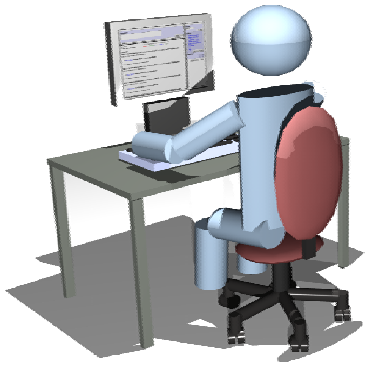
Integration of Earth Observation Data and Domain Knowledge Using Topic Maps



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SATOPI project which is being developed by Space Applications Services as a co-funded activity with the European Space Agency (ESA contract number 21520/08/I/OL).

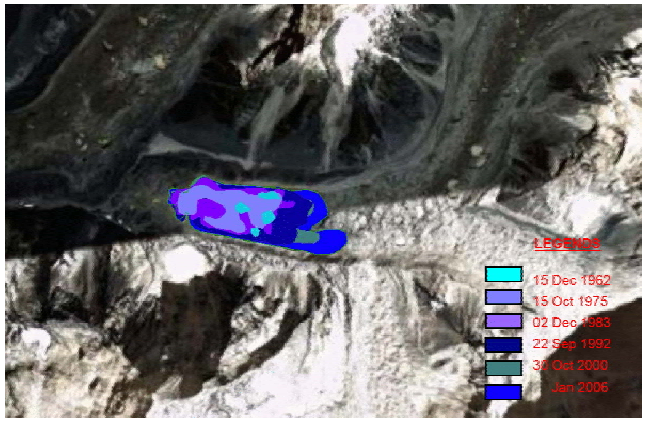
The Use Case – GLOFs in the Himalayas

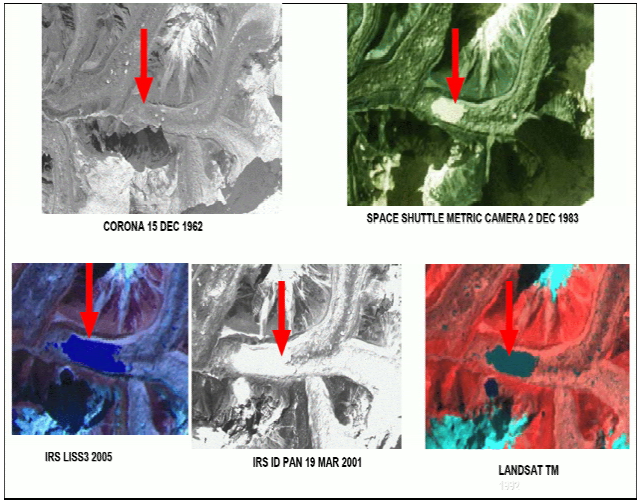
- Glacial Lake Outburst Flood (GLOF) happen when glaciers melt, and glacier lakes are formed next to them.
- The glacier lakes are usually dammed by a natural dam made partly from ice. These dams are unstable.
- When the water level goes up, the ice in the dams floats causing the dam to break.
- The resulted floods can be very intense. For example, in a GLOF event happened in 1985, the water from Dig Tsho Lake went downhill in a flood that lasted 4-6 hours, and with a flow of 1600 to 2350 cubic meters per second.

The Need

- The phenomena of GLOF events depend on many factors such as weather, topography and characteristics of the glacier, the glacier lake and its dam.
- In order to identify precursors for a GLOF event the researcher has to collect data from different resources:
  - Different remote Earth Observation sensors each might have its own interface.
  - Data which is already collected about the glacier lake and similar glacier lakes
  - Weather data
  - etc.

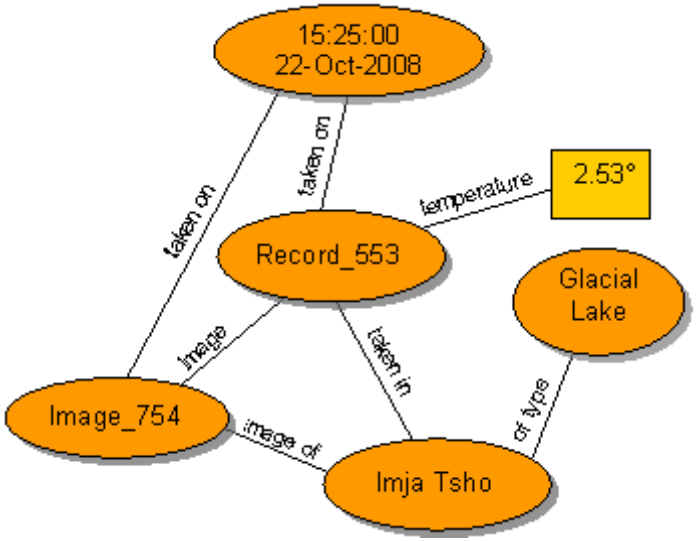
➔The process of accessing and collecting the data slows down the research.



