Abstract: Cloud computing is emerging technology due to pay-as-you-go pricing model. It is spreading globally, due to its easy and simple service oriented model as it offers utility-oriented IT services. Some people are having perception that cloud computing is just another name of Internet. The numbers of users accessing the cloud are rising day by day. Clouds are based on data centers, which are powerful to handle large number of users, who can access anytime and anywhere. Data centers consumes huge amount of energy leads to increase cost and carbon emission. Large number of data centers is easy to built, but not good for environment. In cloud computing we are available with different virtualized resources in order to complete the user task, hence in cloud computing. In this paper we have analyzed various algorithms by considering various parameters in which energy efficiency is mainly focused, in order to resolve the issue of large energy consumption in data servers, scheduling place a vital role, either in assigning virtual machines on servers or assigning tasks to various virtual machines. There are some limitations in these algorithms which further need improvement. Meta-heuristic algorithms could be used for solving the issue of energy consumption based on scheduling. Cloudsim simulator a toolkit for simulation is also discussed in brief.

Keywords: Cloud Computing, Scheduling, Energy efficiency, Virtualization, CloudSim

I. INTRODUCTION

Earlier business organizations was investing huge amount of cost, efforts and time in maintenance of computational resources. In the past few years, it has emerged as an enabling technology. The adaptation of Cloud computing has rapidly changed this approach. Some people is having perception that cloud computing is nothing it is just another name of Internet. But this is not true, cloud computing helps to provide on-demand self-service to users without having any kind of interaction with the cloud service provider personnel [2]. National Institute of Standards and Technology NIST [1] 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 that can be rapidly provisioned and released with minimal management effort or service provider interaction. Cloud computing meant to configure, manipulate, storage and access applications on-line. Cloud Computing is not any new technology, instead it brings together the technologies like Utility-based pricing and Virtualization to perform various operations in more efficient manner. Cloud computing reduces capital expenditures and also improves computational efficiency to a large extent. Because of these features it is successful in attracting attention from industry as well as academia. In cloud computing resources are provided virtually and also the details of the physical machine used by user on which software runs or any application is performed are abstracted from the user. As cloud performs its features via internet but some features it performs similar to internet. Cloud computing is provided with us two types of models. Service Model and Deployment Model. Service Model contains three types of services provided by clouds[7]. IAAS (Infrastructure as a service) provides the basic level of service. It provides access to fundamental resources such as physical machine, network capacity, rent processing storage. In IAAS service provider provides resources to users without disclosing details of location and hardware. Example- Amazon Web Service [2]. PAAS (Platform as a service) provides run time environment for the applications, deployment tools. In order to develop applications service provider provides different environments to user for development of applications. As per required user can use that particular environment in order to generate applications as per need. Example- Google app Engine.

Figure 1. Overview of Cloud Computing

SAAS (Software as a service) allows the user to use software application as a service. Service providers or vendors provide software on internet. Customers or user do not have any knowledge regarding the development or maintenance of the software applications. They can use particular software as per need and pay as per use. Example- Drupal, Turbo Tax, Google Maps for navigation [2]. Deployment Model provides us type of access to cloud. These are further
categorized into three types i.e. public, private and hybrid clouds [6].
Public clouds provide access to general public. Public clouds help in
minimizing IT infrastructure costs and viable for managing heavy
loads on the local infrastructure. They provide an easy access to
system and services. These may be less customizable and secure as
these are open in its nature but highly scalable, flexible and less
controllable. Examples of public clouds are like Google App Engine
provides Paas (Platform as a service), Amazon EC2 provides Iaas
(Infrastructure as a service), and Microsoft. Private clouds provide
services within the organization which are controllable and can be
provided to a different range of users. This is much reliable, cost and
efficient and secure then public cloud but less flexible and
limited scalable in its nature. Hybrid clouds are a mixture of both
private and public environments. In this critical activities are
performed by private clouds whereas non-critical are performed by
public clouds. It can take resources from the public cloud if resources
of private cloud are not sufficient. These provide security, flexibility,
cost efficient and secure but network issues may arise in this hybrid
cloud. Cloud computing caters to the following needs [32]: 1.
Dynamism: Cloud computing provides dynamism, means we can
increase or decrease demand of resources as and when required
according to our needs. For this we need to just configure and the
service provider will take care of fluctuating demands. 2. Abstraction:
Cloud computing provides abstraction to the end users. The end users
do not need to care for the plug-ins, web security, and software plat-
form. All these things are abstracted from users in the cloud. 3.
Resource sharing: Cloud computing provides resource sharing which
allows optimum utilization of resources in the cloud. The cloud
architecture is executed in such a way that it delivers you the
pliability to division of application as well as other network
resources.

