IJCSN International Journal of Computer Science and Network, Volume 5, Issue 2, April 2016
ISSN (Online) : 2277-5420 www.IJCSN.org
**Impact Factor: 1.02**



# An Analysis of Priority, Length and Deadline Based Task Scheduling Algorithms in Cloud Computing

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**Abstract - The cloud computing can be simply stated as delivery of computing environment where different resources are delivered as a service to the customer or multiple tenants over the internet. The task scheduling mainly focuses on enhancing the efficient utilization of resources and hence reduction in task completion time. Task scheduling is used to allocate certain tasks to particular resources at a particular time instance. Many different techniques have been presented to solve the problems of scheduling of numerous tasks. Task scheduling improves the efficient utilization of resource and yields less response time so that the execution of submitted tasks takes place within a possible minimum time. This paper discusses the analysis of priority, length and deadline based task scheduling algorithms used in cloud computing.**

**Keywords -** *Cloud Computing, Makespan, Scheduling Algorithms, Task Scheduling.*

## 1. Introduction

Cloud computing is the computing services delivered to the user over the internet. [1] Cloud computing is nothing but the accessing the pooled resources required for computing through your browser's window. Cloud computing is a pay-per-use service rather than a product. And who provides this kind of services are called as cloud service providers. For Example Google, Amazon, Microsoft are the cloud service providers.

In IT industries the word 'cloud' is commonly used in some networks which setup is not commonly known to us. For example, Internet Service Provider's (ISP) network. The user of the internet is not known to the network setup, but they use it easily. Generally in networking diagrams ISP's networks are represented by cloud symbol. So the computing, which is done over the internet without knowing the resource's location can be called as cloud computing.

### 1.1 Architecture of Cloud

Cloud architecture is designed with many components. The components of cloud architecture are loosely coupled. These components are distinguished as Front End and Back End. Both ends are connected to a network by the internet. The Front End components are clients, mobile devices. It provides the applications and interface to access the cloud platform. For Example Web browser.

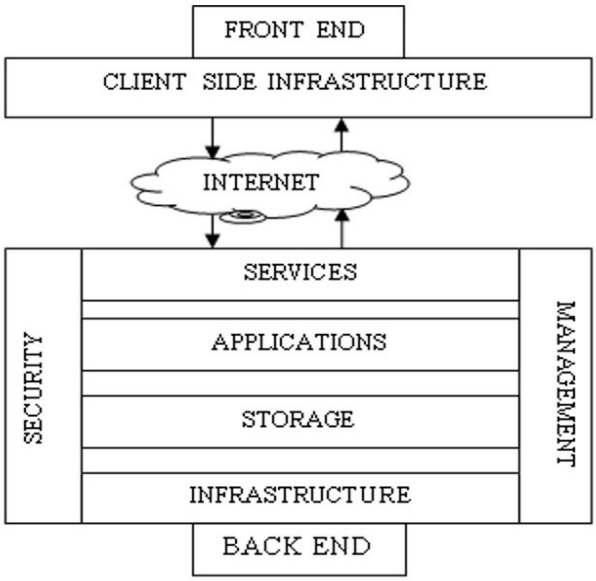


Fig 1: Architecture of Cloud [2]

The Back End components are Servers, applications, Storage Devices, Virtual Machines, Datacenters etc. The security and management of cloud are maintained at Back End.

### 1.2 Scheduling in Cloud

Task scheduling is the process of allocating the resources to the particular job in specific time. The objective of scheduling is to maximize the resource utilization. Minimizing the waiting time is the goal of scheduling. A betterscheduling algorithm yields better system performance. In the cloud there are numerous and distinct resources available. The cost of performing tasks in cloud depends on which resources are being used so the scheduling in a cloud environment is different from the traditional scheduling. In a cloud computing environment task scheduling is a biggest and challenging issue. Task scheduling problem is an NP-Complete problem. A lot of heuristic scheduling algorithms hasbeen introduced, but more improvement is needed to make the system faster and more responsive. The traditional scheduling algorithms like FCFS, SJF, RR, Min-Min, and Max-Min algorithms are not the much better solution to scheduling problems with cloud computing. So we need the better solution to this heuristic problem.

### 1.3 Types of Scheduling

The scheduling can be distinguished as Static and Dynamic Scheduling.