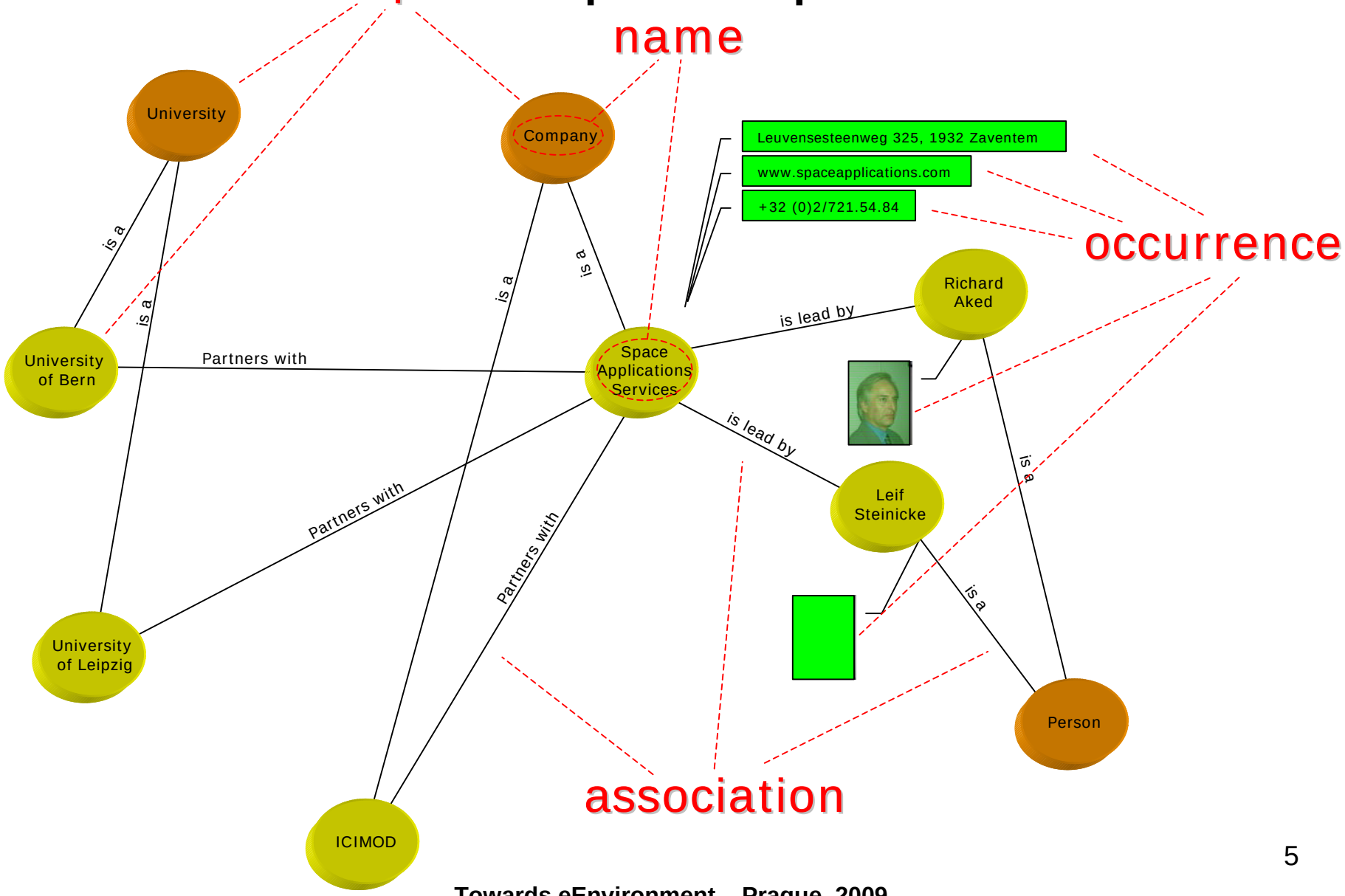


The Technology Used – Topic Maps

- Topic Maps is an international standard (ISO/IEC 13250: 2003) for knowledge representation and information integration.
- Topic Maps provides the ability to represent knowledge in a natural way – the way we, humans, grasp knowledge.
- Dynamic topic maps (which describe events) can be created.
- Topic Maps standard guides how to merge different topic maps.



