A Approach to Optimal Strategy for Energy Efficiency in Cloud System

Shruti Dadhich
M.tech scholar dept. of computer science
Arya college of engineering & I.T.
Jaipur
Shruti.dadhich7@gmail.com

Prof (Dr.) Vibhakar Pathak
Professor dept. of CS/IT
Arya college of engineering & I.T.
Jaipur
vibhakarp@rediffmail.com

Abstract:- Cloud is a combination of datacentre software and hardware. People may be provider, user of SaaS, users or providers of Utility Computing. Most of the energy in system devices is squandered because they are built to deal with worst case scenario. Different scheduler like SJFGC, DENS, and DCEERS are reported by different researches. Green CloudSim makes total of energy utilization information in data centre. It is utilized by communication and computing components of the data centre possible on an unprecedented fashion. In the paper comparision of total energy consumed by two scheduling viz. Random and RandomDENS algorithms is presented.

Keywords—*Cloud computing; Green Cloud; data centre;*

*****

I. INTRODUCTION

In recent years, the popularity and quick development in processing and storage technologies and the success of the Internet, computing resources have turned out to be less expensive, more powerful and more ubiquitously accessible than any other time in recent memory [1]. This technological trend is prominently known as cloud computing. Cloud computing gives an adjustable on the web environment, which urges the capacity to manage with a large amount of work without influencing on the execution of the framework.

Cloud computing is web based processing that conveys platform as a service (PaaS), infrastructure as a service (IaaS), and software as services (SaaS). In SaaS, the cloud provider makes software application accessible. In PaaS an application development stage is given as a service to the developer to make an online application. In IaaS computing framework is given as a service to the requester in form of Virtual Machine (VM).These services are made available on a subscription basis utilizing pay as- you-use model to customers, regardless of their location. Cloud Computing emergence is changing rapidly on the basis of subscription oriented approach which provides access to scalable infrastructure and service on demand. Users can store, access, and share huge amount of information in Cloud.

The energy consumption varies as a result of power efficiency and awareness of wired network, for e.g. network protocol design, the network equipment or system design, topology design. Most of the energy in system devices is squandered because they are built to deal with worst case scenario. During both idle state and peak time, the energy utiliztion of these devices remains around same. To get high energy efficiency much improvement are required in these devices. Around 40% of energy consumption in the world is utilized by information technology (IT) equipment. It consist energy utilized by the computing servers and data centre system hardware.

Data center power consumptions have increased in recent years because of increment in size and number of data centers. The information and communication technology (ICT) division has developed exponentially in the current years. An basic part of the ICT associations is composed by the data centers that are higher populated with communicational connections and inessential servers to ensure connections to guarantee the provision of 99.99 % availability of services; a fact responsible for the heavy energy utilization by data centers. For energy economy, the non-essential components can be operated as and when required based on the workload .

Green Cloud architecture aims to decrease data center energy utilization, while ensure the execution from users perspective. Green Cloud architecture permits live virtual machine migration, VM placement optimization, online-monitoring. It is an extension of Network Simulator 2. It demonstrates the Cloud data centre's energy efficiency by using two procedures, which are DPM and DVFS. The vast majority of the current methodologies for energy-efficiency concentrate on various methods, like reduce traffic congestion, balance between energy efficiency and performance by job scheduling in data centres of Cloud computing.

In this paper a data centre management approach is utilized which bring a change up in energy consumption and increase different upgrades , for example, reduce traffic, balance between energy efficiency and execution and congestion in system of Cloud computing. For execution, Shortest arrival time first algorithm is used .

Our study presents a simulation environment of Green-Cloud. Green Cloud compiles, extracts, and makes data for the energy utilized by computing and communication components of the data centre possible on another design. In this paper we also compare total energy consumption of two scheduling Random and RandomDENS algorithms.

