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SOLID STATE DRIVE PERFORMANCE ANALYZER USING FLEXIBLE I/O

Shrish P. Agone[1], Nikhil S. Kekan[2], Tushar D.Mungre[3], Virbhadra G.Patil[4], Prof. P.V.Kasture[5]

Student, Dept. Of Computer Engineering, Sinhgad Academy of Engineering, Pune, India [1,2,3,4]

Assistant Professor, Dept. Of Computer Engineering, Sinhgad Academy of Engineering, Pune, India [5]

Abstract: A solid-state drive (SSD) is a data storage device using integrated circuit assemblies as memory to store data persistently. SSD technology uses electronic interfaces compatible with traditional block input/output (I/O) hard disk drives. Solid state disks (SSDs) consisting of NAND flash memory are being widely used in laptops, desktops, and even enterprise servers. SSDs have many advantages over hard disk drives (HDDs) in terms of reliability, performance, durability, and power efficiency. Typically, the internal hardware and software organization varies significantly from SSD to SSD and thus each SSD exhibits different parameters which influence the overall performance. In this paper, we propose a methodology which can extract several essential parameters affecting the performance of SSDs. The target parameters of SSDs considered in this paper are (1)the size of read/write unit, (2) the size of erase unit, (3) the size of read buffer, and (4) the size of write buffer. Obtaining these parameters will allow us to understand the internal architecture of the target SSD better and to get the most performance out of SSD by performing SSD specific optimizations. FIO is an existing tool for I/O performance measurement. It is a tool that will spawn a number of threads or processes doing a particular type of I/O action as specified by the user. FIO has limitations in terms of the number of IO patterns a user can generate. Analyzing performance and understanding behavior of SSDs becomes difficult due to these limitations. We plan to make enhancements to FIO so that a user can generate IO patterns specifically required to exercise various components in an SSD. These will help users characterize SSD performance quicker and precisely.

Keywords: Solid State Drive, Flexible I/O, Hard disk, Nand Flash memory.

I. INTRODUCTION

A solid state disk (SSD) is a data storage device that uses solid state memory to store persistent data. In particular, we use the term SSDs to denote SSDs consisting of NAND flash memory, as this type of SSDs is being widely used in laptop, desktop, and enterprise server markets. Compared with conventional hard disk drives (HDDs), SSDs offer several favorable features. Most notably, the read/write bandwidth of SSDs is higher than that of HDDs, and SSDs have no seek time since they have no moving parts such as arms and spinning platters. The absence of mechanical components also provides higher durability against shock, vibration, and operating temperatures. In addition, SSDs consume less power than HDDs[24]. During the past few decades, the storage subsystem has been one of the main targets for performance optimization in computing systems. To improve the performance of the storage system, numerous studies have been conducted which use the knowledge of internal performance parameters of hard disks such as sector size; seek time, rotational delay, and geometry information. In particular, many researchers have suggested advanced optimization techniques using various disk parameters such as track boundaries, zone information, and the position of disk head[17], [26], [28]. Understanding these parameters also helps to model and analyze disk performance more accurately.

However, SSDs have different performance parameters compared with HDDs due to the difference in the characteristics of underlying storage media. For example, the unit size of read/write operations in SSDs, which we call the clustered page size, is usually greater than the traditional sector size used in HDDs. Therefore, if the size of write requests is smaller than the clustered page size, the rest of the data should be read from the original data, incurring additional overhead [1]. To avoid this overhead, it is helpful to issue read/write requests in a multiple of the clustered page size.

There is a wide gap between the potential performance of NAND flash-based solid state drives (SSDs) and their performance in many real-world applications. Understanding this gap requires knowledge of their behaviour and internal algorithms for various workloads. By performance analysis of a storage system," we mean the application of a variety of approaches to predict, assess, evaluate, and explain the system's performance characteristics, along dimensions such as throughput, latency, and bandwidth. FIO is an existing tool for I/O performance measurement. It is a tool that will spawn a number of threads or processes doing a particular

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In this paper, we propose a methodology which can extract several essential parameters affecting the performance of SSDs. The parameters considered in this paper include the size of read/write unit, the size of erase unit, the type of NAND flash memory used, the size of read buffer, and the size of write buffer. To extract these parameters, we have developed a set of micro benchmarks which issue a Sequence of read or write requests and measure the access Latency . By varying the request size and the access pattern, important performance parameters of a commercial SSD can be successfully estimated.

