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Comparison of Energy Efficient Scheduling Schemes for Private Cloud Environment

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Abstract: A Scheduler is main role to schedule number of virtual machines VMs as per virtual machines request VMr from cloud consumer. Scheduler schedules number of virtual machines VMs requests call Lease such as conserve maximum amount of energy, achieves greater scale of load balancing and less resource utilization with less time less efficiency. In this paper we review scheduling schemes in private cloud environments which is recently proposed in our previous work on base of Energy Efficient.

Keywords: VM, VMr, Energy Efficient, VMs, Host, Guest.

I. INTRODUCTION

Cloud Computing is capable computing pattern. Google engineers say a magnificent sentence about cloud maintains thousands of servers, warned that if power consumption continues to increase, power cost can easily overtake hardware cost by a large margin [1]. The development of hypervisors Xen, KVM, VMware, Virtual box, Eucalyptus [2] etc. trigger development of commercial and Open source obscuring environment creators. It can offer services on support of energy, power Pay-per use model. In office, Institutes, Universities environment computers, monitors account for highest energy consumption after lighting. Power dissipation is also a major concern in portable battery operated devices that have rapidly increased [2]. Green computing is new trend of Cloud computing and need of Green Computing. Verities of scheduling schemes are developed sunlight hours for allocation of virtual machines as per requirement of user mentioned in lease.

II. REVIEW OF RELATED WORK

In this decade, we refer many schemes, methods, algorithms, techniques how to scheduled virtual machine Guest which is running on physical machine Hosts such that it consumes less power total workload distributed with less efficiency.

Jiandun Li et al [3] proposed a hybrid energy-efficient scheduling algorithm for private clouds environments to reduce coming request response time, balance workload when data centre is running in low power mode and design algorithm on the base of pre power techniques and Least-load first algorithm [9][10][11].

Jiandun Li et al [4] introduce a hybrid energy-efficient scheduling algorithm for private clouds, concentrated on load balancing, Load migration on the base of state of virtual machines, count response time. If response time increases then energy also increases. So they minimised response time in their algorithm [9][10][11].

Gregor Von Laszewski et al [5] proposed scheduling virtual machine in a compute cluster to reduce power consumption through Dynamic Voltage Frequency Scaling (DVFS), implementation of energy efficient algorithm to allocate virtual machine [9][10][11].

Bo Li, Jianxin Li et al [6] states Energy aware heuristic algorithm on base of distributes workload in virtual machine with minimum number of virtual machines or nodes required that workload. So that workload migration, workload resizes virtual machine migration these approaches are used in algorithm [9][10][11].

Gaurav Dhiman, Giacomo Marchetti et al [7] focus on vGreen developed MPC balance algorithm that concentrates on CPU and memory utilization decrease, amount of power save up to 15% to 20% of total power required. Power is directly propositional to energy so amount of energy also save [9][10][11].

M.Sheikhalishahi et al [8] proposed multi-level and general-purpose scheduling approach for energy efficient computing through software part of the green computing. The consolidation are well defined for IaaS cloud paradigm, however it is not limited to IaaS cloud model. The policies, models, algorithms and cloud pricing strategies are being discussed in general. The solutions in the context of Haizea are shown, through experiments. The big improvement in utilization and energy consumption is found as workloads are running with lower frequencies. The coincidence of energy consumption and utilization is improved [9][10][11].

Deore S., Patil A. [9] proposed systematic review of energy efficient scheduling techniques in which compare three scheduling methods which is better scheduling in energy efficient manner allocation of VMs as per request of consumer [9][10][11].

Deore S. , Patil A. [10] proposed Energy Efficient Scheduling Schemes for virtual machines in cloud computing call EESS migration, clone, pause, resume basic concept is introduce using minimum load distribution in private cloud environments by using Julimeter1.2 to measure energy [9][10][11].

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Deore S. , Patil A. [11] introduce Energy Efficient and allocation scheme EESAS for virtual machines in cloud environments, distribute total workload on minimum number of Hots that is physical machine by using Julimeter1.3 to measure energy [9][10][11].

Gaurav Dhiman, Giacomo Marchetti et al [12] focus on vGreen developed MPC balance algorithm that concentrates on CPU and memory utilization decrease, amount of power save up to 15% to 20% of total power required. Power is directly propositional to energy so amount of energy also save [9][10][11].

