ENERGY AWARE RESOURCE MANAGEMENT IN CLOUD DATACENTER

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Abstract : Cloud computing is a one type of "parallel and distributed system". it is model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (e.g., computer networks, servers, storage, applications and services). However, the energy consumption is one of the biggest problems on current cloud computing for further evolution.Among several challenges in the cloud environment,energy efficient storage for the cloud computing is taken as majar challenges in this work for which the solution being discussed.Threshold mechanism and Bin packing algorithm is being proposed to reduce the impact of energy consumption.Implementation done using simulation environment to ensure the efficiency of the proposed algorithm.Finally,the energy consumption is been reduced and balancing the load in cloud datacenter is done.

***Index Terms* - Cloud computing,Energy efficiency,Resource management,Service level agreement(SLA).**

I. INTRODUCTION

Cloud computing is a one type of "parallel and distributed system consisting of a collections of inter-connected and virtualized computers.That are dynamically provisioned, and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers.Cloud computing delivers infrastructure, platform, and software that are made available as subscription-based services in a pay-as-you-go model to consumers. These services are referred to as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service(SaaS) in industries. Clouds aim to power the next-generation data centers as the enabling platform for dynamic and flexible application provisioning. This is facilitated by exposing data center's capabilities as a network of virtual services (e.g. hardware, database, user-interface, and application logic) so that users are able to access and deploy applications from anywhere in the Internet driven by the demand and Quality of Service (QoS) requirements.The cloud computing maintains the five essential characteristics that are,**On demand self-service:** A consumer can computing provisioning capabalities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.**Broad network access:**Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops and workstations). **Resource pooling:**The computing providers resources are pooled to serve multiple tenant consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.To the consumer,the capabalities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time. **Measured services:**Cloud system automatically control and optimize the resource(e.g., storage, processing, bandwidth and active user accounts).

II. BACKGROUND

Cloud computing consisting of three planes namely,userlevel,userlevel middleware,core level,system level.

2.1 Cloud Applications

This layer is directly available to the end users. We define end-users as the active entity that utilize the SaaS applications over the Internet. These applications may be supplied by the Cloud provider (SaaS providers) and accessed by end-users.

2.2User-Level Middle ware

The user-level middleware includes software frameworks, such as Web 2.0 Interfaces(Ajax,IBMWorkplace).This layer also provides those programming environments and composition tools that ease the creation, deployment, and execution of applications in clouds.This layer support multilayer application and several frameworks development.

2.3 Core Middleware
This layer is used to implements the platform-level services that provide run-time environment for hosting and managing User-Level application services. The core middleware services at this layer include Dynamic SLA Management, Billing, Acconting, Execution monitoring and management,and Pricing. The examples of services operating at this layer are Amazon EC2, Google App Engine, andAneka.

2.4 System level
The computing power in Cloud environments is supplied by a collection of data centers that are typically installed with hundreds to thousands of hosts . At the System-Level layer, there exist massive physical resources (storage servers and application servers) that power the data centers. These servers are transparently managed by the higher-level virtualization services and toolkits that allow sharing of their capacity among virtual instances of servers.

