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Scheduling Optimization in Cloud Computing

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Abstract-: Cloud computing is a most recent new computing paradigm where applications, records and IT services are provided over the Internet. Cloud computing is the fastest new paradigm for delivering on demand services over internet and can be described as internet centric software. Cloud computing has come out to be an interesting and beneficial way of changing the whole computing Schedulers for cloud computing determine on which processing resource jobs of a workflow should be allocated . Scheduling theory for cloud computing is in advance a lot of awareness with increasing popularity in this cloud era. Service provider like to ensure that income are utilized to their fullest and best capacity so that resource power is not left unused. The received tasks are grouped on the basis of data and requested resources by the task and prioritized. Resource selection is done on the basis of its cost and turnaround time both using greedy approach. Task selection on the basis of a priority formula. This way of resource selection and task selection gives more better results over sequential scheduling.

Keywords-: Cloud Computing; Job Scheduling; Resource Managers;

1. Introduction

Cloud computing is everywhere. When we open any IT magazines, websites , radios or TV channels, ”cloud” will definitely catch our eye. Today’s most popular social networking, e- mail, document sharing and online gaming sites, are hosted on a cloud. More than half of Microsoft developers are working on cloud products. Even the U.S government intends to initialize cloud-based solutions as the default option for federal agencies of 2012. Cloud com- puting makes software more attractive as a service, and shapes the way in which IT hardware is purchased. Predictably, it will spark a revolution in the way organizations provide or consume information and computing. Cloud computing is rising as the next generation platform for computation. May be in future Cloud computing will be the main platform to save the world; this makes people can have everything they need on it. Main advantages of the Cloud computing is used for on-demand gathering of information, technology services and products. The name Cloud has come from the Internet, based on how it is depicted in computer network diagrams, and is an abstraction for the complex infrastructure it conceals. In general we can define cloud computing is style of computing in which IT-related capabilities are provided “as a service”, allowing users to access technology-enabled services from the Internet without knowledge of, expertise with, or control over the technology infrastructure that supports them. Email application was probably the first service on the “cloud” [5] [6]. As now a day many computing industry shifting toward providing Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Software as a Service (SaaS) for consumers and enterprises to access on demand regardless of time and location, this helps in avoiding the over-supplying of the resource when used with utility pricing, which meets the demands of millions of users

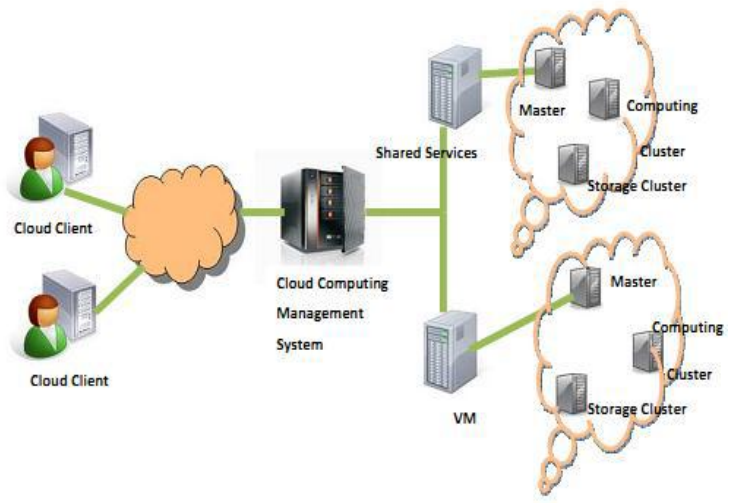

Figure1. Cloud Computing Architecture[2]

Cloud computing provides three different kind of services are-

- Different Services
- Platform as a Service(PaaS):

Examples: Google AppEngine, Azure services and Amazon web services.

- Infrastructure as a Service (IaaS):

Examples: VMware, Amazon EC2.

- Software as a Service (SaaS):

Examples: salesforce.com: for buying software's on demand.

Cloud computing is used in many applications are-

- Applications
- Educational – Image filtering, rendering.
- Commercial – online gaming.
- Scientific- Protein structure prediction etc.
-

2. Cloud Service

As an underlying delivery mechanism, cloud computing ability is provisioned as services, basically in three levels: software, platform and infrastructure.

2.1.1 Software as a Service

Software as a Service (SaaS) is a software delivery model in which applications are accessed by a simple interface such as a web browser over Internet. The users are not concerned with the underlying cloud infrastructure including network, servers, operating systems, storage, platform,etc. This model also eliminates the needs to install and run the application on the local computers. The term of SaaS is popularized by Salesforce.com, which distributes business software on a subscription basis, rather than on a traditional on-premise basis. One of the best known is the solution for its Customer Relationship Management (CRM). Now SaaS has now become a common delivery model for most business applications, including accounting, collaboration and management.

