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Green Computing Turns Green IT

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Abstract: The notion of Green computing is the contemporary style that is gaining high esteem. Green computing is the study and practice of environmentally sustainable computing. Green Computing practices entail crafting, mechanizing, employing and disposing of computers proficiently with negligible impact on the atmosphere. Green computing can also be termed as Go-Green practice that assists lessening the carbon foot-print. Green computing facilitates us to a secure, safe and sound environment for the mankind. This paper will mainly focus on two of the major solutions to Green IT- Virtualization and Docker. We also consider some of the other notable solution such as Server Consolidation. Apart from this, this paper also presents some of the noteworthy green computing practices.

Keywords: Green Computing, Virtualization, Docker, Container, Hypervisor.

I. INTRODUCTION

Green computing is the study and practice of environmentally sustainable computing. It is an eco-friendly strategy that can be implemented in our daily life to reduce the environmental impact. Green computing has drawn its attention in business and industries too for the reason that the ideas of green computing can reduce the cost of computing and can also extend the lifespan of IT products because green computing is about using the computer and its related resources in an environmentally responsible way. It involves implementing energy-efficient computer, CPU, Server and other peripherals to reduce the resource consumption. The GCI has promoted five core technologies for green computing and they are Cloud Computing, Grid Computing, Virtualization, Green Data Center and Power Optimization. Data center is the major source of energy consumption. It consumes an incredibly large amount of energy, i.e. It consumes 50 times more the energy per square foot than the energy consumed by companies. As a consequence it discharges a huge amount of heat and detrimental gases that brings impairment to environment and human. According to an American survey, the energy consumption of the data center all over the world will double in next few years. Green computing can reduce this problem by introducing energy-efficient computing. Industries and Companies are increasingly focusing on developing and using such devices. One such technique employed by companies is Virtualization in which Server Consolidation is mostly engaged. Another technique that is gaining high popularity is Docker. These two techniques are the major elucidation to Green IT.

II. GREEN COMPUTING

Green Computing is the catchphrase of current era. It is in reality a part of Green Technology and it is our social responsibility to practice it. The concepts of Green have to be introduced right from Design phase to Disposal phase of a product. It is a study and implementation of eco-friendly computing. At a time where business runs 24/7, there is an obligatory need to collect, store and analyze the large amount of data generated in business. All this comes at a cost for both business and environment because this big amount of data is stored in Data Centers and Data Warehouses. Data center use so much power to run the servers that house these data and releases so much heat which has to be cooled down so that servers are not affected by this heat. So the actual problem here is to reduce the amount of energy consumption. This is indeed is in the minds of IT industries as they are the ones to use large number of computers and servers. Hence, the Industry and Business people are

increasing moving to approaches that use energy-efficient system, efficient cooling system, virtualization and more recently Dockers. The combination of these techniques can reduce the data footprint, reduce the number of resources and in overall the management and maintenance also reduces. The attention on computers has turned towards efficient and less energy consumption from speed and cost. Though computers are the wealth of knowledge, they also have obvious problems such as causing pollution, producing e-wastes and increasing the Green House Gases. Employing Green computing not only alleviate these problems but also has additional benefits such as;

1. It reduces the energy consumption and thereby saving energy
2. It is environmentally responsible and eco-friendly
3. It reduces the detrimental effects of computing and its resources
4. It facilitates energy-efficient computing and increases productivity
5. It implements the concepts of Recycle and by this means reducing the e-waste.

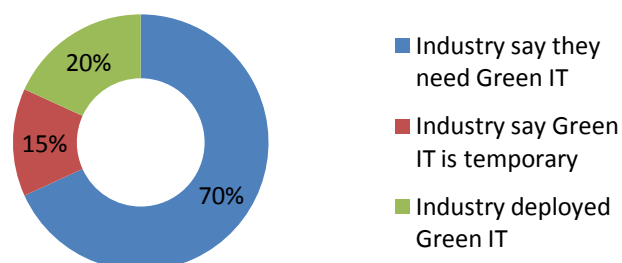
III. GREEN IT

Green IT is a tag in the IT market. It is the second step towards Green Technology, while the first being Green Computing. It is certainly not a new technology but a supplementary stratagem to the existing Green technologies. The goals of Green IT is the same as Green Computing, as they both belong to the same family of Green Technology. As said, Green IT helps reduce energy consumption, cost of computing and augments the performance.