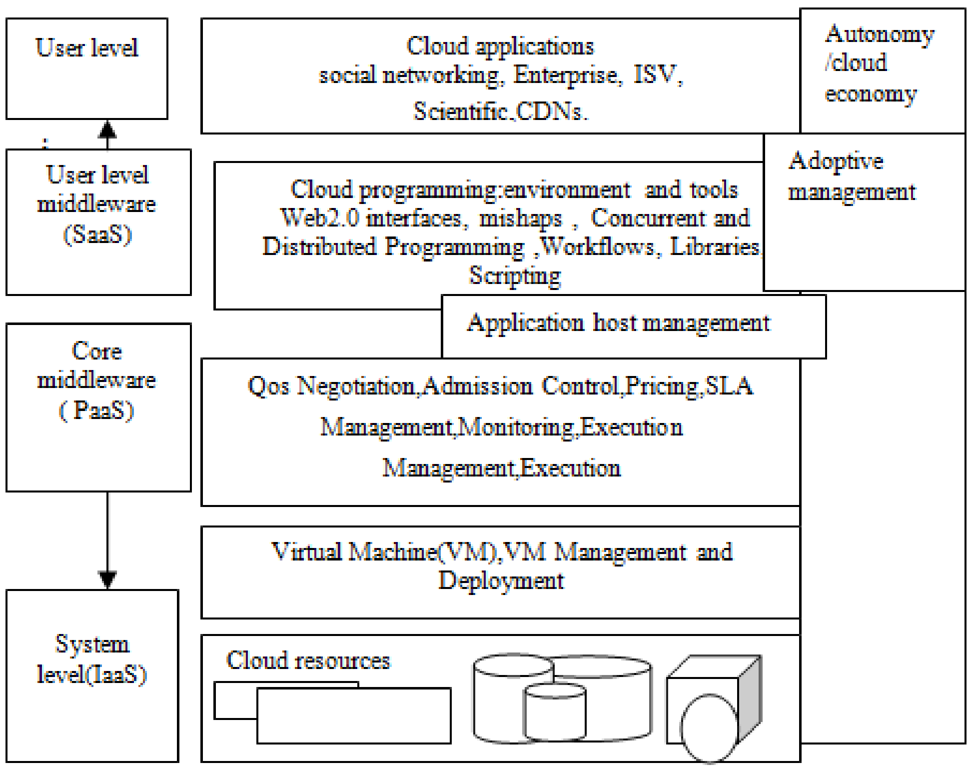

Fig 1 Layered Cloud Computing Architecture

III. CLOUD RESOURCE MANAGEMENT

Cloud resource management contains large number of shared resources. So Resource Management is always a major issue in cloud computing like any other computing paradigm. Due to the availability of finite resources it is very challenging for cloud providers to provide all the requested resources.

3.1 SLA Management: The Service Level Agreement (SLA) Management module makes an agreement between the client and the service provider for services requested by the client**.** The agreement contains the resource requirements of a client such as, CPU, memory and other architectural configuration of a VM. It also includes Quality of Service (QoS) requirements like job completion time, response time, operational cost and so on. The client can also negotiate with service provider for price of the services provided by them in this agreement. The SLA Management module communicates with the admission controller before an agreement is made. After successful agreement the user requests are sent to the scheduler**.**

3.2 Admission Controller: The admission controller avoids provisioning of invalid jobs onto the cloud resources.

3.3 Pricing: Pricing is done for dynamic jobs based on its usage of resources. The time and cost of the resources consumed are calculated and charged to the clients in real time.

3.4 Scheduler: The scheduler provisions the requested job on the available VM or provisions a requested VM on the Physical Machine (PM).

