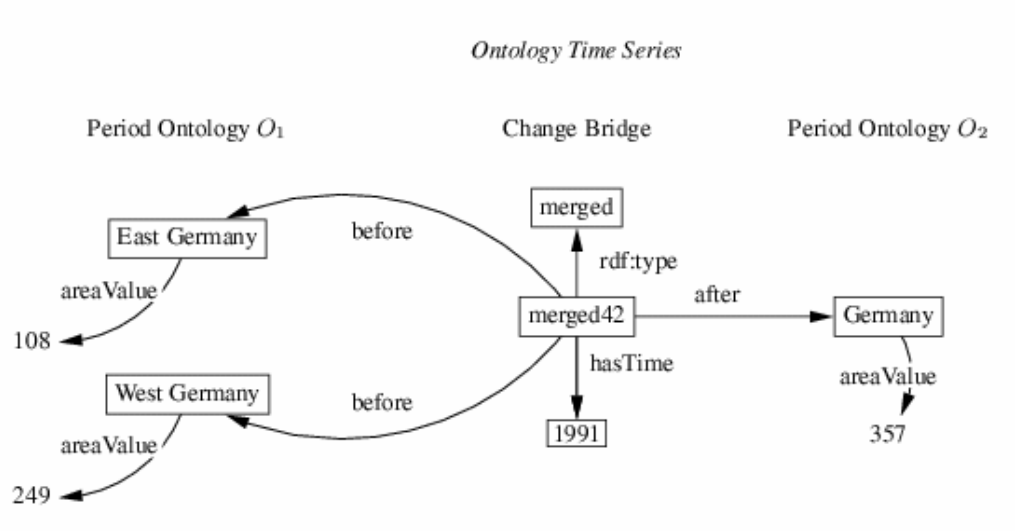
An example

- **Problem: Due to changes in geographic regions, annotation of items in museums and libraries is hard.**
  - **An example: East Germany and West Germany were *merged 1991 to form* Germany.**