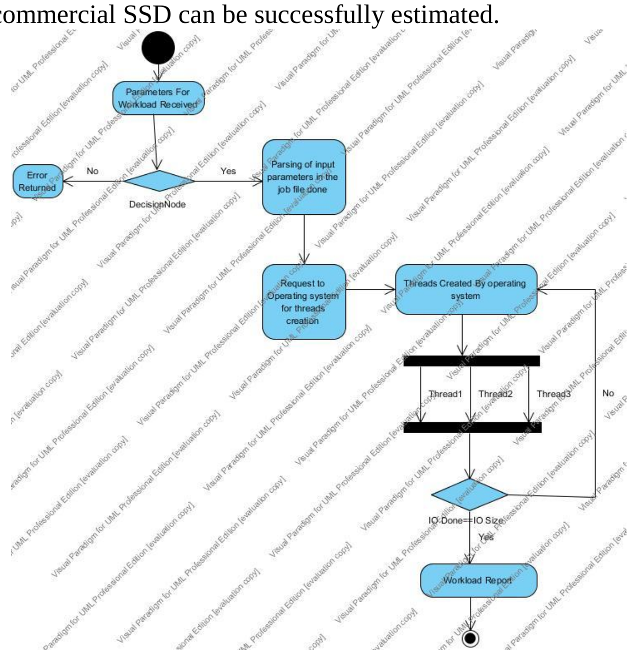

Fig. 1 Activity Diagram

II. DATA FLOW DIAGRAMS

LEVEL-0 DFD:

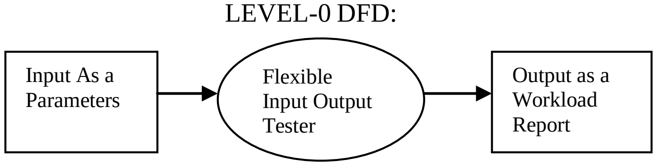

Fig 2. Level 0 DFD

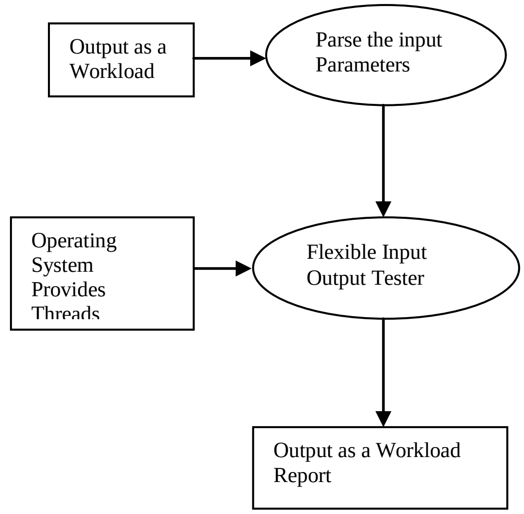

Fig 3. Level 1 DFD

III. PROJECT PLAN

The project plan for proposed system i.e., SSD Performance and Analyzer gives step by step flow of the system implementation plan.

It includes the requirements gathering and analysis, design of project, GUI development, coding, testing, modification and deployment phases.

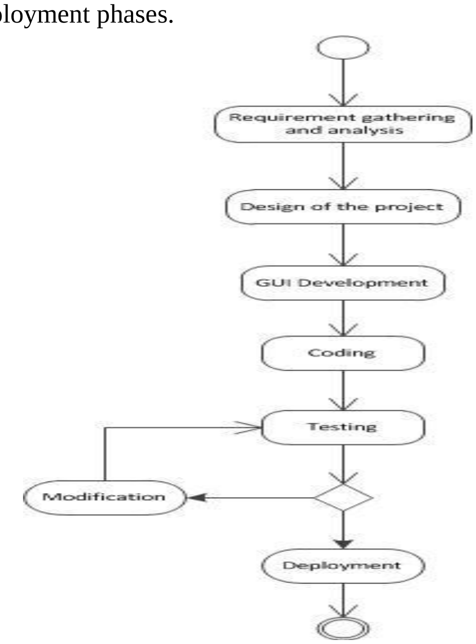

Fig. 4 Project Plan

The above figure (fig. 2) depicts the project plan. It describes the activity plan of the project. The activities will be carried out in the same order. We are implementing the proposed system on the basis of object oriented concepts. It means dividing whole system into different modules.

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IV. ABBRIVIATION

SSD : Solid State Drive
HDD : Hard Disk Drive
FIO : Flexible Input Output
Fig. : Figure

V. CONCLUSION

SSD can be an effective replacement for HDD. Flexible input output tester can be used for effective input output performance analysis for Solid State Drive. Hence the performance of read/write operation in SSD may be improved using this analysis.

VI. ACKNOWLEDGEMENT

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