Cloudlet Migration in Cloud Application & its Domination on Other Scheduling Approaches

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Abstract:
Cloud Computing can be defined as delivering computing power (CPU, RAM, Network Speeds, Storage, OS software) as a service over a network (usually on the internet) rather than physically having the computing resources at the customer location. The task scheduling mainly focuses to enhance the efficient utilization of resources and hence there is reduction in completion time. Scheduling plays a vital role in Cloud Computing. The association of Virtual Machines (VM) to schedule the assigned tasks (cloudlet) is a most pleasing field to research. This topic will show the scheduling flowchart using Enhanced-First Come First Serve (CM-eFCFS). The major objective of this work is to produce the maximum efficiency for the resource utilization. The proposed work has been taken up in the CloudSim toolkit package. The results have been compared with already existing scheduling algorithms with same experimental configuration. Important parameters like makespan and resource utilization are compared to measure the performance of the given proposed work. The results proved that introduced work has better results than existing approaches. Resource utilization of 99.7% has been achieved by CM-eFCFS. The proposed algorithm (CM-eFCFS) is proved to be very effective for cloudlet scheduling and is shown with the help of calculated values and plotted graphs.

Keywords: Cloud computing, Cloudlet, Makespan, Resource utilization, Virtual machine.

1. INTRODUCTION
Cloud computing is the latest generation technology with a high IT infrastructure that provides a means by which the applications can be used and utilizes as utilities via the internet. Cloud computing makes IT infrastructure along with their services available "on-need" basis. The cloud technology includes a development platform, hard disk, computing power, software application, and database. This technology doesn't require large-scale capital expenditure to access cloud vendors. Instead, the cloud facilitates 'pay-per-use,' i.e., the users of the organizations have to pay only that limited amount as much they use the cloud infrastructure. In other words, cloud computing refers to applications and services that run on a distributed network using virtualized resources and uses the standard internet protocols for accessing. The cloud computing service models are categorized into three different types, i.e., Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). SaaS or software as a service is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network (e.g., Google App, Facebook, etc.). Platform as a service, is referred as PaaS, it provides a platform and environment to allow developers to build applications and services. This service is hosted in the cloud and accessed by the users via internet (e.g., Google App Engine, Github, etc.). Infrastructure as a Service, is referred as IaaS, it provides virtualized computing resources over the internet (e.g., Amazon Elastic Compute Cloud, etc.). Figure 1 shows the architecture of cloud computing with deployment model and cloud services. Cloudlet scheduling offers appropriate resources for performing cloudlet execution in a cloud environment. These resources assign cloudlets to the VMs to improve resource utilization. Cloudlet scheduling in cloud technology is one of the major challenges to achieve high efficient computations among the machines [1-3].

The primary objective of this paper is:
Formulation of a method to schedule the cloudlets in a cloud based environment to increase the resource utilization and reduce the makespan (overall execution time).

2. DEFINITION AND LITERATURE REVIEW
In cloud, scheduling focus on optimizing the task-resource requirements, CPU memory, execution time and execution cost of the system. Cloudlet scheduling over cloud computing is gaining popularity these days .Several cloud-based task
scheduling schemes have been proposed [4] and are reviewed in this section. Several metrics are described below to analyze the processing unit in the resource system as follows:

- **Makespan**: The total time from the beginning of the Scheduling process to the end is termed as makespan. Makespan should always be as low as possible.

- **Execution time**: The actual time needed to execute the cloudlet is termed as the execution time. An appropriate scheduling algorithm is directed to minimize the execution time.

- **Resource utilization**: The resource utilization is defined as the percentage of the total time for which the processor is performing some operation and is not idle.

The focus of task scheduling algorithms: First Come First Serve (FCFS), Round Robin (RR) and Shortest Job First (SJF) is to boost the advancement of scheduling. In this paper, these basic algorithms is compared with the proposed scheduling algorithm to find out the benefit of the proposed method. In FCFS, what comes first (cloudlet) is handled first; the next request in line will be executed once the one before it is complete. SJF process the cloudlet with the shortest length first and assigns it to VM. RR works on assigning cloudlets to each VM equally with the principle of Time-Shared Cloudlet Scheduler. The proposed work has conquered the drawback of these basic algorithms.