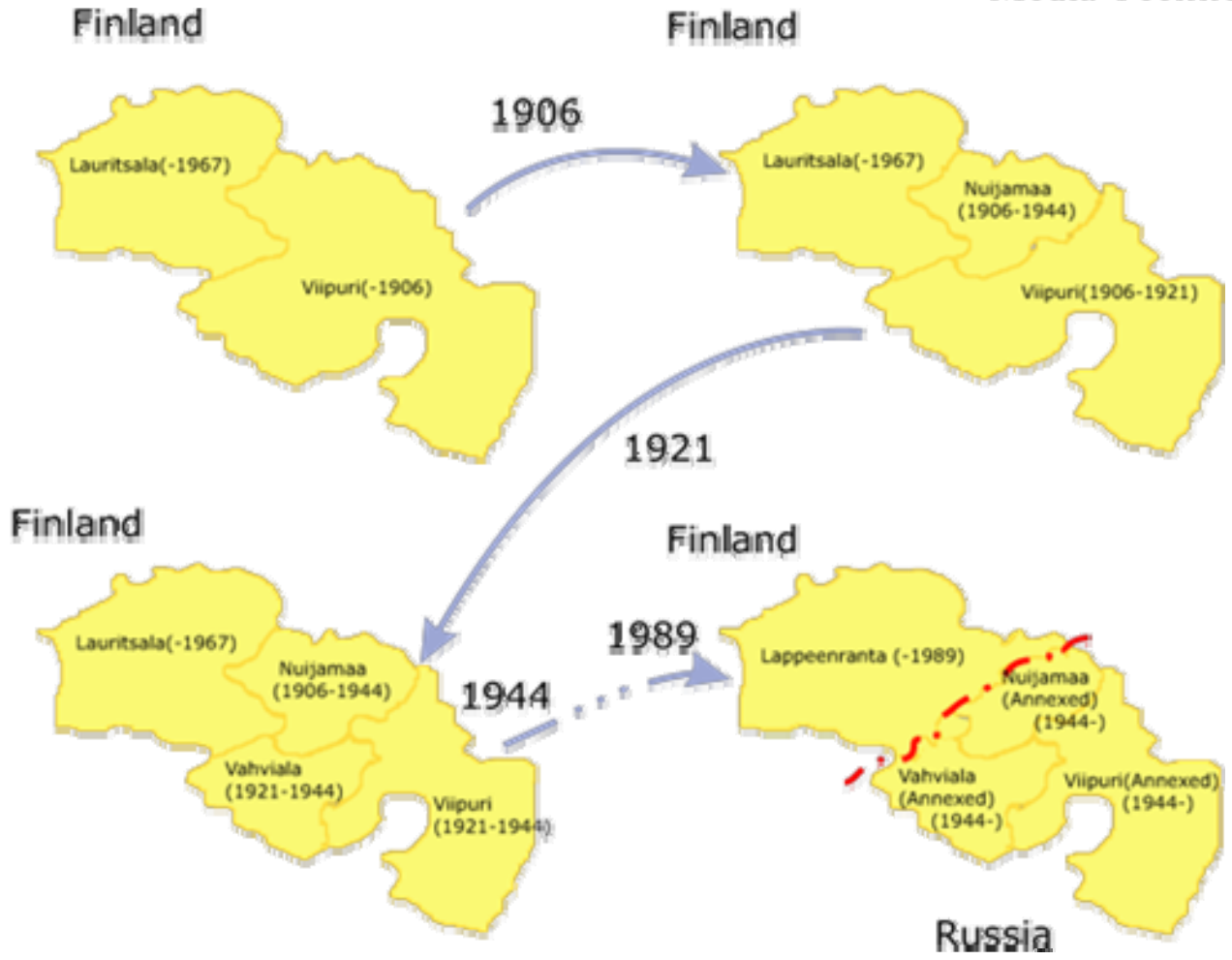


An example

- **Solution: Changes in regions are bridged using Semantic Web -technologies and modeled as an ontology time series**
  - **An inference engine reasons about coverages between the temporal regions of the ontology**



An example of changes in Finnish regions

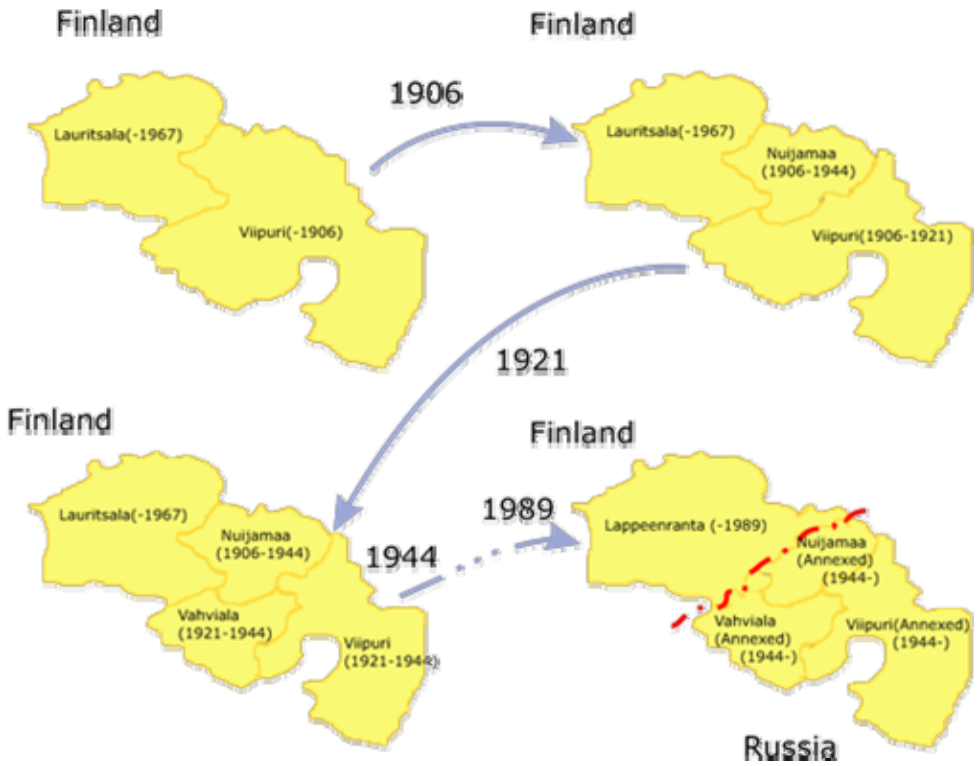


An example of changes in Finnish regions

- Changes around **Lappeenranta** and **Viipuri** region from **1906** until today

