Embedding a Query Language into C++

Attila Góbi, Zalán Szűgyi, and Tamás Kozsik

The integration of query languages and programming languages is an old, returning problem. In the case of SQL, traditional solutions were either based on language embedding or on representing queries as string values. The latter approach is very fragile since no compile time checks are performed. The former (relational) approach re-emerges in the object-oriented paradigm with the rise of LINQ, which appeared in .Net 3.5. LINQ is a language integrated into .Net languages providing native data query capabilities. The upcoming JavaSE 8 standard is planned to provide similar functionality, and until then Criteria Queries of JPA 2.0 can be used.

This paper addresses the same problem in C++. We develop an embedded language using the `boost::proto` library [2]. This library provides a quasi standard way to embed languages into C++. Unlike the above mentioned solutions, we are not trying to introduce a language similar to SQL or OQL, but one which is based on object comprehensions. Object comprehensions are introduced by D.K.C. Chan and P.W. Trinder [1] and are designed especially for object-oriented databases.

Due to our approach, namely the application of C++ template metaprogramming, it is possible to process a significant part of the language in compile-time. Similarly to LINQ, our query language can be compiled to work on collections as well as on databases. Furthermore, the processor of the query language is designed to be non-intrusive – an existing source code, or even a compiled object code can be integrated with the queries by providing the necessary metainformation.

Acknowledgements

Supported by the European Union and co-financed by the European Social Fund (grant agreement no. TAMOP 4.2.1./B-09/1/KMR-2010-0003).

References

[1] D. Chan, P. Trinder. Object comprehensions: A query notation for object-oriented databases. *D. Bowers (ed.) Directions in Databases, Lecture Notes in Computer Science*, vol. 826, pp. 55–72. Springer Berlin / Heidelberg (1994).

[2] E. Niebler. Proto: a compiler construction toolkit for DSELs. *Proceedings of the 2007 Symposium on Library-Centric Software Design*. pp. 42–51. ACM, New York, NY, USA (2007). `http://doi.acm.org/10.1145/1512762.1512767`