

# The information broker
# problem-solving knowledge for location-based services

**Author(s):**
Timpf, Sabine

**Publication Date:**
2001

**Permanent Link:**

https://doi.org/10.3929/ethz-a-004365125 →

Timpf, S. (2001). The information broker: problem-solving knowledge for location-based services. AGILE - GI in Europe: Integrative Interoperable Interactive. M. Konecny. Brno, Czech Republic, Masaryk University Brno: 203-204.

# The Information Broker: Problem-solving knowledge for location-based services

**Sabine Timpf**
Department of Geography, University of Zürich
Winterthurerstr. 190, CH-8057 Zürich, Switzerland
Tel.: +41 1 63 551 52, Fax: +41 1 63 568 48
timpf@geo.unizh.ch

**Abstract**

In demonstrations how a location-based service will work, an information broker receives a query from a hand-held device and is in charge of providing an answer (OGC, 1999). For example, someone wants to know where the next vegetarian restaurant is when driving into Brno coming from Vienna.

First this query assumes the availability and accessibility of information from the yellow pages (vegetarian restaurants and their addresses) and a city map (for route instructions and the distance computation) as well as information about the main access route when coming from Vienna. This also assumes that the data comes in a readable format and can be transmitted over the web using, e.g., a pay-per-use concept with online geographic databases.

Second this query assumes that the broker has problem-solving knowledge and will be able to direct, delegate, evaluate, and integrate the answers coming back from the various agents (assuming a multi-agent based system). In order to do this, the broker needs knowledge about the decision-making process, i.e., about the tasks needed to fulfill the query as well as knowledge about the subdivision of these tasks into operations. Operations will be executed somewhere on the web using perhaps an online Geographic Information System (GIS). The answers will have to be evaluated and integrated within the context of the task by the broker. The more complex the query the more likely it is that more than one task has to be performed. Knowledge about the overarching activity, within which the tasks have to be carried out, is also needed (Kaptelinin et al. 1999).

The goal of this paper is to demonstrate with examples which types of knowledge the broker needs to answer the query to the full satisfaction of the mobile user. So far, we have identified knowledge about data and knowledge about problem-solving processes. This needs to be broken down into, for example, essential data, additional (confirmatory) data, activities, tasks, and operations. GISs provide the data (both essential and confirmatory) and the operations (e.g., distance calculations, buffering, nearest-neighboor etc.). We need methods to make the distinction between essential and confirmatory data. Unfortunately, we have as yet scant information about how geographic activities (like finding the nearest restaurant) are broken down into tasks (like determine where I am, find the nearest restaurant, guide me there). We should know how tasks are broken down into operations, although this information is usually in the head of the operator or expressed in theoretical constructs.

Within the GIScience community there has been work done on functionalities of GIS (Maguire and Dangermond 1992, Albrecht 1996). These will provide valuable starting points to derive a task hierarchy (Freksa 1991, Timpf et al.1992). In addition, there is a body of research within the knowledge engineering community that deals with problem-solving knowledge (Chandrasekaran 1986, Chandrasekaran 1998, Fensel et al. 1997, Schreiber et al. 1999). We will determine within the framework of the paper the suitability of those approaches for spatial tasks.

Timpf, S. (2001). The information broker: problem-solving knowledge for location-based services. AGILE - GI in Europe: Integrative Interoperable Interactive. M. Konecny. Brno, Czech Republic, Masaryk University Brno: 203-204.

Albrecht, J., 1996, Universal GIS operations for environmental modeling. In Proceedings of the 3rd International Conference on Integrating GIS and Environmental Modeling, Santa Barbara.

Chandrasekaran, B., 1986, Generic tasks in knowledge-based reasoning: high-level building blocks for expert system design. IEEE Expert, 1 (3), 23-30.

Chandrasekaran, B., Josephson, J.R., and Benjamins, V.R., 1998, Ontology of Tasks and Methods. Ohio-State University. URL http://ksi.cpsc.ucalgary.ca/KAW/KAW98/chandra/index.html.

Fensel, D., Motta, E., Decker, S., and Zdrahal, Z., 1997, Using ontologies for defining tasks, problem-solving methods and their mappings. In Knowledge Acquisition, Modeling, and Management, edited by Plaza, E. and Benjamins, V.R. Springer-Verlag, 113-128.

Freksa, C., 1991, Qualitative Spatial Reasoning. In Cognitive and Linguistic Aspects of Geographic Space, edited by Mark, D. M. and Frank, A. U. Dordrecht, The Netherlands: Kluwer Academic Press, 361-372.

Kaptelinin, V, Nardi, B., and Macaulay, C., 1999, The activity checklist: a tool for representing the 'space' of context. interactions, (july/august), 29-39.

Maguire, D.J. and Dangermond, J., 1991, The functionality of GIS, in Geographical Information Systems: Principles and Application, edited by D. J. Maguire, M. F. Goodchild and D. Rhind (Harlows: Longmans), Vol1, 319-335.

OGC, 1999, The OpenGIS ® Guide: Introduction to Interoperable Geoprocessing and the OpenGIS Specification, edited by Kurt Buehler and Lance McKee, 4th edition.

Schreiber, A., Akkermans J., Anjewierden, A., de Hoog, R., Shadbolt, N., Van de Velde, W., Wielinga, B., 1999, Knowledge Engineering and Management, The CommonkADS Methodology, MIT Press.

Timpf, S., Volta, G.S., Pollock, D.W., and Egenhofer, M.J., 1992, A Conceptual Model of Wayfinding Using Multiple Levels of Abstractions. In Theories and Methods of Spatio-Temporal Reasoning in Geographic Space, edited by Frank, A.U., Campari, I., and Formentini, Heidelberg-Berlin: Springer-Verlag, 348-367.