In a survey conducted in US, 75% IT industry presses on the need for Green IT, out of which, 20% have already deployed Green IT techniques and technologies. And only 15% of IT industry feels that Green IT is just a temporary. This survey demonstrates that Green IT has already entered the minds of IT Industry. Basically the enterprises in the IT market are categorized as;

1. Industries that based on Data center's design
2. Industries that are based on compute power
3. Industries that are based on their Green Commitment

Green IT



Out of these three categories, the third class is the one to focus primarily on Green IT and this forms that 75%. Industries use some of the following high level choices to implement the Green IT;

1. Virtualization : Server and Desktop
2. Consolidation : Server
3. Optimization : Application

4. Data Center design

A combination of these techniques can be extremely useful in accomplishing Green IT.

IV. VIRTUALIZATION

Virtualization is a technology that is a step towards Green Computing. It is the most prevalent priority of Green IT. It provides a layer of abstraction called Hypervisor, which lies on the computer hardware. Hypervisor is a software program that focuses on logical view of computing rather than physical view and this allows it to run multiple Operating Systems on a single machine. Virtualization can be applied to core computing devices namely CPU (Processor), Storage (Hard Disk), Networking (Connection) and Memory (RAM). The commonly used Virtualization technique is Server Virtualization, but the focus has turned towards to Desktop Virtualization too. While Server virtualization is matured, Desktop virtualization is still under investigation. Industries view Virtualization as a Capital- Cutback scheme. Server Consolidation plays a major role in Industries and 80% of Industries are taking up projects that support Server Consolidation.

A. Server Virtualization:

In simple terms, Server Virtualization is reducing the number of Servers required and to increase the utilization of servers. Server Virtualization saves around 60%-90% of energy. Despite the fact that 90% virtualization is possible in theory; in practice only 60% is feasible. Reducing the server footprint reduces the power consumption and thereby reducing the cooling requirement. A supplementary benefit to Virtualization is Load Balancing, which balances the load among the servers available. Server Virtualization is achieved through Redundancy. Each server is backed up by 1 backup server. Initially, the backup server count was high. It was later reduced to 3 and now to 1. At the moment, in more sophisticated organization, only one backup server is sufficient to backup n number of servers. This 1-backup server technique is reliable. Server virtualization is the sweet spot and priority of Industries.

Consider a scenario where a Multi-level Industry has 2 data centers housing 4000 servers. This server count is huge enough to backfire on your budget. The industry made a smart move towards Server Virtualization and Virtualized 1500 servers. Now these 1500 servers alone will play the role of 4000 servers. This means that only 40% of the entire infrastructure has to be maintained now. This truly reduces the cost of computing and maintaining. In addition, the utilization of servers increased to 10%-16% and 60% reduction in networking is a side-benefit. In two more years, the industry will be able to virtualize 80% of servers thereby doubling the benefits and profits. In my next paper, I shall talk about Server Virtualization in depth.

B. Desktop Virtualization:

Though desktop virtualization is still under investigation, it has already found its way into IT industry. It shares the same pros of server virtualization like saving energy and reducing power requirement. In desktop virtualization, all desktops in the enterprise are made to run in Data center and the computation is pushed out to the desktop. Thin clients are an alternative to normal desktop computing. Though virtualization is the primary priority of Green IT, it faces some disadvantages like High upfront cost and server sprawl. It should also be noted that not all applications are ready to be virtualized. To overcome all these problems, we use Docker.

