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

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Abstract

In demonstrations how a location-based service will work, an information broker receives a query from a handheld 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 (Kaptelein 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-neighbor 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.


