Autonomic Resource Management and Energy Consumption in Cloud Environment

G. Ravi, PhD
Research Adviser, Head & Associate Professor
Department of Computer Science
Jamal Mohamed College (Autonomous)
Tiruchirappalli-20, India

T. Sujithamani
Research Scholar
Department of Computer Science
Jamal Mohamed College (Autonomous)
Tiruchirappalli-20, India

ABSTRACT
In computing clouds, it is desirable to pass up slaying resources as a result of under-utilization and to avoid long response period as a result of over-utilization. This paper, proposes a latest approach for dynamic autonomous resource managing in computing clouds. The core involvement of this work is two-fold. First, it adopts a distributed design where resource management is decaying into independent tasks. The results show that the total energy consumption and decision-making time were compacting additional in the proposed algorithm than Sequential Executive Algorithm (SEA). In adding, the advantage would be increasingly apparent with the growing in assignments.

Keywords
Cloud Computing, Task Tolerance, Resource consumption, Energy Consumption Optimization

1. INTRODUCTION
Computing at present is increasingly moving into large-scale data centers, giving computing resources on a pay-per-usage foundation. An Infrastructure as a Service, Cloud allows clients to provision resources with low-level contact, on demand. In order for the IaaS cloud provider to reduce costs, it should ensure that its data center resources are being highly utilized. This allows both the hosting of added client workloads, as well as for unused resources to be switched into a reduction mode to decrease costs. However, the source must also gather the resource requirements of hosted client applications.

Modern resource exhaustive activity and scientific applications create growing demand for large performance computing infrastructures. This has lead to the production of large-scale computing data centers consuming enormous amount of electrical. Despite of the improvements in energy efficiency of the hardware, overall energy consumption continue to develop due to growing necessities for computing funds. For example, in 2006 the cost of energy utilization by IT infrastructures in US was estimated since 4.5 billion dollars and it is likely to twice by 2011 [7]. Apart from the covering operational expenses, construction a data center leads to excessive establishment expenses as data centers are typically build to serve infrequent peak many resulting in low average utilization of the resources. Also, there are other critical problems that arise from high consumption. Insufficient or malfunctioning cool system can lead to overheating of the resources dropping system consistency and devices lifetime. In addition, high consumption by the infrastructure leads.

Traditionally, an organization purchases its own computing resources and deals with protection and upgrade of the outdated hardware, resulting in added operating cost. The newly emerged Cloud computing paradigm [4] leverages virtualization equipment and provide the capacity to provision resources on-demand on the pay-as-you-go foundation. Organization can outsource their addition needs to the Cloud, thereby eliminating the need to maintain own computing infrastructure. Cloud computing physically leads to energy-efficiency by given that the following characteristics:

- Economy of scale due to removal of redundancies.
- Enhanced utilization of the resources.
- Position independence – VMs can be moved to a put where energy is cheaper.
- Scaling up and down – Resource usage can be used to current requirements.
- Efficient resource organization in the Cloud provider.

2. PROBLEM SCOPE
The center of this work is on energy-efficient resource organization strategies that can be functional on a virtualized data center by a Cloud contributor (e.g. Amazon EC2). The major mechanism that leverage is live migration of VMs. The capacity to migrate VMs among physical hosts with low overhead gives elasticity to a resource provider since VMs can be animatedly reallocated according to present resource supplies and the allocation policy. In active physical nodes can be switched off to reduce energy expenditure.

In this paper we present a decentralized design of the resource organization system for Cloud data centers and suggest the development of the following policies for constant optimization of VMs placement:

2.1 Optimization Over Numerous System Resources
at each instance frame VMs are reallocated according to present CPU, RAM and network bandwidth utilization.

2.2 Network Optimization
Optimization of effective network topologies produced by intercommunicating VMs. Network communication between VMs must be observed and measured in reallocation decision in organize to reduce data transfer overhead and network devices load.

2.3 Thermal Optimization
Present temperature of physical nodes is considered in reallocation decision. The anthology is to pass up “hot spots” by dropping workload of the overheated nodes and thus reduce error-proneness and cooling system load.

