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A Review on Divisible Load Scheduling and Allocation on Cloud Computing

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Abstract - *Cloud computing is a rising as a new model of large – scale distributed computing. In these system a large amount of data is used that is distributed between many systems. Dividing the data and allocate them to different systems is the main challenge because the performance of the system has been directly propose to the distributed data. Hear the one method is proposed for managing data distribution called Divisible Load Theory (DLT). Since many years divisible load theory has become a popular area of research. According to the divisible load theory the computations and communications can be divided into some arbitrarily independent parts and each part can be processed independently by a processor. In some situation the fraction of load mast be allocated based on some priorities but some existing divisible load scheduling algorithm do not consider any priority for allocating fraction of load so this paper proposes model that consider many criteria with different priorities for allocating fractions of load to processors. Experimental result indicates that the existing algorithm can handle the priority of processors using the Analytical Hierarchy Process.*

Key Words: **Cloud computing; Divisible Load Theory; Priority; multi criteria; AHP**

I. INTRODUCTION

Cloud computing is a type of parallel and distributed computing environment with having a pool of resources, on-demand network access, various development platforms and useful software are delivered as a services to users on the basis of pay as per use over the internet. Rajkumar Buyya defined cloud computing as "Cloud is a parallel and distributed computing system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service level agreement established through negotiation between the service provider and consumers".[2] The characteristics of cloud computing are Cost effectiveness, scalability, reliability, fault tolerance, service-orientation, resource management and scheduling, utility based, portability, virtualization and service level agreement (SLA). Cloud computing components includes the web and central server to take care about the resource like data, storage, applications, etc.

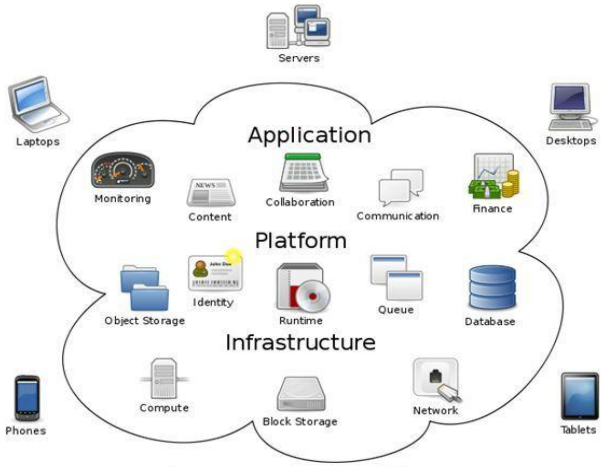

FIGURE 1. Cloud Computing [13]

Cloud computing provides various types of service and deployment models. The major service models are Infrastructure-as-a-service (IaaS), Platform-as-a-service (PaaS) and Software-as-a-service (SaaS). The common deployment models are Public Cloud, Private Cloud, Hybrid Cloud and Community Cloud.

Infrastructure-as-a-service (IaaS):

Infrastructure-as-a-Service (IaaS) model is used to access essential IT resources. These essential IT resources include services that are connected to resources of computing, data storage and the communications channel. It is delivery model where cloud service providers provide the necessary hardware and software upon which a customer can build a customized computing environment. This service model handle an applications, middleware and service provider manages the virtualization, servers, networking and storage.

Platform-as-a-service (PaaS):

In a computing platform as a service that allows creation of web applications easily without the complexity of maintaining the software. This is delivery model architecture in which a Cloud service providers provides an online software development platform for an organization. It

include the environment for developing and provisioning cloud applications. Cloud platform tend to represent a deal between complexity and flexibility that allows applications to be implemented quickly and loaded in the cloud without much configuration.

Software-as-a-service (SaaS):

Software- as-a- Service is a software model in which applications are hosted by a service provider and made available to customers over an Internet. SaaS is convenient a growing prevalent delivery model as main technologies that support web services and service-oriented architecture (SOA). SaaS is also provide pay-as-you-go subscription licensing model. They only access the application website, enter their billing details, and can immediately use the application, which, in most of the cases, it can be customized for their needs.

