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An Approach for Energy-Efficient Cloud Computing Using Improved Cloud Scheduling

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ABSTRACT

Cloud computing (CC) is included in one of the fastest-growing technologies used for computer use these days. Cloud computing consumes enormous amount of energy, as a result, the cost of CC service also increases and carbon emission. Therefore, green computing become a vital research area, green computing solutions can minimize energy consumption. In this paper, we have proposed an improved scheduling algorithm in cloud for work allocation among different data centers. In the experimental study, we will compare the proposed algorithm with our earlier work based on a task finish time and average task finish time. Efficient scheduling of tasks among virtual machine will reduce energy consumption.

Key Words: CC, VM, IaaS, SaaS, PaaS

1. INTRODUCTION

As a new standard for the powerful supply of computer services supported by data centres in a condition that generally uses Virtual Machine (VM) integration technology and environmental separation objectives [1,] cloud computing may be defined as follows: It makes infrastructure, platform and software (applications) available to purchasers on a pay-as-you-go basis using cloud computing, which is a type of on-demand computing. According to the industry, this type of service is referred to as Platform As A Service (PAAS), and Software as a service (SaaS), Infrastructure As A Service (IAAS) among other names. Google, Microsoft, Yahoo, and IBM are just a few of the computer service companies who have instantly deployed data centres in various places across the world to provide Cloud computing services to its customers.

According to the National Institute of Standards and Technology (NIST), the cloud architecture is comprised of five fundamental aspects, which are Broad Network Access, Resource Pooling, On Demand Self Service, Rapid Elasticity, and Measured Services [2].

- On-demand self-service: The customers are supplied with the one-sided data-processing capabilities such as the server time interval and network storage that they require through the usage of on-demand self-service.

- Broad network access: Capabilities are reachable across the network and handled by customary processes, which are also driven by confined or broad user stages (for mobiles, instance, tablets, laptops, as well as workplaces).

- Resource pooling: Multiple users can benefit from the supplier's computing assets because they are configured to work in a framework where cloud services are used by multiple users at the same time and a variety of physical and simulated resources that are dynamically assigned and reallocated in response to the users' requests. When it comes to position and individuality, there is an intellect in which the user's general does not have control or familiarity with the position of the assets that are being offered; yet, this may be competent to designate position on the side of a higher degree of abstraction (for example, state, country, or information center). Memory, storage handling, and network bandwidth are all examples of assets that may be found in use.

- Rapid elasticity: In spite of the fact that the competences are given in an elastic manner and are unconstrained, there are some instances in which the measuring is done with outward proportional as well as inside proportionate through request. When it comes to provisioning, the proficiencies available to the user typically appear unconstrained and also capable of being used in any sort of magnitude at any one point in time.

- Measured service: Cloud frameworks automatically regulate and optimise resource use by employing metering proficiency at various levels of abstraction that are appropriate for the type of services being controlled and optimised (for example, handling, storage, bandwidth, as well as vigorous client accounts). If there is calmness for both providers and customers of the services that are being used, asset consumption may most likely be reviewed, managed, and tested.

The term "Green Computing" was coined in 1992 by the United States Environmental Protection Agency as part of the Energy Star initiative. The Energy Star label is a form of label that is applied to computers and other electrical devices. Environmental Protection Agency (EPA) A system that minimises energy consumption while maintaining or improving efficiency is described as follows: In order to become green, one of the first things you should do is turn off your computer when you're sleeping. How to Sleep is a function that places the computer in standby mode at a certain time. Figure-1 displays the function.

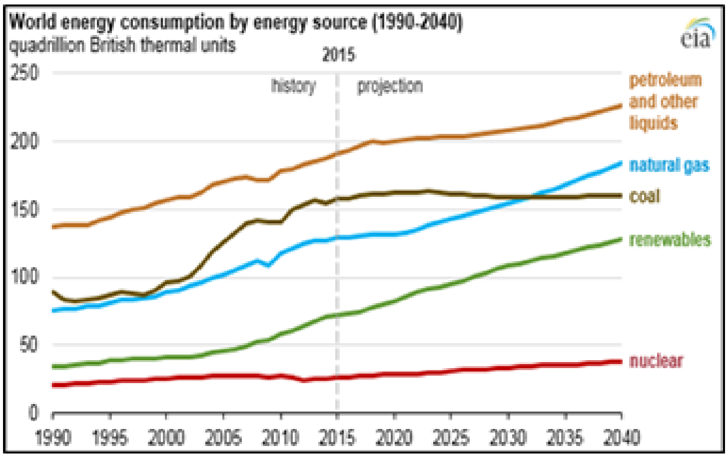

Fig:1 International Energy Outlook 2017, published by the United States Energy Information Administration, provides information on energy use..

