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# Contribution of SSDs to Green Computing

Study on : Contrubution of SSDs towards Green Computing

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**Abstract** — *Green computing is a global effort which aims at manufacturing, implementing, using and disposing the computer systems in an efficient way to minimize its impact on the surroundings. Going green is very helpful to make our atmosphere and globe healthy. This paper aims at providing details how SSDs (Solid State Drives) can contribute to Green Computing.*

***Keywords***- *Green Computing, Active Storage, Power consumption, Energy Efficiency*

## INTRODUCTION

The primary goal of adapting green computing is to facilitate the organizations to use various computer resources proficiently by maintaining and increasing its overall performance. Green computing is the branch of an environmental science which enables the responsible use of computer resources, servers and its associated subsystems like display devices, various input and output devices, Storage Devices.

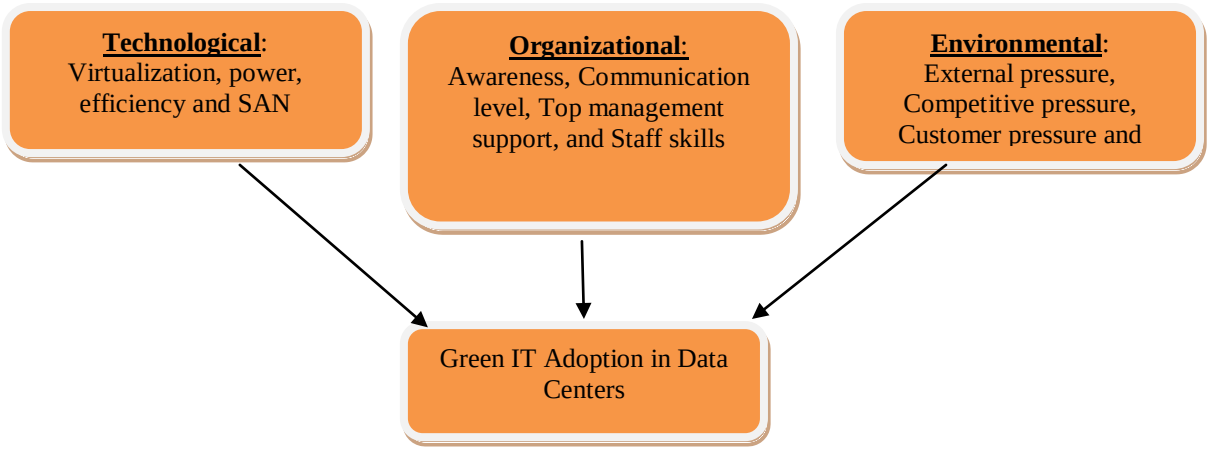


***Figure 1:*** *Factors influencing Green Computing at Data Centers*

## DATA CENTERS

In many companies, there has been a shift away from dedicated data centers, as part of an attempt to provide all IT requirements by using smaller boxes within the office environment.
Within a data centre/server environment, technological improvement is driving requirements for greater energy into the building, for increased floor area and for increased cooling capacity.

## SSD CONTRIBUTION TO GREEN COMPUTING

In the past, it was necessary for each computer system to have its own storage to function. Storage virtualization makes it possible for systems to access a shared light use, a 120GB or 160GB laptop drive is a very affordable, lower-power alternative toa 3.5" disk. The lowest-power option is to use a solid state hard drive (SSD), which typically draw less than

 

one-third the power of a 2.5" disk. The latest, highest-performance SSDs are very fast but extremely expensive, and currently top out at only64GB.

**Solid-state drive (SSD )** – It is also called as a solid-state disk or solid-state disk. It is a non volatile storage device which is used to store the data permanently. The memory doesn't move in SSD. SSD devices insert the memory chips made up of silicon as storage media for reading and writing data persistently. SSDs are also called as flash cards or flash drive, which are embedded into computer server called as server-side flash storage. Like HDD, SDD doesn't contain any mechanical part. An SDD is an array of semiconductor memory which is well ordered as the disk, by using integrated circuits instead of optical or magnetic storage media. There are different manufacturers of SSD such as Intel, SK Hynix samsung SanDisk, Toshiba and much more.