II. RELATED WORK

There are many results that resolve making data centre hardware energy efficient. For reducing power consumption in computing systems Green Cloud shows the Cloud data centre's energy efficiency by using two techniques which are DVFS and DPM. First are the Dynamic Voltage and Frequency Scaling (DVFS) that grants processors to keep running at particular at distinct combinations of frequencies with voltages to diminish the power usage of the processor. [2] Second is the dynamic power Management (DPM) which settles a large portion of energy savings by organized and circulating the work between every single available nodes. The scheduler makes data centre jobs with least possible arrangement of computing resources to make DPM scheme efficient and to increase the measure of unloaded servers. The average data centre workload generally remains around 30%, so the part of unloaded servers can be as high as 70%. [3][4] Compare to traditional computing there are distinctive technologies and methodologies connected with by Cloud providers to manage better utilization and efficiency.

A compilation of related research are as follows.

In 2011 **Saurabh Kumar Garg et al** introduced carbon aware Green Cloud architecture to redesign the carbon footprint of Cloud Computing. They proposed carbon aware Green Cloud architecture, which addresses this natural issue from the general utilization of Cloud Computing resources. Author additionally proposed a Carbon efficient Green Policy (CEGP) for Green broker which plans client application workload with urgent deadline on Cloud datacenters with higher energy efficient and low carbon footprint [15].

DENS approach for scheduling is introduced by **DzmitryKliazovich** in 2011. The approach helps in balancing the energy utilization of a data centre, traffic demands and single job performance. Methodology intends to obtain the balance between individual job's performance, traffic demands, Quality-of-Service requirements, and energy consumed through data centre. The scheduling approach optimizes trade-off between job consolidation (to decrease the amount of computing servers) and traffic patterns distribution (to prevent from hotspots in the data centre network). DENS approach is depends on data centres for running data-intensive jobs. It needs less computational load but creates heavy data streams directed towards the end-users. [4]

In 2014 **Junaid Shuja et al** proposed a Data Centre wide Energy-Efficient Resource Scheduling framework (DCEERS) that manages data centre resources as indicated by the present workload of the data centre. They presented Benders decomposition algorithm that explains the MCMCF problem in linear time for data centre environments. The present workload is ascertained by solving using the Benders decomposition algorithm. They presented that simulated results of DCEERS framework saves more energy as compared with different heuristics. Author simulated this algorithm on the Green Cloud simulator for all data centre network architectures to demonstrate the consistency of these outcomes[16].

Abeer H. El Bakely et al in 2015 introduced the SJFGC (Shortest Job First Scheduling) approach which performs the best-effort workload consolidation on a minimum set of servers. The proposed approach optimizes the tradeoff between job consolidations (to limit the measure of computing servers) by executing firstly task with minimum arrival time and minimum processing time. In this author use simulator program that is called Green Cloud [17].

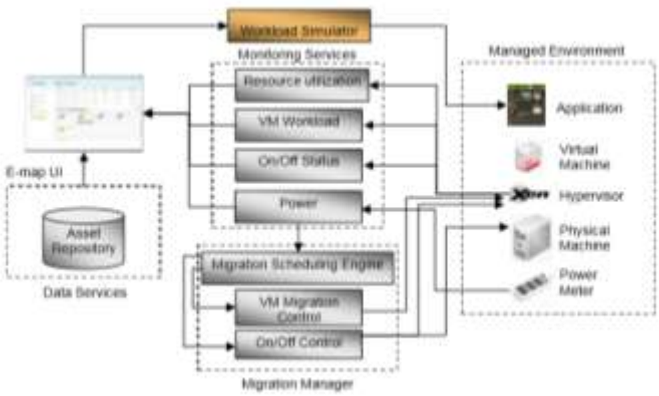


FIG 1: GREEN CLOUD ARCHITECTURE

.