**Static Scheduling:** In Static Scheduling all information are known to scheduler about tasks and resources before execution. It has less runtime overhead. [3]

**Dynamic Scheduling:** In Dynamic Scheduling information about task components is not known before execution. Task execution time may not be known. It has more runtime overhead. [3]

## 2. Literature Survey

The many scheduling algorithms already exist in cloud computing but more research is going on in this field. As it is a heuristic problem hence it needs more and more efficient techniques. Two criteria are focused that are task length and deadline in the presented approach. There are some other parameters which tempt the utilization of resources and scheduling of tasks.

Improved Cost-Based Algorithm [4]: This algorithm ameliorates the traditional cost-based scheduling algorithm for making appropriate resource allocation. The tasks are grouped as per processing power of resources.

PBJS Algorithm [6]: In this algorithm, the approach is presented for job scheduling by using mathematical calculations. In this algorithm for scheduling the priority is considered and each job request for resources with some priority. As per author makespan can be reduced further by improving the algorithm.

A Priority-Based Scheduling Strategy for VM Allocation [7]: The objective of proposed algorithm is to gain more benefits to the service providers since the current resources are not adequate to process all the requests. This paper proposes a priority algorithm to find the best choice. This technique can increase the benefits than applying typical FCFS strategy. If more information can be made available, e.g. the regular pattern of the usage the algorithm can be improved further.

Generalized Priority Based Algorithm (GPA) [9]: The GPA mainly focuses on minimizing the completion time of tasks. In this algorithm tasks and Virtual Machines (VM). The VMs are prioritized according to million instructions per second (MIPS) VM can execute and tasks are prioritized according to length or size of tasks. The VM having highest MIPS value and the task having largest size has the highest priority. Tasks having highest priority is scheduled on the VM having the highest priority. The results of the algorithm are analyzed with basic FCFS and RR algorithms, where the outcome of GPA is better than FCFS and RR.

Greedy-Based Job Scheduling Algorithm [10]: This algorithm focuses on QoS, as the cloud computing is a business-oriented service. The goal of the algorithm is to reduce completion time and to give a faster solution to a scheduling problem. This algorithm classifies tasks based on QoS and then as per the task category, the appropriate function is assigned. The results of the algorithm are compared with another existing algorithm that are, the algorithm based on Berger model and existing scheduling strategy of CloudSim tool.

Priority-Based EDF Algorithm [13]: In this method there is two task scheduling algorithms are used, one is Earliest Deadline First and other is priority-based scheduling algorithm. This algorithm focuses on resource allocation and memory utilization. This approach will minimize the completion time of preempted jobs and efficiency of scheduling will increase. This algorithm overcomes the waiting time problem of preempted tasks. The waiting queue is introduced which processes the preempted tasks..

Heuristic-PSO based Scheduling Algorithm (H-PSO) [15]: This algorithm is based on Particle Swarm Optimization (PSO) technique. This is a static procedure for scheduling. It reduces makespan and improves memory utilization.

When this algorithm is compared to another PSO-based algorithm, it reduces more makespan. The Heuristic-PSO method increases processing speed and gives an optimal solution.

Improved Max-Min Task Scheduling Algorithm [16]: In paper [16] results are not obtained, but they only reviewed the Max-Min algorithm and proposed advanced Max-Min algorithm. The new advanced algorithm overcomes the anomalies of Max-Min algorithm. The proposed approach considers the user priority. The Improved Max-Min algorithm reduces more makespan than traditional Max-Min algorithm.

Hybrid Cuckoo Algorithm [17]: This algorithm focuses on optimization of task scheduling. The Hybrid Cuckoo algorithm is a union of Genetic Algorithm & Cuckoo search algorithm. This algorithm increases resource utilization and reduces energy consumption. The result of the Hybrid Cuckoo algorithm is compared with FIFO, Genetic Algorithm and Cuckoo algorithms.

