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A RESEARCH ON HYBRID PROCESS PARTITIONING ALGORITHM FOR MOBILE CLOUD COMPUTING

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ABSTRACT

The mobile cloud computing (MCC) is the branch of cloud computing, which is associated with the mobile based applications or services provided from the cloud platforms. Now-a-days a number of online applications and service are emerging as the developers and researchers are kept working upon them. The mobile partitioning applications must be capable of understanding the process load, data associated, total process cost, etc. in order to calculate the correct or nearly correct decision for the process offloading. The proposed model has been designed as the major improvement to the process partitioning models in the mobile cloud computing (MCC). The proposed model has been designed to understand the process load, data association, process dependency, and process return, process input and is capable to associate the processes in the batches. The proposed model has been designed irrespective of the specific mobile platforms. The proposed model of process partitioning and process offloading has been designed for the empowerment of processing on the low computationally powered devices by sharing their load with the cloud based platforms. The execution is calculated on the basis of execution cost evaluation parameters, whereas the communication cost is evaluated on the basis of process memory allocation, memory requirement & data size, which is further used for final decision making by comparing the communication cost with the process cost. The dynamic threshold is computed on the basis of the communication cost, EFT and CPU cycles, which plays the important role in taking the offloading decision. The experimental results have been evaluated in the form of time and cost based performance parameters. The experimental results have proven the effectiveness of the proposed model in comparison with the existing models.

Keywords: Process Partitioning, MCC, EFT, CPU Scheduling, Remote Scheduling.

I. INTRODUCTION

In the recent years, the main aim of IT industry is to lower the computational costs and achieve high productivity. This can be done by improving the utility of computing resources, reducing administrative costs and avoiding large amount of investments to provide a service. The main goal of any computing model is to make a better use of resources, put them together in order to achieve high throughput and able to tackle large computation problems and provide better results. Cloud computing is the recent technology, which was growing in popularity, which enables these functions. [1, 6-7] Cloud computing is coined recently and gained popularity in 2007, which can be also called as Internet based Distributed Computing.

The roots of cloud computing can be traced to early stages of Grid computing and Distributed Computing. Cloud computing is a combination of utility computing (on-demand computing), Software as a service, and distributed computing. [14] Utility computing and Software as a service are two services that are provided by cloud computing, whereas distributed computing is one of the underlying technologies for implementing cloud computing. "Cloud Computing refers to both the applications delivered as a service over the internet and hardware and system software in the datacenters that provide these services." [1].

Mobile cloud computing intends to make the advantages of cloud computing for mobile users. It will also provide some additional functionality to the cloud as well as Mobile cloud computing helps to overcome the limitations of mobile devices in particular of the processing power and data storage. Mobile cloud computing helps to extend battery life by transferring the execution of computation intensive application to the cloud.[12]

Mobile Cloud computing is regarded as the next generation computing infrastructure. Here the information is permanently stored in servers on internet and cached temporarily on clients through mobile devices. [5, 8] Although the wireless network brings us many benefits, there are many challenges that will hinder the growth of mobile computing.[1-2] With the growth of mobile industry, a considerable amount of mobile applications and services are available. Nowadays users are capable sharing and distributing digital media contents easily through internet. Here only authorized users who have obtained the license should access the information. [6-8]

Our proposed model is based upon the remote scheduling for the mobile systems for the purpose of energy conservation and to enable the longer lifetimes. The proposed model has been developed with the amalgamation of the earliest finish time algorithm with directed acyclic graph for the process offloading in the mobile cloud computing environments.

