MATE - A METASYSTEM WITH CONCURRENT ATTRIBUTE EVALUATION

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New techniques of formal language processing have been a subject of research for years. Items of main interest are ease and wide of applicability, but also utilization of new silicon facilities, e.g. of multiprocessors. We are interested in language processors which are generated from formal specifications fully automatically. MATE - the Metasystem with concurrent ATtribute Evaluation - was designed and implemented to investigate the reasonability of new concepts in practice. It is to serve as a tool of further research in developing new domains for language processors and parallelization. The MATE metasystem consists of a metalanguage translator, which generates language processors from MML-specifications, and a library of runtime support routines. The generated processors look like pure one-pass ones but their power is not restricted to L-attribution.

Parallelization of language processing has turned out to be a very difficult job. Event-synchronization of parallel processes is still regarded as a viable solution, see c.f. [1]. The theoretical background of this method is rather simple. As attribute grammars form a functional description, one can interpret every attribute as an event and every attribute evaluation as a process. This process is interrupted and suspended if it needs the value of an attribute event that has not occurred yet. For every well-defined attribute grammar the system of evaluation processes is deadlock-free.

Its main benefit is the high descriptioNal level making it fully independent from specific multiprocessor architectures. So it also allows to check the functional correctness even on a simple PC.

On the other hand, there are substantial drawbacks. At least on today's hardware the implementation of event-controlled processes causes a considerable organising overhead.

The implementation presented is based on Modula-2 and runs under MS-DOS. It consists of two parts, a MML-to-Modula translator and a module library of runtime support routines. Translation is done by means of the DEPOT metasystem [2].

It turned out that the event-controlled attribute evaluation technique can be implemented satisfactory on today's personal computers. Storage requirements allow the handling of at least modest-sized problems. Considering the prototype character the results seem acceptable.

The metasystem includes proved features of DEPOT systems [2], e.g. a parsing method that frees the user from being worried about grammar classes.

Our approach aims at a close connection between parsing and evaluation. So there is no need of storing intermediate results and integrability is improved. Attribute evaluation proceeds incrementally. That is why (in this single processor implementation) the number of parallel activated processes is rather small usually. This is not surprising because even in complex languages just a few features destroy L- or R-attribution.

In fact, in conventional applications one or two additional processors would be able to evaluate all the attributes in parallel with parsing. This indicates the need to incorporate syntax analysis into consideration if one wants to achieve a higher degree of parallelization.

Although one may regard MATE as a simple re-implementation of FOLDS [3] there are some essential differences. Of course, it demonstrates that technological development enables us to apply highly sophisticated methods of the past on simple computers of today, too.

Further research will be in two directions. Besides the disposability of advanced language processing tools potential domains of application must be developed. We think a hopeful way is to turn specialised languages from a means of description and interpretation only to one of reasoning, rewriting and calculating automatically.

On the other hand, our attempts aim on developing the MATE metasystem. There are investigations to explore actual parallelism by simulation. After event controlled evaluation having implemented one of the next steps will be the integration with local parsing [4]. It may also be used for experimental applications. Thus, besides its role as a subject of research it may also serve to prepare the practical application of more sophisticated language processing in the future.

References

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