Table1. Comparative Analysis and Summarizationof Scheduling Techniques

| ***Algorithms*** | ***Objective*** | ***Scheduling Category*** | ***Scheduling Parameters*** | ***Future Work*** | ***Tool*** |
|---|---|---|---|---|---|
| Improved Cost Based algorithm [4] | To reduce makespan and processing cost | Cost Based Task Scheduling | Activity Based Costing, Time, Cost | Algorithm, need improvement to work in a dynamic environment. | CloudSim |
| Earliest Feasible Deadline First [5] | To reduce time complexity | Deadline Based Scheduling | Deadline of Jobs | The algorithm can be improved to use in Real-Time Systems. | - |
| PBSA [6] | To reduce completion time of execution. | Priority based, Multiple Criteria Decision Making Model | Priority | To gain less finish time. | - |
| A Priority based Scheduling Strategy for VM Allocation [7] | To maximize benefits of the service provider and improve resource utilization | Priority Based VM Scheduling | Priority of Jobs | The proposed algorithm can be optimized if more information is provided such as the regular pattern of usage. | - |
| Queue Based Job Scheduling Algorithm (QHS) [8] | To reduce average waiting and response time. | Queue Based Job Scheduling | Priority and Time Quantum | - | - |
| Generalized Priority Based Algorithm (GPA) [9] | To reduce execution time | Priorities Based Scheduling | Cloudlet Size and Priority. | By taking more tasks and execution time can be reduced. Proposed algorithm tested in a grid environment and the time difference can be observed by testing it in a cloud environment. | CloudSim |
| Greedy Based Job Scheduling Algorithm [10] | To improve QoS and reduce makespan | Greedy Algorithm Based Job Scheduling | Time Preference, Bandwidth Preference, Expectation Time Preference, JEF Function and function result | Improvement can be done in the proposed algorithm to reduce completion time and to gain more fairness. | CloudSim |
| IPBJSA using Iterative Method [11] | To reduce makespan | Priority-Based Job Scheduling | Priority of Jobs | The proposed algorithm can be optimized further to reduce makespan. | CloudSim |

| | | | | | |
|---|---|---|---|---|---|
| Heterogeneous Factoring Self-Scheduling [12] | To assign low weighted service node to execute task in minimum execution time | Self-Scheduling Scheme | Task Complexity, Percentage CPU utilization | Solving task dependency and factoring large tasks for further execution on multiple computing nodes. | Microsoft Windows Azure |
| Priority-Based EDF Scheduling Algorithm [13] | To minimize the average waiting time | Priorities Based Scheduling | Priority and Deadline of tasks | Waiting time can reduce further. | CloudSim |
| Credit-Based Scheduling Algorithm [14] | To improve resource utilization and reduce makespan | Credit Based Scheduling | User Priority and Task Length | The proposed algorithm can be enhanced further considering deadline as a scheduling parameter. | CloudSim |
| Heuristic-PSO based Scheduling Algorithm (H-PSO) [15] | To reduce makespan and to improve memory utilization. | Based on Particle Swarm Optimization Technique | Number of Particles in Swarm, Number of Iterations, Learning rate with regards to individual ability and Learning rate with regards to social ability | The proposed algorithm can be implemented with a hybrid heuristic algorithm. | CloudSim |
| Hybrid Cuckoo Algorithm [17] | To increase resource utilization and to decrease energy consumption. | Optimization Based on Genetic Algorithm and Cuckoo Search Algorithm | Workload Type, Priority, Temperature (Capacity of Machine) | The Results can be checked with more than 120 jobs and results can be compared with different algorithms. | Visual Studio 2010 |

## 3. Proposed Plan

The proposed plan is to simulate the cloud on CloudSim [18] simulator tool and to schedule the tasks on the basis of task length as well as the task's deadline. Final results will be compared with the results of the existing algorithm. As per workflow diagram the new algorithm can be implemented and the comparative analysis can be carried out. The task length and deadline can be taken as the scheduling criteria. The deadline for the task is an important constraint in the scheduling. Scheduling cannot be dependent on only task length. The task having least deadline could be scheduled first but the issue of starvation to the other tasks should not be aroused.

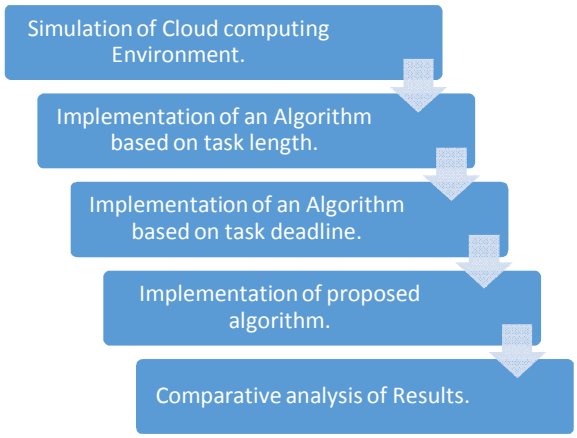


Fig 2: Workflow Diagram

## 4. Conclusion and Future Scope

As the cloud computing technology is changing day by day a lot of new challenges are emerging. One of them is the task scheduling in a cloud computing environment. The main objective of the scheduling is to maximize utilization of resources and to reduce makespan. A lot of algorithms are proposed to achieve effective scheduling, but since the task scheduling is aheuristic problem the more research can be done in this field and more optimized solutions can be achieved. In future more efficient scheduling algorithms can be introduced by focusing different scheduling parameters such as priority, length and deadline combinely.

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