Topic Maps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Leuvensesteenweg 325, 1932 Zaventem
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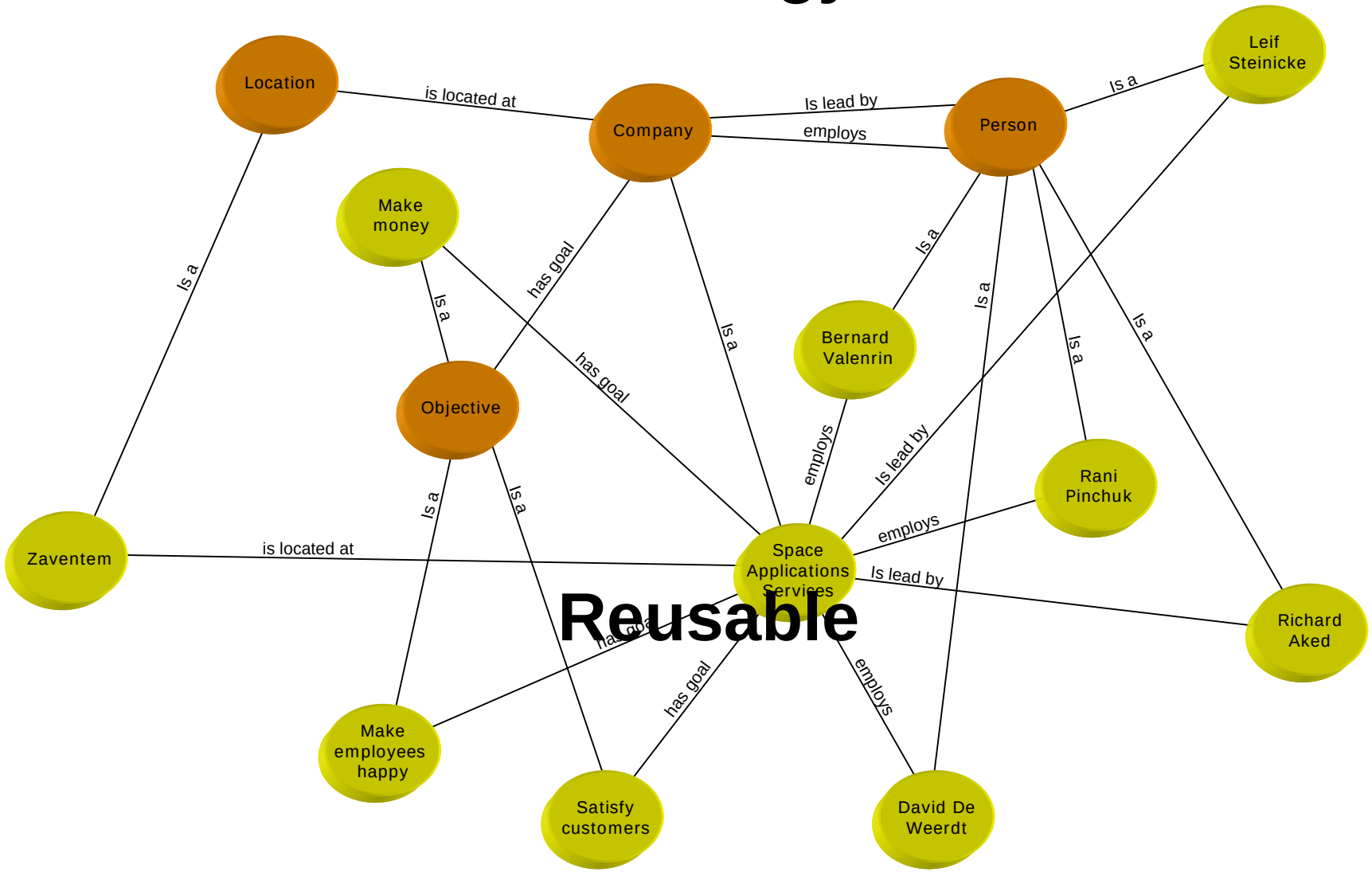
ICIMOD

