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Study of Green Algorithm in Cloud Computing for Efficient Energy Consumption

Abhinandan Prafull Mangaonkar*, Anand Diggikar**

Abstract

Global warming is the greatest test for environment now a days and cloud computing is one of the main motivation for an unnatural weather change as global warming. After numerous years of examination in systems administration, virtualization and distributed computing field Cloud Computing was assembled. Cloud Computing is one of the best innovation in IT field. The fundamental standard of Cloud Computing is to process on distributed PCs instead of figuring on stand alone or remote servers. The thought behind Cloud Computing is to give secured, quick and appropriate data storage and figuring administrations. As there is a positive side of any innovation there is likewise a negative side of it, so do could computing has its negative side. There is huge measure of energy wastage furthermore huge carbon dioxide discharge in cloud computing which is the most compelling motivation for a dangerous atmospheric deviation. Hence there ought to be an approach to decrease the energy utilization furthermore diminishes the discharge of perils components like carbon dioxide. Giving a green solution for cloud computing is important to diminish contamination and utilization of energy. For this we should examine the power utilization in cloud computing and examination should be done in both private and public cloud. Green Cloud Computing Solution decreases energy utilization and consequently lessens the operational coasts in cloud computing furthermore spares energy, henceforth, diminishes the negative impacts on environment. This work tries to actualize the task combination (consolidation) algorithm coordinated with job submission and scheduling algorithm and also trying to save energy by sending the unused servers to rest and migration of virtual machines in cloud computing.

Keywords: Cloud Computing, Green Algorithm, Virtual Machine (VM), VM Migration, Physical Machine (PM), Task Consolidation

1. Introduction

Cloud computing is computing of various concepts where real-time communication takes place between thousands of computer systems to fulfill the user's needs, where user feels that as if he/she using a single large resource. Cloud computing provides larger numbers of computing resources, applications, storage for huge amount of data and many more. Another advantage of Cloud computing is that, the users of Cloud services need to pay only for the services they use from cloud and no other extra amount. Because of these utilities provided by the Cloud computing, numerous organizations and consumers are using cloud services and day by day as needs are increasing Cloud computing field is also growing.

The main objective of Cloud computing is to provide maximum numbers of shared resources and support for user requests in real time and on other hand the major disadvantage is its unnecessary power consumption, great amount of energy loss and higher infrastructure cost.

* Mtech Student, Computer Science and Engineering, KLS Gogte Institute of Technology, Visvesvaraya Technological University, Belagavi, Karnataka, India. Email: abhimangaonkar123@gmail.com

** Asst. Prof Anand Diggikar, Dept. of Computer Science and Engineering, KLS Gogte Institute of Technology, Belagavi, Karnataka, India. E-mail: vm4anand@gmail.com

Why Cloud Needs Green Computing?

Global warming is becoming a biggest issue to face now days and Cloud computing is one of the biggest fields who is causing global warming in huge amount. Cloud uses thousands of storage areas which are known as data-centers and to run these data-centers and to process many processes cloud needs bulk amount of power. As there are so many numbers of data-centers each uses large amount of power and also emits huge amount of heat and hazardous elements like Carbon die-oxide.

According to the survey, [2] Power Usage Effectiveness (PUE) is used to quantify how effectively data-centers utilizes theirs energy. PUE qualities can be in the middle of 1.0 to infinity. In the event that PUE quality is 1.0 that implies full power is utilized by equipments and productivity of that data center is 100%. In past years some organizations like Google, Facebook, YouTube achieved low PUE values. For instance the PUE estimation of Google was 1.13. On the off chance that the estimation of PUE is 1.5 that implies data center is utilizing 1.5kWh of energy, 1kWh energy is devoured by the equipment and 0.5Wh is squandered in cooling of the frameworks. If such a large amount of energy is expended and wasted in one hour then there is tremendous measure of energy loss every day, every month and every year which is exceptionally unsafe for environment.

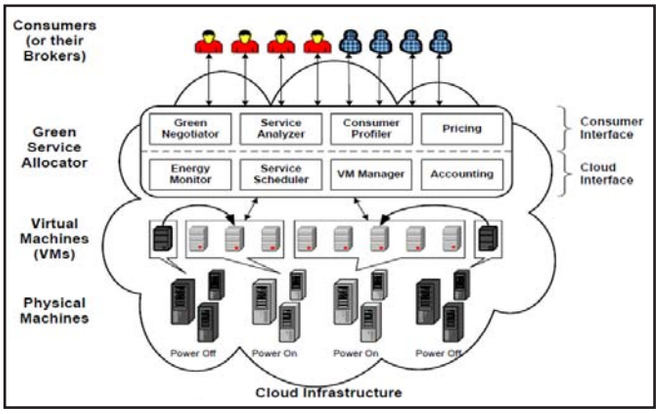
Green Solution gives a path by which we can decrease the amount of energy being devoured and amount of energy being squandered in Cloud computing.

