Web-based Decision Support for Event, Temporal, and Geographical Data

Abstract

Emerging Web applications such as context-adaptive Web systems and Semantic Web applications raise the need for combining automated reasoning methods with Web languages, especially with Web query, schema, and update languages. In order to develop an integrated approach, this working group investigates powerful mechanisms for handling geotemporal, geospatial and topical data in different application scenarios.

Almost all developments in the Semantic Web area - XML, RDF, query languages, rule languages, ontology mechanisms, etc. - are frameworks with very little built-in support for non-trivial concrete datatypes and theories. Theories which have a strong algorithmic aspect are not easy to specify and use in these systems. The frameworks would become much stronger and much more user-friendly if algorithmic realizations of frequently used concepts could be directly integrated.

In the working group "Event and Location" we develop theories for "geotemporal" and "geospatial" notions and topics, ready for the integration into, for example, query languages or ontology mechanisms.

Use Scenarios

The investigated reasoning mechanisms can be used in different scenarios.

■ **Suppose there is an XML database about cinemas and movies in Munich.**
A reasonable query to this database could be: "Which cinema in the eastern part of Munich plays a movie about a sports event this weekend?" To process this query, the system must be able to match "eastern part of Munich" for example with addresses in a database (geospacial reasoning), it must map "this weekend" to a personal specification of "weekend" (geotemporal reasoning), and it must understand the topic "sports event". The primary goal is to provide the theoretical and implementational basis for integration of this kind of reasoning into query languages.

■ **Another, more complicated scenario deals with the search for a pharmacy in a city:**
A person is on vacation in a foreign city on a Sunday afternoon. For some reason a certain medication is needed rather urgently, therefore a handheld device with wireless access to the Web is used to send a query similar to the following: „Where is the nearest pharmacy with medication xyz in stock?''. Already the proper treatment of "nearest" causes a series of complex computations. Taking the Euclidean distance for "nearest" does not help at all in this case. The evaluation of "nearest" triggers a path planning problem, namely the problem to get to the pharmacy as soon as possible. The path planning problem depends on many parameters, the road map, the public transport systems, the person's profile and preferences etc. It turns out that many other spatial relations, not in abstract spaces, but in real life situations, also amount to path planning problems.

■ **Another use scenario, which will be investigated, is that of an international appointment scheduling system:**

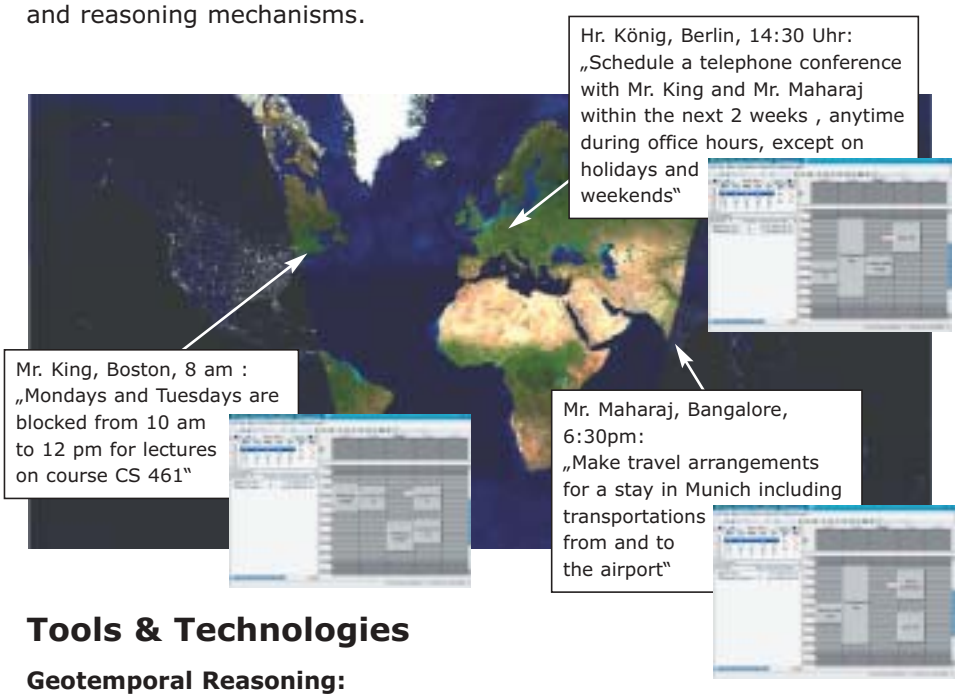
Suppose three business men in New York, London and Tokio want to meet in Riad, Saudi Arabia. For planning this appointment one has to take into account the different calendar systems, the personal constraints of the business men, the general constraints, and the problem to get to the meeting place. Different calendar systems include not only time zones or daylight savings times, but also local customs and traditions like holidays, business hours, different notions of "weekend" etc. This scenario also requires a complex interplay of constraint solvers for geotemporal and geospacial theories.

More information available at

http://rewerse.net/a1

Description of Research

The work package "Event and Location" focuses on three different areas, which eventually will grow together to a powerful support system for understanding and manipulating geotemporal, geospatial and topical information. In the workpackage, suitable theories for geotemporal and geospatial notions and concepts will be developed. On this basis, matching and constraint solving mechanisms for temporal and spatial reasoning will be realised. A thesaurus for events will be constructed that describes real-world events and positions them in a temporal-spatial-topical hierarchy. The construction of the hierarchy is a part of this task. A Web-based appointment scheduling system will be realised for proof-of-concept of the ontologies and reasoning mechanisms.



Tools & Technologies

Geotemporal Reasoning:

- WebCal: This is a system for representing and manipulating complex geotemporal notions.

Subsystems, which can also be used independently are:

- the FuTiRe library for representing fuzzy temporal intervals and relations
- the PartLib library for representing periodic temporal notions
- GeTS, a specification language for complex temporal notions.

Geospatial Reasoning:

- MPLL (Maple): Multi Paradigm Location Language
- Ontologies for Public Transport / SVG GUI

Topical Information:

- EFGT Net: Organization of Encyclopaedic Knowledge and Named Entities

Glossary

With **geotemporal information** we mean any kind of temporal information that is based on some established human calendar system plus real-life temporal reference points such as events ("last Sunday", "begin of easter holidays","next elections", etc.) seasons ("early spring", "late summer", etc.)

With **geospatial information** we mean any kind of spatial information that is based on an established system of geographic coordinates and on real-life locations such as countries, cities, places and rivers. The kind of spatial information that we address includes geographic positions, distances, directions, and relations such as neighbour-hood, inclusion etc.

With **topical information** we mean any orientation scheme that helps to position information in a suitable hierarchy of thematic fields, areas, domains and topics. Examples of general topics are "arts", "sports", "entertainment", examples of specific topics are "generation of electricity", "photographic equipment", "personal security". Topical information is ordered and represented in taxonomies and classification schemes such as, e.g., the UDC (universal decimal classification).

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