Understanding and Optimizing SSD Performance

Project in Concurrent and Distributed Systems 236371[1]

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NAND flash based Solid State Drives (SSDs) are used to replace hard disk drives in many large scale, mission critical storage systems, due to their fast read latency. However, they may suffer long write response times due to their physical properties. Many algorithms were suggested to improve the management of data on the flash media to improve SSD performance and error handling.

The first step in improving device performance is to understand the factors that affect it, such as bottlenecks, overheads, and other inefficiencies. This is most easily done by simulation of the main device features. After the problems have been identified, simulation is also used to test and evaluate possible solutions.

The goal of this project is to focus on a specific aspect of SSD performance and evaluate the benefit from solutions suggested in literature. The students will implement a new policy or method within the existing, widely used DiskSim simulator, and demonstrate its benefits and limitations by simulations.

Examples:

- Advanced coding techniques
- Optimized RAID configurations
- Garbage collection policies

Requirements:

Part I
The students will survey existing literature on Flash and memory in general and the specific aspect in focus, as well as the documentation and code structure of the simulator.

Part II
After discussion and in coordination with the project supervisor, the students will implement the policy/method in question. They will then analyze its performance by simulating and comparing several traces and configurations.

Platform:

The students will add their code to an existing SSD simulator, and in some cases use existing schemes for their analysis. DiskSim is written in C and is set up on the Linux machines at the Computer Systems Lab (CSL).

Prerequisites:

- Operating systems course. The project is designed for a group of 1 or 2 students.

References (specific references will be added for each aspect)

- N. Agrawal, V. Prabhakaran, T. Wobber, J. D. Davis, M. Manasse, R. Panigrahy. Design Tradeoffs for SSD Performance. In USENIX ATC 2008.

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[1] Also available as Project in Operating Systems (236366)