

How to Build Your Own Moving Objects Database System

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KEYNOTE ABSTRACT

Representing descriptions of movements in databases and querying them is a basic capability required in mobile data management. In this talk we present a prototype of a moving objects database system and an environment for building such prototypes called *SECONDO*. The *SECONDO* environment is freely available on the Web. So you could build such a system yourself, and we hope to convey in this talk the fun of building prototypes.

SECONDO provides a modular, extensible architecture for building database systems with different data models. It consists of three major components: the kernel, the optimizer, and the graphical user interface. The kernel provides query processing over a set of algebra modules - all data model dependent functionality is encapsulated in such algebra modules. For example, there may be modules for spatial data types with an example operation such as overlap, relations with hash-join, and R-trees with window queries. The kernel allows one to enter query plans (or equivalently, algebra terms) directly in a relatively comfortable syntax; these are type-checked and evaluated. This is a quite useful feature for prototyping and experimenting with database systems. The kernel is written in C++. The optimizer implements a new algorithm for conjunctive query optimization. It deals with expensive predicates and selectivity and cost estimation for them in a generic way. The optimizer is written in PROLOG which makes formulating extensions such as optimization rules and cost functions relatively easy. The GUI is extensible by viewers for different applications. For example, viewers for jpeg images, midi files, or chess games have been implemented. One viewer, the Hoese viewer, provides sophisticated functionality for displaying and animating spatial and moving objects. It is itself extensible by display functions for new data types. The GUI is written in Java. A screenshot is shown in Figure 1.

The prototype of a moving objects DBMS is based on the concept of spatio-temporal data types, providing abstractions such as moving point and moving region. These can represent time dependent positions or objects with extent, respectively, such as vehicles or forest fires. Moving point and moving region are offered as data types with suitable operations. We

explain the basic idea, the distinction between abstract and discrete model, and the design principles for an abstract model with carefully designed types and operations. The discrete model defines finite representations for all data types and can serve as a blueprint for implementation.

We discuss the steps needed to implement this model in *SECONDO*, extending the kernel, the optimizer and the GUI. The talk includes a demo part to show the *SECONDO* environment and the moving objects prototype realized within it.

Finally, extensions of the model to deal with network-constrained movement and periodic movement are briefly described.

Further Reading

SECONDO has been described in [9, 4] and demonstrated in [7, 1]. The *SECONDO* web site contains the system for download and further material [12]. Major references for the approach of spatio-temporal data types are [5, 10, 6, 3]. Network-constrained movement and periodic movement are addressed in [8, 2]. A text book on moving objects databases is [11].

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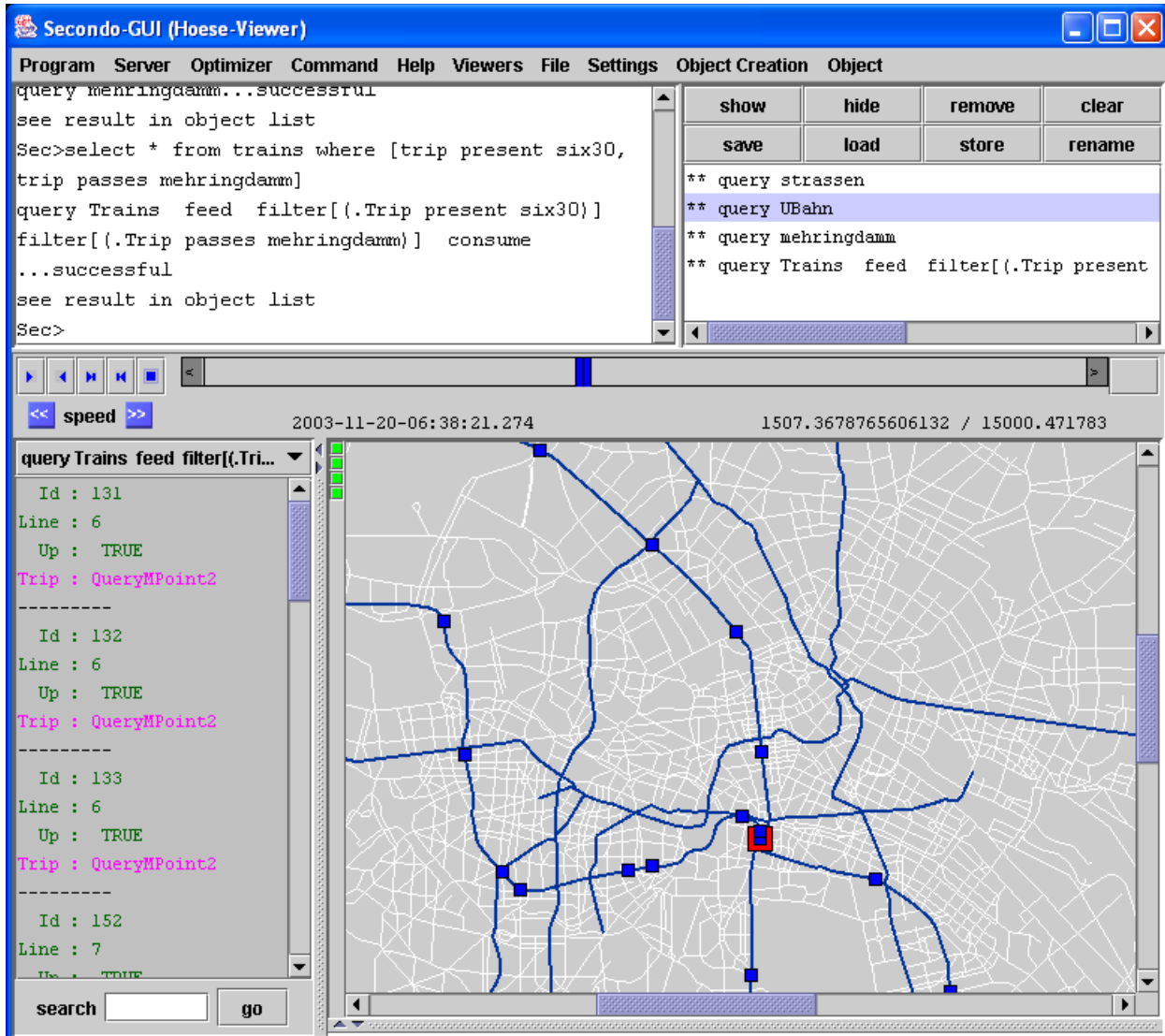


Figure 1: The graphical user interface of SECONDO during an animation of some trains moving in Berlin

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