III. SIMULATION SCENARIO

We use Green Cloud simulator which is an augmentation to the network simulator NS2. It is developed for the investigation of Cloud Computing environments. The Green Cloud offers clients a definite fine-grained modelling of the energy consumed by the components of the data center, for example, switches, links and servers. In addition, Green Cloud offers a exhaustive investigation of workload distributions. Besides, a particular concentrate is devoted on the packetlevel simulations of communications in the data center infrastructure, which gives the finest-grain control and is not present in any cloud computing simulation environment. [5] The Green Cloud simulator executes energy model of switches and connections as per the estimations of energy utilization for various components. The implemented powers saving schemes are: (a) DVFS only, (b) DNS only, and (c) DVFS with DNS. [5]

A. Three-tier data centre architectures

Three-tier data center architectures are the most common these days. They include (Fig 2): Aggregation, Access, and Core layers. The accessibility of the aggregation layer facilitates the expansion in the number of server nodes while keeping inexpensive Layer-2 (L2) switches in the access network, which gives a loop-free topology. Since the greatest number of ECMP paths permitted is eight, a run of the mill three level is eight, a typical three tier architecture comprise of eight core switches. Such architecture implements an 8-way ECMP that incorporates 10 GE Line Aggregation Groups (LAGs), which enable a network client to address several connections and network ports with a single MAC address.

The structure of the Green-Cloud extension mapped onto the three-tier data centre architecture [6, 7, 8]. A three-tier tree data centre topology made out of servers and sorted out into racks. Each holding servers and served through cores and aggregation switches (see Fig. 2). It is used in simulation experiment. 10 GE links were used for forming a fat-tree topology interconnecting access, aggregation and core switches. The workloads produce a stable bit-rate stream of 1 Mb/s directed out of the data centre during executions.

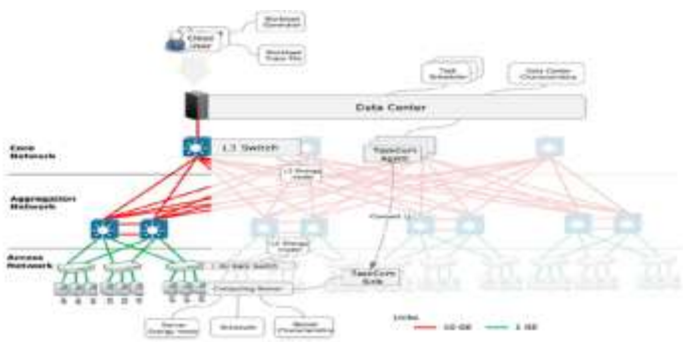


FIG. 2 ARCHITECTURE OF THE GREEN CLOUD SIMULATION ENVIRONMENT [4]

B. Simulator Components

I. Servers

Computing servers are fundamental of data center that are responsible for task execution, so it is main factor in energy consumption. In Green Cloud, the server parts execute single core nodes that have a preset on a processing power limit in FLOPS or MIPS, associated size of the memory resources. The power utilization of a computing server is proportional to the CPU usage. An idle server consumes approximately two-thirds of its peak-load consumption to keep disks, memory, and I/O resources running. The remaining one-third changes almost linearly with the increment in the level of CPU load.
Server contains task scheduling mechanisms and these have a range from the simple round-robin to complex DVFS and DNS enabled.

II. Dynamic Voltage/Frequency Scaling

There are two fundamental methodologies for reducing energy consumption in computing servers: (a) DPM (b) DVFS. The DVFS scheme adjusts the CPU power according to the offered load. The fact is that power in a chip diminishes proportionally to V 2 *f, where f is the operating frequency and V is a voltage. This implies a cubic relationship from f in the CPU power consumption. The scope of the DVFS optimization is restricted to CPUs. Computing server components, for example, memory, disks and buses remain functioning at the original operating frequency. The DPM scheme can decrease power of computing servers (that comprise of all components). The power model took after by server parts are dependent on its CPU usage and the server state. An idle server expends around 66% of its completely loaded configuration. This is because of the fact that servers must manage disks, I/O resources memory modules and other peripherals in an adequate state. At that point, the power utilization increments with the level of CPU load linearly. Power model permits execution of power saving in a centralized scheduler that can provision the union of workloads in a minimum possible amount of the computing servers. [9][10][11]