### 3. SYSTEM MODEL AND PROPOSED WORK

The system model involves a set of VMs=$(VM1, VM2,.,VMj)$ in each host of a datacenter. The cloudlets=$(C1, C2, Ci)$ are assigned to each VM respectively to execute the processing of cloudlets. The VM runs on its own resources independently and in parallel. The simulation work has been performed under CloudSim tool, which involves various cloud environment configurations such as Datacenter Characteristics: architecture, operating system, CPU cost, cost per memory. VM Characteristics: RAM, bandwidth, storage and VM scheduler. Host Characteristics: RAM, MIPS, and VM scheduler. Cloudlet Characteristics: Length, input file size, output file size.

#### 3.1. System architectural description for proposed work

Cloudlets are accredit to VMs in the order as they arrive in the system. $ECT$ of first cloudlet is measured for each VM and that cloudlet is assigned to VM, which has minimum $ECT$. This process is repeated for entire cloudlets. Figure 2 shows the basic functioning mechanism of the algorithm.

#### 3.2. Makespan

The total time from the starting of the scheduling process to the end is called makespan and is calculated as:

$$Makespan = \max(CT_j) \quad j \in VMs$$  

The $j$th VM that has maximum completion time consider as makespan.

#### 3.3. Resource utilization

High resource utilization is always a major challenge in cloud computing environment. Resource utilization is the percentage of total time for which the processor is performing some operation and is not idle. The average utilization of an algorithm can be evaluated as [5]:

$$\text{Average Utilization}=\frac{\sum_j CT_j}{\text{Makespan} \times \text{Number of VMs}}$$  

### 4. IMPLEMENTATION

The CloudSim [6] toolkit has been used to simulate the proposed scheduling algorithm. The overview of cloud setup configuration is shown in Table 1.

![Figure 2. Flow chart of CM-eFCFS.](image)

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<thead>
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<th>Tool configuration</th>
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<td><strong>VMM</strong>:</td>
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</table>

Table 1. Cloud setup configuration details.
5. RESULTS AND DISCUSSION

This area shows the comparison of CM-eFCFS with the other scheduling algorithms. The four scheduling algorithms (FCFS, SJF, RR and Min-Min) has been compared under the same cloud computing system configuration. The performance of proposed work has been compared on the basis of two metrics, i.e., Makespan and Resource Utilization. Cloud computing provides services based on on-demand basis. Data centers utilization percentage is only between 5% to 20%. Main issue in cloud computing is under-utilization of resources. Hence, maximizing the utilization of resources at same time minimizing the makespan is a challenging task. Scheduling can be centralized or distributed. In the centralized scheduling, the objective of the scheduling is to increase the overall performance of the system. Whereas distributed scheduler aims to increase the performance of the end user. Cloud computing needs centralized as well as distributed scheduler which makes the scheduling in cloud computing complex.

5.1. Comparison of makespan

Here four VMs are performed for 600 to 1000 number of cloudlets. Makespan is calculated using Eq. (1). Figure 3 shows the makespan of algorithms having four VMs with a cloudlet length of different range. It is shown clearly that with an increasing set of cloudlets CM-eFCFS achieves less makespans.

Figure 3. Makespan Calculated for four number of VMs by algorithms.

5.2. Comparison of resource utilization

The resource utilization must be high to achieve high performance for a system. The utilization of resources is calculated using Eq. (2). In this, the resource utilization performance of the CM-eFCFS algorithm is compared with Min-Min, RR, SJF and FCFS algorithm. Figure 4 shows the comparative analysis of resource utilization with respect to time. The figure clearly shows that resource wastage in the CM-eFCFS is low. Thus CM-eFCFS achieves high resource utilization which in turn minimize the resource wastage. Thus CM-eFCFS is proved to be the best scheduling approach.

6. CONCLUSION

This paper proposed and formulated a new approach of cloudlet scheduling. The calculation of expected completion time gave a new algorithm, which is called as CM-eFCFS. The results have shown remarkable improvement in Execution time and Resource utilization over the pre-existing scheduling algorithms. The results shows CM-eFCFS as one of the finest algorithms that achieves 99.7 % resource utilization which makes the introduced approach most suited to cloud computing. In future, we wish to extend introduced work by drawing inferences and formulating the algorithm for CM-eFCFS Scheduler.

Figure 4. Illustration of resource utilization by algorithms.

7. REFERENCES