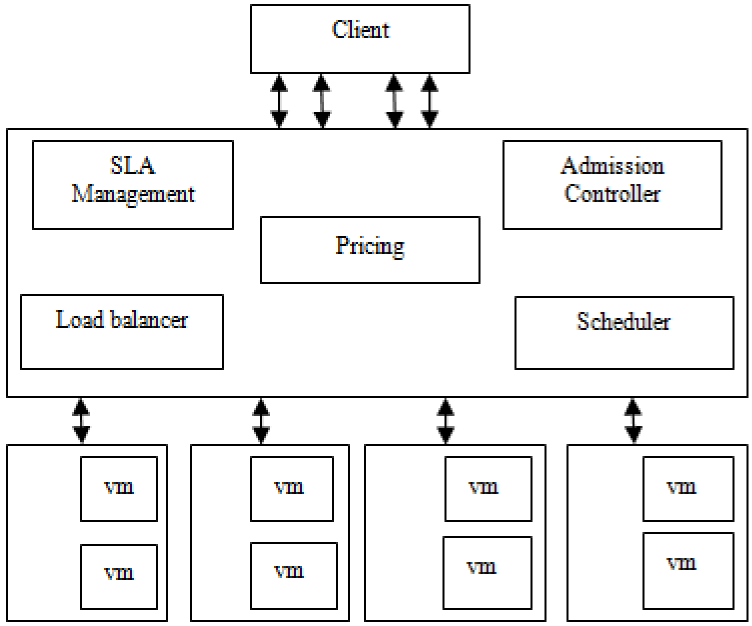

Fig 2 Cloud resource management

IV. CLOUD RESOURCE MANAGEMNET CHALLENGES

Cloud resource management contains several challenges that are,

- Predictable and unpredictable workloads
- Homogenous and Heterogeneous Workloads
- Minimization of costs and maximization of resource utilization
- VM Migration
- Energy efficient allocation
- Networked Cloud

V. PROBLEM DESCRIPTION

Cloud computing has large-scale computing because it can share globally distributed resources. That has evolved with the development of large-scale data centers including thousands of servers around the world. However, cloud computing data centers utilize the vast amounts of electrical energy, contributing to high operational costs and carbon dioxide emissions. Dynamic virtual machine(VMs)consolidation using live migration technique is used to optimize resource utilization and reduce energy consumption.

The main objective of this paper is,

- To reduce the energy consumption of resources in cloud datacenters and to Improve the energy efficiency and Increase service level agreement(SLA)process,Quality of services(QOS).

- Load Balancing is used for optimized resource utilization.

VI .EFFICIENTLY ALLOCATE VMS TO HOST

The Efficiently allocate the VMs to host using the several vm selection policies.The functionality of the Vm Allocation Policy is to select the available host in a data center that meets the memory, storage, and availability requirement for a VM deployment.The different allocation policies are,

6.1 Random selection: That policy is used to randomly select the vms in set of vm sets after to put the vms in the host.

6.2 Minimum Utilization: The vms to select under constrains minimum energy utilization vms in the host.

6.3 Inter quartile range: This policy to select the vms based on the energy utilization in betweeen the above memory 90% and cpu 80% in the cloud data center.

6.4 Maximum Correlation: To select the vms in the vms sets based on maximum correlated of the vms in the host.that vms to reject from the host list.

6.5 Minimum Migration Time: we consider the time for complete the vm selection process for given time.

6.6 Minimum Correlation: To select the vms in the vms sets based on minimum correlated of the vms in the host.that vms to reject from the host list.

This selection policy to reduce the no of host and vms in the cloud data center.The vm selection policy to improve the system life time and save the energy.

VII. PROPOSED METHODOLOGY

The Proposed work represent the energy cost minimization is classified into two groups: 1) bin packing-based static resource allocation and 2) threshold-based dynamic resource consolidation.

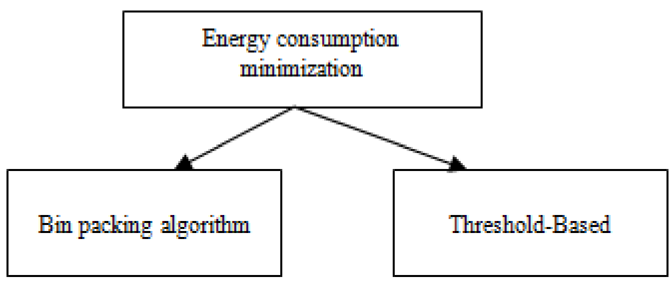

Fig 3 Proposed methodology

7.1 Bin Packing Algorithm

One natural objective of efficiently allocation of VMs to PMs is to reduce the number of active PMs, which can be called static resource allocation. Intuitively, the static energy aware resource allocation problem can be modeled as the bin-packing problem, where VMs and PMs are the items and bins, respectively, in the bin packing problem. first computed the lower bound of the optimal solution (LB-OPT) and then designed a polynomial resource allocation algorithm. By considering the multiple type resources of PMs,presented a space partition model for the multidimensional bin packing problem. Based on this model, they then propose an efficient VM allocation approach to alleviate the imbalanced utilization of the multi type resources.

