

Developing geospatial ontologies: SUO and SAPO ontologies

XML Finland 2009

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Acknowledgements

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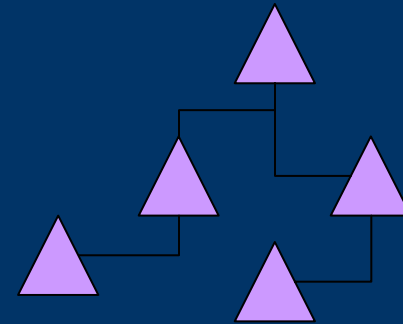
Acknowledgements

Work has been done by

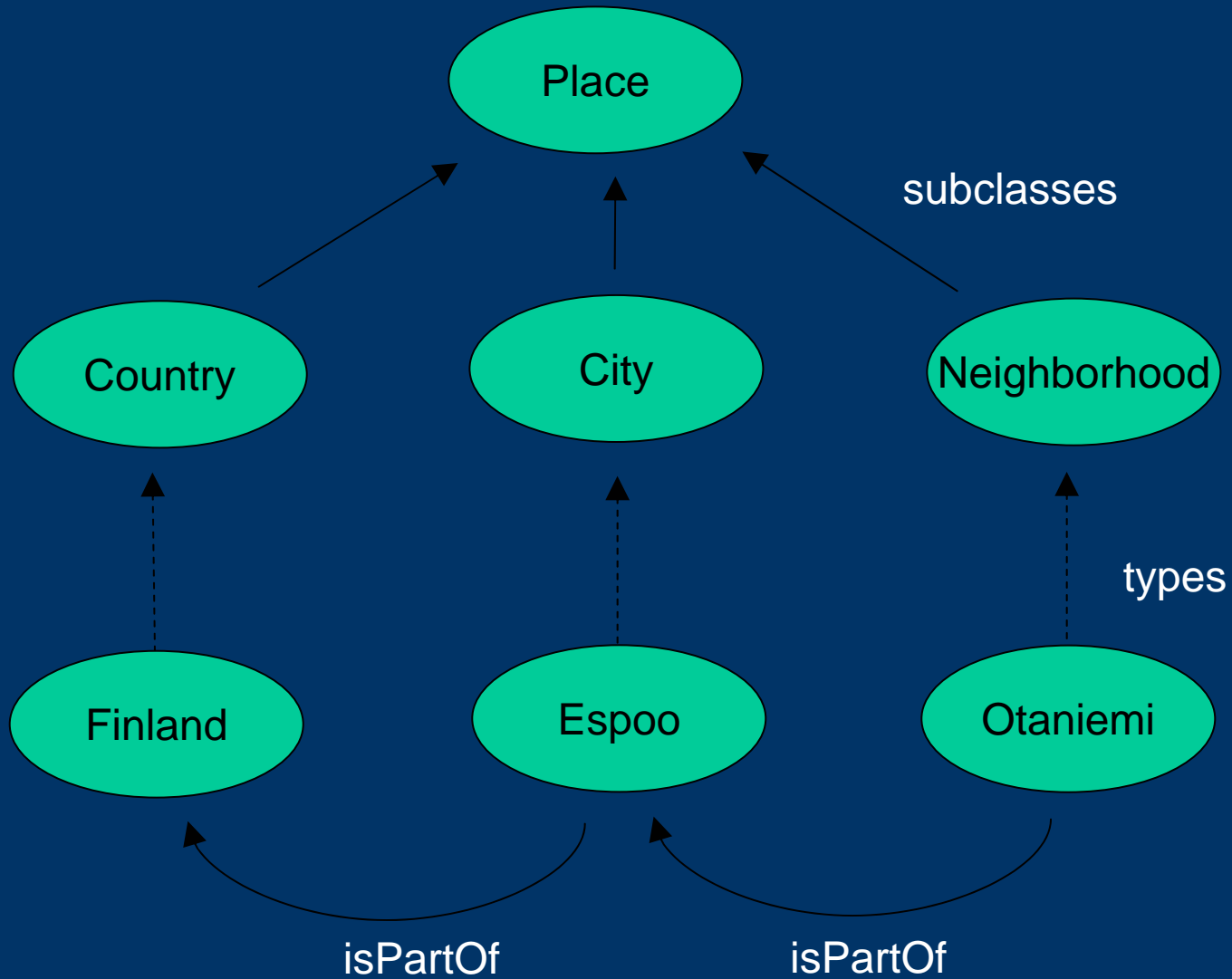
- Tomi Kauppinen
 - Riikka Henriksson
 - Robin Lindroos
 - Kimmo Puputti
 - Jari Väätäinen
 - Jouni Tuominen
 - Kim Viljanen
 - Reetta Sinkkilä
 - Eero Hyvönen
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Why it is hard to find correct information?

- Information retrieval from the web – how to find place related resources? e.g. hotels in Paris
 - Place names are not unique
 - e.g. Isosaari (496)
 - Place names may have other meanings
 - e.g. Turkey
 - Places may have variant names
 - Beijing – Peking, New York – Big Apple
- Need for geo-ontologies
 - What are the top-level, middle-level and lower-level concepts?
 - e.g. place, area, region, location, position, etc.

