

## Task Scheduling in Cloud Computing Environment

Nidhi Rajak<sup>1\*</sup>, Diwakar Shukla<sup>2</sup>

<sup>1</sup>Department of Computer Science and Applications, Dr.Harisingh Gour Central University, Sagar :M.P., India

<sup>2</sup>Department of Computer Science and Applications, Dr.Harisingh Gour Central University, Sagar :M.P., India

\*Corresponding Author: [nidhi.bathre@gmail.com](mailto:nidhi.bathre@gmail.com).

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**Abstract :** Cloud computing is the recent area of research where many applications are used. It provides virtual resources and it is based on parallel computing, distributed computing and grid computing which is the extension of previous computing. In this paper, we have introduced the fundamental of cloud computing, brief introduction of task scheduling in cloud environment and its classification of task scheduling such as heuristic, energy efficient and hybrid scheduling. Discussed some performance metrics such as make span, resource cost scalability, reliability and resource utilization. Task scheduling is play very important role in the cloud environment because it's provide efficient utilization of resources and also provide the user requirements. The major objective of any task scheduling problem is to minimize overall execution time and reduces the cost.

Keywords— *Cloud Computing, Task Scheduling, Static scheduling, Dynamic scheduling, efficiency.*

### I. INTRODUCTION

Cloud computing is an inheritance of supercomputing and it works in distributed system mode. There are number of definitions of cloud computing. According to National Institute of Standards and Technology's NIST[1], Cloud computing can be defined as “*a model for enabling convenient, on-demand network access to share pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or services provider interaction*”. It is also called as Internet based computing.

It has three types of services[2] based on platform, software and infrastructure such as *Platform as a Service(PaaS), Software as a Service(SaaS) and Infrastructure as a Service(IaaS)*.

The main characteristics [3] of cloud computing are *virtualization, distribution and elasticity*. In the new era of technology, the computing system supports the concepts of virtualization which can be either software or hardware.

Task scheduling is a method to allocates the cloud resources among the user requests, so that it should be minimize completion and allocation time. Task scheduling is belongs to NP hard problem [4]. There are number of task scheduling algorithms are developed for the above objective. Task scheduling [ 5] is the most important parameters in the cloud computing environment because it schedule the jobs as per the requirements which minimize the time. The conventional scheduling problem works on grid and distributed system environment but the major problem raised in grid

environment due to heavy workload. To solve this problem the cloud computing environment has been used for scheduling.

In this paper, we have introduced the basic model of task scheduling, various classification of task scheduling and some performance metrics. The paper has been organized as followed:

Section 1.has been introduced the basic cloud computing and some definition of task scheduling, the task scheduling model will be presented in the section 2. Section 3. will be presented the classification of various existing scheduling and the performance metrics in the section 4. The section 5. concludes the paper.

### II. TASK SCHEDULING MODEL

The basic task scheduling model in the cloud environment is divided into four components [6].

The components are discussed as following:

- *Computing entity:* This component is also known as computing capacity which is used for indication how much instruction it can be processed in a time.
- *Job Scheduler:* It is another component of the model and the primary component of the task scheduling. It contains the information of the task sequence which is waiting in the waiting queue.
- *Job Waiting Queue:* This component contained the number of jobs which are waiting in this queue and

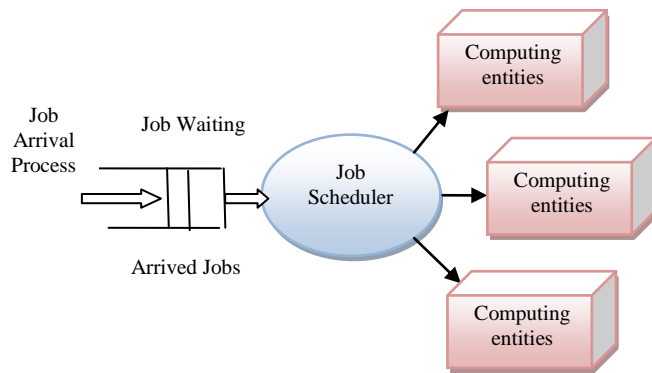


Figure 1. Task Scheduling Model [6]

which are assigned onto the available machine for execution when it will be free.

- *Job Arrival Process*: It contains information of the job which will be entered into the system.