Ontology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Richard Aked
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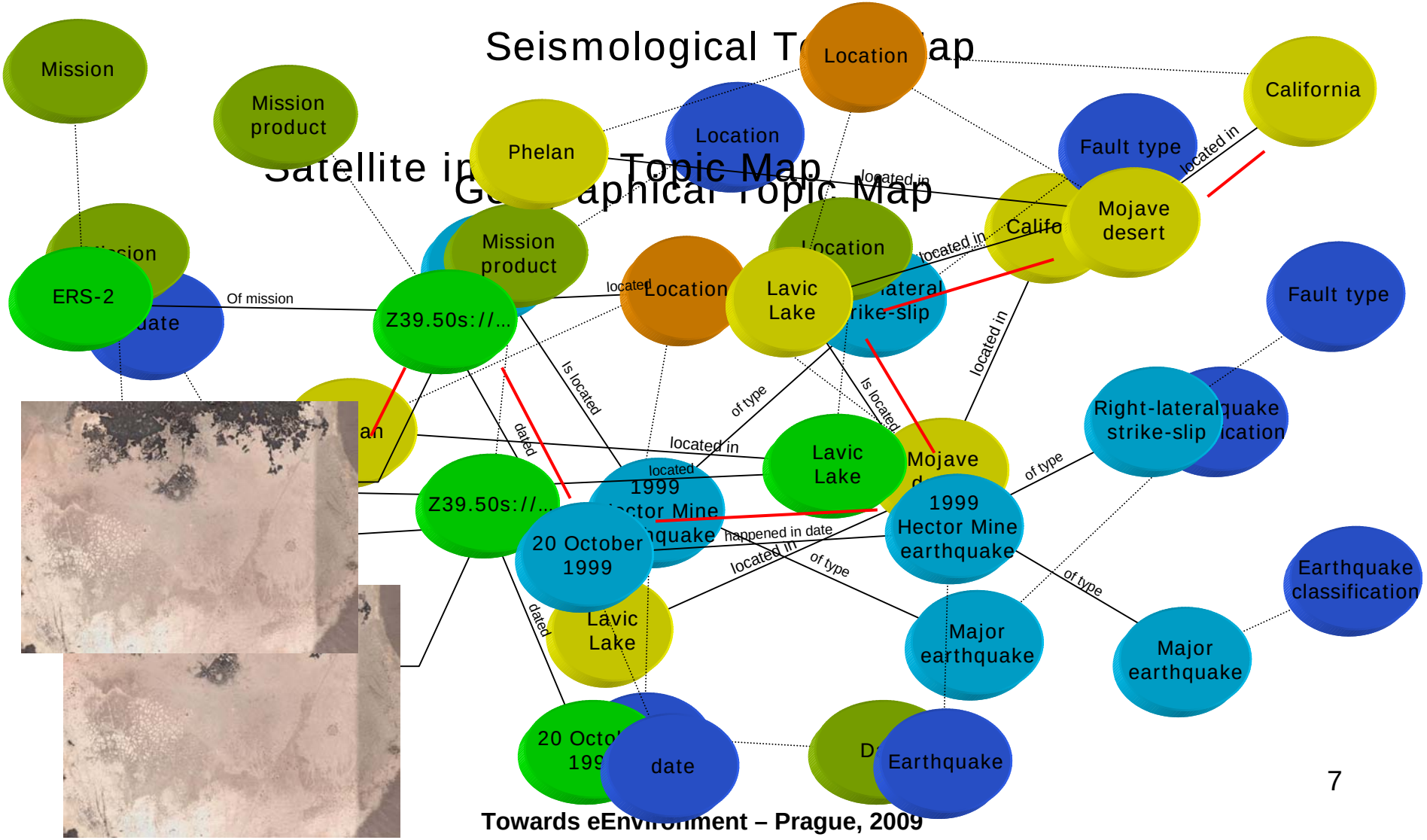
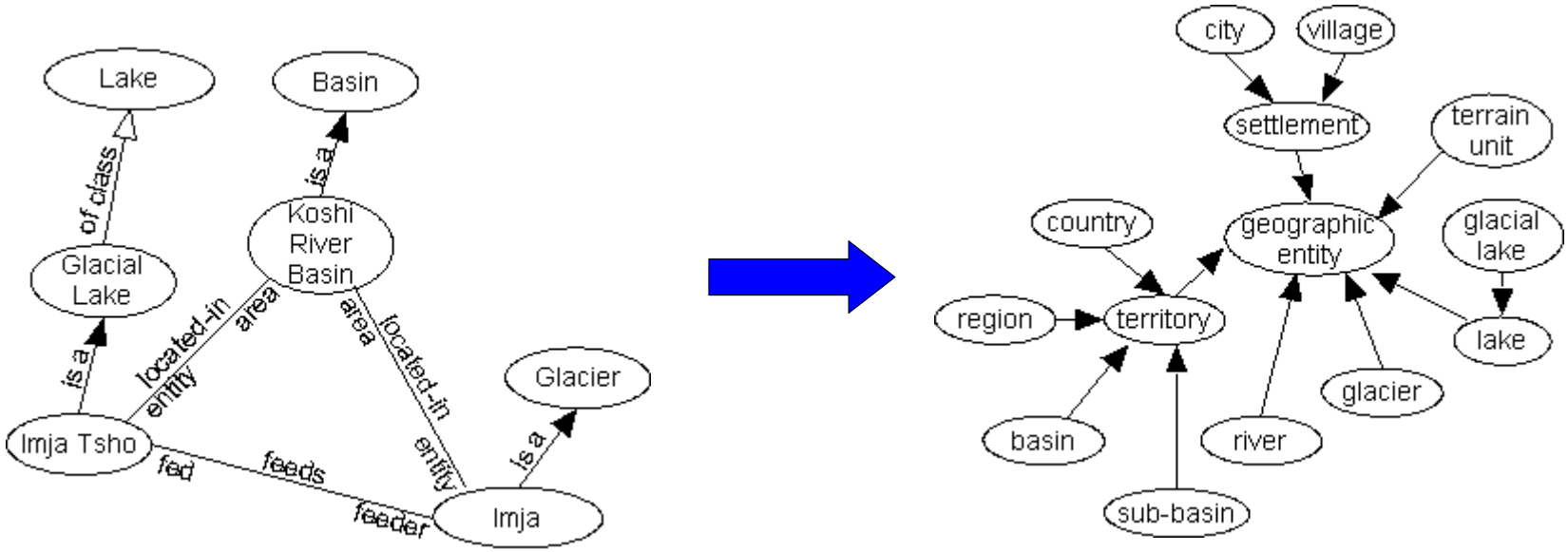
David De Weerdt