V. DOCKER

Docker is a newer technology that aims at building, shipping and running distributed applications. It is a Virtual Machine technique without the overhead of Virtual Machine. This does not have any starting overhead as in Virtualization techniques. One of the components of Docker is Docker Hub. It is a cloud service for sharing applications. The building part of Docker is handled by Docker Images. The distribution part of Docker is handled by Docker Registries. The running part of Docker is handled by Docker Containers. Docker is known for its inexpensiveness, fast booting and shutting down, low CPU and memory requirement and finally it is fast and elegant. Docker is efficient in the sense that Docker Container runs on the kernel

level so that containers can efficiently share resources. Moreover, Docker Containers promises to provide better portability across cloud. Linux Containers, the forerunner of Docker is established, while Docker is not. Docker faces some serious problems in Isolation, Security perspective. It is also less matured than traditional Hypervisor.

VI. BEING TOGETHER FOR GREENER TOMORROW

Neither Docker Containers nor Virtualization technique can provide complete performance. They are not adequate for an application in their own stand. Containers are good at providing portability of application. Even multi-level applications can also be easily ported. Moreover, Dockers provide a template for this purpose. But, portability is not the only criteria for an application to run successfully. Other operational factors like flexibility, security, performance and much more has to be considered. Such high-level factors can be provided only by a matured technology like Virtualization. Besides, the application can be first put in a Docker Container and then they can very well run inside Virtual Machine, though they both seem to be absolutely different technologies. This way the container can get the benefits of Virtualization.

So far, we have Containers that are basically suited for Linux system. But, Windows based Containers are still under investigation. It is said that, Windows based Containers are normally suited for Desktops and they will not depend on any Virtualization technique, not even Hypervisor. They have their customized virtualization system. Spoon is one such technology to offer Windows based Containers.

VII. CONCLUSION

Neither Green Computing nor Green IT is just a new style; they are newer technologies that promise to provide environmental friendly computing. Corporate are moving not only for image but also to alleviate their budget problems. Though many newer techniques and technologies are mounting every other day, Server Consolidation is the top priority among corporate. To get an enhanced advantage, Industry should spotlight on reorganizing their datacenter infrastructure.

In this paper, we used two major solutions to Green IT namely Virtualization and Docker. While Virtual Machines' focus is on application flexibility, Dockers' is on application portability. Neither Docker containers nor Virtual Machines could completely annihilate each other. So it is not about which works better; either Virtualization or Dockers? To enjoy the maximum performance, both Virtualization technique and Docker Container should go hand in hand. This can be achieved by containerizing the applications and then applying Virtualization technique to it. This way we can achieve Green IT in an effective manner.

References

1. Mayanka Katyal, Atul Mishra, *A Comparative Study of Load Balancing Algorithms in Cloud Computing Environment*, December 2013 International Journal of Distributed and Cloud Computing, Volume 1 Issue 2.
2. Fazel Mohammadi, Dr. Shahram Jamali, and Masoud Bekravi "Survey on Job Scheduling algorithms in Cloud Computing" International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) Volume 3, Issue 2, March – April 2014.
3. Dharmesh Kashyap, Jaydeep Viradiya(2014), *A Survey Of Various Load Balancing Algorithms In Cloud Computing*, INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 3, ISSUE 11, NOVEMBER 2014 ISSN 2277-8616 115 IJSTR©2014 www.ijstr.org
4. Upendra Bhoi, Purvi N. Ramanuj, —Enhanced Max-min Task Scheduling Algorithm in Cloud Computing|| International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 2, Issue 4, April 2013
5. Karanpreet Kaur, Ashima Narang, Kuldeep Kaur, "Load Balancing Techniques of Cloud Computing", International Journal of Mathematics and Computer Research, April 2013
6. Dhinesh B. L.D, P. V. Krishna, —Honey bee behavior inspired load balancing of tasks in cloud computing environments||, in proc. Applied Soft Computing, volume 13, Issue 5, May 2013, Pages 2292-2303.
7. Tushar Desai, Jignesh Prajapati, || A Survey Of Various Load Balancing Techniques And Challenges In Cloud Computing|| International Journal of Scientific & Technology Research, Volume 2, Issue 11, November 2013
8. Baris Yuce, Michael S. Packianather, Ernesto Mastrocinque, Duc Truong Pham and Alfredo Lambiase "Honey Bees Inspired Optimization Method: The Bees Algorithm" insects 1 July 2013; Published: 6 November 2013.
9. Shilpa V Pius, Shilpa T S "Survey on Load Balancing in Cloud Computing" International Conference on Computing, Communication and Energy Systems (ICCCES-2014).
10. Kousik Dasgupta, Broto Mandal, Paramartha Duttac, Jyotsna Kumar Mondal, Santanu Datta, A Genetic Algorithm (GA) based Load Balancing Strategy for Cloud Computing" International Conference on Computational Intelligence: Modeling Techniques and Applications (CIMTA) vol 10, 2013.
11. N. S. Raghava and Deepthi Singh "Comparative Study on Load Balancing Techniques in Cloud Computing" OPEN JOURNAL OF MOBILE COMPUTING AND CLOUD COMPUTING Volume 1, Number 1, August 2014.

