Asian Journal of Research in Computer Science

2(1): 1-6, 2018; Article no.AJRCOS.44634

Performance Evaluation of Various Scheduling Algorithm Based on Cloud Computing System

Nobo Chowdhury[1*], K. M. Aslam Uddin[1], Sadia Afrin[1], Apurba Adhikary[1] and Fazly Rabbi[2]

[1]Department of Information and Communication Engineering, NSTU, Bangladesh.
[2]PDBF, Ministry of LGRD & C, Bangladesh.

Authors' contributions

This work was carried out in collaboration between all authors. Author NC designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KMAU and AA managed the analyses of the study. Authors SA and FR managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRCOS/2018/v2i124768
Editor(s):
(1) Dr. Stephen Mugisha Akandwanaho, Department of Information Systems and Technology, University of KwaZulu-Natal, South Africa.
Reviewers:
(1) Degan Zhang, Tianjin University of Technology, China.
(2) Irshad Ullah, Education (E&SE) Khyber Pakhtunkhwa, Pakistan.
(3) Hui Yang, Beijing University of Posts and Telecommunications (BUPT), China.
Complete Peer review History: http://prh.sdiarticle3.com/review-history/26925

Original Research Article

Received 12 August 2018
Accepted 20 October 2018
Published 30 October 2018

ABSTRACT

Cloud computing is an information technology archetype which has been used significantly for providing various services through Internet. It ensures easier access to resources and high-level services. The working procedure of cloud systems must be scheduled, so as to efficiently provide services to people. The goal of task scheduling is to acquire best system throughput and to allocate various computing resources to applications. The unpredictable situation increases with the size of the task and becomes high potential to solve effectively. Numerous intellectual methods are recommended to clarify this situation in the territory of scheduling of cloud computing. In this research, a comparative analysis has been conducted for different types of existing scheduling algorithms in the cloud environment with their respective parameters.

Keywords: Cloud computing; task scheduling; scheduling algorithm; algorithm comparison; resource allocation.

**Corresponding author: E-mail: nobochowdhury.icenstu@gmail.com;*

1. INTRODUCTION

Cloud computing is a very emerging technology where cloud means how a network or remote servers can be accessed via an internet connection. It refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. Cloud Computing is an aggregation of two terms in the field of computing technology - Cloud and Computing. Cloud is a pool of heterogeneous resources and a mesh of gigantic framework that includes both these applications delivered over the internet as services along with the hardware and system software in data centers required to support those services. Computation in the cloud is done based on service-level agreement (SLA) with the aim to achieve maximum resource utilization with higher availability at a minimized cost [1]. Cost effectiveness, scalability, reliability, fault tolerance, service-orientation, utility based, virtualization and service level agreement (SLA) are some of the salient features of Cloud Computing [2,3]. The continuing growth of cloud computing in information technology has led to breeding several definitions of cloud computing. The U.S. NIST [4] (National Institute of Standards and Technology) address cloud computing as an evolving paradigm and provides a definition including key common allows on - demand and very dynamic resources that can be conventional provisioned network approach to a shared pool of configurable computing and released involving least management effort or service provider interaction". The main intention of cloud computing is to provide dynamic access to remote and geographically distributed resources. An efficient scheduling is a key to manage the access to different resources, load balancing as well as resource allocation [5]. The main objectives of the job scheduling algorithms in the cloud environment are to utilize the resources accurately while managing the payload between the resources so that to get the minimum execution time. Our paper is organized as follows. Section 2 types of scheduling algorithms; Section 3 materials and method; Section 4 comparison of algorithms; Section 5 conclusion and future work.

2. TYPES OF SCHEDULING ALGORITHMS

There is various scheduling algorithm has been made for scheduling, allocating, and scaling the resources adroitly in cloud computing to achieve great performance. These algorithms are first come first serve, round robin, min-min, max-min, genetic algorithm, resource aware algorithm, earliest dead line first, and greedy [6,7]. Conventional task scheduling algorithms are unable to arrange scheduling in the cloud environment. Task scheduling can be performed based on different parameters in different ways. They can be statically allocated to various resources at compile time or can be dynamically allocated at runtime [8]. In cloud computing process scheduling algorithms can be classified into two groups; Batch Mode Heuristic scheduling Algorithm (BMHSA) and online mode heuristic scheduling algorithms. In BMHSA tasks are queued and further collected into a set as they arrive in the system and the scheduling algorithms are begins after a time slot. Example of BMHSA based algorithms are; First Come First Served (FCFS) scheduling algorithm, Round Robin (RR) scheduling algorithm, Min - Min algorithm and Max - Min algorithm. Example of online-based heuristic scheduling algorithm is Most Fit Task scheduling algorithm.