7.2 Thresholed Based

Live migration technology, allowing a VM to be migrated from one PM to another PM, has proved to be effective in addressing dynamic resource consolidation. During VM migration, on the one hand, the system should move VMs on the low resource utilized source PM to another target PM,thus allowing the source PM to switch off without consuming any power. On the other hand, the system should also avoid the target PM over-utilized. To achieve these goals,the threshold-based resource consolidation approach has been investigated.This approach works by first predetermining two thresholds, the high threshold th and the low threshold tl. When the resource utilization of a PM pi,exceeds th, the system will transfer some VMs on pi to another PM **for hotspot avoidance**. When the resource utilization of pi falls below tl, the system will migrate all of the VMs on pi to another target PM for energy saving(**coldspot)**.In dynamic cloud systems, to predict the two thresholds th and tl precisely.

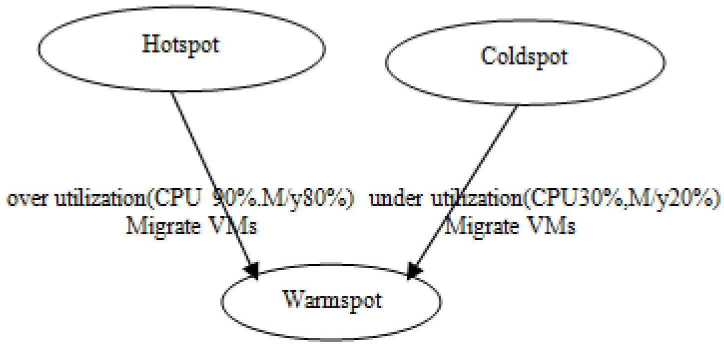

Fig 4 Migrated VMs

The threshold based mechanism used in three ways such as,

7.3 hotspot

We define a server as a hot spot if the utilization of any of its resources is above 90% and 80% hot threshold(memory 90%,cpu 80%).

7.4 coldspot

We define a server as a hot spot if the utilization of any of its resources is below 30% and 20% cold threshold(memory 30%,cpu20%).

7.5 Warmspot

The server is in between the hotspot and coldspot.that is called warmspot.

VIII. DESIGN OF THE SYSTEM

Framework tells about the resource allocation for users..Many number of users present in the cloud data center. The cloud data center to maintain all the host. User to submit their requirements(CPU,MEMORY,BANDWIDTH) to the cloud broker.The cloud broker can easily negociate with online request to the cloud information system.Cloud information system to gather information bought from the resources such as,hosts,VMs.Sensor to monitor the how much resources provided by the resources. The deferred queue to implement all the deferred resources.

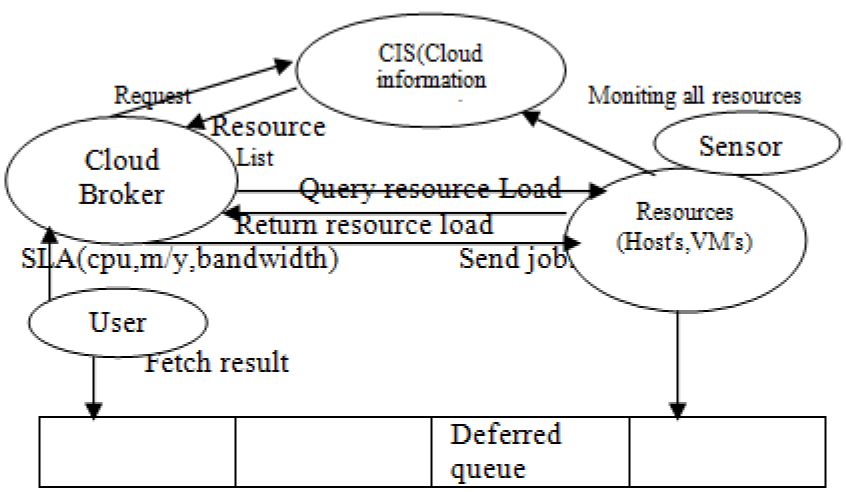

Fig 5 Design of the system

How to efficiently allocate the VMs to host.The holdsopt threshold utilize the energy is exceed from the given allocated memory and bandwidth.So,the VMs is migrated from hotspot to warmspot.Because the server is overloaded. In this situation to save the energy consumption and balancing the workload on the hotspot threshold after migrated process.The coldspot is overloaded in cloud data center,To migrate the VMs from coldspot to warmspot.