An example:

- **Viipuri (-1906)** was split in **1906** to **Nuijamaa (1906-1944)** and to **Viipuri (1906-1921)**



Features of the *OntoFlux*-method

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- **Changes are defined as a Semantic Web ontology.**
- **Each region has an own identifying URI.**
- **Changes are bridged using specific change mappings, "**change bridges**":**
  - ***merged, split, usedtobe, ...***
- **Change bridges are transformed automatically to a local coverage graph and then to a global coverage graph.**
- **An inference engine reasons about local and global coverages between regions.**
  - **Lappeenranta (1989-)** ***covers 12% of Viipuri (-1906).***

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Phases of the *OntoFlux*-Method

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- The method has the following phases:

1. **Local Bridges.** Changes are modeled as instances of basic change classes such as split and merged.
2. **Local Coverings.** The bridges represented in RDF are transformed into a form where the local coverings are made explicit using the sizes of geospatial resources.
3. **Global Coverings.** Global overlaps are calculated by chaining local coverings and by considering different change paths between concepts.
4. **Visualization** of global coverings.

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Example (SAPO)

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- **Method (*OntoFlux*) is applied to construct a "Finnish temporal region ontology (SAPO)"**
- **From the beginning of 20th Century, there are over 1100 changes (merges, splits, name changes, …) in Finnish counties.**
  - ***Changes are collected by Geological Survey of Finland.***

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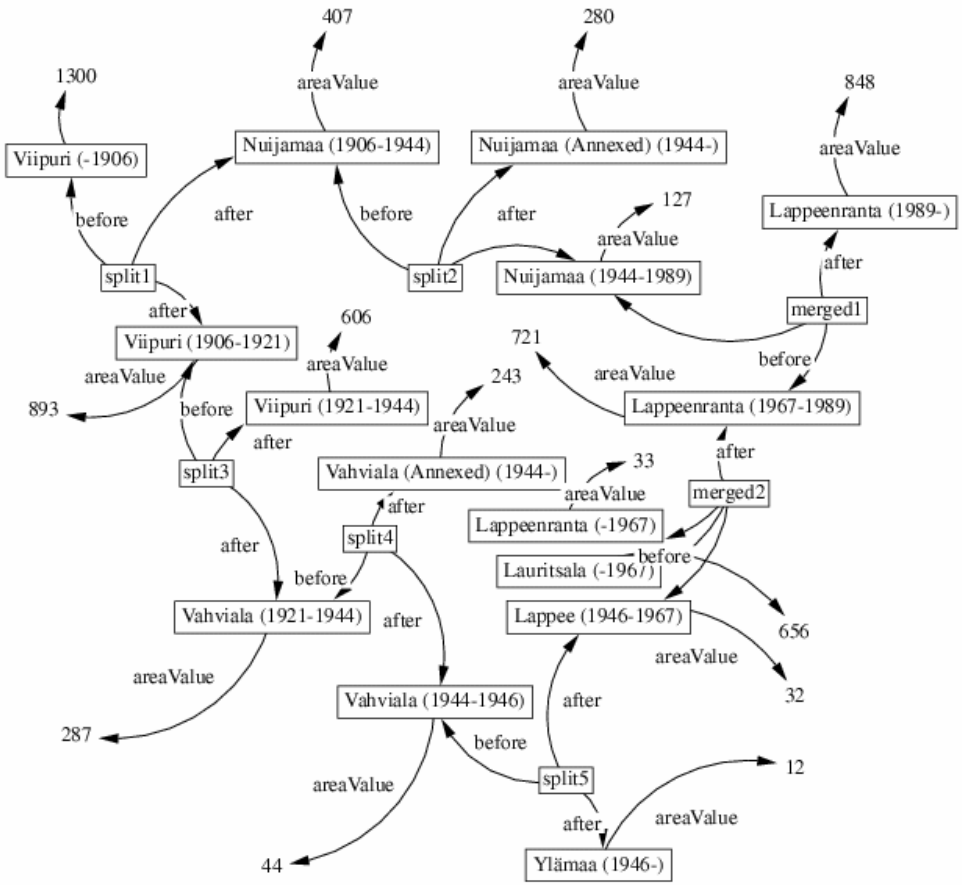
Changes bridged using Semantic Web-technologies