2.1 First Come First Serve (FCFS)

First Come First Serve is a simplest scheduling algorithm which serves in (FIFO) manner. That means FCFS algorithm serves those jobs which are first arrived in the queue. After completing one task, then it is assigned to the next task that is at the queue. The executing task is then to eliminate from the queue. In this scheme, all the tasks which are queued behind have to wait a long time for the long task to complete [9].

2.2 Round Robin Scheduling Algorithm (RR)

The Round Robin (RR) scheduling algorithm is one of the simplest scheduling algorithms and constructed especially for timesharing systems. It also similar to FCFS scheduling algorithm, but the assumption is included to enable the system to substitution between processes. It shares the load uniformly to all the resources. It works in a similar way in cloud computing as it does in process scheduling. It works in a circular queue with a small unit of time, called a time quantum. The main profit is that it executes all the tasks in sequentially and waits until the previous task to get complete. For this, there is no starvation issue. But when the queue is fully loaded and the workload is heavy then it takes a huge amount of time to complete all the tasks and

moreover, it is difficult to decide on a suitable time quantum [10].

This section describes the associated materials and method for task scheduling in cloud computing environment. In paper [11] conferred a brief description of cloudSim toolkit and his functionality. CloudSim is a cloud simulator where we tested our work before applied to real work, in this paper we studied how to simulate a job with different approaches and different scheduling policy.

2.3 Genetic Algorithm (GA)

The Genetic algorithms are speculative search scheduling algorithms based on the mechanism of natural selection strategy. It begins with a set of a preliminary solution, called the initial population, and will identify new solution using genetic operators. Its approach is to compute the impact in advance, which it will have on the system after the new VM resource, is deployed in the system, by using historical data and the recent case of the system. Finally, it picks up the solution, which will have the least effect on the system [12]. The main benefit of this technique is it can handle a large searching space and can avoid trapping by a local optimum solution. In paper [13] have developed a cost-based job scheduling algorithm, which provides a multi-Quality of Service scheduling in cloud computing environment.

2.4 Resource Aware Scheduling Algorithm (RASA)

RASA is a hybrid scheduling algorithm which is consist of two techniques -Min-min and Max-min. Min-Min technique is utilized to execute little tasks before huge tasks and Max- Min is used to escape the delays in vast tasks execution. Both the methodologies are utilized alternatively for tasks and exchange results in successive execution of a little and a huge task on diverse resources thus overlooking the waiting time of the small tasks in Max-min calculation and the waiting time of the vast assignments in Min-min calculation [14].

2.5 Priority Scheduling Algorithm (PSA)

In Priority scheduling algorithm a priority is assigned with each process and based on priority services are provided. The task with the highest priority can serve first and the lowest priority tasks are served. For a task with the equal priority, it follows FCFS rules. The disadvantage of this algorithm is starvation of a process [15].

3. MATERIALS AND METHODS

This section describes the associated materials and method for task scheduling in cloud computing environment. In paper [11] conferred a brief description of cloudSim toolkit and his functionality. CloudSim is a cloud simulator where we tested our work before applied to real work, in this paper we studied how to simulate a job with different approaches and different scheduling policy.

5 Virtual Machines have been created using VM component and fixed the property of Random Access Memory (RAM) as 512 MB for all VMs, and the Million Instructions Per Second (MIPS) as 250, 1000, 250, 500 and 250 respectively. We have created 12 tasks using Cloudlet component and set the property of Cloudlet length as 20000, 10000, 20000, 10000, 10000, 20000, 10000, 20000, 10000, 10000, 20000 and 10000 respectively.

To accomplish this goal, 5 VMs with MIPS 1000, 500, 250, 250, 250 and RAM size of all VM as 512 MB. The experiment is conducted for a varying number of tasks like 20, 40, 60, 80 and 100 respectively.