Merging

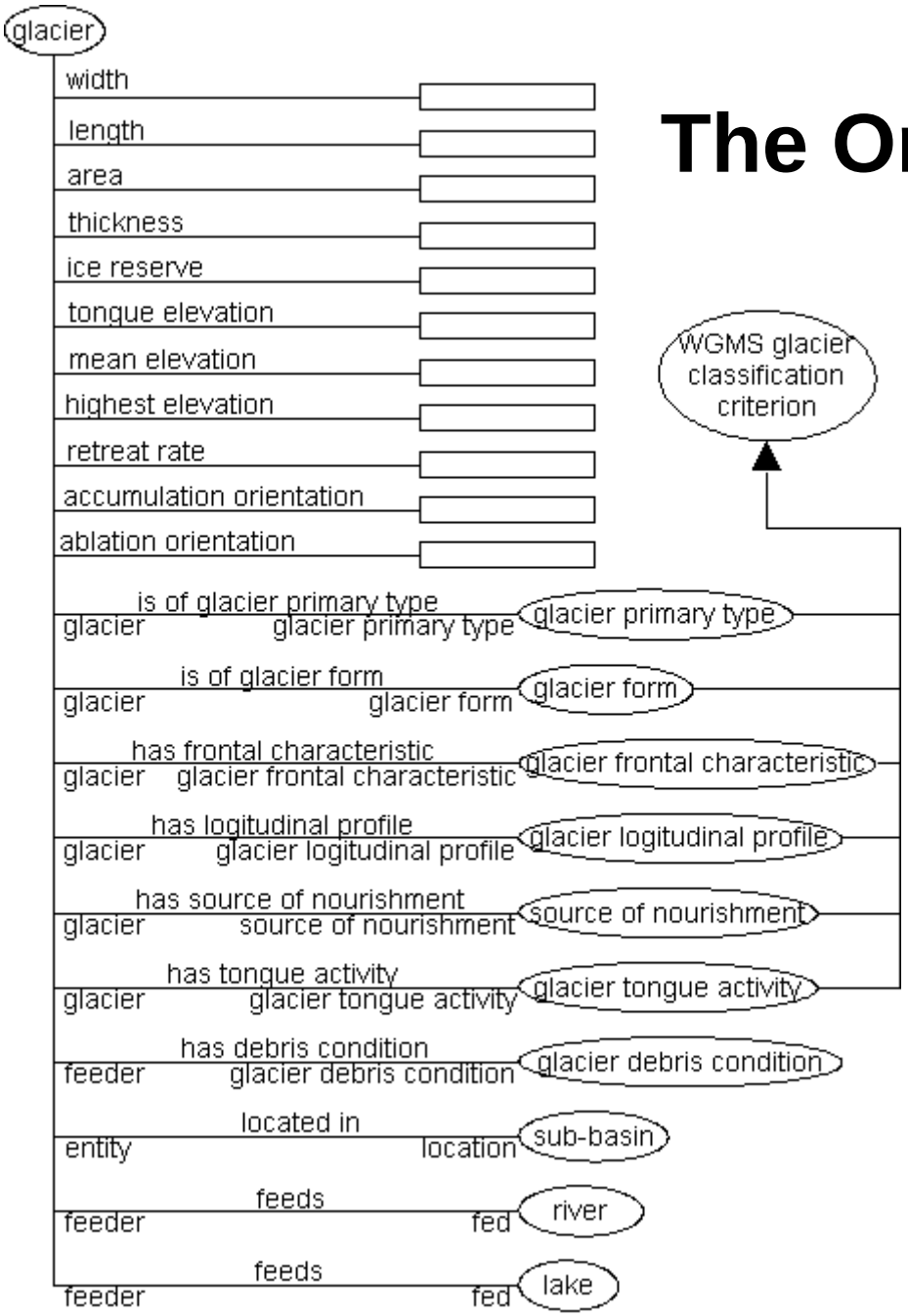
Goal: get satellite images of earthquake sites in California, after 1998