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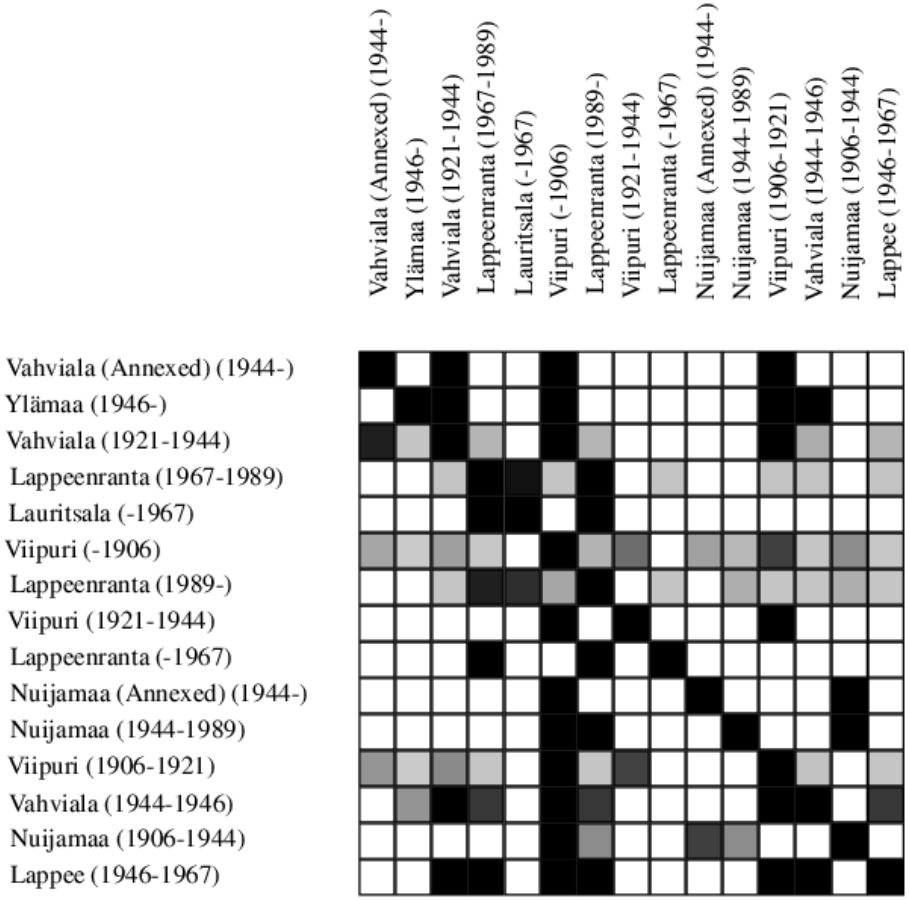
Coverages visualized



- Shades of grey indicate the **level of coverage**: the darker the box, the higher is the coverage.
- The black color indicates a full **100% coverage** between the SAPO regions and the white color a **0% coverage**.
- From this illustration it is easy to see the **mutual asymmetric coverages** between the regions

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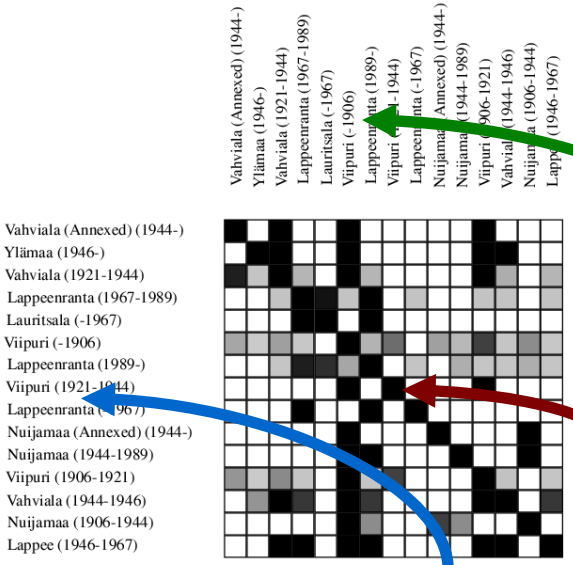
Method used to improve searches