2.1.2 Platform as a Service

Platform as a Service (PaaS) offers a high-level integrated environment to build, test, deployand host customer-created or acquired applications. Generally, developers accept some restrictions on the type of software that can write in exchange for built-in application scalability. Customers of PaaS do not manage the underlying infrastructure as SaaS users do, but control over the deployed applications and their hosting environment configurations .PaaS offerings mainly aim at facilitating application development and related management issues. Some are intended to provide a generalized development environment, and some only provide hosting-level services such as security and on-demand scalability. Typical examples of PaaS are Google App Engine, Windows Azure, Engine Yard, Force.com, Heroku, MTurk.

2.1.3 Infrastructure as a Service

Infrastructure as a Service (IaaS) provides processing, storage, networks, and other fundamental computing resources to users. IaaS users can deploy arbitrary application, software, operating systems on the infrastructure, which is capable of scaling up and down dynamically. IaaS user sends programs and related data, while the vendor's computer does the computation processing and returns the result. The infrastructure is virtualized, flexible, scalable and manageable to meet user requirements. Examples of IaaS include Amazon EC2 , VPC, IBM Blue Cloud, Eucalyptus, FlexiScale, Joyent, Rackspace Cloud,

3. Related Work

Joel Anandraj E et[2012] : Scheduling tasks in a heterogeneous computing environment is a NP-hard problem, so in order to manage it and obtain a performance oriented schedule many heuristic algorithms have been suggested. And also many energy conserving algorithm have been presented to obtain an energy conscious scheduling in order to save more energy. These algorithms have to be evaluated and compared so as to determine the best among all of these algorithms. The evaluation will be based upon assumptions and functionalities. Makespan and power consumption are the very important performance factors that are to be considered here. Most of this method that have been suggested considered both the performance factor into consideration so as to achieve a better solution.

Mrs.S.Selvarani, Dr.G.Sudha Sadhasivam et [2010] : Cloud computing has been build upon the development of distributed computing, grid computing and virtualization. Since cost of each task in cloud resources is different with one another, scheduling of user tasks in cloud is not the same as in traditional scheduling methods. The objective of this paper is to schedule task groups in cloud computing platform, where resources have different resource costs and computation performance. Due to job grouping, communication of coarse-grained jobs and resources optimizes computation/communication ratio. For this purpose, an algorithm based on both costs with user task grouping is proposed. The proposed scheduling approach in cloud employs an improved cost-based scheduling algorithm for making efficient mapping of tasks to available resources in cloud. This scheduling algorithm measures both resource cost and computation performance, it also improves the computation/communication ratio by grouping the user tasks according to a particular cloud resource's processing capability and sends the grouped jobs to the resource.

QI CAO, ZHI-BO WEI, WEN-MAO GONG et [2012] : In cloud computing, traditional way for task scheduling cannot measure the cost of cloud resources accurately by reason that each of the tasks on cloud systems is totally different between each other. There may be no relationship between the overhead application base and the way that

different tasks cause overhead costs of resources in cloud systems. The traditional way for task scheduling cannot meet the cloud market well enough. introduces an optimized algorithm for task scheduling based on ABC (Activity Based Costing) in cloud computing and its implementation. Compared with the traditional methods of task scheduling, a new method with an optimized algorithm based on ABC algorithm .

Traditional way for task scheduling in cloud computing tended to use the direct tasks of users as the overhead application base. There are some problems with it. This problem leads to over-costed and over-priced in some high-volume simple tasks while under-costed and under-priced in low-volume complex ones. Activity-based costing is a way of measuring both the cost of the objects and the performances of activities and it can measure the cost more accurate than traditional ones in cloud computing

Chee Shin Yeo et[2009]: The use of High Performance Computing (HPC) in commercial and consumer IT applications is becoming popular. They need the ability to gain rapid and scalable access to high-end computing capabilities. Cloud computing promises to deliver such a computing infrastructure using data centers so that HPC users can access applications and data from a Cloud anywhere in the world on demand and pay based on what they use. However, the growing demand drastically increases the energy consumption of data centers, which has become a critical issue. High energy consumption not only translates to high energy cost, which will reduce the margin of Cloud providers, but also high carbon emissions which is not environmentally sustainable. Hence, energy-efficient solutions are required that can address the high increase in the energy consumption from the perspective of not only Cloud provider but also from the environment. To address this issue we propose near-optimal scheduling policies that exploits heterogeneity across multiple data centers for a Cloud provider. We consider a number of energy efficiency factors such as energy cost, carbon emission rate, workload, and CPU power efficiency which changes across different data center depending on their location, architectural design, and management system. Our carbon/energy based scheduling policies are able to achieve on average up to 30% of energy savings in comparison based scheduling policies leading to higher profit and less carbon emissions.