Deployment Models:

Public Cloud: It is the standard cloud computing paradigm, in which a service provider makes resources, such as applications and storage are available to the public over the Internet. Service providers provides services may be free or a pay as to use manner.

Privet cloud: It looks more like a marketing concept than the traditional mainstream sense. It describes a proprietary computing architecture that provides services to a limited number of people on internal networks. Organizations expect accurate control over their data will select private cloud, so they can get all the scalability, metering, and agility benefits of a public cloud without give any control, security, and costs to a service provider.

Hybrid cloud: It a combination of public cloud, private cloud and even local infrastructures, which is typical for most IT sellers. Hybrid provide a proper placement of workloads depending upon cost and operational and compliance factors. Hybrid deployment models are difficult and require careful planning to execute and

Manage especially when communication between two different cloud deployments is necessary.

Community cloud:

It describe that several organizations in a private community share cloud infrastructure. The organizations usually have similar care about mission, security requirements, policy, and compliance opinion. Community cloud can be further aggregated by public cloud to develop up a cross-boundary structure.

The paper is unified as follows: In section II, describes the Introduction about Divisible Load Theory. Section III Introduction about Analytical Hierarchy Process. Section IV Approaches of Divisible Load Scheduling and Section V conclusion.

II. INTRODUCTION ABOUT DIVISIBLE LOAD THEORY

In 1988 the first article about Divisible Load Theory (DLT) was published [6]. Based on DLT, it is assumed that the computation can be partitioned into some arbitrary sizes, and each partition can be processed independently by one processor. In the past two decades, DLT has found a wide variety of applications in parallel processing area such as data intensive applications [3], data grid application [5], image and vision processing [4] and so on. Also it was applied for various network topologies including chain, star, bus, tree, three-dimensional mesh.

Divisible Load Scheduling

In general, DLT assumes that the computation and communication can be divided into some parts of arbitrary size and these parts can be independently processed in parallel by processors as bellow figure. 2. DLT assume that initially amount of load is held by the originator P0. The originator does not do any computation. It only distributes α1, α2, α3, … , αm fractions of load on worker processors P1,P2,…,Pm. condition for optimal solution is that all the processor stop processing at the same time. This fraction of load must be allocated based on criteria and priorities.

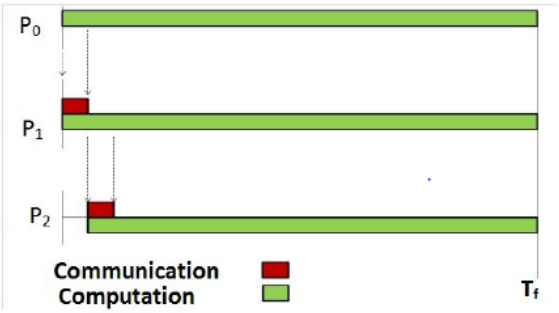

FIGURE 2. Gantt Chart-like timing diagram for divisible load [1]

III. INTRODUCTION ABOUT ANALYTICAL HIERARCHY PROCESS

The Thomas saaty was developed a multi-criteria decision making method that is called Analytical Heretical Process that consider Criteria's. AHP consider of three levels including objective level, attribute level and alternative level. AHP allows to model complex problem in a hierarchical structure, showing relationships between goal, attributes and alternatives [7]. AHP is made up of several components

like hierarchical structure, pairwise comparisons, judgements and consistency considerations [7]. AHP provides solution by splitting the problem in hierarchy of sub problems for easy evaluation. AHP method consists of following steps [8].

