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ISSUES FOR MEASURING ENERGY EFFICIENT OF CLOUD COMPUTING DATA CENTER

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Abstract: The Technology, Cloud computing provides a platform for the sharing of resources such as hardware, software, infrastructure, application and other information. Cloud Computing brings a revolution in Information Technology industry by offering on-demand of resources. Clouds are basically virtualized datacenters and applications offered as services. Datacenter (Server infrastructure) hosts hundreds or thousands of servers which comprised of software and hardware to respond the client request. A huge amount of energy requires to perform the operation. A data center with 500*100 servers consumes around 9 Megawatt to perform operation. Energy consumption is a key concern in data center. Energy consumption by Google is 2,675,898 MWh in 2011. United States datacenters use more than 90 billion Kilowatt-hours of electricity a year requiring roughly 34 giant(500-megawatt) coal-powered plants. Global data Centers used roughly 416 terawatts (4.16 x 1014 watts) in 2017 nearly 40% more than the entire United Kingdom. Cloud Computing is facing lot of challenges like Security of Data, Server Consolidation, Consumption of energy etc. The research work focuses on the study of task scheduling management in a cloud environment.

Different issues for measuring Energy efficient of cloud computing are:-1) Server consolidation: Energy optimization is an important issue to reduce this, a idea is to redeem the idle power going waste by underutilized servers. 2) Security of data. It hampers the expansion of the cloud.

3) Energy consumption: It has been found that a server even runs a very small workload, then also it consume over 50% of the peak power. 4) VM Migration: virtual machines have to be migrated between physical machines loaded in any datacenter in order to achieve better provisioning of resources.

Keywords: Data Center, Cloud computing, Virtual Machines, Physical Machines, Workloads, Energy, Utilization of Resources, Operating System, peak power, etc.,

1. INTRODUCTION

This incorporate cloud computing, the evolution of cloud computing, other technologies related like grid. It also discuss with characteristics of cloud, cloud computing services. The progress of the cloud goes phase by phase that include the Grid Computing, Distributed Computing. Cloud Computing is used first in 1950s, the time during which large-scale mainframes were available in the business industry. The hardware used by the mainframe was installed in a big room and all users are accessing the mainframe through terminals. Later in the year 1970, the IBM launches Operating System having a number of virtual machines at a single machine. The data are stored in a data center (a centralized infrastructure), which is a vast data storage space. The processing of the request or data performed through servers thus availability and security of the data will be addressed. The service provider and the clients has an agreement for the usage known as SLA(Service level Agreement). Then in 1999, salesforce.com put this idea to an application. Then in 2002, a Cloud based services of web launched by Amazon. It provides on demand services to the subscribed users. There are many proposed definitions of the Cloud computing due to its growing popularity defining its characteristics. Some of the definitions given by many well-known scientists and organizations are:

National Institute of Standards and Technology (NIST) defines Cloud computing as follows: Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This Cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models [2].

2. CLOUD COMPUTING CHARACTERISTICS

The characteristics of cloud computing are:- Reduction of Cost, Elasticity, Security and Availability, Flexibility, Geographical independence.

2.1 Reduction of Cost

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There are a number of reasons to attribute Cloud technology with lower costs. The billing model is pay as per usage; the infrastructure is not purchased thus lowering maintenance. Initial expense and recurring expenses are much lower than traditional computing.

2.2. Elasticity

Services offered by cloud are rapidly provisioned, and in few cases by itself, rapidly released to quickly scale in. To consumer, the capabilities available for provisioning appears to be endless and could be purchased whenever required.

2.3. Security and Availability

The cloud should authorize the data access by the end users. However a fear of security always there with the end users . The requests have to be fulfilled in every case , the data and infrastructure should always available.

2.4. Flexibility

Cloud computing mainly stress on deployment of applications in market as quickly possible , by using the most appropriate building blocks necessary for deployment.

2.5. Geographical independence

A user can access the data shared on cloud from any location across the globe.