III. Switches and Links

Switches and Links frame the interconnection fabric that conveys job requests and workload to any of the computing servers for execution in a timely convenient manner. The interconnection of switches and servers requires distinctive cabling solutions relying upon the supported data transfer capacity, physical and quality attributes of the link. The quality of signal transmission in a given cable decides a trade-off between the transmission rate and the link distance, which are the components characterizing the cost and energy consumption of the transceivers.
Energy consumption of a switch relies on upon the:
(a) Employed cabling solutions, (b) Number of ports, (c) Type of switch and (d) Port transmission rates.

IV. Workloads

Workloads are the objects. It is designed for universal modeling of various Cloud client services. In Green-Cloud, A successful finish of its two main components: communicational and computing [12, 13] is required for the execution of each work load. The computing component describes the measure of computing. Prior to a given deadline on a time scale it must be executed. The deadline objectives at introducing QoS constraints detailed in SLA. The communicational part of the workload gives us the amount and the size of data transfer that ought to be performed before, during, amid, and after the procedure of workload execution in Green Cloud. To the data centre communications it is made out of three sections: size of external, size of the workload, size of internal[12, 14].

IV. RESULT

Simulation was created with following parameters. After several result of simulator following result set were obtained as average or best case.

Table 1: Dynamic parameters

Parameters	**Result analysis**
CPU	100MIPS
Storage capacity	1Gb
Packet Size	1KB
Delay	0.2ms

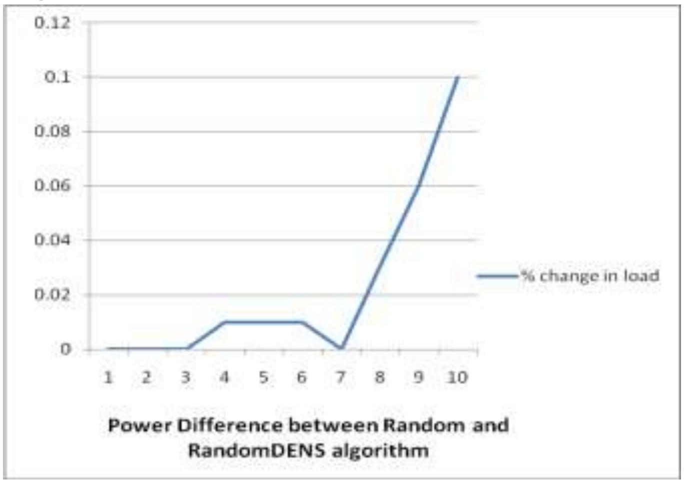
Table 2: Basic parameters whose values are fixed in all the above results are:

S.no	Basic parameters	values
1	Simulation duration	65.5 Sec
2	Datacentre architecture	Three-tier
3	Switchs (Core, Agg.End)	1,2,3
4	Servers	144
5	Users	1
6	Power mode(Severs)	DVFS DNS
7	Power mode (switches)	DVFS
8	Task.memory	1000000
9	Task.output size	250000
10	Switch energy(core)	51.4 W*h
11	Switch energy (agg.)	102.8W*h
12	Switch energy(access)	9.1 W*h

Table 3(a): Result analysis: Simulation result analysis-I

load /10	Total Energy W*h(Random)	Total Energy W*h (RandomDENS)	% change in load
0.1	278.5	278.5	0
0.2	392.3	392.3	0
0.3	479.7	479.7	0
0.4	504.6	504.5	0.01
0.5	528.1	528.2	0.01
0.6	552.8	552.7	0.01
0.7	576.7	576.7	0
0.8	601.3	601.5	0.03
0.9	628	628.4	0.06
1	653.6	654.3	0.1

I.Comparision between Total energy (Random) and Total energy (RandomDENS) In %



V. CONCLUSION

In this paper we have compare total energy consumption of two scheduling algorithms: Random and RandomDENS. In this we observe that energy consumption is approximately same upto 70% load for all scheduling algorithm. After that when we increases the load then total energy consumption increases exponentially.