8.1 Cloud broker: It discover suitable cloud service providers by querying the CIS and online negotiation for allocation of resources/services that can meet the application Qos's needs.

8.2 CIS(cloud information system): It is used for new resource automatically register themselves in the cloud information system(CIS) to enable dynamic resource discovery.

8.3 Deferred queue: This class implement the deferred event queue.

8.4 Sensor: This class must be implemented to instantiate a sensor component that can be used by a Cloud Coordinator for monitoring specific parameters(energy consumption,resource utilization).

IX. METHODOLOGY

Support the load balancing and energy cost minimization under threshold set mechanism,

9.1 Resource monitoring: To moniting all the resources are correctly function or not using the sensor components.

9.2 Policy/mechanism: Bin packing method is used to manage the load balancing process.Threshold value is used to reduce the energy consumption.

9.3 Metering: To identify the level of usage for resource allocation.

9.4 Report generate: The report contains:Amount of total energy consumed and,How efficiently the energy is saved.

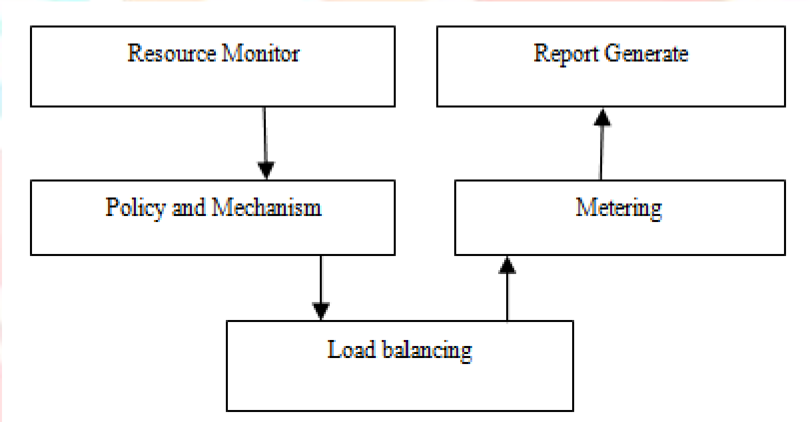

Fig 6 Methodology

X. MULTI USER-BASED RESOURCE ALLOCATION

Input: overloadedHostList.hostVMlist

Output: selected VMList

- foreach host in overloaded HostList do
- foreach VM in host VMList do
- SelectedVM<-NULL;
- Proposed VMselection technique;
- SelectedVM list<-selected VM;
- end for
- currentCPUutil<-currentCPUutil.selectedVM CPUutil;
- currentRAMutil<-currentRAMutil.selectedVMRAMutil;
- currentBWutil<-currentBWutil.selectedVMBWutil;
- if((currentCPUutil<-upperThreshold)&&(currentRAMutil<-upperThreshold)&&(currentBWutil<upperThreshold,))
- then
- hostVMlist<-hostVMlist.selectedVM;
- go to line 2;
- end if
- end for
- returnSelectedVMlist

XI PERFORMANCE EVALUATION

The first tests the overhead and scalability of memory usage,cpu usage and the overall efficiency of energy in cloud data center. we provide the threshold mechanism and pin packing algorithm to satisfied the all the conditions. The energy is efficiently provides from datacenter to users.

