

Research/Industry Tutorial: The Open-Source DRAM Simulator DRAMSys4.0

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DRAMSys4.0 is a flexible, fast, and open-source DRAM subsystem design space exploration framework based on SystemC TLM-2.0. It was developed at the Microelectronic Systems Design Research Group of the Technical University of Kaiserslautern and Fraunhofer IESE in order to tackle the challenges of today's memory systems with respect to applications, performance, power, temperature, retention errors, and different DRAM architectures.

DRAMSys consists of models that reflect the DRAM functionality, power, and temperature. With these models, system designers are able to analyze the limiting parameters and issues with respect to current DRAM standards in their system context. DRAMSys will help you explore the design space of the DRAM subsystem to replace your gut feelings with evidence obtained by simulations.

The use cases are manifold and include, among others:

- Which DRAM configuration/standard fits best to my system?
- How will new standards like DDR5, LPDDR5 or HBM3 change the behavior of my system – do they bring any new benefit for my system?
- How should I configure the memory controller to gain the maximum performance or minimal energy consumption?
- How can I optimize my system application with respect to the DRAM subsystem used?

For this purpose, the framework provides a user-friendly Trace Analyzer tool for deep analysis and insights. With these valuable insights, the designer can optimize the DRAM subsystem with respect to the controller architecture, power and thermal management, as well as device selection and channel configuration for a specific application.

In this tutorial we will show the basic structure of DRAMSys and how the source code is generated from the high level DRAMml language. Moreover, we will show how the simulator can be used to simulate current DRAM standards and how results with the Trace Analyzer can be easily obtained.

Further Links:

- <https://github.com/tukl-msd/DRAMSys>
- https://www.iese.fraunhofer.de/en/innovation_trends/autonomous-systems/memtonomy/DRAMSys.html