Several variables influence our decision to do so:

- Due to the fast expansion of the Internet
- Increasing the power density of the equipment
- Cooling requirements are increasing.
- Costs of energy are rising.
- Supply and access restrictions to energy are in effect.
- Server usage rates are quite low.

Following that, we will analyse some literature and present a tabular comparison, followed by a discussion of recommended methodologies in section-III, followed by experimental data in section-IV, and finally a conclusion to our research.

2. LITERATURE SURVEY

Anton Beloglazov in 2011 proposes: (a) an architectural postulate for energy-efficient Cloud management; (b) resource allocation policies and scheduling algorithms that balance QoS expectations with device power consumption; (c) a set of open research challenges that benefit both resource providers and consumers. Kavita Arjun Sultanpure in 2017 suggested an approach based on transmission and caching to get the request faster.

An algorithm that analyses the synergy between various data centre infrastructures (e.g., software, hardware and so on) as well as performance was presented by Sukhpal Singh in 2014. This algorithm was developed in response to the creation of an energy-based resource scheduling framework, which was highlighted in 2014. This work presents (a) architectural principles for energy-efficient Cloud management; (b) energy-efficient resource allocation techniques and scheduling algorithms that take into account the perspectives of Quality of Service (QoS); and (c) energy-efficient resource allocation techniques and scheduling algorithms that take into account the perspectives of Quality of Service (Quality of Service).

Table-1 Comparison

S. No.	Year	Author/ Title	Description
1.	2009	Robert R. Harmon, Nora Auseklis/Sustainable IT services: Assessing the impact of green computing practices	Sustainable IT service design is examined in this study, which identifies a core set of principles that may be used as a guide.
2.	2013	Dr. Pardeep Mittal, Navdeep Kaur/ Green Computing – Need and Implementation	This study highlights the value of Green computing. Author's interest for Green computing, its demands, and average man's steps
3.	2017	Laith Farhan, Rupak Kharel, Omprakash Kaiwartya, Mohammed Hammoudeh and Bamidele Adebisi/ Towards Green Computing for Internet of Things: Energy Oriented Path and Message Scheduling Approach	This research presents an energy-efficient path selection and message scheduling framework for sensor-enabled wireless networks. The suggested framework's design, development, and analysis showed that combining path selection with message scheduling considerably increases energy efficiency in sensor-enabled wireless networks.
4.	2011	Anton Beloglazov, Jemal Abawajy, Rajkumar Buy/ Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing	In two ways, this study advances Cloud computing. First, it helps establish a robust and competitive Cloud computing sector by reducing data centre energy usage expenses. Second, customers are becoming more eco-conscious.
5.	2018	Kavita Arjun Sultanpure, Abhishek Gupta, L. S. S. Reddy/An Efficient Cloud Scheduling Algorithm for the Conservation of Energy through Broadcasting	As a result of this, the author stated that the suggested approach performed effectively for managing tasks in terms of delay (140), load (43), energy (3.5), and CPU (45).

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3. PROPOSED METHOD

Proposed Multi-Threaded Scheduling Algorithm

Step-1: Initialize the datacenter (number of grid users).
Step-2: boolean trace_flag = false //Initialize mean trace events
Step-3: Create Data Centers
Step-4: Create Broker //Cloud Broker is an entity that manages the use, performance, and delivery of cloud services
Step-5: Create VMs and Cloudlets and send them to the broker
Step-6: Create a thread that will create a new broker at clock time Scheduling

Create Datacenter

Step-1. Create a list to store one or more Machines
Step-2. A Machine contains one or more PEs or CPUs/Cores. Therefore, we should create a list to store these PEs before creating a Machine.
Step-3. Create PEs and add these into the list. For a quad-core machine, a list of 4 PEs is required. // need to store Pe id and MIPS Rating
Step-4. //Create Hosts with its id and list of PEs and add them to the list of machines

int hostId=0
int ram = 16384 //host memory (MB)
long storage = 1000000 //host storage
int bw = 10000