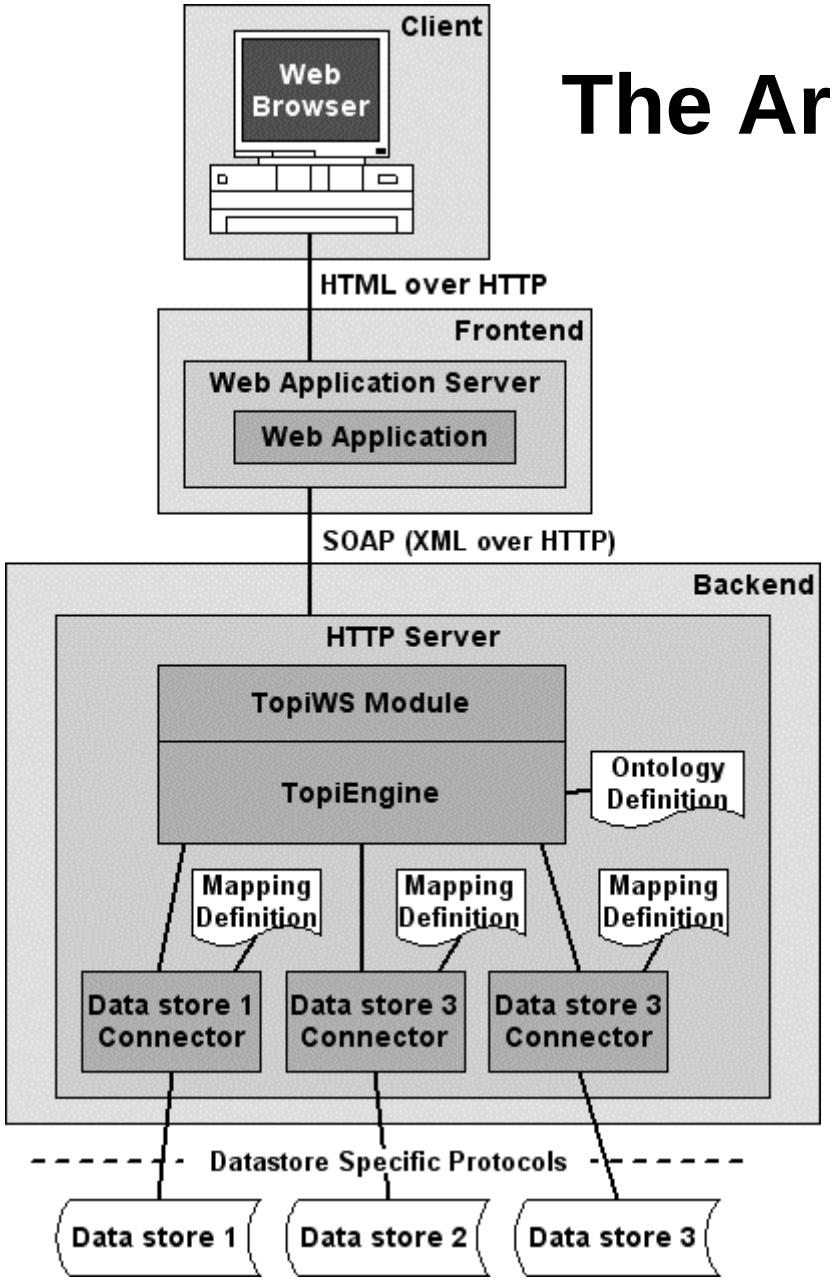
The Ontology (1)