12. Doddini Probhuling L., *LOAD BALANCING ALGORITHMS IN CLOUD COMPUTIN*, International Journal of Advanced Computer and Mathematical Sciences ISSN 2230-9624. Vol4, Issue3, 2013, pp229-233.,<http://bipublication.com>
13. Nusrat Pasha, Dr. Amit Agarwal Dr. Ravi Rastogi, *Round Robin Approach for VM Load Balancing Algorithm in Cloud Computing Environment*, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 5, May 2014 ISSN: 2277 128X
14. Amandeep Kaur sidhu1 and Supriya Kinger2, "Analysis of Load Balancing Techniques in Cloud Computing", International Journal of Computers & Technology, volume 4, No. 2, March- April 2013, pg 737- 741.
15. Pooja Samal1 and Pranati Mishra2, "Analysis of Variants in Round Robin Algorithms for Load Balancing in Cloud Computing", (IJCSIT) International Journals of Computer Science and Information Technologies, Volume 4 (3), 2013, pg. no. 416- 419.
16. B. Santosh Kumar1 and Dr. Latha Parthiban2, "An Implementation of Load Balancing Policy for Virtual Machines Associated with a Data Centre", International Journal of Computer Science & Engineering Technology (IJCSSET), volume 5 no. 03, March 2014, pp. 253- 261.
17. Sonika Matele1, Dr, K James2 and Navneet Singh3, "A Study of Load Balancing Issue Among Multifarious Issues of Cloud Computing Environment", International Journals of Emerging Technolog Computational and Applied Science (IJETCAS), volume 13- 142, 2013, pg. 236- 241
18. Dr. Rakesh Rathi1, Vaishali Sharma2 and Sumit Kumar Bole3, "Round Robin Data Center Selection in Single Region for Service Proximity Service Broker in Cloud Analyst", International Journal of Computer & Technology, Volume 4 no. 2, March- April 2013, pg. no. 254- 260.
19. Kunal Mahurkar1, Shraddha Katore2 and Suraj Bhaisade3, Pratikawale4, "Reducing Cost of Provisioning in Cloud Computing", International Journal of Advance in Computer Science and Cloud Computing, Volume- 1, Issue- 2, nov.- 2013, pg. 6- 8.
20. Dr Hemant S. Mahalle1, Prof Parag R. Kaver2 and Dr. Vinay Chavan3, "Load Balancing on Cloud Data Centres", Internatinal Journal of Advanced Reserch in Computer Science and Software Engineering, volume 3, issue 1, January 2013, pp. 1- 4.
21. Subasish Mohapatra1, Subhadarshini2 and K. Smruti Rekha3, "Analysis of Different Varients in Round Robin Algorithms for Load Balancing in Cloud Computing", International Journal of Computer Application, Volume 69- no. 22, may 2013, pp. 17-21.
22. Ajay Gulati1 and Ranjeev K. Chopra2, "Dynamic Round Robin for Load Balancing in a Cloud Computing", International Journal of Computer Science and Mobile Computing, volume 2, issue 6, June 2013, pg 274- 278.