Step-5. Create a DatacenterCharacteristics object that stores the
// properties of a data center: architecture, OS, list of
// Machines, allocation policy: time- or space-shared, time zone
// and its price (G$/Pe time unit).
String arch = "x86" // system architecture
String os = "Linux" // operating system
String vmm = "Xen"
double time_zone = 10.0 // time zone this resource located
double cost = 3.0 // the cost of using processing in this resource
double costPerMem = 0.05 // the cost of using memory in this resource
double costPerStorage = 0.1 // the cost of using storage in this resource
double costPerBw = 0.1 // the cost of using bw in this resource

Step-6. Return PowerDatacenter object

4. EXPERIMNETAL RESULT

The Cloudsim simulator was used to test the proposed technique. We utilised Java 1.8, a Core i5 processor, and 4GB of RAM to test it.

```
Simulation completed.

========== OUTPUT ==========
Cloudlet ID    STATUS    Data center ID    VM ID    Time    Start Time    Finish Time
    0          SUCCESS        2              10     1000       0.1         1000.1
    1          SUCCESS        2              11     1000       0.1         1000.1
 finished!
```

Fig-2 Earlier Datacenter Scheduling

Proposed

```
Simulation completed.

========== OUTPUT ==========
Cloudlet ID    STATUS    Data center ID    VM ID    Time     Start Time    Finish Time
    4          SUCCESS        2              4      199.9       0.1          200
    3          SUCCESS        2              3      199.9       0.1          200
    0          SUCCESS        2              0      320         0.1          320.1
    5          SUCCESS        2              0      320         0.1          320.1
    1          SUCCESS        2              1      320         0.1          320.1
    6          SUCCESS        2              1      320         0.1          320.1
    2          SUCCESS        2              2      320         0.1          320.1
    7          SUCCESS        2              2      320         0.1          320.1
```

Fig-3 Proposed Datacenter Scheduling

Table-2 Result (No. of Datacenter=2)

Proposed			
Datacenter.Datacenter ID	**VM ID**	**Start Time**	**Finish Time**
2	4	0.1	200
2	3	0.1	200
2	0	0.1	320.1
2	0	0.1	320.1
2	1	0.1	320.1
2	1	0.1	320.1
2	2	0.1	320.1
2	2	0.1	320.1
Average		**0.1**	**290.075**
SD			**52.0048255**
Earlier			
Datacenter ID	**VM ID**	**Start Time**	**Finish Time**
2	10	0.1	1000.1
2	11	0.1	1000.1
Average		**0.1**	**471.797117**
SD			**345.686152**

Table-3 Result (No. of Datacenter=3)

Proposed			
Data center ID	**VM ID**	**Start Time**	**Finish Time**
3	4	0.1	200
3	3	0.1	200
3	0	0.1	460.1
3	0	0.1	460.1
3	1	0.1	460.1
3	2	0.1	460.1
3	1	0.1	460.1
3	2	0.1	460.1
Average		**0.1**	**395.075**
SD			**112.626603**
Earlier			
Datacenter ID	**VM ID**	**Start Time**	**Finish Time**
3	10	0.1	1561.1
3	11	0.1	1561.1
Average		**0.1**	**715.743086**
SD			**546.664469**

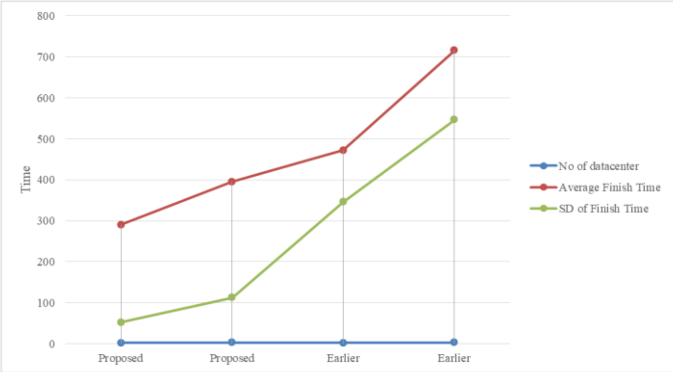

Fig.-4 Comparison Graph

5. CONCLUSION

A significant contribution to the reduction of data centre energy consumption expenses is made by the suggested algorithm, which in turn leads to the establishment of a robust and competitive Cloud computing sector. Next, customers are becoming more and more environmentally sensitive with each passing year.

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