The point of Green-Cloud Computing is to accomplish productive processing, as well as minimizing the energy devoured by cloud. This is required for making sure that the development later on of Cloud-Computing is supportable. Something else, Cloud-Computing with progressively broad user-end interface customer gadgets cooperation with back-end of cloud will bring about a huge danger of energy use. To reduce this risk, data center should manage the resources [8] to increase in an energy productive way [l0] to achieve Green-Cloud Computing. That implies, Cloud assets ought to be apportioned to fulfill requirements of (QOS) quality of service requirements by means of Service-Level-Agreements (SLA) furthermore to diminish energy use of cloud computing.

Represantation of Green Cloud Computing

Fig. l, represents the architecture for Green-Cloud Computing structure. Mainly it contains 4 main parameters:

Figure l. Green Cloud Computing Architecture [1]



1. Green Assets Allocator It is the interface amongst Cloud and also users of the cloud administrations. For vitality productive asset administration, taking after segments are required:

a. Green Negotiator

Helps in negotiation amongst cloud and consumers by finishing the service level agreement (SLA) contingent upon the client's quality of service (QoS) prerequisites and energy sparing plans.

b. Service Analyzer

Analyses the service required by the request which are submitted before it can decide if it is to be rejected or accepted.

c. Energy Monitor

The job of energy monitor is to decide which PM (Physical-Machines) is to be on or is to be power off.

d. Consumer Profiler

Collects characteristics of consumers and important consumers are granted privileges and also prioritized over non-prioritized consumers.

e. Service Scheduler

Creates the cloudlets for each request and decides which virtual machine to be allocated for that re-

quest and also decides which physical machine to be allocated to virtual machine.

f. Accounting:

keeps the track of how many resources are being used by particular requests and computes the usage costs.

2. Consumers Consumers of the cloud requests services to the Cloud. There is a difference amongst the consumers of Cloud and the users those use service of cloud. A Cloud consumer may be a company or organization which deploy their software, load on cloud varies depending on the number of users using it.

3. VMs There can be multiple VMs on single PH. These VMs can be put on and also can be stopped dynamically to meet the requests. In addition, we can migrate the VMs dynamically across physical machines so that workloads on PMs can be consolidated and also put the resources on a machine which uses less power. VMs can be turned to sleep mode or these can be framed to operate at levels where it can use less energy so that we can save energy.

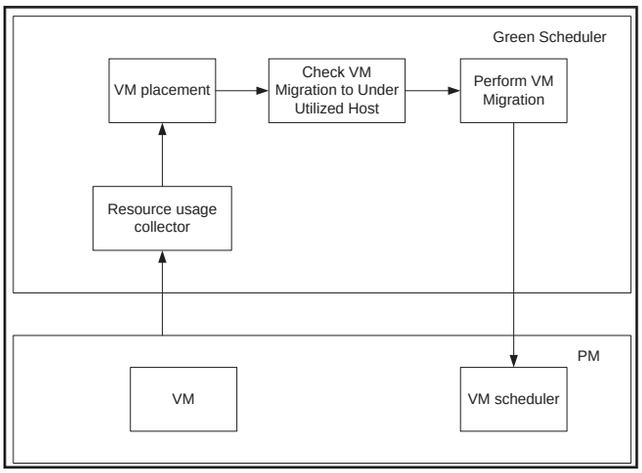
4. Physical Machines Physical machine is nothing but the physical computing servers which provides hardware infrastructure using which we can create virtual resources to meet user's service demands.

Architecture of System

System architecture is the applied configuration that characterizes the structure of the system and behavior of the same. This Architecture depiction is sorted out in a way that backings delineation about the auxiliary properties of the system. It characterizes the system components or building blocks and gives an arrangement from which output can be kept securely and systems built up, that will cooperate to execute the general framework.

The architecture of this System is:

Figure 2. Workflow for Assigning the VMs to PMs



2. Algorithmic Approaches

In this work two algorithms are being referred one is for consolidation of tasks and another is for submitting and scheduling the jobs.

Following are the algorithms being used as a reference:

A. Task Consolidation Algorithm. [1]

B. Algorithm for Job Submission and Scheduling. [2]

Before understanding about the algorithmic approaches we will first see the metrics which are considered for calculations of energy consumption, resource utilization and performance function.

Following are the metrics to be considered:

a. Utilization function: for a specific task, if we know the processing time and processor usage then we can ascertain the energy devoured by that task. For the resources at any point of given time, the utilization function U_i can be defined as:

$$Ui = \sum_{J=1}^{n} u_{ij}$$

Here,

n - number of tasks running at that point of time,

$u_{i,j}$ - usage resource of that task.

b. Energy consumed by resource r_i at any time is defined using E_i as:

$E_i = (p_{max} - p_{min}) \times U_i + p_{min}$

Where,

Pmax- it is a consumed energy at full load(100% utilization),

Pmin- it is minimum power consumed when the mode is active (1% utilization).

c. To computes the actual energy consumption of the current task, Cost function is used which subtract the minimum energy consumption (p_{min}).The value $f_{i,j}$ of a task tj on a resource ri is obtained using:

$fij = (p\Delta \times u_j + p_{min}) \times T_0\Delta - \Delta(p\Delta \times u_j + p_{min}) \times T_1 + p\Delta \times u_j \times T_2\Delta$

Where,

$p\Delta$- difference of p_{max} and p_{min},

u_j - the utilization rate of task t_j

and T_0, T_1 and T_2 are the total time taken for processing of t_j.