3. SERVICES OF CLOUD COMPUTING

The meaning of cloud computing services is to use reusable and fine grained components on a network provided by Cloud service provider(CSP). Cloud computing generally offers three types of services:

3.1 Software as a Service

In Software as a service an application is provided as a service to the customers who can access it through the network. The application is hosted by cloud data centers. Since the application is hosted not on customer site so the customer doesn't have to bother about the maintenance and support of application. But the customer can't be able to make changes Introduction in application while the service provider can make change in it. The thing is that the customer can only use the software while all changes will be done by provider. The biggest benefits of software as a service are costing less money than to buy the software application. Ex salesforce.com: for buying software on demand.

3.2 Infrastructure as a Service

It simply offers the hardware so the customer can keep anything onto it. IaaS allows the customer to take resources like Server space, CPU cycles, memory space and network equipment on rent. Based on requirement the infrastructure can be enhancing up or down. VMware and EC2 cloud offered by Amazon as a IaaS.

3.3 Platform as a Service

Platform as a service model provides all the resources required to build applications and services through the internet. You don't need to install or download the software. The PaaS Services include application design, development, testing, deployment, and hosting. The hurdles in Paas is that the developers are not having interoperability and portability among the providers. The cost of changing the application to different provider is very high. Example of PaaS is Azure services and Amazon web services.

4. CLOUD COMPUTING DEPLOYMENT MODEL

The deployment model explained as follows:

4.1 Public Cloud

A public cloud network enables users to distribute and access data from anywhere at any given point in time. This means that public cloud computing systems are incredibly accessible and can be shared with third parties. Based on the standard cloud computing model, in a public cloud the service provider makes its applications, storage or other resources, available to the general public. Examples of the public cloud include Google AppEngine. The main benefits of a public cloud service are: easy and inexpensive to set up, scalability, and a pay per what you use model (no wasted resources).

4.2. Private Cloud

Availability and distribution mediums in a private cloud network are limited only for authorized users from behind a firewall. This form of cloud computing is specifically designed for companies that do not want to distribute their internal work information to third parties. Nonetheless, these outside users can still access or distribute data provided they are authorized by the main client to access. Private cloud computing networks are much safer to use than public ones since they require all users to be authorized.

4.3. Hybrid Cloud

Hybrid cloud is developed with both public and private cloud characteristics. While public and private cloud systems are more prevalent, hybrid types have been growing in demand. Hybrid cloud systems occur when an organization provides some cloud services in-house and has others provided externally. The advantage to this approach is that companies are able to host external data off-site with an external provider , while maintaining control over internal customer data. Issues for Research To reach the extent of CLOUD computing, major aspects have not yet been developed and realized and in some cases not even researched. Many issues are still needs to be known.

5. ISSUES FOR RESEARCH

In the field of cloud computing, major aspects have not yet been developed and realized and in some cases not even researched. There are so many issues are still needs to be known

5.1 Server Consolidation

Energy optimization is an important issue in cloud computing environments. To reduce this ,a idea is to redeem the idle power going waste by underutilized servers. The fact is that a server even runs a very small workload, then also it consume over 50% of the peak power [6]. Thus the focus of conserving energy is to turn on as few servers as possible by consolidating the workload. This condition is referred to as server consolidation. It is a nice approach to better utilize the resources and to redeem the consumption of power.

5.2 Security of Data

Security of data is a vital and important research issue in cloud computing. It hamper the expansion of the cloud. Usually, the services of cloud computing are delivered by a third party known as service provider, who owns the infrastructure. Even for a virtual private Cloud, the service provider can only specify the security setting remotely, without knowing whether it is fully implemented. It is hard to make the trust at each layer of the Cloud. Firstly, the hardware layer must be trusted using hardware trusted platform module. Secondly, the virtualization platform must be trusted using secure virtual machine monitors. VM migration should only be allowed if both source and destination servers are trusted.