A .HOST CONFIGURATION

MEM(GB)	CPU(units)	BW(storage in GB)
30	16(4 cores*4 units)	3380
136.8	52(16 cores*3.25 units)	3380
14	40(16 cores*2.5 units)	3380

B.VM's CONFIGURATION

MEM(GB)	CPU(units)	BW(storage in GB)	VM
1.7	1(1 coresx1 unit)	160	1-1(1)
7.5	4 (2 coresx2 units)	850	1-2(2)
15.0	8(4 coresx2 units)	1690	1-3(3)
17.1	6.5(2 coresx3.25 units)	420	1-4(4)
34.2	13(4 coresx3.25 units)	850	1-5(5)
68.4	26(8 coresx3.25 units)	1690	1-6(6)
1.7	5(2 coresx2.5 units)	350	1-7(7)

Table 2:VMs configuration in host

C.RESOURCE CONFIGURATIONS

Hosts	Cloudlet	VM's
1-35	120	120

Table 3:Resource configuration in cloud data center

D . NUMBER OF HOST SHUITDOWN WITHOUT THRESHOLD

Hotspot	Coldspot	Warmspot
18	12	5

Table 4 Shutdown the host without threshold

I have taken 120vms and 35hosts in the data center.To evaluate the energy consumption with in the given time for complete the task in data center using the threshold mechanism.Usage of memory and cpu is above 90% exceed of the given task time.So,the host is overloaded in cloud datacenter.After set the threshold for all the present host.

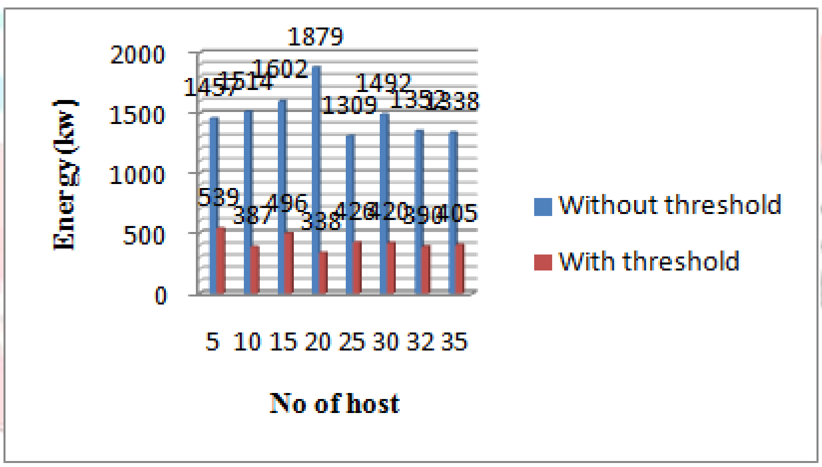

Fig 7 Energy consumption

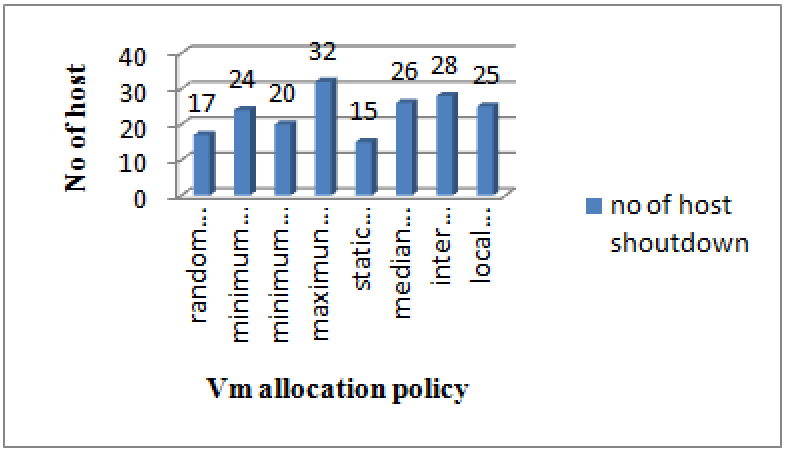

Fig 8 No of host shutdown using VM allocation policy

I have taken the static vm allocation policy.because,the static vm allocation policy to reduce the no of host shown in figure.8

