ROCK & ROLL: A Deductive Object-Oriented Database with Active and Spatial Extensions

Andrew Dinn, M. Howard Williams
Department of Computing and Electrical Engineering,
Heriot-Watt University, Riccarton,
Edinburgh, UK.
<andrew,howard> @cee.hw.ac.uk

Norman Paton
Department of Computer Science†,
University of Manchester, Oxford Road,
Manchester, UK.
norm@cs.man.ac.uk

1. Overview

ROCK & ROLL is a deductive object-oriented database system that supports two languages, one imperative and the other deductive, both derived from the same object-oriented data model. As the languages share a common type system, they can be integrated without manifesting impedance mismatches, and thus programmers can conveniently exploit both deductive and imperative features in a single application. The components of ROCK & ROLL are as follows:

- **Data Model OM**: OM supports a range of conventional modelling constructs, such as sets, sequences, aggregations and (both single and multiple) inheritance;
- **Deductive Language ROLL**: ROLL is a conventional first-order deductive database language, which differs from Datalog with negation in being strictly typed (through type inference), having a structured clause base that associates rules with classes, and in that the extensional database is that of OM, rather than the relational model; and
- **Imperative Language ROCK**: ROCK is a conventional imperative object-oriented programming language, with facilities for creating and manipulating OM objects, iteration, I/O, etc.

The use of two languages has allowed us to keep the logic language ROLL simple, as facilities such as updates are not handled within ROLL, but rather in the closely integrated imperative language ROCK. The basic ROCK & ROLL system provides comprehensive modelling and programming facilities, but recent work has extended it with both active rules and spatial data types.

2. Active Extensions

The ROCK & ROLL Active Programming System (RAP) adds event-condition-action rules to the behaviour management facilities of the core, passive, system, as follows:

- **Knowledge Model**: The condition and action languages of RAP are ROLL and ROCK, respectively. The event language follows the syntax of ROLL, in providing a declarative description of what has happened, with a range of composite event operators and parameter unification facilities that permit precise description of situations;
- **Execution Model**: The execution model supports immediate and deferred rule processing, and both set and tuple level transition granularities.

The RAP system is thus one of the most powerful rule systems to exploit declarative language features, and is also being used as a basis for work on rule analysis and optimisation.

3. Spatial Extensions

The ROCK & ROLL system kernel is being extended with support for spatial values, based on the ROSE algebra. The spatial data types are treated as values in the ROCK & ROLL type system, and both ROCK and ROLL have been extended to allow these values to be manipulated and operated over in a manner that is consistent with the closed, finite resolution properties of the ROSE algebra. The resulting system provides comprehensive kernel support for spatial database programming and for deductive analysis of spatial information. Ongoing work is focusing on effective optimisation and efficient evaluation of spatial ROLL.

4. Status/Availability

The core ROCK & ROLL system has been available (from http://www.cee.hw.ac.uk/databases, where there is also a collection of papers on ROCK & ROLL and its extensions) since early 1995—it has been supplied by this route to over 500 sites. The active and spatial extensions will be made available in the summer of 1997.