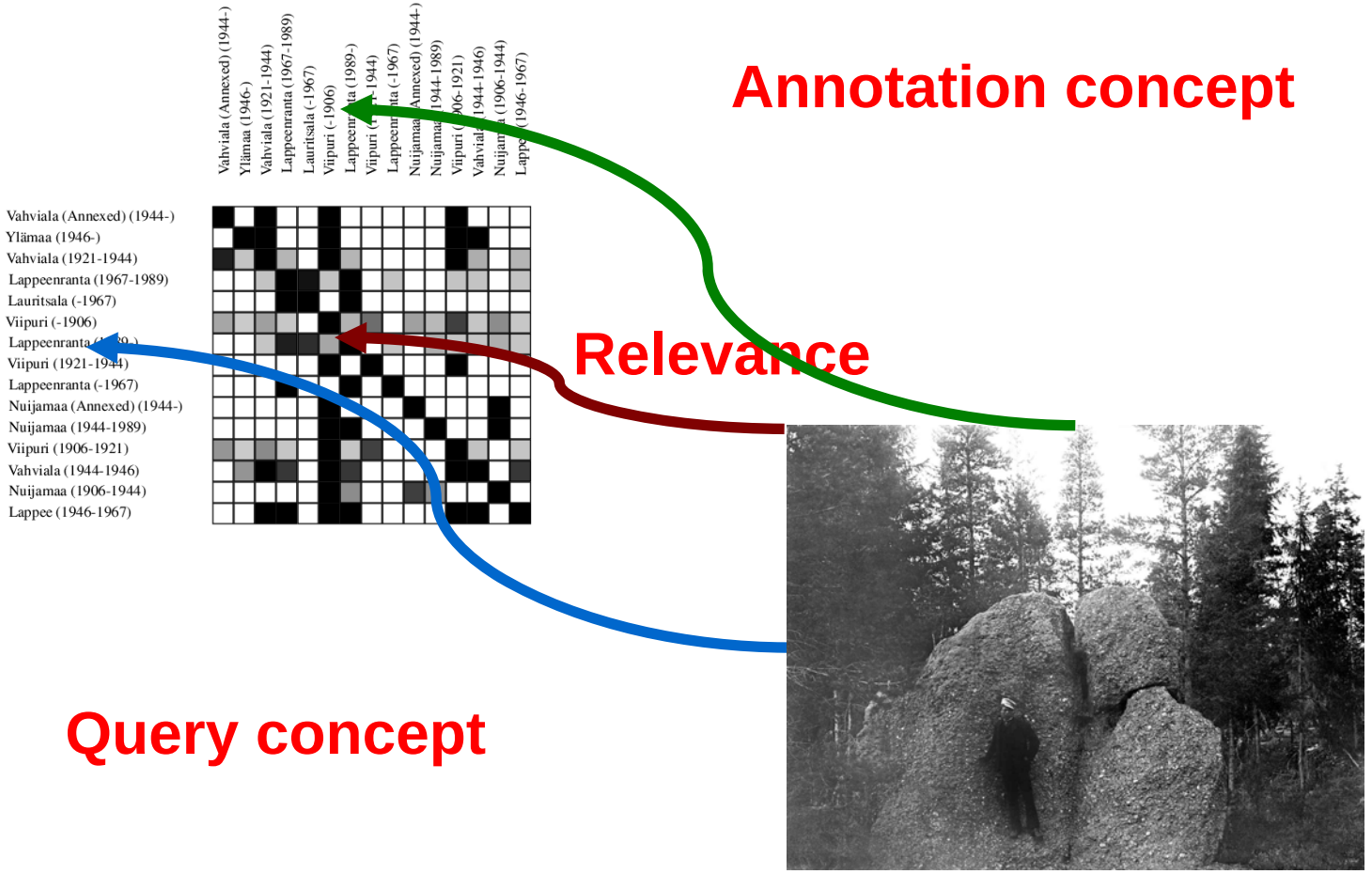


Annotation concept

Relevance

Query concept

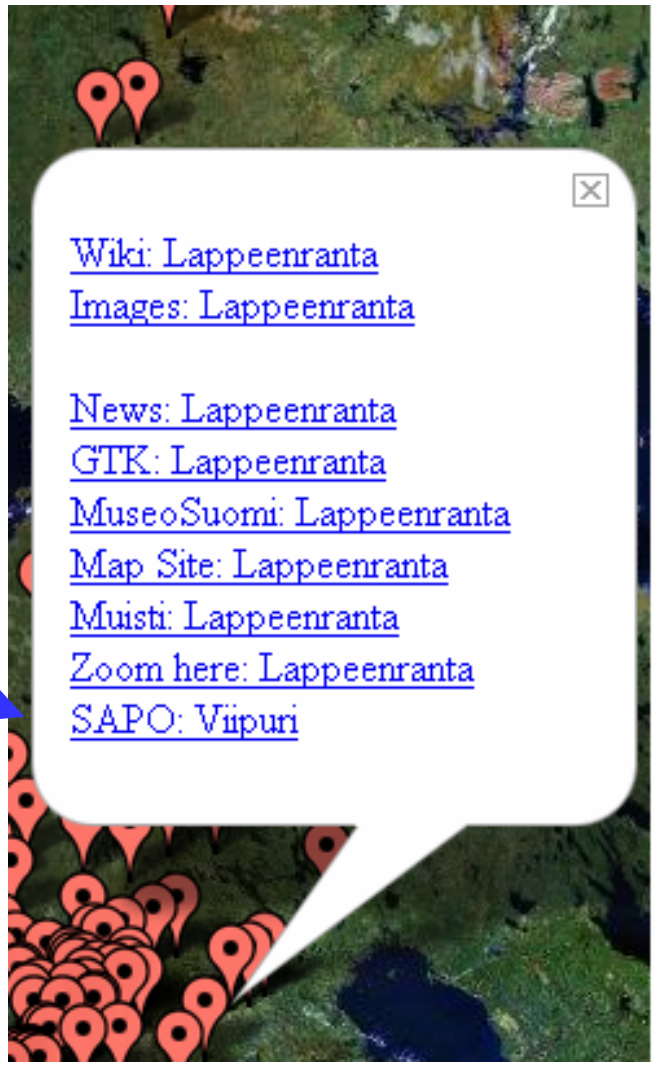
Method used to improve searches



Method used to improve searches

A demonstration about a **”metasearch”** based on the presented method OntoFlux, Google Maps, MuseumFinland and several other search engines

Method used to improve searches



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An old place **Viipuri** is found in the search

Valmistuspaikka > ... > **Viipuri** (2),
Valmistuspaikka > ... > **Viipuri** (2),
Käyttöpaikka > ... > **Viipuri** (6),
Käyttöpaikka > ... > **Viipuri** (6),
Käyttäjä > ... > **Viipurin** linja-autoase
Kokoelma > ... > **Viipurin** museo:kirk
Kokoelma > ... > **Viipurin** museo:vaa

Esinetyyppi (koko luokittelu) (ryhmittele
astiat ja taloustarvikkeet (3),
pukineet ja tekstiilit (11), säilyttimet (2
valaisuun käytettävät esineet (1),
sisustus (1)

Materiaali (koko luokittelu) (ryhmittele
materiaalit (17)

Valmistaja (koko luokittelu) (ryhmittele
henkilöt (12), yritykset (6)

Valmistuspaikka (koko luokittelu) (ryh
Eurooppa (16)

Valmistusaika (koko luokittelu) (ryhmitt

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Acknowledgemens

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References

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- Tomi Kauppinen and Eero Hyvönen. Modeling Coverage Between Geospatial Resources. In 2nd European Semantic Web Conference ESWC2005, Heraklion, Crete, May 29 - June 1, 2005. Best Poster Award ESWC2005

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