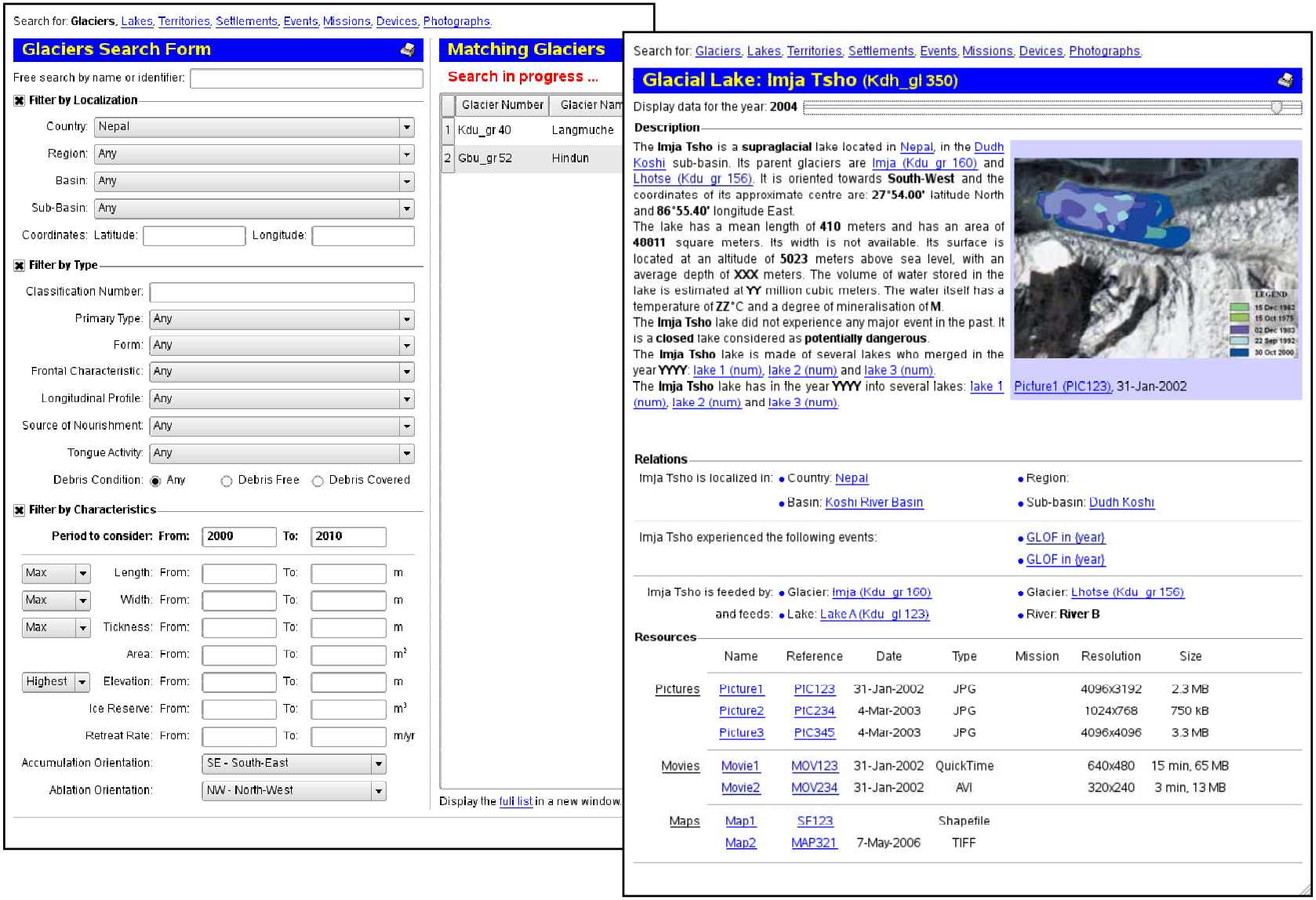
The Ontology (2)