Aman Kansal et al [13] states virtual machine power metering and provisioning architecture i.e. Joulemeter measure power of virtual machines per second in watt [9][10][11].

III. METHODS

3.1 Energy Efficient Scheduling Scheme (EESS)

In our previous work proposed Energy-efficient scheduling scheme call EESS [10] with start, stop, migration, clone, pause, resume capabilities. Basic concept is introduce using Minimum load distribution, First Come First Serve (FCFS) Scheduling [3][4], Hybrid energy efficient scheduling algorithm Li et. al [3][4], Li et. al and Power aware scheduling Von Laszewski et. al [5] of VMs, incoming VM request call jobs minimum then start virtual machines if request is increased beyond our capacity then apply migration for workload distribution. If VM request is platform, software services then applies cloning of VM.

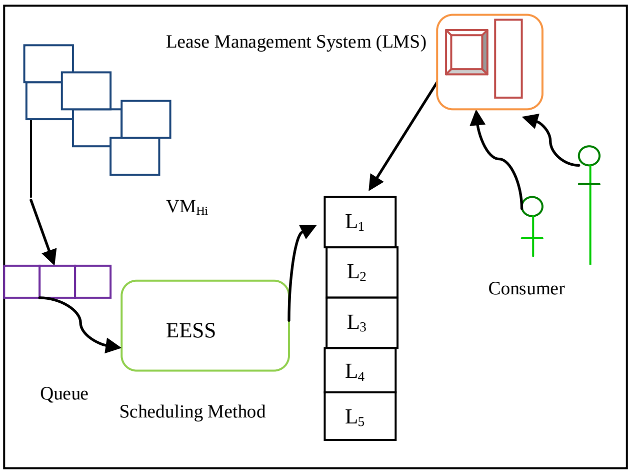

Fig1 Working of EESS

E=Energy in Joule , P=Power in Watt, T= Time in second and N=number of VM, so we can write fallowing expression

$$E, P \propto N \propto T \qquad (1)$$

so convert power into energy using physics conversation [14][15][2]

$$E_J = P_W \times T_S \qquad (2)$$

Consumer provide lease L to lease management system(LMS), incoming jobs collect in set of lease's i.e. $L_1, L_2 L_3 L_4, \ldots\ldots L_n$, algorithm serve these jobs to virtual machines as their configuration and requirement such as

$Job_1 = VM_{11}$

$Job_2 = VM_{12}$

$Job_3 = VM_{13}$

$Job_4 = VM_{14}$

$Job_5 = VM_{15}$

. .

. .

. .

$Job_n = VM_{1n}$

States of Virtual Machines: Algorithm contain following states of virtual machine running, active, poweron, poweroff, pause, teleportin. Using pause and active to save maximum amount of energy poweron and poweroff to save maximum amount of energy.

Metrics in EESS:

U - set of Hosts (physical machine) and Guests (Virtual machine) ,U= $\{H_1, H_2, H_3, \ldots.n, VM_1, VM_2, VM_3 \ldots. VM_n\}$

H -Total no of Host's $H \in U$, H=1, 2,3,4…. n

VM_{Hi} - set of virtual machine on each each Host H and i=1,2,3,4, ……n, i for virtual machine, $VM_{Hi} \in U$.

L= number of leases, $L_1, L_2, L_3 \ldots\ldots L_n$

P= Lease contain VM request such as consumer required Platform as a Service.

j- Incoming VM requests from consumer

J- Total number of VM requests from consumer

VM_{Hi} =

{

Host=1 , i=1,2,3,4…n , $VM_{11}, VM_{12}, VM_{13}, VM_{14}.VM_n$

Host=2 , i=1,2,3,4…n , $VM_{21}, VM_{22}, VM_{23}, VM_{24}.. VM_n$

Host=3, i= i=1,2,3,4 , $VM_{31}, VM_{32}, VM_{33}, VM_{34}.. VM_n$

Host=4 , i= i=1,2,3,4 , $VM_{41}, VM_{42}, VM_{43}, VM_{44}.. VM_n$

}

VM - Total number of virtual machine in each host (VM=1, 2,3,4 ……n)

VM_S - Virtual machine source required for migration (always in Active state before migration)

VM_T - Virtual machine target required for migration (always in Teleport-In state before migration)

Roles in EESS:

PowerONVM (j, H , VM_{Hi}),Migration (VM_S , VM_T) ,Pause (VM) ,Resume (VM),Clone(VM),Update (VM_{Hi} , j, J, L),Find (VM_s,VM_T),Exit() this function use how to handle virtual machines.