5.3 Energy Consumption

To reduce the energy consumption in data centres is another issue in cloud computing. It has been found that that a server even runs a very small workload, then also it consume over 50% of the peak power. Energy consumption by Google 2,675,898 MWh in 2011 and it is increasing regularly. Thus there is a need to control the consumption of energy otherwise the cost of cloud computing will increase tremendously. The aim is to reduce the energy consumed in data centers by following the service level agreement. This issue is now started gaining importance. This issues can be addressed by a lot of approach. For example by selectively shutting down the unutilized server the power consumption can be greatly reduced. The utilization of resources can be enhanced by addressing the problem.

5.4 VM Migration

In a cloud environment having more number of datacenters, virtual machines have to be migrated between physical machines located in any(same or different) datacenter in order to achieve better provisioning of resources. Migration of VMS which means to transfer a virtual machine from one to another physical machines helps in greatly reducing the energy consumption. The benefits for VM migration are to avoid the hotspots.

6. MOTIVATION

Cloud computing offers software, infrastructure and platform as a service in a pay as you go model to end users. There are various research issues in a cloud computing environment such as Vm Migration, Server Consolidation, Security of Data, Energy Consumption, etc. as explained in section before. One of the core issue is the Management of Energy. Typically size of data centers are consists of hundreds or thousands of servers and resources, and the size of data centres are getting a huge expansion due to the rapid increase in use of Cloud computing technology. This rapid growth has made a increase in energy consumed in clouds. Thus in order to reduce energy consumption there is a need to effectively utilize the resources and executes the requests. The less consumption of energy provides a Green Computing environment.

7. POWER CONSUMPTION SOURCES

As per the data provided by Intel Labs [8], the mainly consumption of power by a server has been used by the CPU, then it's memory in utilizing the power and after that the loss due to the inefficiency in power supply. The data shows that the CPU does not dominates the power consumption by a server. Current desktop and server CPUs can consume less than 30% of their peak power in low-activity modes, leading to dynamic power ranges of more than 70% of the peak power [9].the power consumed by the CPU further reduced with the evolution of multi core technology.

8. LITERATURE REVIEW

The techniques explains the scheduling of workloads considering a number of parameters such as length, number of CPUs required and buffer size of input and output

• M. Steinder et al. [10], proposed the method of how to manage heterogeneous workloads in a data center consists of virtualization.

They convey a method of placement of workload dynamically, on the same hardware, in order to increase utilization of resources. The performance function in the method used to check out the performance of different workloads and analyze them.

• Gaweda et al. [11], proposed the method that manage the data centers running the workloads according to the situations.

In this method the workloads are located at the server then assigned the resources based on the better utilization of them. The author has used the real system and also the simulated environment to verify the result.

• Yatendra et al. [12], proposed a dynamic compare and balanced algorithm that works on dynamic threshold values[12].

The method is an algorithm uses load balancing and consolidation of server techniques. In the technique, the resource consumption is noted and whenever needed process are migrated so that the load get balanced and thus minimizing the power consumption.

• Liu et al. [13], proposed the technique of assigning the tasks to the most efficient server.

The total energy that the datacenter consumes is defined as the sum of energy consumed by task proceeding of all tasks at the data center. The problem solved using a greedy approach. Here the servers are sorted on the based of their energy efficiency and then the most efficient server is assigned the task.

• Beloglazov et al. [15], focuses on provisioning of resources in a dynamic manner and provides algorithm for efficiently handling of workloads between the datacenter.

They proposed (i) architectural principles to efficiently manage the clouds (ii) policies to effectively and efficiently utilize resource and also scheduling algorithms for that which consider QOS expectations, and data center characteristics of using power. and (iii) a novel software technology for energy-efficient management of Clouds.