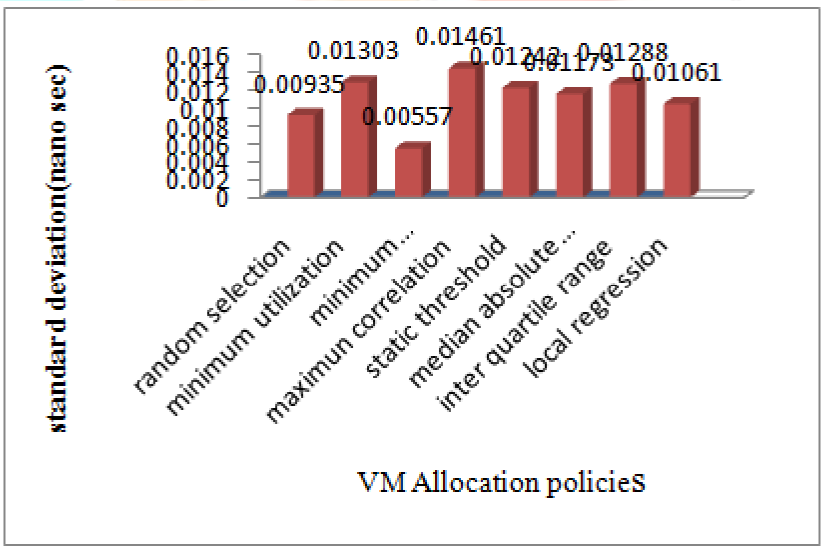

Fig 9 Find total standard deviation using vm allocation policy

Using vm allocation policies,Standard deviation (SD)is been computed for every host to allocate the vm properly,as shown in figure 9.

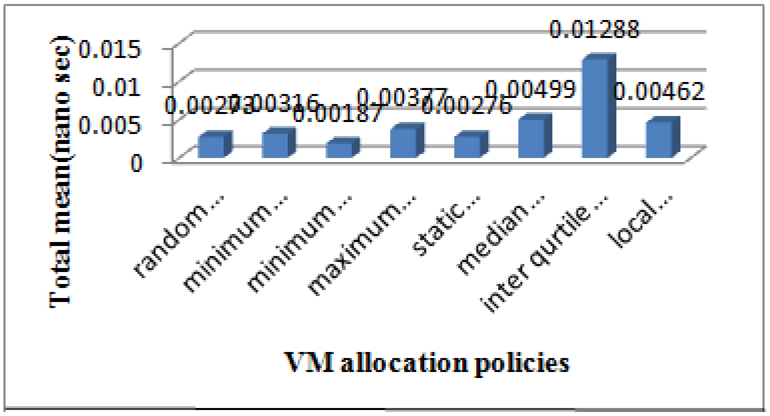

Fig4 Find mean using vm allocation policy

Using vm allocation policies,mean(total incident setup time) in been computed for every host to allocate the vm properly,as shown in figure4.

E . NUMBER.OF HOST SHUTDOWN WITH THRESHOLD

Hotspot	Coldspot	Warmspot
5	10	21

Table 5 Shutdown the host with threshold

XII CONCLUSION

In this paper,focus on presents a distributed user-based resource allocation approach to minimize cloud system energy cost. The proposed approach consists of two complementary mechanisms: Threshold and Bin packing algorithm.In this mechanism to satisfy the user service level agreement(SLA) and quality of service(QOS).To maintain the load balancing process and Ensure the quality of service for user resouces.Improve the system life time.

XIII FUTURE WORK

In the future, in the front end, the CIS prefers to take full advantage of VM resources to satisfy as many user requests as possible, thereby increasing CIS's revenue. In the back end, the CIS prefers to allocate the VMs to PMs efficiently to generate as little energy cost as possible, thereby decreasing CIS's operation cost of running users' applications.

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