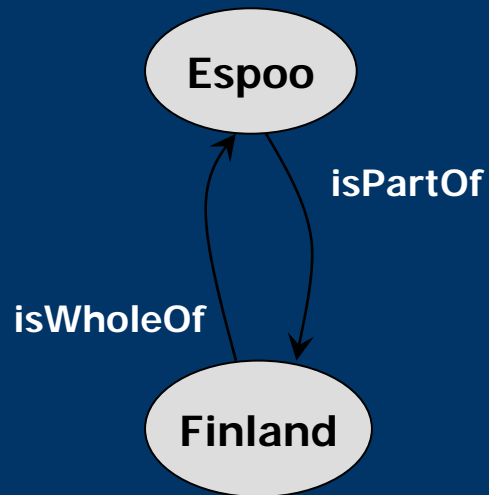


What is geo-ontology?

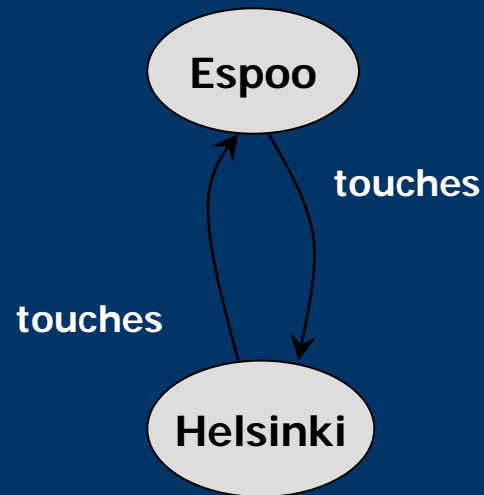


Ontological Representations Are Needed

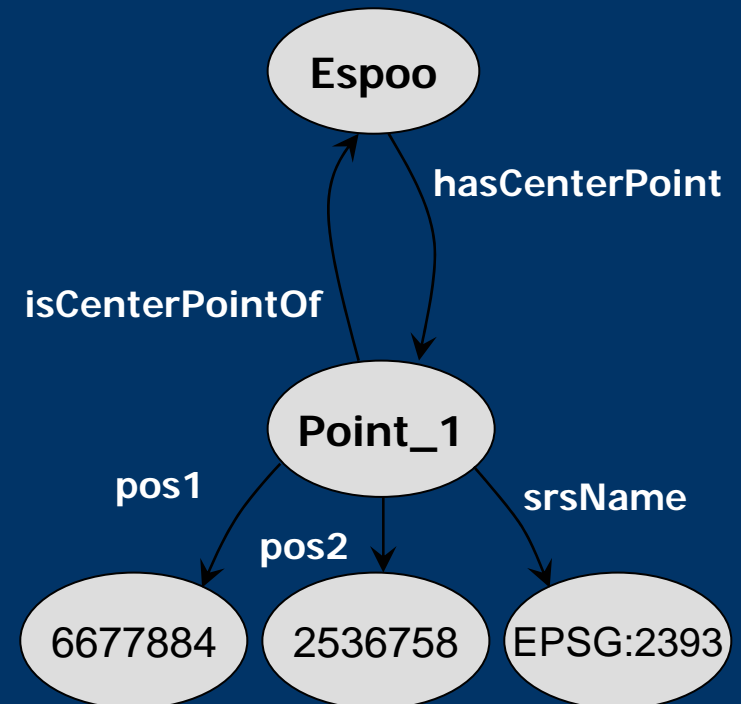
- Mereology



- Topology



- Geometry



Spatial relations

Topology

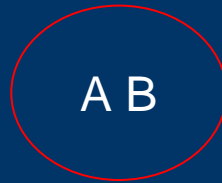
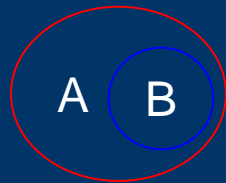
equals, disjoint, intersects, touches, crosses, within, contains, overlaps



A disjoint B



A contains B

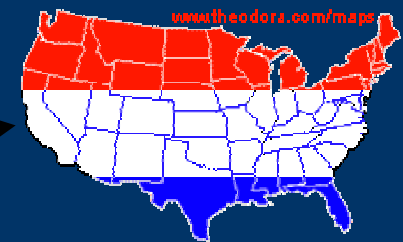


A equals B

Mereology

isPartOf, isWholeOf

isPartOf

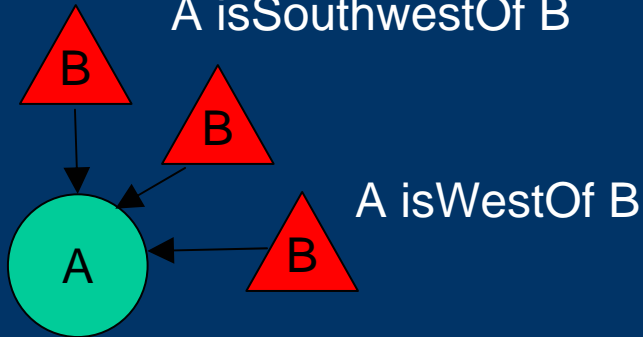


Spatial relations

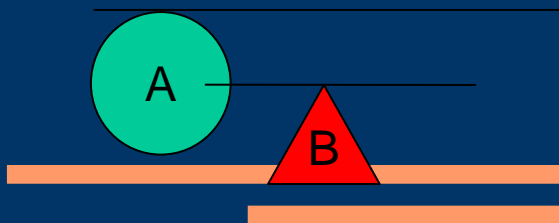
Directional	isSouthOf, isSouthWestOf, isWestOf, etc.
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A isSouthOf B