REFERENCES

[1] Armbrust, Michael, et al."A view of cloud computing." Communications of the ACM, 53(4), pp. 50-58, 2010.
[2] Wissam.C, Chansu.Y, "Survey on Power Management Techniques for Energy Efficient Computer Systems", ClevelandStateUniversity, 2003.
[3] R.Satsangi, P.Dashore and N.Dubey, "Risk Management in Cloud Computing Through Fuzzy Logic", IJAIEM, Vol.1, Issue 4, Dec. 2012
[4] D.Kliazovich, P.Bouvry, S.U.Khan," DENS: data centre energyefficient network-aware scheduling", Springer Science+Business Media, 10 Aug. 2011.
[5] D.Kliazovich, P.Bouvry, S.U.Khan, "GreenCloud: a packet-level simulator of energy-aware cloud computing data centers", Springer Science+Business Media, 9 Nov. 2010.
[6] Gong Chen, Wenbo He, Jie Liu, Suman Nath, Leonidas Rigas, Lin Xiao, Feng Zhao, "Energy-aware Server Provisioning and Load Dispatching for Connection-Intensive Internet Services", in 5th USENIX symposium on networked systems design and implementation", PP: 337-350, Berkeley, USA 2008
[7] Dzmitry Kliazovich, Pascal Bouvry, Samee Ullah Khan, "GreenCloud: a packet-level simulator of energy-aware Cloud computing data centres", Springer Science+Business Media, LLC, Nov 2010.
[8] Chuanxiong Guo, Haitao Wu, Kun Tan, Lei Shiy, Yongguang Zhang, Songwu Lu, "DCell: A Scalable and Fault Tolerant Network Structure for Data Centres," In SIGCOMM 2008 on Data communication, PP: 75-86, Seattle, USA, August 2008.

[9] D.Kliazovich, P.Bouvry, S.U.Khan," DENS: data center energyefficient network-aware scheduling", Springer Science+Business Media, 10 Aug. 2011

[10] D.Kliazovich, P.Bouvry, S.U.Khan, "GreenCloud: A Packet-level Simulator ofEnergy-aware Cloud Computing Data Centers",in proc.IEEE Globecom, 2010,paper 978-1-4244-5637-6/10.

[11] Chia.-M.W, Ruay.-S.C, Hsin.-Y.C, "A green energy-efficient scheduling algorithm using DVFS technique for cloud datacenters", Future Generation Computer Systems, 2013, http://dx.doi.org/10.1016/j.future.2013.06.009

[12] Dzmitry Kliazovich, Pascal Bouvry, Samee Ullah Khan, "GreenCloud: a packet-level simulator of energy-aware Cloud computing data centres", Springer Science+Business Media, LLC, Nov 2010.

[13] Priya Mahadevan, Puneet Sharma, Sujata Banerjee and Parthasarathy Ranganathan, "A power benchmarking framework for network devices", Proceedings of the 8th international IFIP-TC 6 networking conference, Aachen, Germany, May, 2009.

[14] Moore J, Chase J, Puneet Sharma and Parthasarathy Ranganathan, "Making scheduling cool: Temperature aware workload placement in data centres", Proceedings of the Annual conference on USENIX Annual Technical Conference, ATEC '05, USENIX Association, Berkeley, CA, USA, 2005.

[15] Saurabh Kumar Garg1, Chee Shin Yeo2 and Rajkumar Buyya1 "Green Cloud Framework For Improving Carbon E_ciency of Clouds" Springer 2011.

[16] Junaid Shuja · Kashif Bilal · Sajjad Ahmad Madani · Samee U. Khan" Data center energy efficient resource scheduling" Springer 2014.

[17] Abeer H. El Bakely1, Hesham A.Hefny "Using Shortest Job First Scheduling in Green Cloud Computing" IJARCCE 2015.