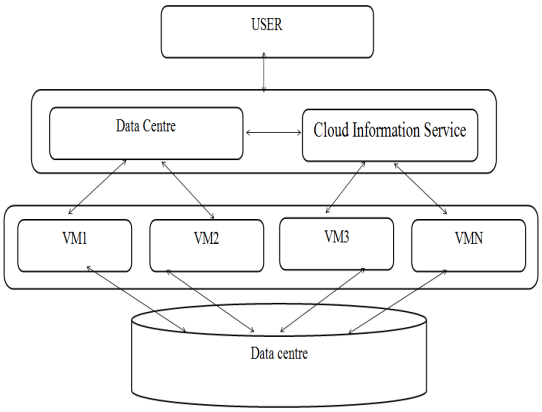

Fig. 1. Process of scheduling

3.1 Scheduling Process

In cloud computing scheduling process can be classified into three categories namely:

1. Discovering a resource and filtering: Data center Broker detects the resources

present in the network system and gathers status information related to them.
2. Selecting a target resource (decision stage): Target resources are preferred based on certain parameters of task and resource. This is deciding stage.
3. Submission of a particular task to a target resource: In this stage, a task is submitted to selected resources.

4. COMPARISON OF ALGORITHMS

The results of the studies are presented and compared within this section. By using CloudSim an analysis has been performed among five algorithms; First Come First Serve (FCFS), Round-Robin (RR), Genetic Algorithm (GA), Resource Aware Scheduling Algorithm (RASA), Priority Scheduling Algorithm (PSA),. Four parameters are considered to evaluate the performance. These parameters are the completion time, resource utilization, throughput and environment.

4.1 Completion Time

Table 1 and Fig. 2 represent the completion time in second of FCFS, RR,GA,RASA and PSA algorithms using 5 VMs.

According to the results in Fig. 2, it is found that the completion time of the RR algorithm is better than other algorithms.

4.2 Resource Utilization

The utilization of resources represents the ratio between the total busy time of Virtual Machine and the total finish execution time of the parallel application. It is defined as:

Utilization= (Final VMs available time/(VMs * Schedule time))*100 [16]

Table 2 and Fig. 3 represent the resource utilization of FCFS, RR, GA, RASA and PSA algorithms using 5 VMs.

Table 1. The completion time of FCFS, RR, GA, RASA and PSA algorithms using 5 VMs

Tasks	FCFS	RR	GA	RASA	PSA
20	423.78	406.19	412.51	425.22	420.23
40	578.77	416.12	420.21	430.21	501.01
60	582.16	501.97	680.84	498.32	543.67
80	954.37	513.7	812.89	782.10	630.73
100	997.37	601.78	901.83	805.17	778.73

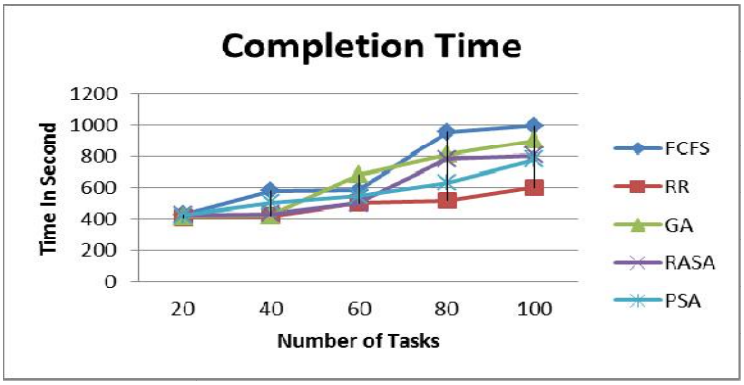

Fig. 2. Comparison of completion time

Table 2. The resource utilization of FCFS, RR, GA, RASA and PSA

Tasks	FCFS	RR	GA	RASA	PSA
20	65.44	75.89	31.51	30.13	45.01
40	70.33	80.43	47.88	44.36	55.23
60	75.98	84.75	54.96	69.4	61.66
80	80.77	88.78	60.7	72.04	79.76
100	88.17	90.83	66.78	75.01	83.73

Table 3. Comparison based on performance

Scheduling algorithms	Completion time	Resources utilization	Throughput	Types of system environment
FCFS	-	-	-	Cloud
RR	✓	-	✓	Cloud
GA	-	✓	✓	Cloud
RASA	-	✓	-	Cloud
PSA	-	-	✓	Cloud

According to the results in Fig. 3, it is found that the resource utilization of the GA algorithm is better than other algorithms respectively.

Table 3 illustrates the RR is designed to work well on the batch processing or time sharing system based on the parameter of make span and waiting. The GA and RASA provides better resource allocation.