A isSouthwestOf B



eg. A isNorthOf B

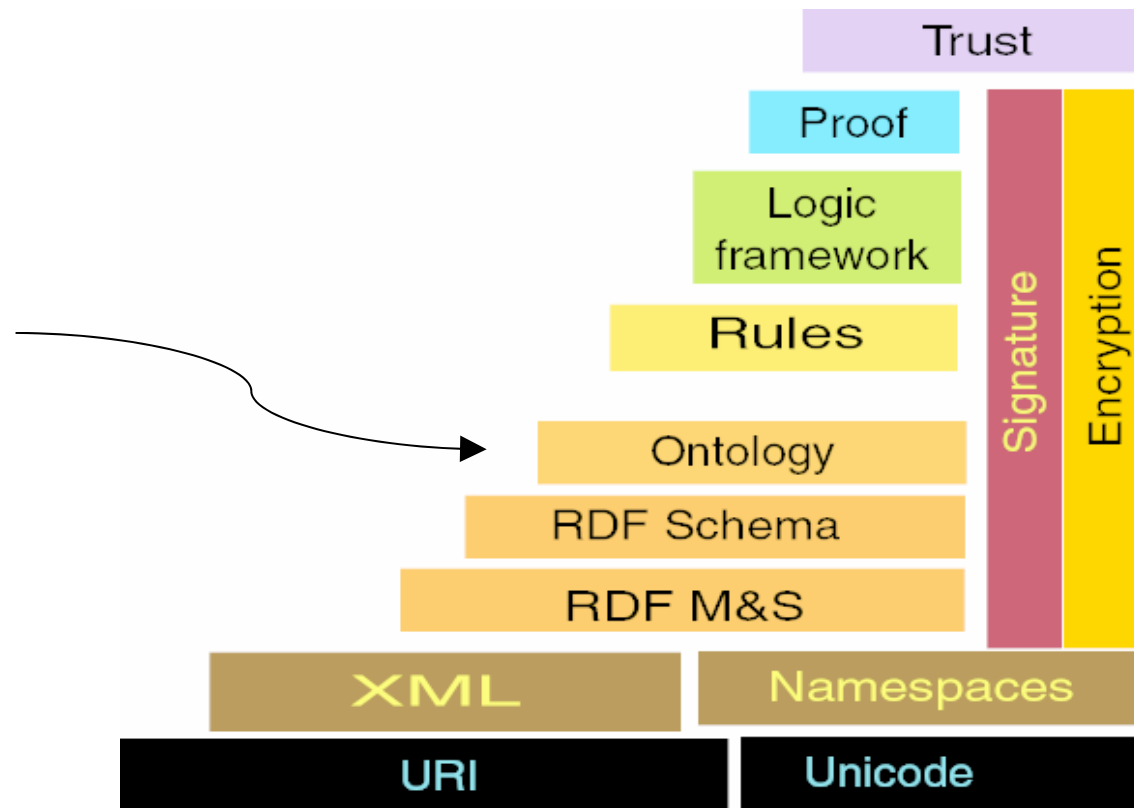


Distance	Quantitative distance
	Qualitative distance



Status in geo domain

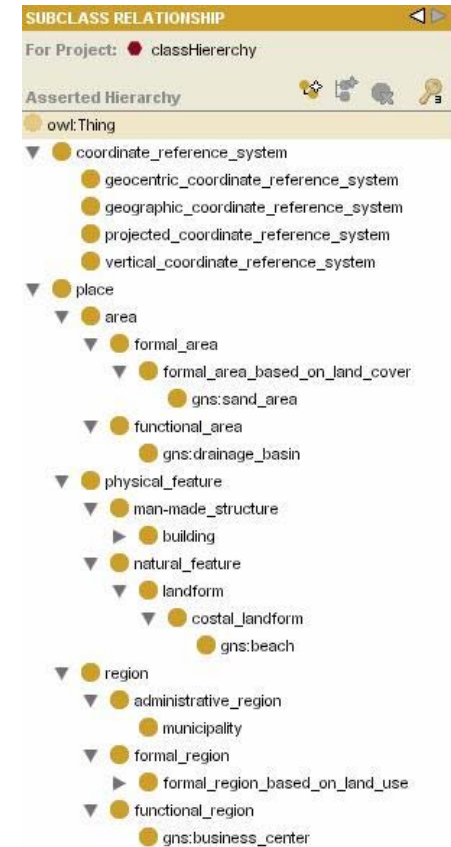
**NOW:building
and sharing
geo-ontologies**



(Tim Berners-Lee, W3C, 2003)