### III. CLASSIFICATION OF TASK SCHEDULING

Task scheduling in the cloud computing environment is classified into three groups [7] which are as followed: *Heuristic Task Scheduling*, *Energy Efficient Task Scheduling*

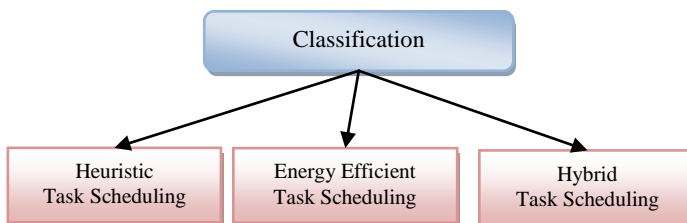


Figure 2. Classification of Task Scheduling

and *Hybrid Task Scheduling*.

*Heuristic Task Scheduling* can be classified into two categories such as: *Static Scheduling* and *Dynamic Scheduling* [8]. In *Static scheduling* algorithm all the information about the task are given in advance like resource and space but in *dynamic scheduling* algorithm all the information are given in run time.

There are number of algorithms has been developed based on heuristic scheduling such as First Come First Serve , Round Robin, Min-Max, Minimum Execution Time, Minimum Completion Time, Genetic Algorithm etc. *Energy Efficient Task Scheduling* is concerned with power consumptions management in cloud computing. The major objectives[7] of this scheduling are increases energy efficiency, power consumptions reduction , cost reduction and the primary

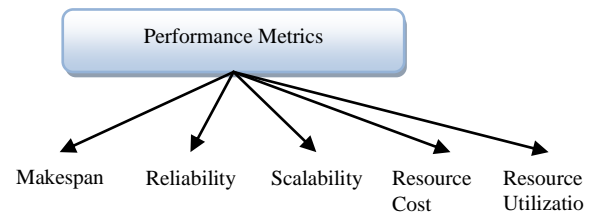


Figure 3. Types of Performance Metrics

objective is how to reduce load balancing in cloud computing data centers due heavy communication delay and congestion.

*Hybrid Task Scheduling* is concerned with the scheduling approaches which are formed combining by two or more scheduling parameter. The objective of this scheduling is to increase the execution time. There are number of algorithms has been developed which is based on cost reduction, Quality of Service (QoS), response time and resource utilizations etc.

### IV. PERFORMANCE METRICS

There are few metrics [9] is discussed which are used for comparing different task scheduling algorithms in cloud environment. These are shown in the figure 3.

Here in the figure, five performance metrics are discussed such as

- *Makespan*: It is also called as completion time which is defined as the span time between the beginning and ending of task scheduling.
- *Reliability*: It is defined as the system which works continue in case of failure of any module and the loads of failure module are distributed among the active modules.
- *Scalability*: It is defined as the ability to addition of the cloud resources and work efficiently in case of workload has been increased.
- *Resource Cost*: It is defined by two parameters such the capacity of resource and used time.
- *Resource Utilization*: This metric is defined as efficient utilization of cloud resources in the cloud computing environment.

### V. CONCLUSION

Task scheduling is the important strategies in the cloud computing environment because it helps to manage the execution of application in the efficient manner. In this paper, we have introduced the basic structure of task scheduling, different types of task scheduling such as heuristic scheduling, energy efficient and hybrid scheduling. We have also study some sub categories of task scheduling such as static scheduling and dynamic scheduling.

To comparison of various scheduling methods, we have discussed some performance metrics such makespan, reliability, scalability, resource cost and resource utilizations.

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### Authors Profile

*Nidhi Rajak* pursued Bachelor of Engineering (B.E.) from RGPV, Bhopal in 2010 and Master of Technology(M.Tech.) in Computer Science in 2014 from Galgotias University, U.P. She is currently pursuing Ph.D. in Computer Science from Department of Computer Science and Applications, Dr.Harisingh Gour Central University, Sagar M.P. She has published 5 research papers in reputed international journals Her main research work focuses on Cloud Computing , Scheduling Problem and Parallel Computing.

*Diwakar Shukla* pursued Bachelor of Science ,Master of Science and Ph.D. from BHU,Varanasi, U.P and M. . He is currently pursuing Ph.D. and Master of Technology(M.Tech.) in Computer Science from DAVV, Indore, M.P. He is currently working as Professor in Dr.Harisingh Gour Central University, Sagar M.P He has published more than 50 research papers in reputed international journals and conferences.His main research work focuses on Graph theory, Scheduling, Computer Networking etc.