A. Task Consolidation Algorithm

Task consolidation algorithm can be also named as the server or workload consolidation algorithm. Here we should consider that we have to consolidate the tasks without violating time constraints. The aim of consolidation is to minimize energy consumption by maximizing resource utilization.

It is the process of assigning a set "T" which has "t" tasks, which is nothing but requests for the service or just services, to a set "R" which has "r" resources of cloud.

Steps in Algorithm

- Input to the algorithm is task and set of resources.
- Output is the matching of the task and resource.
- Assign all the resources to null at the beginning.
- For all resources r_j in resource set R, compute the cost function $f_{i,j}$ for the task t_j with resource r_i.
- If new cost function is better than old cost function the assign the resource to that task.
- If new cost function is not better than old cost function then assign the next resource to that task, compute the cost function and again compare it with old cost function.
- Repeat this process till we get a better cost function and good mapping of resource and task.

Input: A tasks $\mathbf{t_j}$ from set **T** and **r** cloud resources from set **R**

Output: matching of task and resource

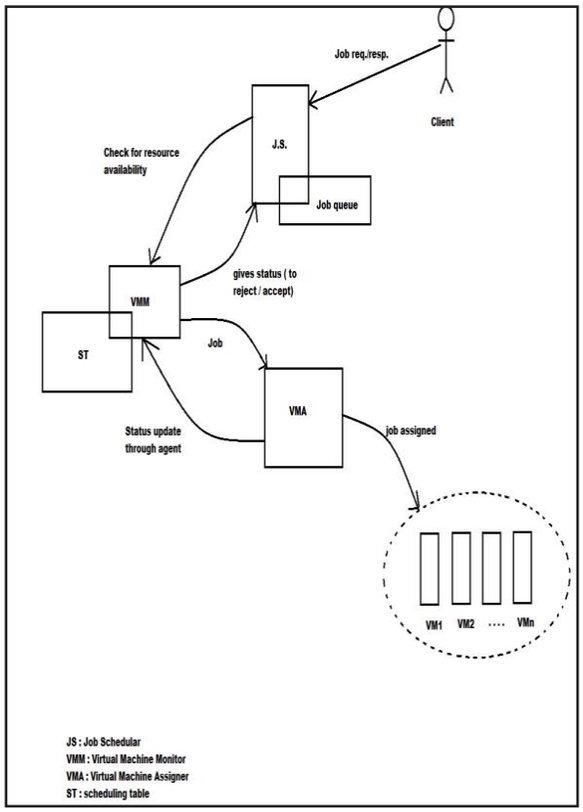
1. Let r* = ∅
2. for $\forall r_j \in R$ **do**
3. Compute the cost function value f_{ij} of t_j on r_i
4. **if** $f_{ij} > f^*j$ **then**
5. Let r* = r_i
6. Let f*j = f_{ij}
7. **end if**
8. **end for**
9. Assign t_j for r*

B. Algorithm for Job Submission and Scheduling

Steps in Algorithm

- Client of the cloud submits the request to the job scheduler.
- Job scheduler will check the resources are available through VM monitor.
- VM monitor will check the scheduling table containing threshold value & information about congestion on the machines.
- If the threshold value is less than the maximum and if there is no congestion then accept the job and send it to the job queue, else reject.
- If the requested job is accepted, then go to VM assigner.
- Assign the job to the VM only when there are under loaded CPU of VM and update the information in the database of the scheduler.
- Else return the job to the job queue if CPU of VM is overloaded.

Figure 3. Workflow of Job Submission and Scheduling Algorithm [2]



3. Conclusion & Future Scope

The architectures presented here tended to a typical issues in cloud computing and answers for those issues. By using the consolidation algorithm and algorithm for job scheduling and submission we can control the CPU cycles which assistant decreases the energy utilization. At the point when less energy is devoured by cloud equipments, then the energy wastage is additionally decreased which assist diminishes the emission of hazardous components like carbon die-oxide. It can in like manner easily be composed with estimate figuring and be used as case-based desire and improvement strategy.

with parameters values which we can get it from simulation which should be done using CloudSim simulator, the outcomes we get from simulator are as far as SLA Violation and Number of Migrations furthermore CPU energy utilization, Although there cloud administrators may pick each of these strategies as per level of significance of every parameters for their cloud framework.

Current scheduling strategies migrates VMs to upgrade general parameters, without considering client's behavior and history about their SLA Violations, and every so often cause starvation for changing and incredible SLA violations for a couple of customers with specific VM outline. We are currently concerning this subject and attempt to make estimation of most extreme SLA Violation that happens for a client to normal SLA Violation esteem while attempt to decrease the energy utilization furthermore the heat emanation. Considering two strategies said here we can have another strategy which can help us to diminish the energy utilization in much better way.

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