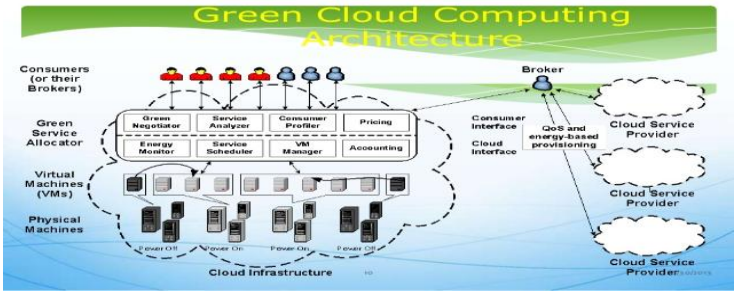
9. VIRTUALIZATION IN CLOUD

Virtualization is the abstraction of physical network, server, and storage resources and it has greatly increased the ability to utilize and scale compute power. It is a technology that allows running two or more operating systems side-by-side on just one PC or embedded controller [7]. Virtualization greatly helps in effective utilization of resources and builds an effective system. Many applications are having a limited number of concurrent tasks, thus having a number of unused (idle) cores. This problem can be solved by using virtualization, allocating a group of cores to an OS(Operating system) that can run it concurrently. It enables the service providers to over virtual machines for work rather than the physical server machines. It forms the basis of Cloud computing on-demand, pay-as-you-go model. The physical server is called the host. The virtual servers are called guests. Virtualization also helps in reducing power consumption by reducing the number of physical machines since it provides a number of virtual machines per physical machines and in this way helps in effective utilization of resources. Migration of Vms which means to transfer a virtual machine from one to another physical machines helps in greatly reducing the energy consumption. There are 2 ways to perform migration

1. Regular migration moves the Vms by pausing the server currently in use, copying the contents then resumes on the moved one machines.
2. Live migration moves the Vms without pausing the server currently in use, and copying the contents then resumes on the moved one machines. The source server keep on running without intercepting the moved Vms perform its functions.

10. CLOUD COMPUTING ARCHITECTURE

Green Cloud architecture of Data Center, whose aims is to reduce data center power consumption, and also to guarantee the users performance lifting the live migration of virtual machine.



There is a challenge for the architecture of making the decision for scheduling on dynamically migrating Virtual machines between the physical machines by reducing the energy uses. Above figure shows the architecture for Green Cloud computing supporting energy-efficient allocation. Basically there are four main entities:

End-users: Consumers or end-users they submit their requests from any place in the world to Cloud. A consumer could be a single user or a company having deployed
a Web application, that have workload changes based on users online accessing it.
Resource Allocator: It acts as an interface between the infrastructure of cloud and end users. It gathers the interaction of the various components to support energy-efficient utilization of resources.
Virtual Machines: On a single physical machine many VMs could be managed for working or stop, in order to meet accepted requests, thus it provides maximum flexibility to configure various partitions of resources on the same physical machine to different specific requirements of service requests. Multiple Virtual Machines can simultaneously process the user requests depending on the different OS environments.
PMs : The physical servers are providing hardware infrastructure which forms the baseline for generating virtualized resources to serve the customer demands.

11. PROBLEM STATEMENT

The problem is to have a technique that can effectively allocated task so that the energy wastage will reduce and resources can be effectively utilized. The problem is to determine what kind of applications can be allocated to a single host that will provide the most efficient overall usage of the resources. The approach provided for energy efficient scheduling in data centers do not deals with the problem of gathering different workloads. Those focuses on a single type of workload and also not consider various kinds in the application by considering different workload. The aim of this paper is to propose an efficient task scheduling technique, So, that the utilization of the resources can be enhance and the consumption of energy in data center will be minimized thus developing a Green-computing environment. A existing techniques is also implemented and compared with the proposed techniques.

12. CONCLUSION

In this paper we have seen different issues for measuring energy efficiency of cloud computing Data Center .The important issues are Server consolidation, Security of Data, Energy Consumption and VM Migration. Among these issue Energy Consumption and VM migration are helping us to improve the efficiency of cloud data center by using balancing load technique. Further PaaS Layer includes the Heterogeneous Workload Consolidation different issues to calculate the energy consumption of the data center and also gives the information about the SLA violation, as the allocation policies are implemented on PaaS layer which are followed by the IaaS layer.

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