II. LITERATURE REVIEW

Xia, Feng et. al. (2014) has developed the Phone2Cloud framework which is used for manipulating computation offloading for energy saving on smartphones in mobile cloud computing. Phone2Cloud offloads computation of an application running on smart phones to the cloud. The objective is to increase energy competence of smartphones and at the same time, enhance the application's performance through reducing its performance interval. In this way, the user's experience can be enriched. Wang, Lian et. al. (2014) has worked on Energy efficiency on location based applications in mobile cloud computing: a survey. Due to the severity of the issue of battery consumption by the location based services in the mobile platforms, the considerable researches have focused on energy-efficient localizing sensing mechanism in the last a few years. In this paper, we provide a comprehensive survey of latest work on low-power design of LBAs. An overview of LBAs and different locating sensing technologies used today are introduced. Methods for energy saving with existing locating technologies are investigated. Reductions of location updating requests and generalizations of trajectory data are also mentioned. Ma, Xiao et. al. (2012) has conducted the survey on Energy efficient location based applications in mobile cloud computing. With the emergence of mobile cloud computing (MCC), an increasingly number of applications and services becomes available on mobile devices. In the meantime, the constrained battery power of mobile devices makes a serious impact on user experience. Nir, Manjinder et. al. (2014) has worked on an energy optimizing scheduler for mobile cloud computing environments. In this paper, the authors have extended their earlier task scheduling problem for a large number of mobile devices to a mobile cloud computing environment. They optimally solve the task scheduling problem for task assignment to minimize the total energy consumption across the mobile devices subject to user defined constraints. Zhang, Weiwen et. al. (2014) has proposed the service called "Toward trans coding as a service", which is an energy-efficient offloading policy for green mobile cloud. In this article the authors have investigated energy-efficient offloading policy for transcoding as a service (TaaS) in a generic mobile cloud system. Computation on mobile devices can be offloaded to a mobile cloud system that consists of a dispatcher at the front end and a set of service engines at the back end. Particularly, a transcoding task can be executed on the mobile device (i.e. mobile execution) or offloaded and scheduled by the dispatcher to one of the service engines in the cloud (i.e. cloud execution).

III. EXPERIMENTAL DESIGN

The proposed model is based upon the combination of heterogeneous earliest finish time and the cpu time evaluation algorithm, which in turn will improve the cost calculation process and will make it more efficient in comparison with the existing models. The dynamic offloading decision algorithm has been designed to utilize the process cost against the offloading of the directed cyclic graph to the cloud computing platform, which directly affects the performance of the process offloading mechanism. The proposed model dynamic offloading decision algorithm will utilize the comparison between the directed acyclic graphs of different process trees against their individual or combined cost. The process dependency would be analyzed by summarizing the output and input pointer position of each function. The dependent functions or processes in the process queue would be grouped and aligned together to facilitate the continuous process and to minimize the process lag or wait time. The proposed model is expected to resolve the problem of performance lag due to the unmanaged process hierarchy will be solved priority. The process scheduling algorithm defined under this project is a hefty algorithm designed for the purpose of process scheduling. The processes are offloading on the basis of their calculation cost. The process cost evaluation has been defined for the individual process as well as the process trees,

Process Scheduling Algorithm

1. Calculate the process weight for each process
2. Calculate earliest finish time for every process
3. Sequence the processes according to the early finish time
4. Calculate the CPU usage for every process
5. Evaluate the process dependency between the given processes to arrange the connected processes in the batch.
6. Then the communication cost is calculated
7. If communication cost is more than the process cost
8. The process is scheduled for local processing
9. Else
10. The process is offloaded to the cloud platform.
11. The reply is received from the mobile cloud computing server and returned on the local mobile device.

IV. RESULTS ANALYSIS

Task ID	Instruction Count	EFT	CPU Instruction Set	Collaborated Processes
1	7	0.000625	878	0
2	80	0.000775	1469	0
3	6	0.000475	540	0
4	4	0.000388	338	0
5	5	0.00045	443	0
6	2	0.000855	17	1
7	2	0.000416	9	1
8	1	4.23E-05	31	1
9	3	0.000517	33	2
10	2	6.86E-05	48	2
11	7	0.00073	31	2
12	5	0.000386	8	2

Table 1: The cost performance evaluation of the each individual process

Task ID	Instruction Count	EFT	CPU Instruction Set	Collaborated Processes
1	4	0.000388	338	0
2	5	0.00045	443	0
3	6	0.000475	540	0
4	7	0.000625	878	0
5	80	0.000775	1469	0
6	5	0.001313	57	1
7	17	0.001702	120	2