II. ENERGY CONSUMPTION PROBLEM

When cloud computing came into existence its main focus was to
make it a huge data center for high performance computing and
making profit from it by get paid what we used, but with the passage
of time, it became a model of computing services for the dynamic
provisioning[15].Nowadays VMs migration and consolidation
algorithms are mostly based on energy consumption model with
single system resource constraint, i.e. CPU. These algorithms may
not consider the impact of other resources. Some researchers believe
that the energy consumption of whole server varies approximately
linearly with the CPU utilization. However, it still consumes more
than 70% of its peak energy, even if a server is completely idle. Day
to day usage of computing services leads to energy consumption. The
energy consumption has huge impact on the environment with the
dissipation of CO2, which increases greenhouse effect [8]. When
cloud perform operation, cloud use data center to store data, process
stored data with the help of servers and data gets it transferred over
the internet. It is estimated that approximately 10% of the world total
energy is consumed by internet. The cost of energy to power data
centers gets doubled after every 5 years [9]. The amount of power
consumed by data centers grew by 56% between 2005 and 2010. In
2010 approximately 1.1% to 1.5% of the total world energy was
consumed by data centers [11]. In 2011 energy consumed by data
centers was approximately 1,00,00,000 MW, which has generated
40,568,000 tones of CO2 emissions [3]-[5]. The data center consumes
only 20-30% to operate, whereas rest of the 70-80% of the energy
consumption is wasted due to over-provisioned idle resources which
approximately results to 20,000,000 tons of CO2 emission [3]-[5].

In cloud computing to store any document consumes less power
whereas conventional computing consumes much more power as
compared to it. Electricity is needed to operate servers,
interconnecting telecommunication networks and to cooling of
system [10]. Data centers are not much costly to build but not eco-
friendly for the environment [2]. Reducing energy consumption is a
challenging issue. Even government is also pressurizing to reduce
power consumption to reduce CO2 emission and greenhouse effect.
Because of this reason GOOGLE, YAHOO are building their data
centers in Barren desert surrounded by Columbia river, in US in order
to obtain cheap hydro power [2],[9]. From total expenditure spend to
work efficiently Amazon EC2 pays 42% for energy usage [9]. Data
center named Microsoft Dublin consumes approximately 5.4MW of

Figure 2. Cloud Computing Service Model

The rest of the paper is organized as follows: Section II defines
problem of energy consumption due to cloud computing servers.
Scheduling brief introduction is given in Section III. Section IV
describes basics of Cloudsim simulator. In Section V different energy
efficient algorithms are compared by taking various parameters along
with their limitations. Finally in section VI conclusion of paper is
given with scope for future.
energy [14]. A lot of research has been done to gather different aspects for managing and consuming energy used in datacenters. A proficient approach to reduce power consumption is by choosing best resource from available resources for the execution of task as to make its completion time minimized and efficient scheduling can improve the performance in cloud by reducing energy consumption. We must ensure cloud computing to be environment friendly otherwise its pros will get converted into cons for environment.

Energy efficient scheduling can be done in two ways: First in assigning virtual machines to different servers (Server Consolidation) and second in assigning tasks to various virtual machines (Task Consolidation). In this paper various energy efficient algorithms are mentioned which helps in saving energy by reducing its consumption.

III. SCHEDULING

Nowadays scheduling is widely used as an effective power conservation method [12]. Whenever we run any application we need efficient performance for which we need effective scheduling. Scheduling is allocation of various jobs to given resources in order to complete the job in a given time period i.e. how to allocate different type of jobs to different resources with respect to the various constraints implied on it. Task is minimum computational unit whereas set of various tasks is defined as a job and in order to obtain jobs output we need resources such as CPU, memory, network etc. The constraints can be implied from two perspectives. One is from the cloud consumer and second is from the cloud service provider. Deadline for the completion of job and budget are specified by the cloud consumer and maximizing the resource utilization and revenues are to be specified by the cloud service provider. Cloud consumers make tradeoff between time and cost. Cloud service provider want maximum return with their investment they spent in making their resources.

The main objective function of scheduling is divided into two parts. Application centric and Resource centric. Application centric means for cloud consumer should minimize the makespan i.e. the completion time of the job should be minimum and economically affordable whereas resource centric means maximum utilization of resources and economic profit. The energy consumed can be reduced by using as less as possible number of servers by making not used servers power-off [13].

Scheduling algorithms are basically categorized into three different types: Resource scheduling, workflow scheduling and task scheduling. Task scheduling is the optimization process of assigning a task to various available resources[27]. It can be done in heterogeneous and in homogeneous environment. Task scheduling is further divided into two types distributed scheduling (task should physically distributed among various processors) and centralized scheduling (task should physically remain on a single processor). Distributed scheduling can be optimized by dividing it into two algorithms: Heuristic and Hybrid algorithm. Heuristic algorithms are of two types: Static and Dynamic [7]. Static scheduling is done during compile time. Before the program execution begins processor is assigned task. Scheduling is done on the basis of information about the execution time of task and processing resources etc. Drawback of static scheduling is that it cannot adapt to any change during run-time. Dynamic Scheduling refers to mapping the jobs on various resources at run time. In this resources are distributed to various jobs at run time. In this redistribution can take place if resources are overloaded or under loaded. In this we can shift the job from one processor to another in case of failure because of this reason dynamic scheduling is more complex to handle. It is further of two types: Online mode and Batch mode. Dynamic scheduling is one of the biggest and challenging issue [7]. Its goal is to maximize the utilization of resources.