3. ALLOCATION POLICIES
It suggests three stages of VM residency optimization: reallocation according to current utilization of multiple

scheme resources, optimization of effective network topologies established between VMs and VM reallocation considering thermal condition of the resources. Every of these stages is planned to be investigated separately and then combined in an overall resolution. The residential algorithms have to meet the following requirements:

3.1 Decentralization and Parallelism
To reduce SPF and provide scalability.

3.2 High performance
The organization has to be able to quickly answer to changes in the workload.

3.3 Guaranteed QoS
The algorithms comprise to provide reliable QoS by convention SLA.

3.4 Independence of the workload type
The algorithms has to be able to perform efficiently in mixed application environments. The VM reallocation difficulty can be separated in two: collection of VMs to migrate and determining new placement of these VMs on material hosts. The first partition has to be considered separately for each optimization stage. The second part is solved by submission of a heuristic for partly online multidimensional bin-packing problem.

At the first optimization stage, the consumption of possessions is monitor and VMs are reallocated to minimize the number of physical nodes in use and thus minimize energy consumption by the system. However, aggressive consolidation of VMs may lead to violation of performance necessities. That have planned several heuristics for selection of VMs to migrate and investigated the trade-off between presentation and energy reserves. To simplify the difficulty for the initial step it considered only utilization of CPU. The major idea of the policies is to set higher and lower consumption thresholds and keep total utilization of CPU produced by VMs sharing the similar node between these thresholds. If the utilization exceeds the upper thresholds, some VMs contain to be migrated from the node to decrease the risk of SLA violation. If the utilization goes below the subordinate thresholds, every VMs have to be migrate and the join has to be present switch rotten to save the power consumed be the idle node. One more difficulty is to determine particular values of the utilization thresholds.

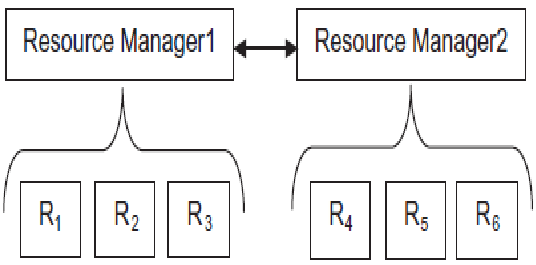

Figure 1: Resource Flow Diagram

4. PROBLEM MODEL
The decision-making consumption of cloud compute was mostly focused in this thesis, so every cloud data centers ran at occupied capability was assumed. In the task development model of cloud computing, computing capital, storage space capital, system capital, etc. exist in the form of services. The task development model of cloudComputing is shown in figure.

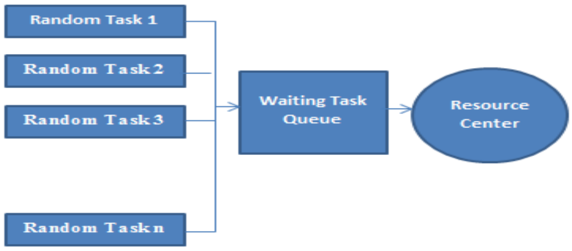

Figure 2: Task Allocation

In figure, a set of arbitrary tasks is scheduled to cloud examination supply nodes for executing through the tasks waiting queue. The appearance time of random tasks is doubtful, range beginning resource requirements.The learn unspecified that the responsibilities waiting queue was extended adequate, and cloud service resource center was in charge for scheduling task to execute reasonably.

5. ALGORITHM DESCRIPTION
In resource development optimization algorithm of power consumption for cloud computing based on the assignment tolerance (ECCT), the entire amount of nodes of cloud computing, the number of tasks and the first task tolerance be specified. The cloud classification checked the resource consumption of every cloud computing node firstly when there was the task in the task pending up queue. If the resource consumption of some cloud computing node was not 100%, tasks be programmed to the cloud node for execute. When the task acceptance was fewer than or identical to the agreed tolerance of itself, the assignment was programmed into the cloud computing joint, and the joint of relatively small consumption was chosen to list the task for executing. At the same time the resource consumption of joint was real-time collected. or else, afterward task of the quest chain queue was scheduled for execute. The iterative computation was completed, and the full amount power expenditure was designed when the resource consumption of each computing joint was 100%. Algorithm is as follow:

For each computing code and traditional tasks Generate τ', τ, U_1, R

End for

For all computing codes

Compute U_1, U_2, U_m

For (i=1; i<m;i++)

For (j=i+1; j$\leq$ m; j++)

If Ui>Uj

U=Ui; Ui=Uj ;UjU ;

End if

End for

End for

End for

While R>0

For (i=1; i≤m; i++)

While U1 < 100%

For (k=1; k<n; k++)

If $\tau' \leq \tau$

Scheduling Tk to computing code c1

Compute U1

End if

End for

End while

End for

End while

Return E

6. EXPERIMENTAL ANALYSIS

In systematize to test the performance and operating efficiency of energy consumption optimization in different modes, the experimental environment was composed of 12 PC whose systems was Windows 7 kernel, CPU was Inter Core (TM) 2 Duo 2.20GHz, RAM was 4G, hard disk was 320GB, the network bandwidth was 100M, and the algorithm was programmed using the Java programming language.

In order to compare the Sequential Executed Algorithm (SEA) was proposed in the study. The SEA algorithm's essential idea was: when there are the tasks in the task waiting queue, the tasks were scheduled serially to cloud computing nodes for executing, the task tolerance didn't need to be considered. The task was scheduled directly to the next node for executing when the resource requirements of task can't be met. The SEA algorithm would be end until there was no idle service node in the data centers.

7. RESULT AND DISCUSSION

This effort developments the Cloud computing field in two ways: First, it acting a substantial role in the reduction of data center consumption expenses, and thus helps to develop a strong and competitive Cloud computing industry. Second, consumers are more and more becoming aware about the environment.

Time of the day(hours)	% of Load
8	8
12	22
18	18
24	30
27	32
42	45
40	47
41	46
53	67

Table 1: Process Table

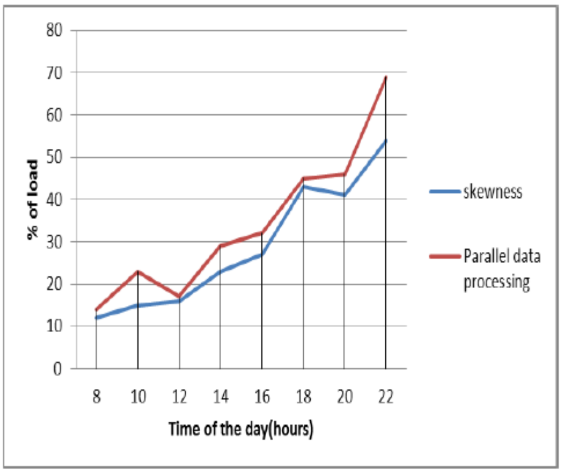

Figure 3: Execution Flow Diagram

The CloudSim toolkit has been modern framework aimed at Cloud computing environments. It have simulated on a single machine with a static numbers of hosts and VMs, it needs a CPU with the performance equivalent to 1000, 2000 or 3000 MIPS, 4 GB of RAM, 40 GB of disk 15 inch colour monitor. Each VM requires one CPU core with 250, 500, 750 or 1000 MIPS, 128 MB of RAM and 1 GB of storage. Initially, the VMs are allocated according to the requested characteristics assuming 100% CPU utilization.

The testing results have shown that this approach leads to a significant discount of energy consumption in Cloud data centers in assessment to fixed resource allocation techniques. Aiming at putting in a strong thrust on open challenges recognized in this paper in order improve the energy-efficient organization of Cloud computing environments.

8. CONCLUSION

Resource scheduling optimization algorithm of consumption for cloud computing based on the task tolerance was proposed by the study of the consumption in cloud computing. The task waiting instance was condensed by improving the task tolerance, through which the service capital of cloud computing were completely utilized. At the same time the parallelism degree of tasks was improved, and the power expenditure of cloud computing was reduced. As can be seen from the large number of experimental results, the entire power expenditure of the cloud system and the total executive time would be reduced with the task tolerance was slowly enlarged, and the advantage of algorithm in saving energy would become increasingly obvious with the amount of tasks was slowly enlarged.

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