Below tables shows power consumption comparison of SSDs and HDDs

***Table 1: Typical power consumption comparison***

| Key Components | HDD WH/Unit | SSD WH/unit |
|---|---|---|
| Head | 125 | - |
| Disk | 2000 | - |
| Motor | 900 | - |
| SOC | 170 | - |
| Flash | - | 200 |
| Assembly and Test | 3100 | 1000 |

***Table 2: Power consumption as per workload and design***

| Measurement | SSD Value | HDD value |
|---|---|---|
| Peak Spin-up current (+5V) | 853 mA | 786 mA |
| Idle power (W) | 0.573 W | 0.859 W |
| Write power (W) | 1.726 W | 2.545 W |
| Read power (W) | 1.239 W | 2.733 W |
| Operating power (W) | 1.249 W | 1.860 W |
| Random read power (W) | 0.653 W | 2.401 W |

*Source for both the tables: Debasis Baral, Storage Labs, Samsung Information Systems America(Flash memory Summit)*

The advantages of solid state drives over traditional hard disks are:

- Greater speed of operation because the disk is not spinning
- Information on solid state drives can be accessed immediately so there is no delay between the request for data and the beginning of data transfer. This means that even when data is fragmented there is no slump in performance
- Decreased start-up time for applications. In SDD, seek time and latency reduced substantially will increase the boot time.
- Greater stability because there are no moving parts. Dust or foreign particles entering the mechanism cease to be a problem because solid state drives can be sealed tightly unlike hard disks which need air to function correctly.
- SSD can save on battery-life significantly. During drive access, the SSD will be back online in a couple of seconds instead of the 15–30 seconds that it takes for a mechanical drive to re-initialize.
- Because of the lag when restarting a mechanical drive, people tend to allow them to run for longer periods before shutting down. This leads to increase in Power Consumption.

 

**CONTRIBUTION TO GREEN COMPUTING USING ACTIVE STORAGE WITH SSDS**

Active Storage is a computer system architecture which utilizes processing power in disk drives to execute application code. Two synonyms, Active Disk and Intelligent Disk, are also used to refer to Active Storage. The basic idea behind Active Storage is to offload computation and data traffic from host computers to the disk drives themselves such that the system can achieve significant performance improvements for data intensive applications such as decision support systems and multimedia applications.

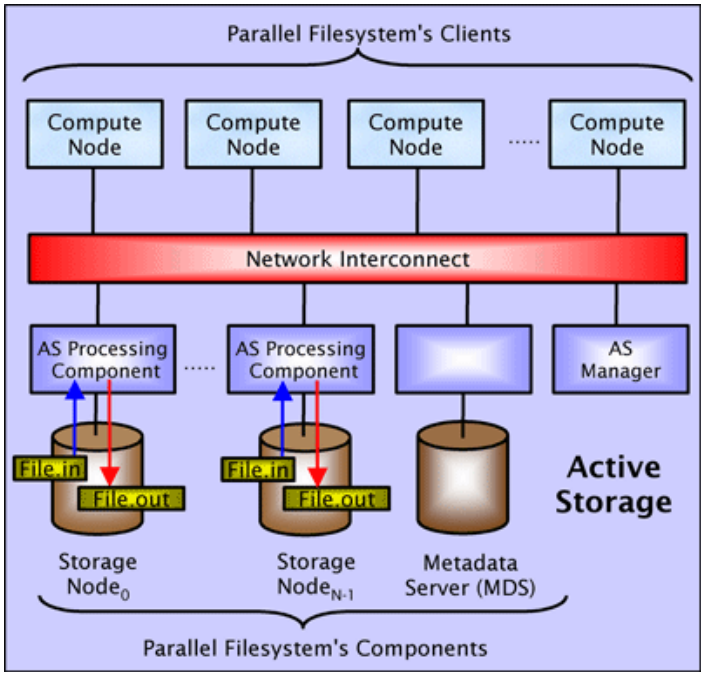


***Figure 2***: Active *storage architecture*

Let us take an example of a storage infrastructure which has 5 servers and a Large single storage device using HDDs. In this structure, the server would be doing the main part of computation and data management. Storage would be used to hold the data. The storage is using HDDs. Power consumption for these mechanical storage can be calculated as
***5V 500mA for, say, 45 mins in every hour of operation amounts to 112 Wh per hour***