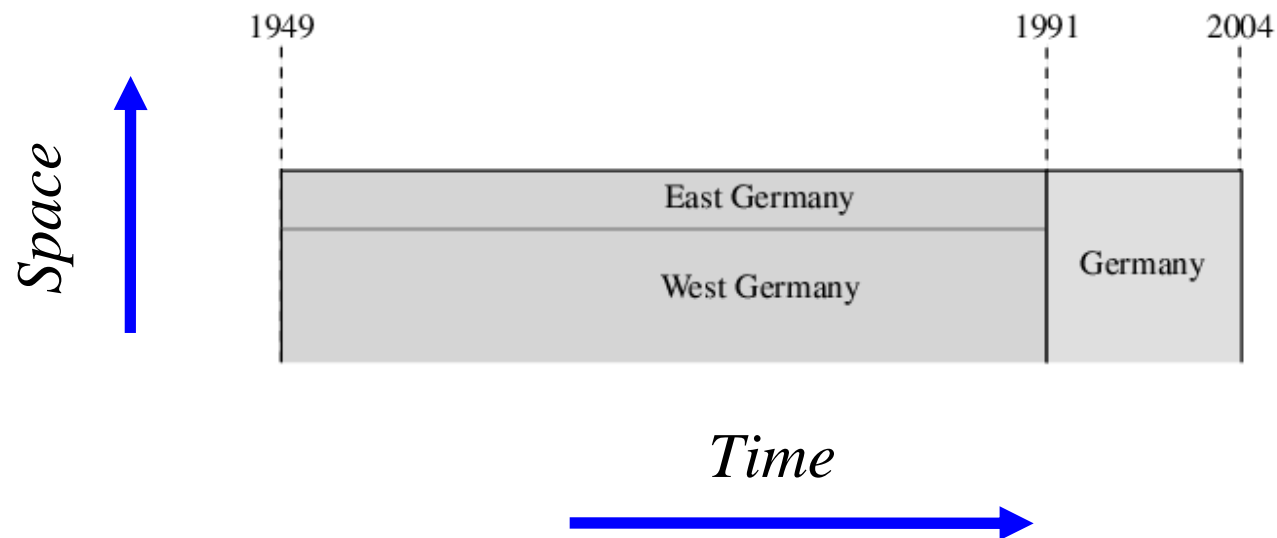
Finnish geo-ontology SUO

- 821 classes
 - Related to places
 - Natural and man-made
 - Related to geometric objects
 - e.g. point, curve, polygon
 - Related to coordinate reference systems
 - e.g. geocentric and geographic coordinate systems
 - e.g. datum and ellipsoid
- Properties
 - Mereological relations (e.g. isPartof)
 - Topological relations (e.g. crosses)
 - Geometry-valued (e.g. isCenterPointOf)
- Instances
 - From Place Name Register and GEONet Names Server

