A Language Based Multidatabase System*

eva Kühn, Thomas Tschernko, Konrad Schwarz
Institut für Computersprachen, University of Technology Vienna,
Argentinierstr. 8, A-1040 Wien, Austria, Europe
{eva,tschernk,schwarz}@mips.complang.tuwien.ac.at

The concurrent logic programming language "Vienna Parallel Logic" (VPL) [2], developed at our department, is expressly designed to integrate local systems (in particular, local database systems). Designed for the multidatabase arena, it aims to make the interoperation of legacy systems possible, providing at the same time high level programming and the declarative style associated with Prolog. Influenced by the Flex Transaction Model [1], the VPL system provides transactions on world-wide shared objects, termed communication variables, at the language level. These special variables can be written only once (*rigorous single assignment property*) by transactions so that all effects become visible at once, or none. This atomic-write mechanism allows simple implementation of global commitment protocols in heterogeneous systems, like MDBSs [3].

Indeterministic transaction specification, like in the Flex Model, is possible. If a task cannot be fulfilled by a local server, it can be replaced by executing it somewhere else (*function replication*).

Subtransactions can be compensatable or non-compensatable. The first type can commit before the global transaction has terminated, thus releasing locks earlier and intermediate results can become visible. If the global transaction finally fails, or this subtransaction is not needed, it is automatically compensated, using VPLs backtracking mechanism. By allowing for *programmed backtracking*, non-2PC systems can be incorporated.

Success and failure dependencies between sub-transactions can be expressly modeled with VPLs concurrency operators. By default, i.e., if no dependencies exist, VPLs parallel operators can be used to obtain maximal execution parallelism.

VPL can serve as the query language and the transaction control language. A query given in terms of VPL is a runnable transaction and can be executed by our VPL runtime system.

*This work is supported by the Austrian FWF (Fonds zur Förderung der wissenschaftlichen Forschung), project "Multidatabase Transaction Processing", contract number P9020-PHY in cooperation with the NSF (National Science Foundation).

In the demo we show the coordination (integration) of autonomous local systems distributed in the Internet. We demonstrate the integration of deductive databases with an integrity subsystem and a two-phase-locking protocol and the integration of Oracle databases.

VPL per se can be seen as a "language MDBS" that ad hoc provides a loose integration. By adding statically stored information (*semantic relations* [4]) the integration can incrementally be turned into a tight one. Semantic relations resemble relational views, with the exception that semantic relations do not physically store data and that they are logic rules (clauses) specifying how to deduce data. As VPL bases on first order logic, it is powerful enough to represent SQL based queries. An embedding of MSQL is provided.

In fact, VPL can not only serve in the domain of MDBSs but is a general purpose tool for programming parallel and distributed systems. In the demo we also show a simple distributed team-editor where several users can edit the same text in a cooperative way.

The prototype implementation is available. For more information, contact the authors via email.

References

[1] A. K. Elmagarmid (ed.), *Database Transaction Models for Advanced Applications*, Morgan Kaufmann, 1992.

[2] e. Kühn, H. Pohlai and F. Puntigam, 'Concurrency and Backtracking in VPL,' *Computer Languages*, Vol. 19, No. 3, July 1993.

[3] e. Kühn, 'Fault-Tolerance for Communicating Multidatabase Transactions,' In: *Proceedings of the 27th Hawaii International Conference on System Sciences (HICSS)*, ACM, IEEE, January 4–7, Wailea, Maui, Hawaii, 1994.

[4] e. Kühn and T. Ludwig, 'VIP-MDBS: A Logic Multidatabase System,' In: *Proceedings of the International Symposium on Databases in Parallel and Distributed Systems*, Austin Texas, IEEE, December 1988. Also included in *Multidatabase Systems: An Advanced Solution for Global Information Sharing*, by A. R. Hurson, M. W. Bright and S. Pakzad, IEEE, 1993.