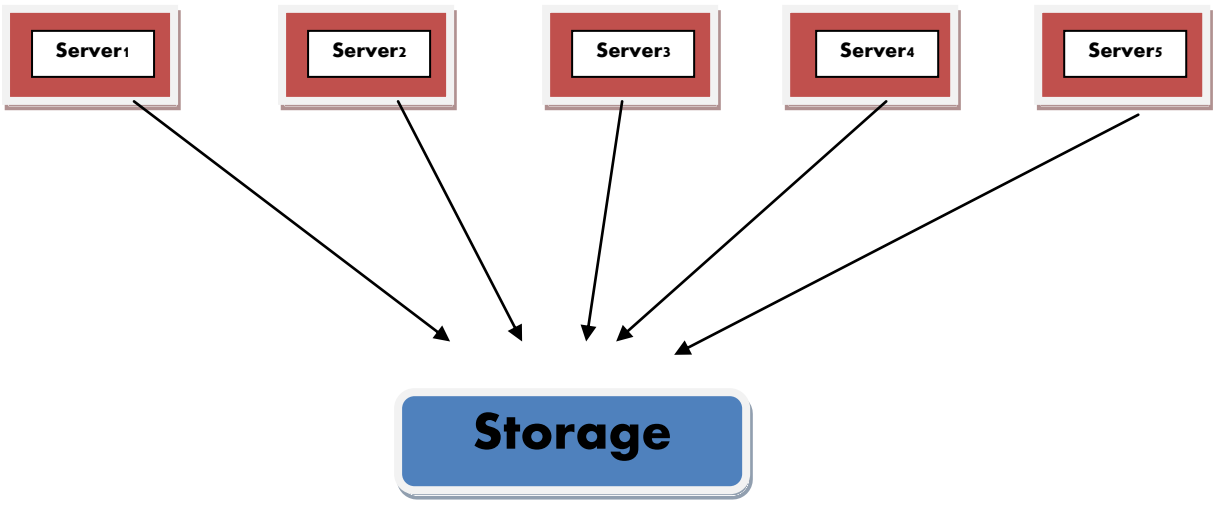


***Figure 3***: *HDD storage connected to 5 servers*

 

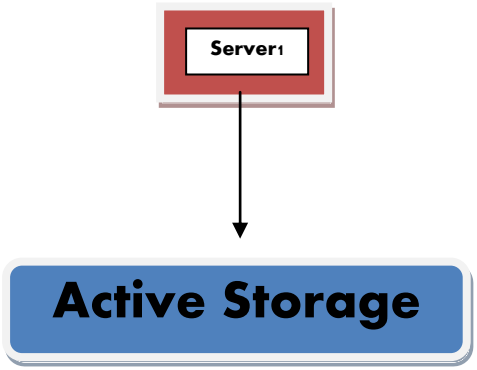


***Figure 4:*** *Active storage using SSD connected to single server*

In the second infrastructure, Active Storage Framework is used, hence only one Server suffices the purpose. Active storage is designed making use of SSDs (and will avoid mechanical working disks).
Simple mathematics shows that the SSDs are more power-efficient.
**5v 1A for, say, 10 mins every hour amounts to 50Wh per hour.**
That means SSD is saving better than 50% in power which has a notable effect on battery-life.

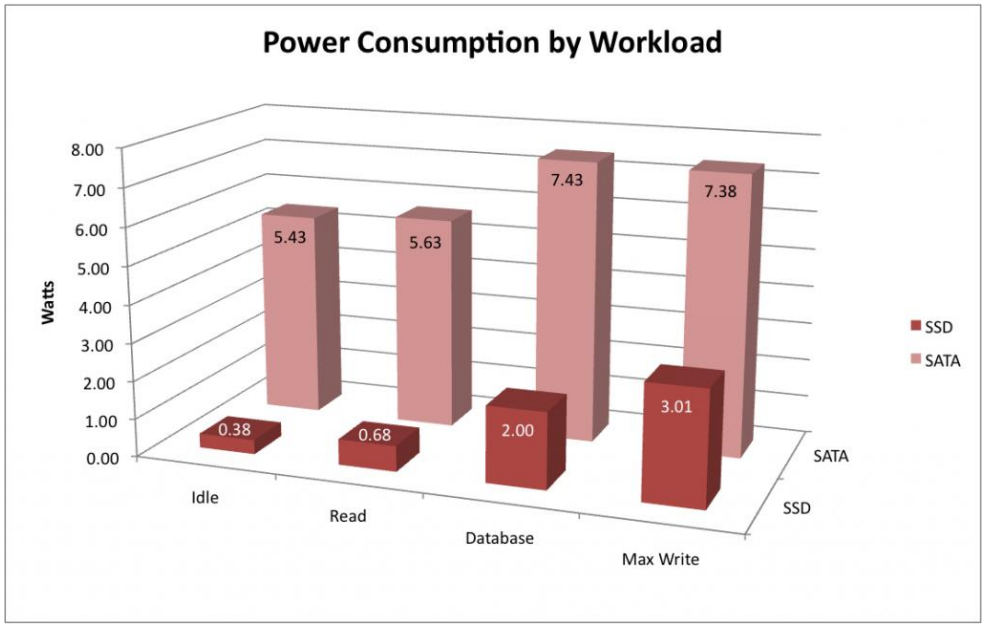


***Figure 5***: *Power consumption by workload*

**RESEARCH AREAS IN GREEN COMPUTING**

There are several research areas where lots of efforts are being put by researchers. To name few

