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Toward an efficient automatic design space exploration frame for multicore optimization

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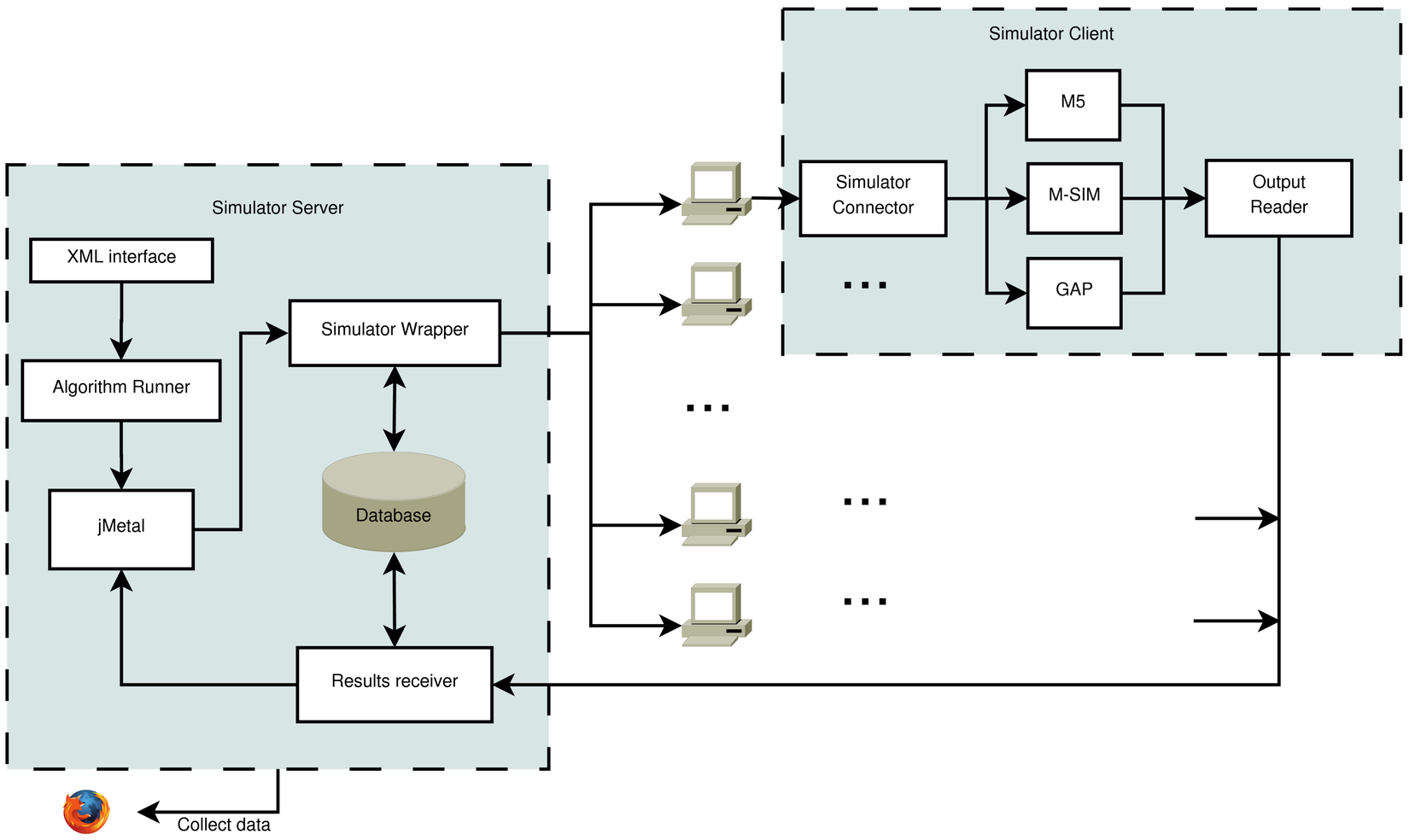
Introduction

- The number of (heterogeneous) cores integrated in the processor, has risen to tens, hundreds or even thousands (GPUs)
- As the number of cores becomes higher, more configurations have to be simulated
- This leads to an extremely huge search space (NP-hard). The current processor optimization methodology will not scale and new methods are needed
- Performance evaluation has become a complex multiobjective evaluation (speed, power consumption, area integration, etc.)
- We propose **FADSE**, a Framework for Automatic Design Space Exploration
- FADSE can be connected with almost any existing multicore simulator

The Developed Framework

Main features

- **Multiobjective optimization** – FADSE is able to perform multiobjective optimization using state of the art algorithms (NSGA-II, SPEA2, PAES). It integrates jMetal, a well known multiobjective optimization library
- **Portability** – implemented in JAVA – it can be used with almost any existing computer system simulator
- **Flexibility** – XML interface which allows a user to specify simulator parameters, architecture parameters and compiler parameters. It allows the user to specify the objectives and a set of constraints
- **Parallel simulation** – the time required to discover good solutions is reduced even more
- **Other speed improvements** – FADSE integrates a database system allowing it to reuse already simulated individuals (configurations)
- **Monitoring** – the system can be monitored using a web interface through the integration with Tomcat (optional)
- **Ease of use** – operating and deploying the simulator is easy. No additional software required for database support



XML interface

- Allows the user to configure FADSE and the used multicore simulator:
  - For FADSE the user has to specify the desired simulator/problem (synthetic problems can be used for testing purposes), the design space exploration algorithm and its properties. The user has to specify the problem's objectives.
  - For the simulator the user has to specify the input parameters and their range of values. The input parameters can be of the type integer (arithmetic progression or geometric progression), float, list of strings.
  - The user can specify a set of constraints (similar with M3Explorer). These are used to limit the size of the design space (avoid impossible or trivial configurations).

References

[CV10] Horia Calborean and Lucian Vintan. An automatic design space exploration framework for multicore architecture optimizations. In Proceedings of The 9-th IEEE RoEduNet International Conference, Sibiu, Romania, June 2010. IEEE Xplore Digital Library.

[DNL+06] Juan J. Durillo, Antonio J. Nebro, Francisco Luna, Bernabe Dorronsoro, and Enrique Alba. jMetal: a java framework for developing Multi-Objective optimization metaheuristics. Technical Report ITI-2006-10, Departamento de Lenguajes y Ciencias de la Computacion, University of Malaga, E.T.S.I. Informatica, Campus de Teatinos, December 2006.

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