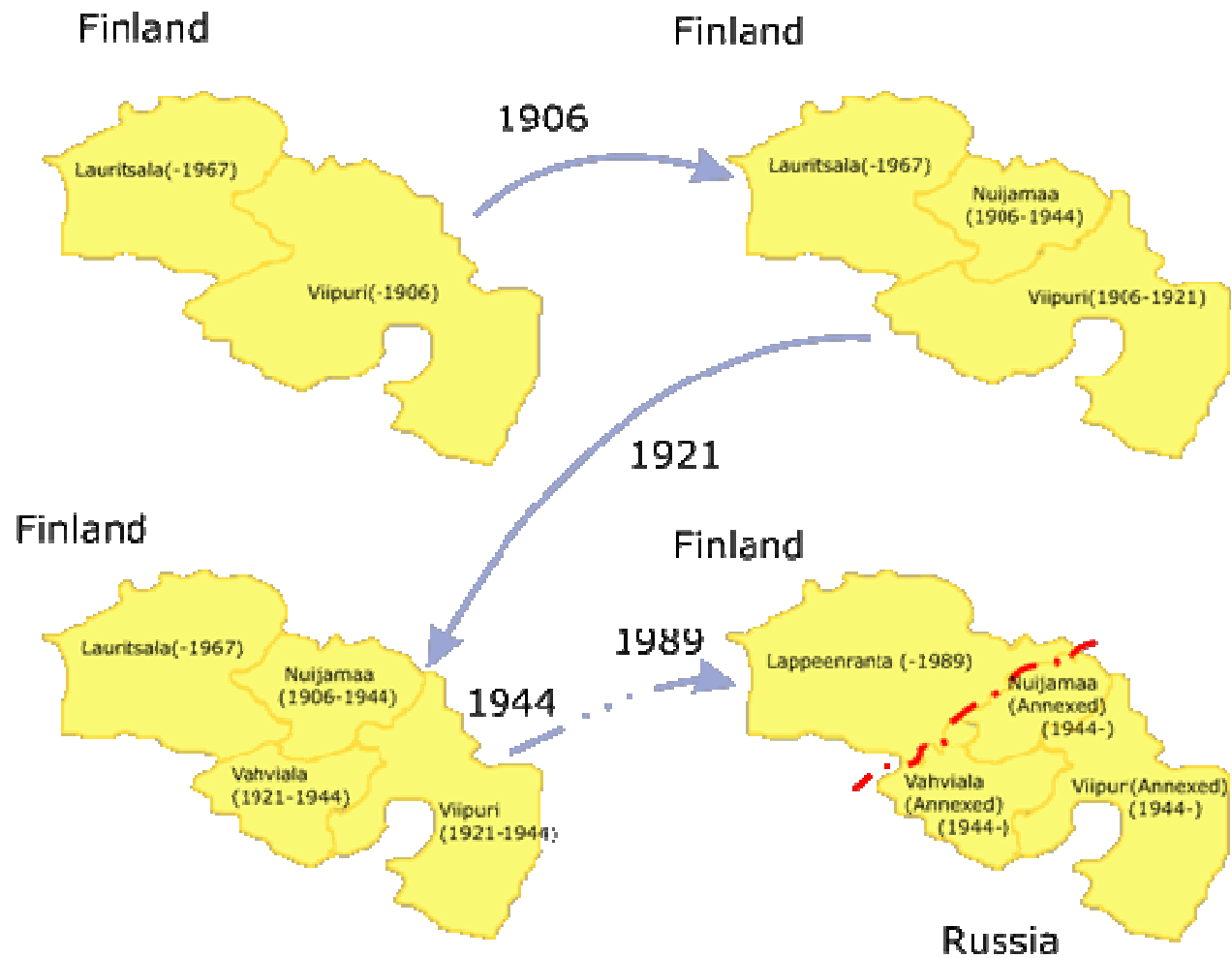


Why also time in geo-ontologies?

- **Locations change over time**
 - An example: East Germany and West Germany were *merged 1991 to form Germany*.



SAPO: Finnish Spatio-temporal Ontology

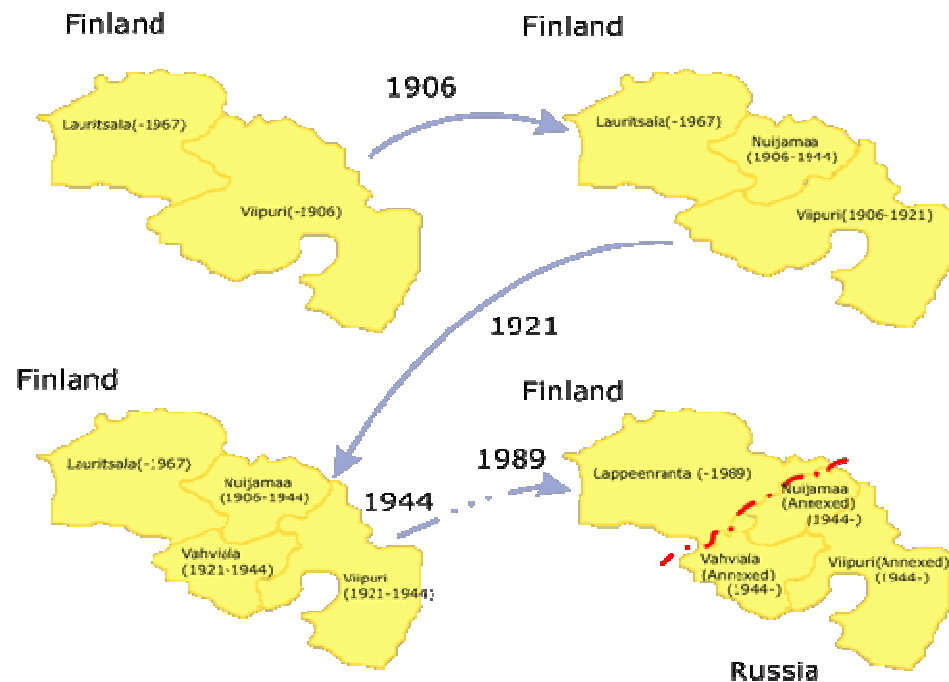


An example of changes in Finnish regions

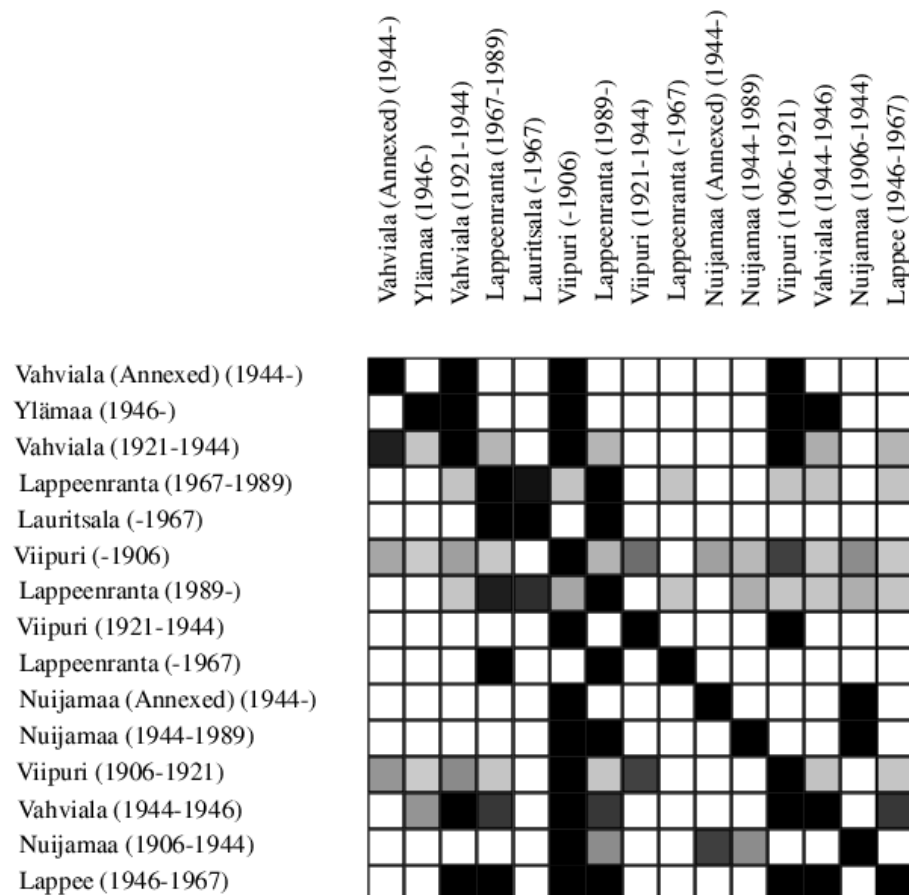
- Changes around **Lappeenranta** and **Viipuri** region from **1906** until today