- Energy Consumption: Organizations are now becoming aware that more energy usage are contributing towards Green-House Gas (GhG). Hence they are taking efforts towards reducing energy usage to reduce the Green-House Gas production.
- E-Waste Recycling: Majority of countries around the world require electronic companies to finance and manage recycling programs for their products especially under-developed Countries. Green Computing must take the product life cycle into consideration; from production to operation to recycling. E-Waste is a manageable piece of the waste stream and recycling e-Waste is easy to adopt. Recycling computing equipment such as lead and Mercury enables to replace equipment that otherwise would have been manufactured.
  The reuse of such equipments allows saving energy and reducing impact on Environment, which can be due to electronic wastes

 

- Data Center Consolidation & Optimization: Currently much of the emphasis of Green Computing area is on Data Centers, as the Data Centers are known for their energy hunger and wasteful energy consumptions. With the purpose of reducing energy consumption in Data Centers it is worthwhile to concentrate on Information Systems, Cooling systems, Air management and selecting electrical equipments for data center.
- Virtualization: Virtualization of computer resources is becoming one of the trends in Green Computing. It manages physical hardware resources with abstraction (with the help of virtualization software). One of the best ways to go towards green and save enough space, enough resources, and the environment is by streamlining efficiency with virtualization. This form of Green Computing will lead to Server consolidation and enhance computer security [6]. Virtualization runs fewer systems at higher levels of utilization. Virtualization allows full utilization of computer resources.

## FUTURE OF GREEN COMPUTING

Opportunities lie in green technology like never before in history and organizations are seeing it as a way to create new profit centers while trying to help the environmental cause. The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings. Researches in above areas are helping green computing to be more and more realistic.
Future work in Green computing will focus on 'Energy Consumption, E-waste recycling, Virtualization and Research work in academics since this is an emerging discipline'.

## REFERENCES

[1] Namdeo, Jyoti, and NaveenkumarJayakumar. "Predicting Students Performance Using Data Mining Technique with Rough Set Theory Concepts." International Journal 2.2 (2014).

[2] Jayakumar, D.T. and Naveenkumar, R., 2012. SDjoshi,". International Journal of Advanced Research in Computer Science and Software Engineering," Int. J, 2(9), pp.62-70.

[3] Raval, K.S., Suryawanshi, R.S., Naveenkumar, J. and Thakore, D.M., 2011. The Anatomy of a Small-Scale Document Search Engine Tool: Incorporating a new Ranking Algorithm. International Journal of Engineering Science and Technology, 3(7).

[4] Naveenkumar, J., Makwana, R., Joshi, S.D. and Thakore, D.M., 2015. Performance Impact Analysis of Application Implemented on Active Storage Framework. International Journal, 5(2).

[5] Naveenkumar, J., Keyword Extraction through Applying Rules of Association and Threshold Values. International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), ISSN, pp.2278-1021.

[6] Jayakumar, M.N., Zaeimfar, M.F., Joshi, M.M. and Joshi, S.D., 2014. INTERNATIONAL JOURNAL OF COMPUTER ENGINEERING & TECHNOLOGY (IJCET). Journal Impact Factor, 5(1), pp.46-51.

[7] Kakamanshadi, G., Naveenkumar, J. and Patil, S.H., 2011. A Method to Find Shortest Reliable Path by Hardware Testing and Software Implementation. International Journal of Engineering Science and Technology (IJEST), ISSN, pp.0975-5462.

[8] Archana, R.C., Naveenkumar, J. and Patil, S.H., 2011. Iris Image Pre-Processing And Minutiae Points Extraction. International Journal of Computer Science and Information Security, 9(6), p.171.

[9] Salunkhe, R. and Jaykumar, N., 2016, June. Query Bound Application Offloading: Approach Towards Increase Performance of Big Data Computing. In Journal of Emerging Technologies and Innovative Research (Vol. 3, No. 6 (June-2016)). JETIR.

 

[10] Salunkhe, R., Kadam, A.D., Jayakumar, N. and Thakore, D., 2016, March. In search of a scalable file system state-of-the-art file systems review and map view of new Scalable File system. In Electrical, Electronics, and Optimization Techniques (ICEEOT), International Conference on (pp. 364-371). IEEE.

[11] Naveenkumar, J., Makwana, R., Joshi, S.D. and Thakore, D.M., 2015. Offloading Compression and Decompression Logic Closer to Video Files Using Remote Procedure Call. Journal Impact Factor, 6(3), pp.37-45.