4. Scheduling

Scheduling theory for cloud computing is gaining consideration with day by day hike in cloud popularity. In general, scheduling is the process of mapping tasks to available resources on the basis of tasks' characteristics and requirements. It is an essential aspect in efficacious working of cloud as many task parameters need to be considered for proper scheduling. The available resources should be utilized efficiently without affecting the service parameters of cloud. Scheduling process in cloud can be generalized into three stages nam**e**ly–

1. Resource discovering and filtering -

Datacenter Broker discovers the resources present in the network system and collects status information related to them.

2. Resource selection -

Target resource is selected based on certain parameters of task and resource. This is deciding stage

3. Task submissions - Task is submitted to resource selected[5].

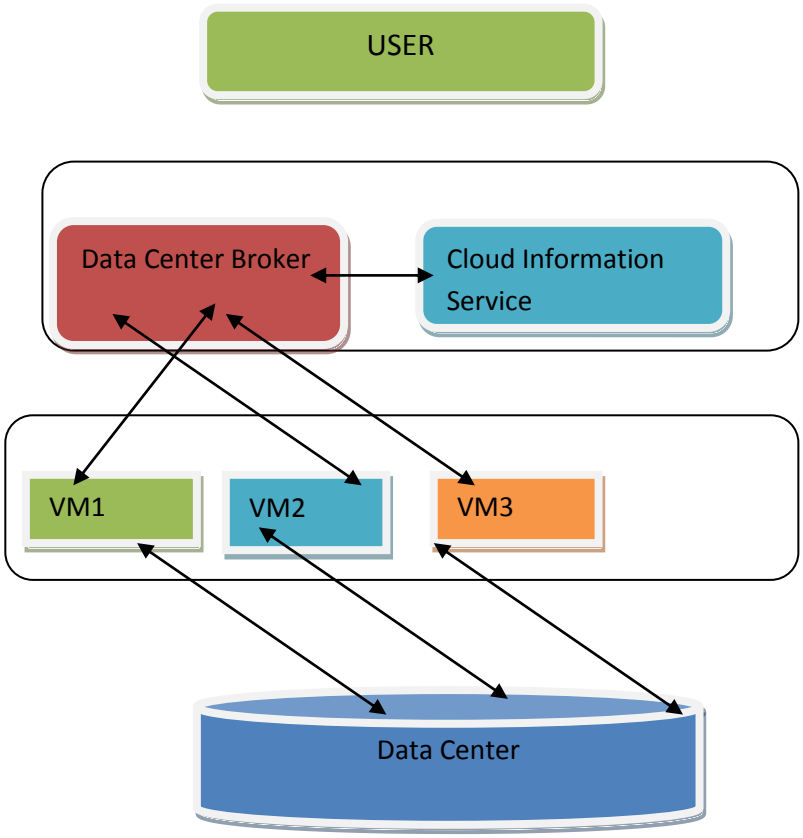

Figure 4.1. Scheduling in Cloud

4.1.1 JOB SCHEDULING PROCEDURE

On the client side or receiving end, there will be cloud
computing users' [2] and on the other end, service providers [2] of the cloud environment making the virtual instances[2] of services available whenever demand arises. The Main Goal here of job scheduler [2, 7, 8]is to do its best to allocate resources efficiently to the user's jobs so that they can get executed. The computation regarding the user's jobs will be done with the help of various parameters and conditions to be encountered in the simulation of jobs. The performance of jobs over a stipulated time will be gauged to chalk out the efficiency of scheduler in handling the web application's jobs.
Discussing about different job scheduling methods in connection-oriented system first, let's discuss FIFO (First in First Out) [2, 4] type of scheduling. This job
Execution procedure takes into account the arrival time of the jobs. Any job which arrives first will get executed first, regardless of their service time. No pre-emption [4] is allowed here. It's a simple first-cum-first-serve concept based scheduling procedure. For queue representation, Gantt charts have been used. The job execution queue will look like the queue shown below in which the order of execution runs from left side to the right side.

F	E	B	A	G	C	D	H

So, job F will get executed first, then E and so on. They
will not be pre-empted and will execute in this order for their full service time. The server time [4] distribution queue is as shown below:

F	E	B	A	G	C	H	D
1	3	10	14	15	17	18	21	26

From this,
Total service time [2, 4] = 26 ms. average service time [2, 4] = 26/8 = 3.25 ms. average waiting time [2, 4] = (10+1+17+21+3+14+15+18) / 8 = 99 / 8 = 12.375 ms

Conclusion

We presented a detailed working of job scheduling methods behind the web application on a web server on the same system or on different systems in a virtual cloud computing environment [1]. The various terminologies and concepts were thoroughly looked and thus explained.
This paper will give way to more future findings regarding the scheduling techniques in a cloud environment. More efficient and faster ways to schedule jobs and increase CPU throughput [2, 4] needs to be discovered.

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