An example:

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



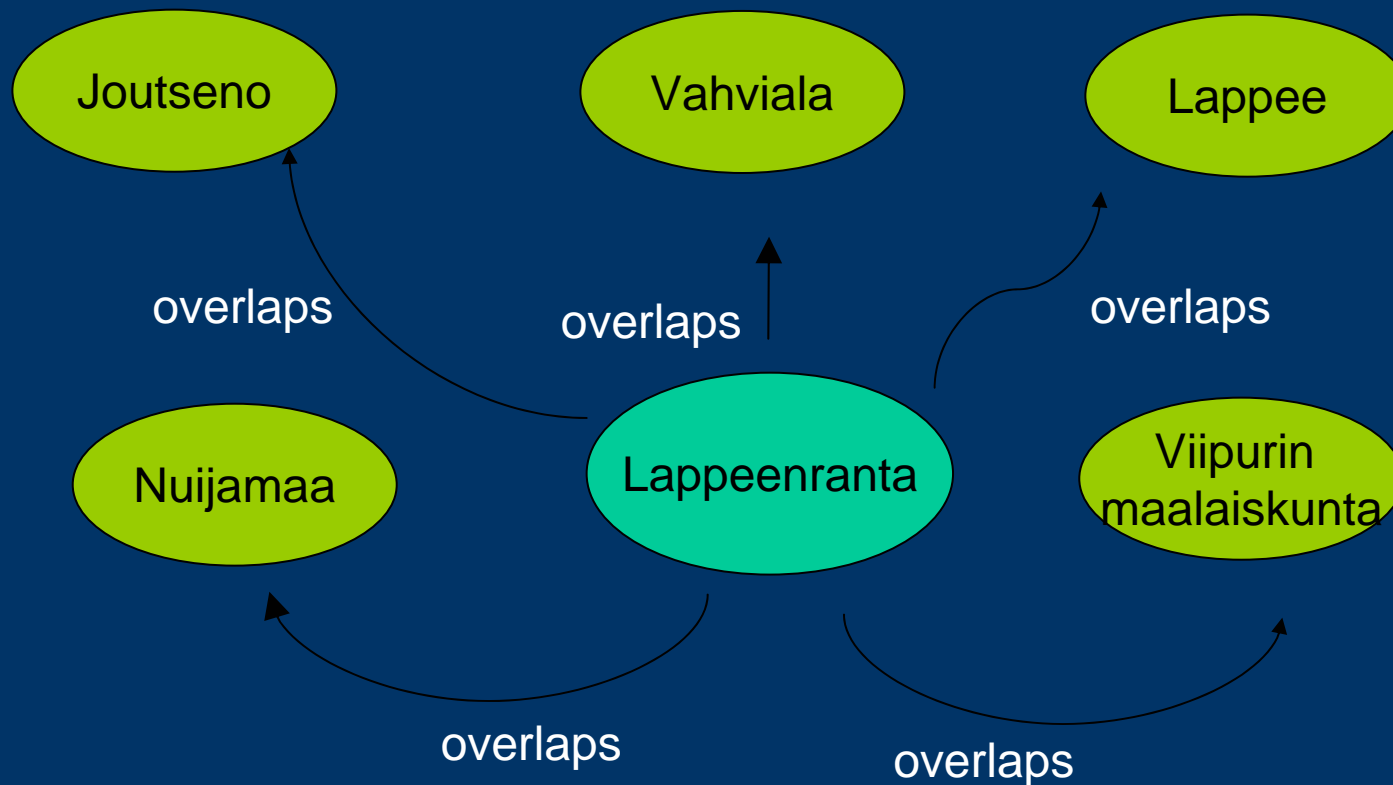
Coverages visualized



- 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

Query expansion with SAPO

- A user queries with Lappeenranta:
- The system suggests also Vahviala, Lappee et cetera



SAPO: A Finnish Spatio-temporal ontology

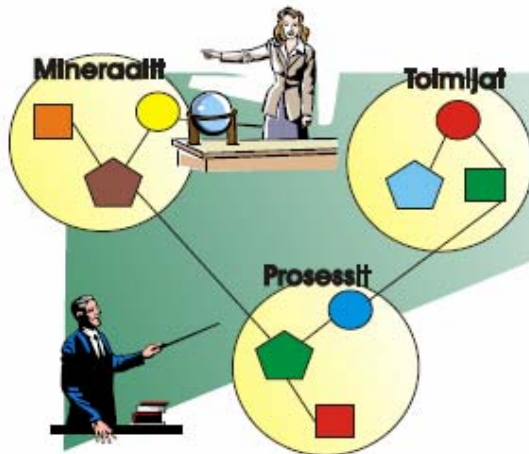
- Complete change history of Finnish municipalities (1865-2009)
- Coordinates and boundaries of most of the municipalities



2. Ontology Services & User Groups

1. Ontology Developers

- Collaborative development of interdependent ontologies
- Versioning and support for updates



2. Information Searchers

- Support concept-based search
- Keyword disambiguation
- Finding the right search concepts

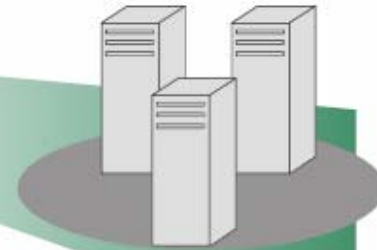


Nokia:
company or city?