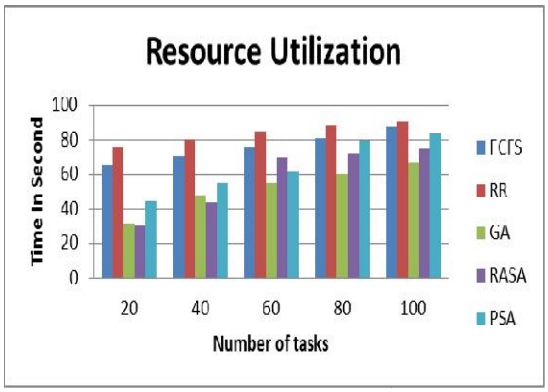

Fig. 3. Comparison of resource utilization

5. CONCLUSION AND FUTURE WORK

In cloud computing environment resources should be handled in an advanced way with efficient scheduling. Scheduling is treated as one of the most influential tasks in cloud computing environment. In our research, we have analyzed a number of scheduling algorithms based on completion time, resource utilization, performance, and environment and also tabulated the associated parameter. Existing scheduling algorithms give high throughput but there are also drawbacks in every scheduling algorithm. There is a lack of security aware scheduling, reliability and availability. For this, there is a need for algorithms those enhance security, reliability, and availability in the cloud computing environment and in future we will design a new algorithm to improve these factors in cloud computing environment. Scheduling Algorithms Completion Time Resources Utilization Throughput Types of System environment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Abhishek Gupta, Bhadauria HS, Annapurana Singh, Jagdish Chandra Patni. A theoretical comparison of job scheduling algorithms in cloud computing environment; 2015.
2. Huang Lu, Hai-shan Chen, Ting-ting Hu. Survey on resource allocation policy and job scheduling algorithms of cloud computing. Journal of Software. 2013;8(2).
3. Elzeki OM, Reshad MZ, Elsoud MA. Improved max-min algorithm in cloud computing. International Journal of Computer Applications. 2012;50(12).
4. Peter Mell, Timothy Grance. 'The NIST definition of cloud computing (Draft); 2011.
5. Braun TD, Siegel HJ, Beck N, Boloni LL, Maheswaran M, Reuther AI, Robertson JP, et al. A comparison of eleven static heuristics for mapping a class of independent tasks onto heterogeneous distributed computing systems. Journal of Parallel and Distributed Computing. 2001; 61(6):810–837.
6. Chunmei Chi, Feng Gao. The trend of cloud computing in China [J]. Journal of Software. 2011;6(7):1230-1234.
7. Isam Azawi Mohialdeen. Comparitive study of scheduling algorithm in cloud computing environment; 2013.
ISSN: 1549-363.
8. Teena Mathew, Chandra Sekaran K, John Jose. Study and analysis of various task scheduling algorithms in the cloud computing environment. International Conference on Advances in Computing, Communications and Informatics; 2014.

9. Kansal N. Jain, Chana I. Cloud load balancing techniques: A step towards green computing. IJCSI International Journal of Computer Science Issues. 2012;9(1):238-246.
10. Lokesh Kumar Arya, Amandeep Verma. Workflow scheduling algorithms in cloud environment - A survey. In Proceedings of RAECS UIET Panjab University Chandigarh. 2014;1-4.
DOI: 978-1-4799-2291-8/14.
11. Burya R, Ranjan R, Calheiros RN. Modeling and Simulation of Scalable Cloud Computing Environments and the CloudSim Toolkit: Challenges and Opportunities. IEEE Publication. 2009; 1-11.
12. Dutta D, Joshi RC. A genetic –Algorithm approach to cost-based multi-QoS job scheduling in cloud computing environment. International Conference and Workshop on Emerging Trends in Technology (ICWET 2011 –TCET, Mumbai, India); 2011.
13. Mayank Mishra, Anwesha Das, Purushottam Kulkarni, Anirudha Sahoo. Dynamic resource management using virtual machine migrations. 0163-6804/12, IEEE Communications Magazine. 2012; 34-40.
14. Parsa Saeed, Entezari-Maleki R. RASA: A new task scheduling algorithm in grid environment. World Applied Sciences Journal. 2009;7:152-160.
ISSN: 1818-4952
15. Ghanbari Shamsollah, Mohamed Othman. A priority based job scheduling algorithm in cloud computing. Procedia Engineering. Elsevier. 2012;50:778-785.
16. Abdelkader DM, Omara F. Dynamic task scheduling algorithm with load balancing for heterogeneous computing system. Egyptian Informatics Journal. 2012;13: 135–145.

Peer-review history:
The peer review history for this paper can be accessed here:
http://prh.sdiarticle3.com/review-history/26925