Experimental Setup and Results:

The testbed is composed on 4 personal computers Each Host contain 4 VM, Host1 acts as a scheduler, calculated save energy (E) in Joule(J) , total time (T), power (W) , number of virtual machines N, number of leases L, VM request from consumer J. We use VirtualBox3.1 [12] API start, stop, pause, resume, clone, and migrate virtual machines in JDK1.7.0 for algorithmic implementation of EESS

Comparison Key Points of EESS:
Number of Virtual Machines (N), Energy Conserved (E), Workload Utilization (W) on base of that key values this scheme is so powerful as compare to round-robin [23], bully [22] approach and hybrid energy efficient scheduling algorithm [3][4].

3.2 Energy Efficient Scheduling and Allocation Scheme (EESAS)

In this section we discussed EESAS [11], EESS[10] all parameters is same only allocation strategy is changed, at time of scheduling EES scheme use migration, clone, pause, resume capability of VMs to conserve more energy. Consumer write request of VM using lease management system call LMS, these number of leases contain number of VMr EESS schedules all VM request to VM using EESS[10] policy.

EESAS [11] is implement on base of three key points i) No workload i.e zero workload ii) Minimum workload and, iii) Maximum workload , when minimum workload then start virtual machine as per VM request, if no workload then do not start any VM for conserving energy purpose, maximum workload then apply migration of VM , clone one VM to multiple VM , in this EESAS only allocation of job to VM is change, In this approach [11] number of Hosts required two, waiting time reduces so consumer fills happy as compare to previous approach and waiting time of lease reduces, number of hosts required two and conserve more energy.

Experimental Setup and Results

The test bed is composed on 4 personal computers Each host contain 4 VM, host1 acts as a scheduler, calculated conserve energy (E) in Joule(J) using Joulemeter1.2 [13][18], total time (T), power (W) , number of VM N, number of leases L, VM request from consumer J. Using VirtualBox3.1 [13] for creating private cloud environment, APIs start, stop, pause, resume, clone, and migrate virtual machines in JDK1.7.0 for algorithmic implementation of EESS. Consider EESS with FCFS and EESAS and show the comparisons which is better for energy saving paradigm.

Comparison Key Points of EESAS and EESS:
Energy Conserved (E), Number of Physical Machines (H), Waiting Time (T)

TABLE I Save Energy through Hosts

Energy (E) In Joule / Methods	Conserved Energy through Host per minute	Conserved Energy through Host per Total time
EESS	0	0
EESAS	4033	173281.2

TABLE II Energy and Time required

Metrices / Methods	Total Energy in J by H	Total Time in S
EESS	912320	1797
EESAS	737922.8	1511

TABLE III Power required with number of VMs

Metrices / Methods	Power in W per min.	Number of VM required as per Method N
EESS	501.9	8
EESAS	424.1	8

TABLE IV Power required with number of VMs

Metrices / Methods	Energy Per minute	Average Waiting Time
EESS	30414	15.14
EESAS	26172	13.47

Fig. 2 Comparison of Number of Hosts

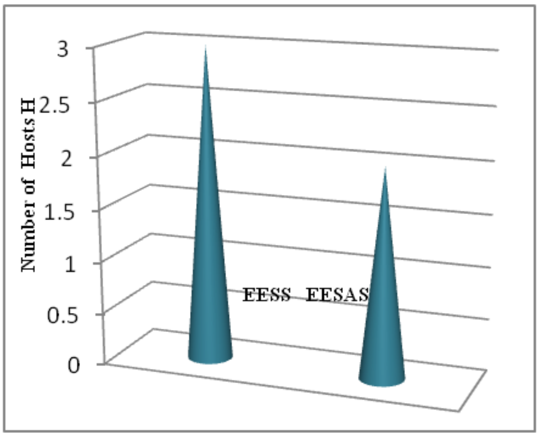

Fig.3 Comparison of Waiting Time T

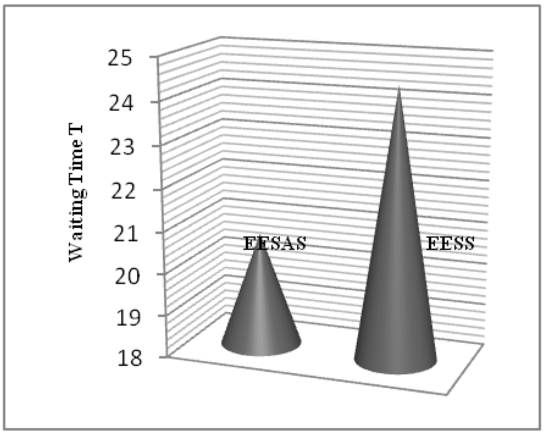

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Fig. 4 Amount of Conserved Energy