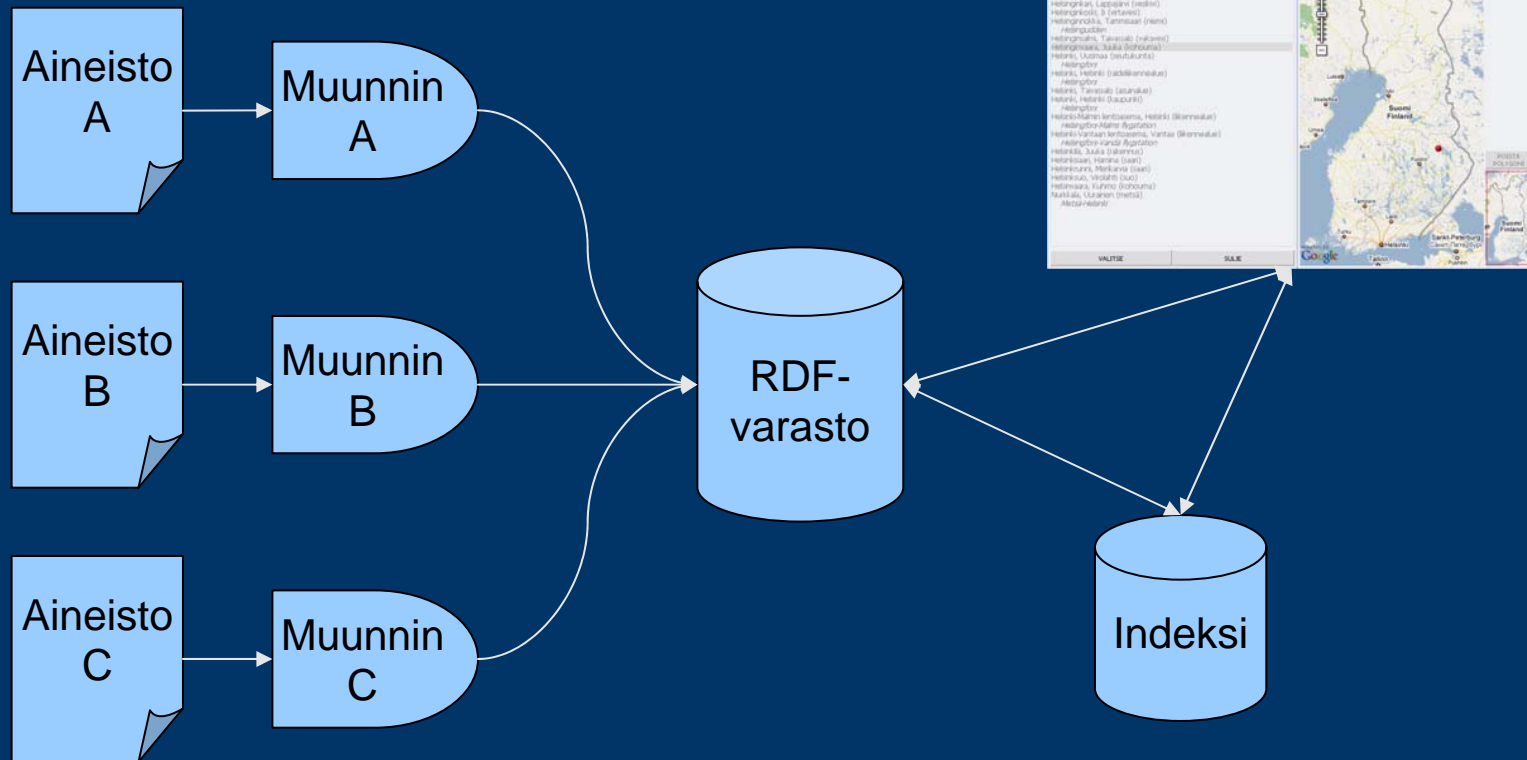


2. Information Indexers

- Support indexing concept finding
- Keyword disambiguation
- Support indexing patterns



Solution for finding place concepts: ONKI-Geo



ONKI-GEO

- finding
place names
made easy

Paikkahaku käli - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://demo.seco.tkk.fi/paikkahaku/

Customize Links Free Hotmail Windows Marketplace Windows Media Windows

Paikkahaku Semantic Computing Research Group (SeCo)

Paikan nimi
Pyhäjärvi

Rajaus paikkatyyppin mukaan +

Rajaus kielen mukaan +

Rajaus ajan mukaan +

HAKUTULOKSET (10)