IV. CLOUDSIM

In cloud computing to create environment similar to real clouds computing servers is very costly and difficult. As if we have supposed something so the possibility that our supposition is correct and all assumptions are satisfied is very less. So we create a simulating environment by considering various entities which are required in real time servers. So simulating toolkit is provided us with controllable and repetitive environment and also helps us in removing limitations and bottleneck problems. The various entities which are required to make simulating environment are discussed below[30]:-

Data Centers: Datacenters are the resource provider in CloudSim. Datacenter class is a Cloud Resource whose host List is virtualized. It deals with handling of VM queries instead of processing Cloudlet-related queries.

Virtual Machines: These are the machines present on the host which are not real in nature. This is where the applications of customers will be deployed. VM runs inside a Host VM share host List with other VMs. It processes cloudlets. This processing of cloudlet takes place according to a policy, defined by the Cloudlet Scheduler. Each VM has a owner, which submit cloudlets to the VM to be executed.

Host: These are the physical computing servers or machines that will provide hardware infrastructure for creating virtual machines. Host executes actions such as creation and destruction related to management of virtual machines. A host has a defined policy for provisioning band-width and memory, also allocation policy for Pe’s to virtual machines. A host is associated to a datacenter. Cloud Infrastructure Service (CIS): CIS contains the information of datacenter, host and various virtual machines allocated to host. Cloudlets: These are the tasks that are given by the user. Cloudlet is an extension to the cloudlet. It stores, despite all the information encapsulated in the Cloudlet, the ID of the VM running it.

Cloudlet Scheduler: This represents the policy of scheduling which is performed by a virtual machine. Also, it implements the interface for cloudlet management.
Figure 5. CloudSim Basic Entities

Vm Scheduler: This class is implemented by a Host that models the policies such as (space-shared and time-shared) required for allocating processor elements to VMs. Processing Elements (PE): These are the number of processors that one Host have.
## VI LITERATURE SURVEY

<table>
<thead>
<tr>
<th>References</th>
<th>Algorithm</th>
<th>Factors or Parameters</th>
<th>Scheduling Type</th>
<th>Description</th>
<th>Limitation or Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel Heuristics VM migration algorithm</td>
<td>Energy</td>
<td>dynamic VM</td>
<td>It has feature of modeling and policies for the allotment of hosts</td>
<td>not implemented</td>
<td></td>
</tr>
<tr>
<td>Energy-Efficient Resource Allocation for Cloud Computing[16]</td>
<td>ESF-ES algorithm based on hybrid algorithms</td>
<td>Consumption, Resource Utilization</td>
<td>Task Scheduling</td>
<td>Combination of most efficient server first and hybrid algorithm focuses on consumption of energy by minimizing the allocated number of servers</td>
<td></td>
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<tr>
<td>Energy-Efficient Task Scheduling Algorithms For Cloud Data Centers[17]</td>
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http://ijmcs.info
| Task Scheduling and server Provisioning for energy Efficient Cloud Computing Data centers[18] | most efficient server first task scheduling | Energy efficiency, resource utilization | Task scheduling | task is assigned to server which is most energy efficient. | Response time of task is long |
| Virtual Machine Consolidation in Cloud Data Centers using ACO Metaheuristic[19] | Ant Colony Optimization | Energy Consumption, Resource Utilization | VM consolidation | used to improve performance and avoiding network congestion number of migrations to be minimized. | resource utilization of network |
| An Energy-efficient Scheduling approach based on Private clouds[21] | energy efficiency, response time, workload | virtual machine scheduling | reduce response time when data centers running on low power response time, makespan |
| An ant Algorithm for balanced Jobs scheduling In grids[22] | ACO makespan, workload grid scheduling | resource utilization | Overload is divided into specific load in order to get most precise virtual machine for migration. |
| Power aware provisioning of cloud Resources for real time services[26] | Lowest-DVS,S energy consumption | VM provisioning | virtual machines are provisioned more resource utilization |
| Power Efficient Resource Allocation Ant Colony Framework[25] | Ant Algorithm Energy efficiency, QOS | dynamic scheduling online and batch jobs | consist of technique of self organizing for the deployment onto physical machine | not implemented |
VI. CONCLUSION

In this paper, one of the major parameter of scheduling is highlighted i.e. Energy Consumption. The main key area is Server Consolidation and Task consolidation in order to improve the energy efficiency via scheduling. Dynamic consolidation should be implemented rather than static as this dynamically change the VM capacity according to its current workload. We surveyed various algorithms for energy efficiency in cloud computing. These algorithms are distinguished on the basis of various parameters such as resource utilization, make-span, response time, energy efficiency, QoS workload etc. The main emphasis is on energy efficient metaheuristic algorithm such as ACO,PSO,G A etc. These algorithms can be improved to make it as an effective algorithm, which can optimize the energy and QoS in the best possible way.

REFERENCES
