

# VSSIM: Virtual SSD Simulator

## (Accompanied by Demo)

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### Abstract

As the complexity of inner structure of Solid State Disks (SSD), both in H/W architecture and software layer, is growing in rapid speed, importance of having holistic performance measuring environment is also rising. Trace driven evaluation methodologies provide a quick understanding of the performance of SSD; however it only allows a detailed view on performance of SSD.

Many trace driven or workload dependent simulators cannot measure the effect of its behaviour and performance of a system. Since holistic system level traces are not available, measuring the interaction of performance is not always possible and also it is difficult to measure performance of various components of a system. It becomes even more important to have system-wide interaction considered in measuring the performance of SSD, as the architecture of the SSD is completely different from hard disk drives and also factors such as choice of file system and other system level optimizations matter to performance of SSD significantly.

In this paper, we present a novel simulator called VSSIM, Virtual SSD Simulator, that not only models the Flash Translation Layer (FTL) of Solid State Disk (SSD) but also its hardware dependent components. It is also accompanied by a system monitoring tool. We list some of characteristics that VSSIM differs from other SSD simulators.

1. VSSIM refines and parameterizes detailed flash chip specific and hardware dependent information. It configures and defines flash chip vendor dependent features such as read, program, erase latency, serial access time, and register

read/write delays. Number and sizes of pages in a block and a block is also configured as well as a number of ways and channels that a SSD incorporates.

2. VSSIM provides modular implementation of FTLs which allows to evaluate the performance of various FTL schemes ranging from page and block mapping to number of hybrid mapping schemes. It also measures different aspects of FTL such as garbage collection and wear-levels.
3. VSSIM measures not only the performance of SSD but also system-wide performance interaction. It operates on top of kernel-based virtual machine of QEMU which makes measuring the correlation of SSD to other system components possible.
4. VSSIM is real-time SSD simulator that allows to capture the essence of the merge operations concomitant of overwrite operations. Merge and overwrite operations are affected by current utilization of SSD. Unlike most other simulators which measures the performance of the FTL from the clean state, VSSIM can capture the exact behavior of FTL and its outcomes.
5. VSSIM exploits real-time workload, which makes easy to measure performance of many different applications.
6. VSSIM accompanies performance monitoring tool that makes log of all actions and performance measurements of various features of SSD.

In this paper we present a novel SSD simulator called VSSIM which models SSD controller, physical characteristics of flash memory with reconfigurable FTL schemes that can measure not only the performance of SSD but its interactions with the system in real-time. VSSIM monitoring tool shows explicit view on current status of the flash memory, and makes log of all status.

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