The REACH Active OODBMS *

A P. Buchmann A. Deutsch J. Zimmermann M. Higa

Technical University of Darmstadt, Germany
{buchmann,deutsch,zim}@dvs1.informatik.th-darmstadt.de

REACH [1] is a full-fledged aOODBMS research platform, that was implemented by extending TI's OpenOODB [2]. The REACH prototype is one of the first running systems that combines most of the advanced features of aOODBMSs that previously have been shown in partial implementations only. It provides a much needed platform for the development of applications and was instrumented to make performance measurements and visualize the flow of execution. It has a graphical user interface and support tool for rule definition and administration (GRANT).

OpenOODB is implemented in an extensible way that resembles the event-driven paradigm of active database systems. A meta-architecture module implements the notions of low-level event, sentry, and policy manager interface. Policy managers are used for handling persistence, transactions, queries, etc. We extended Open OODB with policy managers for event handling and rule execution.

REACH implements primitive method events, temporal events, flow control events and the composition operators for sequence, disjunction, conjunction, closure, negation, and history. It uses the C++ type system and detects method events through inline wrapping of the methods in the extended preprocessor of OpenOODB.

An ECA rule is mapped to an ECA manager which is accessed during event detection and propagates the event object to the relevant rules implemented as two C functions (for condition and action), which are stored in a shared library [1].

REACH supports a rich set of coupling modes. Rules can be executed either in immediate, deferred or detached mode. Detached mode may be independent or dependent with variants parallel, sequential or exclusive which is used for contingency plans. For details see [1].

Event composition semantics are defined relative to transaction boundaries. Composite events that trigger deferred rules must be composed from events originating in one transaction. Composite events where the constituent events originate in multiple transactions may only trigger rules that are executed in detached transactions. Event consumption policies implemented are the SNOOP contexts recent and chronicle. Each composite event has its own syntax tree which simplifies the garbage collection of semi-composed events (either at the end of a transaction or when the validity interval of a composite event elapsed).

OpenOODB's transaction policy manager only supports flat transactions. We modified it to handle the version of nested transactions supported by the ODMG-93 standard. A new transaction manager is needed for fully parallel execution of rules.

The low-level rule language REAL provides the full power of C++ but is inconvenient to use. GRANT is a tool that provides a GUI, prompts for the necessary input, provides certain defaults for coupling modes and priorities of rules and helps the user by creating templates that include some of the necessary C++ language structures and finally maps rules to the C functions stored in a shared library. The graphical user interface is implemented using Tcl/Tk.

REACH offers a trace and a benchmarking mode. In trace mode the execution of methods and rules is visualized by displaying the method invocation stack for rule execution and event detection/composition.

In benchmarking mode the execution times of critical components, such as the detection of events, and the event composition and rule firing mechanisms can be measured.

In the demo we show in the domain of power plant operations the definition and browsing of rules, the execution of rules caused by application events, a visualization of event composition and rule execution, measure the runtime behavior and illustrate achievable performance gains through prefetching.

[1] Buchmann, A., Zimmermann, J., Blakeley, J., Wells, D.; Building an Integrated Active OODBMS: Requirements, Architecture, and Design Decisions, Proc. 11th Intl. Conf. on Data Engineering, Taipeh, 1995.

[2] Wells, D., Blakeley, J., Thompson, C.; Architecture of an Open Object-Oriented Database Management System, Computer, Vol. 25, No. 10, 1992.

* REACH is partially sponsored by ACT-NET, a research network on aDBS which is part of the HCM program of the EU.

SIGMOD ' 95,San Jose , CA USA