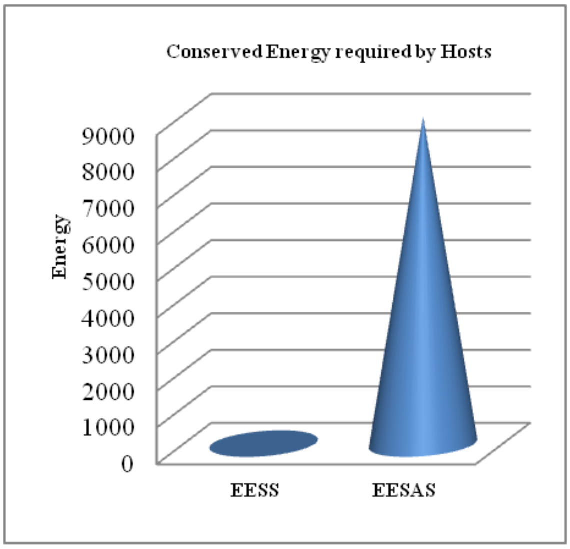
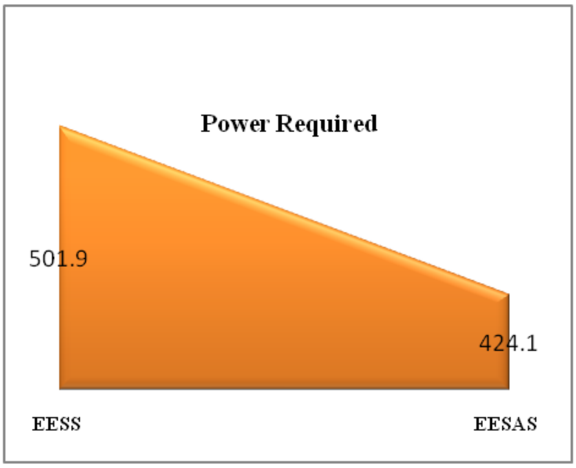


Fig. 5 Comparison of Number of Hosts



IV. COMPARISION

Energy Saved (E): In TABLE 1 it is cleared observed that EESAS is more energy conserved as compare to EESS with FCFS, but if elaborate private cloud environment then it is suitable.

Number of Hosts (H): EESAS is better than EESS as shown in TABLE III, because of number of hosts H is less required and waiting time is reduces and consumer fills happy as compare to EESS allocation strategy through energy saving criteria. Virtual machines required both allocation strategy is same number but waiting time is reduced so some amount of energy is conserved EESAS.

Waiting Time: As shown in fig.4, TABLE I and IV waiting time Of EESAS less as compare to EESS, so consumer fills happy and virtual machine is start but VM request is not allocated, VM wait for job so amount of energy is required their stand by phase, to conserve that energy.

V.CONCLUSION

From the experimental result demonstrated above, it has been proved that energy efficient and allocation scheme based on minimise number of physical machines hosts effective. Results show that it can not only reduce waiting time, response time, conserve more energy but also achieves higher load balancing. In Energy-Aware Heuristic algorithm based on maximum workload distribution on minimum VM and achieves 70% to 80 % workload distribution, this schems is more prevailing in energetic relevance. Cloud service providers need of scheduling schemes not only conserving more energy and consumer satisfaction in service providing.

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BIOGRAPHY

Shailesh Deore was born in Dhule, Maharashtra, India, in 1982. He received the B.E. degree in Computer Engineering from the North Maharashtra University, Maharashtra, India, in 2003, and Ph.D. degrees in Computer Engineering from the Shri J J T University, Rajasthan, India, in 2014. In 2004, he joined the Department of Computer Engineering of SSVPS's B S Deore, COE, Dhule affiliated to North Maharashtra University as a Lecturer, and in 2009 became a Assistant Professor. Since till date, he has been with the Department of Computer Engineering, Dr. Deore current research interests cloud computing, Job scheduler algorithms, Schemes in private cloud environment.