- Pyhäjärvi, Pelkosenniemi (asuinalue) zoom
- Pyhäjärvi, Pelkosenniemi (rakennus) zoom
- Pyhäjärvi, Kittilä (rakennus) zoom
- Pyhäjärvi, Pelkosenniemi (vakavesi) zoom
- Pyhäjärvi, Kittilä (vakavesi) zoom
- Pyhäjärvi, Kittilä (vakavesi) zoom
- Pyhäjärvi, Enontekiö (vakavesi) zoom
- Pyhäjärvi, Savukoski (vakavesi) zoom
- Pyhäjärvi, Kittilä (vakavesi) zoom
- Pyhäjärvi, Enontekiö (vakavesi) zoom

Valitse Sulje

Haun rajaus kartalla POISTA POLYGONI

Map Satellite Hybrid

Suomi Finland

Skellefteå Umeå Rovaniemi Tampere Turku Helsinki Санкт-Петербург

POWERED BY Google MapData ©2007 TeleAtlas - Terms of Use

Done

ONKI-Geo includes following materials:

Aineistokoodi	Aineisto	Paikkainstanssien määrä vuonna 2008
A0001	maailma	1
A0002	maanosat	7
A0003	valtiot	194
A0004	Suomen läänit	6
A0005	Suomen maakunnat	20
A0006	Suomen seutukunnat	77
A0007	Suomen kunnat	415
A0008	Paikannimirekisteri	n. 800 000
A0009	GEOnet Names Server	n. 4 100 000
A0010	Geographic Names Information System	n. 2 000 000
A0011	Suomen ajallinen paikkaontologia	n. 650

Utilizing place concepts



Figure 6: A searchable map interlinked with the semantic portal MuseumFinland.

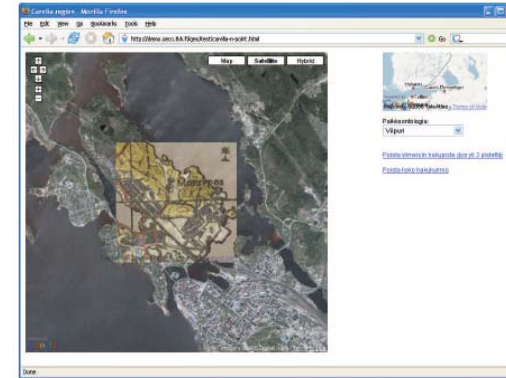


Figure 4: Using multiple maps simultaneously. A historical Karelian map depicting the park of Monrepos in Viipuri is shown semi-transparently on top of a modern satellite image provided by the Google Maps service.



Figure 5: Search results using the n-point search: Viipuri, Koivisto and Maksilahti are matched.

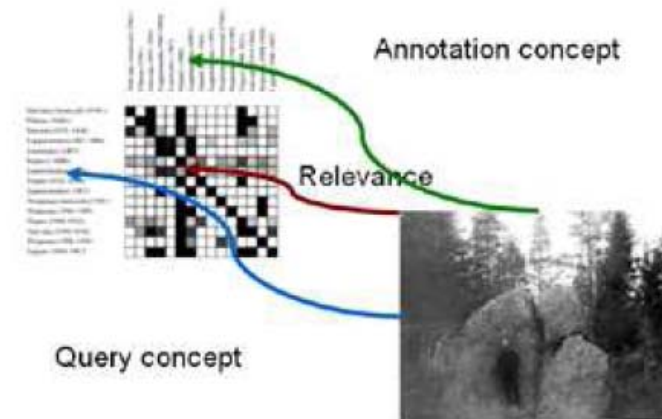


Figure 3: Annotation and indexing concepts matched.

(Kauppinen et al., FAIS 2006)

Demos

1. <http://www.yso.fi/onki/sapo>
 2. <http://www.yso.fi/onki/suo> (TBA)
 3. <http://demo.seco.tkk.fi/onkipaikka>
 4. <http://www.yso.fi/onki/yso/app/annotation/>
 5. <http://www.yso.fi/lusto>
 6. <http://www.kulttuurisampo.fi>
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References

- Tomi Kauppinen and Eero Hyvönen. *Modeling and Reasoning about Changes in Ontology Time Series*. As a Chapter in Book: **Ontologies: A Handbook of Principles, Concepts and Applications in Information Systems**. Rajiv Kishore, Ram Ramesh, Raj Sharman (editors). ISBN: 0-387-37019-6. Springer-Verlag, January, 2007.
 - Riikka Henriksson, Tomi Kauppinen and Eero Hyvönen: **Core Geographical Concepts: Case Finnish Geo-Ontology**. Location and the Web (LocWeb) 2008 workshop, 17th International World Wide Web Conference WWW 2008, Beijing, China, April 21-25, 2008.
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References

- Tomi Kauppinen, Jari Väätäinen and Eero Hyvönen: Creating and Using Geospatial Ontology Time Series in a Semantic Cultural Heritage Portal. *S. Bechhofer et al.(Eds.): Proceedings of the 5th European Semantic Web Conference 2008 ESWC 2008, LNCS 5021, Tenerife, Spain, pp. 110-123, June 1-5, 2008.*
- Tomi Kauppinen, Riikka Henriksson, Reetta Sinkkilä, Robin Lindroos, Jari Väätäinen and Eero Hyvönen: Ontology-based Disambiguation of Spatiotemporal Locations. *1st international workshop on Identity and Reference on the Semantic Web (IRSW2008), 5th European Semantic Web Conference 2008 (ESWC 2008), Tenerife, Spain, June 1-5, 2008.*

Questions?