[12] Jayakumar, N., Singh, S., Patil, S.H. and Joshi, S.D., 2015. Evaluation Parameters of Infrastructure Resources Required for Integrating Parallel Computing Algorithm and Distributed File System. IJSTE-Int. J. Sci. Technol. Eng, 1(12), pp.251-254.

[13] Kumar, N., Angral, S. and Sharma, R., 2014. Integrating Intrusion Detection System with Network Monitoring. International Journal of Scientific and Research Publications, 4, pp.1-4.

[14] Jayakumar, N., Bhardwaj, T., Pant, K., Joshi, S.D. and Patil, S.H., 2015. A Holistic Approach for Performance Analysis of Embedded Storage Array. Int. J. Sci. Technol. Eng, 1(12), pp.247-250.

[15] Jayakumar, N., 2014. Reducts and Discretization Concepts, tools for Predicting Student's Performance. Int. J. Eng. Sci. Innov. Technol, 3(2), pp.7-15.

[16] Salunkhe, R., Kadam, A.D., Jayakumar, N. and Joshi, S., 2016, March. Luster a scalable architecture file system: A research implementation on active storage array framework with Luster file system. In Electrical, Electronics, and Optimization Techniques (ICEEOT), International Conference on (pp. 1073-1081). IEEE.

[17] Naveenkumar, J., SDJ, 2015. Evaluation of Active Storage System Realized Through Hadoop. International Journal of Computer Science and Mobile Computing, 4(12), pp.67-73.

[18] Bhore, P.R., Joshi, S.D. and Jayakumar, N., 2016. A Survey on the Anomalies in System Design: A Novel Approach. International Journal of Control Theory and Applications, 9(44), pp.443-455.

[19] Bhore, P.R., Joshi, S.D. and Jayakumar, N., 2017. Handling Anomalies in the System Design: A Unique Methodology and Solution. International Journal of Computer Science Trends and Technology, 5(2), pp.409-413.

[20] Zaeimfar, S.N.J.F., 2014. Workload Characteristics Impacts on file System Benchmarking. Int. J. Adv, pp.39-44.

[21] Bhore, P.R., Joshi, S.D. and Jayakumar, N., 2017. A Stochastic Software Development Process Improvement Model To Identify And Resolve The Anomalies In System Design. Institute of Integrative Omics and Applied Biotechnology Journal, 8(2), pp.154-161.

[22] Kumar, N., Kumar, J., Salunkhe, R.B. and Kadam, A.D., 2016, March. A Scalable Record Retrieval Methodology Using Relational Keyword Search System. In Proceedings of the Second International Conference on Information and Communication Technology for Competitive Strategies (p. 32). ACM.

[23] Naveenkumar, J. and Joshi, S.D., 2015. Evaluation of Active Storage System Realized Through Hadoop. Int. J. Comput. Sci. Mob. Comput, 4(12), pp.67-73.

[24] Naveenkumar, J., Bhor, M.P. and Joshi, S., 2011. A self process improvement for achieving high software quality. International Journal of Engineering Science and Technology (IJEST), 3(5), pp.3850-3053.

[25] Naveenkumar, J. and Raval, K.S., 2011. Clouds Explained Using Use-Case Scenarios. INDIACom-2011 Computing for Nation Development, 3.

[26] Sawant, Y., Jayakumar, N. and Pawar, S.S., 2016. Scalable Telemonitoring Model in Cloud for Health Care Analysis. In International Conference on Advanced Material Technologies (ICAMT) (Vol. 2016, No. 27th).

 

[27] Naveenkumar, J. and Joshi, S.D., 2015. Evaluation of Active Storage System Realized through MobilityRPC.

[28] kumarSingha, A., Patilb, S.H. and Jayakumarc, N., A Survey of Increasing I/O Latency in I/O Stack.

[29] Bhore, P.R., Joshi, S.D. and Jayakumar, N., 2016. A Survey on the Anomalies in System Design: A Novel Approach. International Journal of Control Theory and Applications, 9(44), pp.443-455.

[30] Singh, A.K., Pati, S.H. and Jayakumar, N., A Treatment for I/O Latency in I/O Stack.

[31] Jaiswal, U., Pandey, R., Rana, R., Thakore, D.M. and JayaKumar, N., Direct Assessment Automator for Outcome Based System.

[32] Kulkarnia, A. and Jayakumarb, N., A Survey on IN-SITU Metadata Processing in Big Data Environment.

[33] Jayakumar, N., Iyer, M.S., Joshi, S.D. and Patil, S.H., A Mathematical Model in Support of Efficient offloading for Active Storage Architectures.

 