1. First the problem is splitting into hierarchy of goal, objective and alternatives.
2. Data are collected from decision maker's relatives to hierarchic structure, in the pairwise comparisons of alternatives.
3. From the step 2 we generate pairwise comparisons of various criteria and make comparison matrix.
4. From the comparison matrix find the eigenvalue and its corresponding eigenvector that gives the relative importance of various criteria being compared.
5. Consistency of matrix of order n is calculated. If the consistency rate fails to reach required level then comparisons may be re-examined. Consistency Rate (CR) is defined as the ratio of Consistency Index (CI) to Random Index (RI). Where CI= (γmax –n) / (n-1)
6. The ratings of each alternatives are multiplied by weights of objective to get local ratings with respect to each objective.

IV. APPROACHES OF DIVISIBLE LOAD SCHEDULING

Optimal work load allocation model for scheduling divisible data grid applications [5]

In this paper authors introduce new model called the IDLT (Iterative Divisible Load Theory).This model provide the optimal work load allocation in effective manner. For the load allocation to processor the IDLT model proposed. It is also used for scheduling divisible data grid applications. The result show that the proposed IDLT model was able to produce an almost optimal solution for single source scheduling. So, it can balance the processing load efficiently [5].

Cost-Based multi-Qos job scheduling using divisible load theory in cloud computing [9]

In this paper authors use the DLT for efficient scheduling jobs by minimize the overall processing time in compute cloud environments. In analysis they consider homogenous processors and derived effective solution for the load fraction that is assigned to all processor. The scheduling of job is done in such a way so that cloud provider can gain maximum benefit and provide Qos to users and studies with rigorous simulation studies [9].

A Priority based job scheduling algorithm in cloud computing [11]

In this paper author proposed a priority based job scheduling algorithm called PJSC. This algorithm is based on the theory of AHP (Analytical hierarchy Process). PJSC algorithm is based on multi criteria decision making model. The PJSC algorithm provide a discussion about some issues such as complexity, consistency and finish time. Evaluation result of this algorithm has reasonable complexity also it decrease finish time (Makespan) [11].

A New Load Balancing Scheduling Model in Data Grid Application [10]

In this paper author proposed a new model namely Adaptive Task Data Present (ATDP) model which reduces the makespan. They try to balance the load by considering the whole system, in other word the node speed fraction was calculated together with communication time. Hear both communication and computation time are considered [10].

A2DLT: Divisible Load Balancing Model for Scheduling Communication-Intensive Grid Applications [12]

In this paper author proposed a new model named as A2DLT which consider both the communication time as well as computation time. These models are better them TDP because TDP model is proposed without considering input transfer time. But main problem with this model is that it transfers data from site to the working node without considering bandwidth and processing capability of the working node [12]

Here there is one comparison table is given below that describes about all the research papers

Table -1: Comparison table

Approaches	Advantages	Disadvantages	Parameter
Optimal work load allocation model for scheduling divisible data grid applications [5]	Iterative DLT model is designed for optimal work load allocation	Model is capable for producing an optimal solution for single source scheduling	Makespan
Cost-Based multi-Qos job scheduling using divisible load theory in cloud computing [9]	DLT based optimization model is designed for getting better overall performance	Machine failure, communicatio-n overheads and dynamic workloads are not considered	Load Balancing, Qos, Makespan, Cost

A Priority based job scheduling algorithm in cloud computing [11]	Priority is considered for scheduling designed based on multi criteria decision making model	Makespan consistency and complexity of the proposed method can be considered for improvement	Makespan
A New Load Balancing Scheduling Model in Data Grid Application [10]	Adaptive Task Data Present (ATDP) model which reduces the makespan.	Does not consider other parameters	Makespan
A²DLT: Divisible Load Balancing Model for Scheduling Communication-Intensive Grid Applications [12]	Reduce the makespan	System can't handle the large number of data file	Makespan

V. CONCLUSION

In this paper, we analysis the divisible load scheduling methods for dividing the load and allocate the load to the virtual machine so that we can achieve more resource utilization. A brief introduction of the algorithm is discussed in this paper. The issues of the algorithm are addressed so that more efficient scheduling technique can be developed in future which can fulfill the various parameters and increase the performance of the system.

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