The Architecture



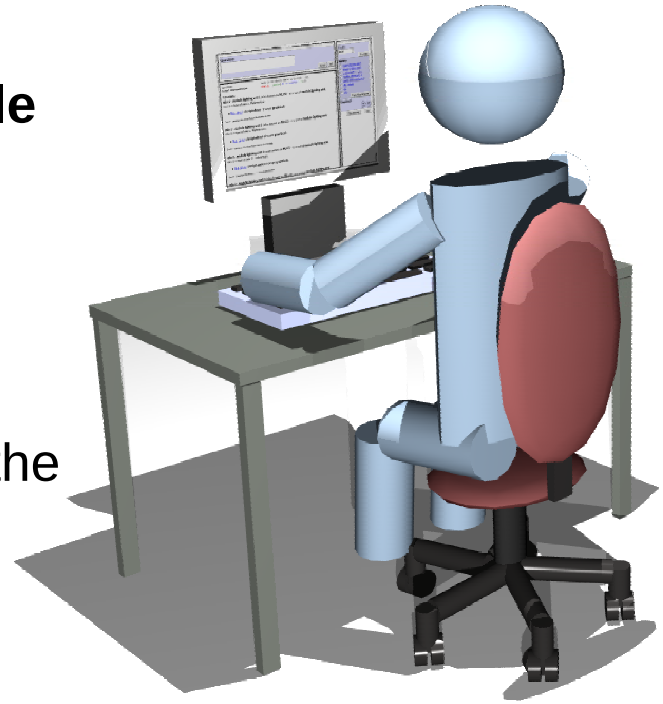
The User Interface



Related Activities - LINDO

Large Scale Distributed Indexation of Multi media Objects (LINDO)

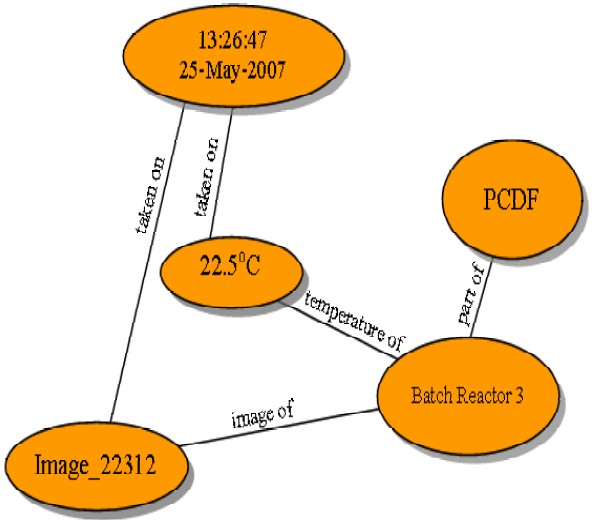
- European project – IWT/ITEA2 project (ITEA2-06011).
- The Belgian part of LINDO targets **a portable domain question answering system over Topic Maps**.
- Has started November 2007.
- A three year research project.
- The results of LINDO will be tested against the topic maps developed in SATOPI.



Related Activities - ULISSE - FP7 IP

Knowledge Integration and Dissemination for Space Science Experimentation

- This project aims at pursuing the exploitation and valorization of scientific data from previous and future space science experiments on the ISS and other space platforms, promoting the involvement of specialized communities and awareness of the general public.
- It will merge and provide access to scientific and technical data of most scientific disciplines, including Life Sciences, Space Medicine and Exobiology, Biotechnology, Material and Fluid Sciences.
- The vision related to Topic Maps in this project is to organize, merge and provide unique access to multi disciplinary data.



Future Work – GLADI

- The project will be build on three conceptual pillars:
  - Innovation related to federation of data from different sources with knowledge, and providing one access point to this data using domain terminology.
  - Innovation related to the collection of data using remote EO data with WSN, and the reduce of cost in deployment and maintenance of WSN.
  - Two use cases, one in the Alps and one in The Himalaya Mountain which take advantage of the semantic backbone and the collected data in order to model, simulate and understand better processes and threats related to GLOFs.
- The development in the project will relay on these three pillars and will be built from the following steps:
  - Indentifying 20 dangerous lakes using remote EO.
  - Installing WSN on some of those.
  - Using the data gathered and the facilitated access to it provided by the semantic integration backbone, research will be done in order to identify precursors for an event, and to understand the processes involved.
  - This research will lead to the understanding of which sensors should be deployed in order to identify future events.

Thank you for your attention