Table 2: The cost evaluation after the process tree generation (Process 6 and 7 are the process trees)

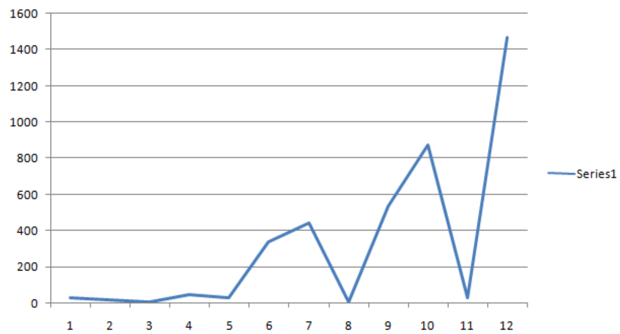

Figure 1: The process computation for all processes CPU Instruction set size

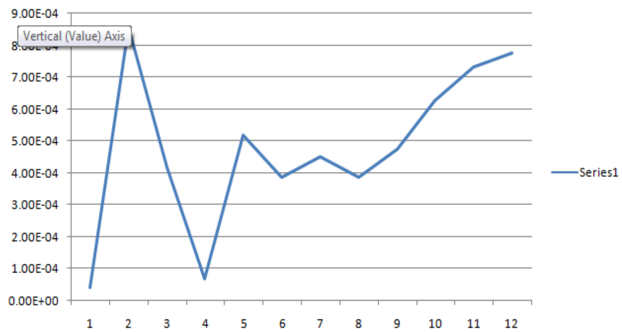

Figure 2: The process computation for all processes Early Finish Time

The results of the proposed model have been obtained in the form of various performance parameters. The performance evaluation has been performed on the basis of accuracy of the system to offloading the processes. The following table indicates the performance of the proposed model in terms of early finish time.

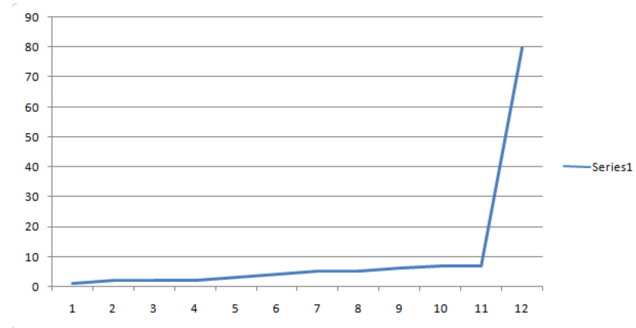

Figure 3: The process computation for all processes number of instructions

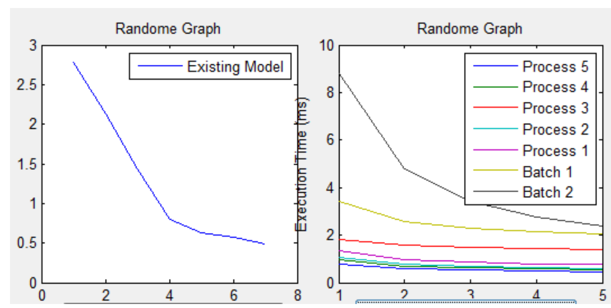

Figure 4: The random graphs obtained from the proposed model

CONCLUSION

The proposed model has been designed for the purpose of process offloading in the mobile cloud computing environment. The proposed model has been evaluated with the processes and process trees. The proposed model has been evaluated on the basis of results obtained in the form of time cost, CPU cost and Communication cost. The proposed model results have been found better than the existing models in handing the process trees and individual processes. The proposed model is highly acceptable in the real-time mobile cloud environments.

FUTURE WORK

In the future, the proposed model can be enhanced with more dynamic ways to empower the existing system. Also the proposed model performance can be evaluated against other popular mechanisms for process scheduling.

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