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Finest Execution Time Approach for Optimal Execution Time in Mobile and Cloud Computing

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Abstract: This is the time when modernism and innovations concerning new technology and trends are hitting at the highest point. Mobile computing becomes the technology where dealings between the computer and man is to be is to be transported even when the usual operation as data, voice, video etc are transferred. The second dimension that we consider into account is the growing trend of cloud technique. It is a huge arrangement of the hardware and applications that makes the surroundings of the cloud. When we consider the smart mobile devices then it is obvious that these are constrained in many terms as energy or the power, the computing resources means the applications etc. so there are many issues those can be considered as challenges as for example energy saving, execution time of the tasks etc. one of the important issue is offloading applications that is related to the incapacitation of the resources. Fundamentally offloading is the technique or procedure by which the heavy tasks i. e the computation intensive tasks is migrated on the cloud. We have done our work in the same context. In this paper we recommend an algorithm known as FET algorithm which stands for Finest Execution Time. Our algorithm is used to reduce the total execution time of the tasks required to be finished at the SMD. We have taken length of the task as a core parameter of this algorithm. The algorithm works in 2 passes. We have proven our results by comparing with the existing methods. Our method or the algorithm gives a benefit or 10 to 13 percent in the total execution time.

Keywords: *Cloud, Mobile, Execution time, virtual machine, optimal execution, migration, offloading*

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I. INTRODUCTION

This is the time when the clients are driving very tough themselves. The clients have to disburse very high in case they are missing any important task. A diverse set of applications or the products is available in the marketplace as for example Desk.com, Google Task those are used to fulfill the needs of the clients in many ways but these are so weighty that they are not suitable to be executed on the smart mobile device. Here the cloud computing is an growing trend that is used to solve many problems of the SMDs. This is an awesome technique where lots of hardware as well as software assets are available for the clients on the base of cost concerning the base of use. This is fully based on the internet. The overall infrastructure is considered in terms of services and the concept of pay as per use is used. The cloud surroundings are made available to the end users as IaaS, PaaS ans SaaS. All these are having the same slogan of if use then pay as use. In SMDs one major issue have concern with offloading applications that is the technique or the procedure of migration the weighty or intensive tasks to a node of the cloud. Today's age group is taking use of the portable devices in terms of an well-organized communiqué gadget. Movable cloud computing is the procedure of the resources of the cloud as well as of the mobile in a smooth and harmonically manner. The job is done at cloud after those results are sent to the mobile. Here the storage on the mobile device is not encouraging because mobile devices are subject to low power, low storage etc. In the same concern the theft of the device or damage is also considerable. The same constraints are having concern with speed of the tasks means that the execution time of the tasks on a mobile device. An approach to get the execution time up to a very optimal value is recommended in this paper. The paper contains total nine sections. In the first part we have given the introduction. The second piece is introducing the basics of the cloud. The third tells about the various challenges concerning MCC. The fourth focuses on the related research that is done till date. The fifth one is related to our recommended FET algorithm. The section number six and seven is having concerned with the experimental issues, performance and the results. and the last section number Eight is related to conclusion and the future scope. In the last section we have mentioned some the reference s that we have used in our work.

II. BACKDROP

This piece discusses basics of the cloud computing, mobile device cloud computing as well as the concept of offloading of the applications and the challenges related to the cloud surroundings.

a. CLOUD COMPUTING

Cloud computing is a surroundings where computing resources are federal and used by the mobile node on demand basis [10]. The SMD leverages the resources of the computing from the cloud as they need. SaaS, PaaS and Iaas are the three various models of the service by which

facilities are provided to the SMD or the mobile node. In the SaaS Model the datacenter of the cloud have some kinds of softwares that are given for use to the SMD as it needs. As for example the GOOGLEDOCS is used to provide the tools of word processing and spreadsheet to the users. In the PaaS model the facility of hardware as well as system software is given to the clients. The Iaas model has concern with the overall infrastructure. Furthermore the cloud can be deployed as a public, private, hybrid or a community cloud. Basically cloud consists of various hosts those have virtual machines with a particular number of cores or CPUs assigned to each virtual machine. Each and every component has its own specifications.

b. MOBILE CLOUD COMPUTING

Movable cloud computing is an up-and-coming mock-up. It is used to take use of the resources by the smart mobile devices so that the devices can conquer from the problem of their resource constraints [10]. The main concept or principle behind the cloud is centralization of the resources on a datacenter at the cloud. These resources are given to the SMDs as they will demand means and the possessions are completely accessible on the base of demand by the mobile device. [12]. the mobile and the cloud when collectively taken are called MCC i. e mobile cloud computing. This contains three main things

1. The SMD itself
2. The transmission medium
3. The computational cloud

The storage space ability of the mobile lump is raised by depiction of the storage space of the cloud. The similar is related to the processing capabilities of the applications [13].

c. Offloading of the applications

It is the process of migrating the application on the cloud [14]. The mechanism where computational load is migrated to the remote cloud server node is called application offloading [14]. The procedure of the outsourcing of the computational load to the distant nodes is called Cyber Foraging. The tasks concerning to the same can be considered in 2 categories. The first category is of light tasks known as the tasks those are computationally not intensive but the second class of the tasks is computation intensive tasks means weighty tasks that are subject to the cloud interfere. There can be two types of tasks: non-intensive and the intensive one. Non-intensive tasks are those which can be executed on the mobile node itself, whereas the intensive tasks are those which cannot be executed on the mobile node so these tasks are migrated to the remote server node [11]. Now applications are also having two classes one class is having concern with the applications that are to be divided at their run time known as elastic applications and the other cannot be divided known as non elastic applications. Moreover the division at the run time concerning non elastic applications can be divided in 2 categories. The first one is static but the other one is dynamic. The static one is compile time but the dynamic one is run time. The dynamic nature of the partition sis done in two steps. First the identification of the intensive tasks is done which is called profiling and second is the offloading itself known as solving.

III. MOBILE CLOUD COMPUTING CHALLENGES AND ISSUES

There are various issues that are concerned with cloud.

1. Well organized utilization of the resources of the cloud
2. How to migrate the task to an appropriate VM
3. Privacy
4. Security
5. Energy consumption
6. Availability etc.

IV. Related Work

Application offloading is the incident in which tasks are migrated to a node at the cloud to get their execution finished. In [6] an active service migration or a light weight migration is proposed that divides the tasks in 2 parts i.e. light and heavy. The light weight tasks are to be executed on the SMD and the heavy tasks are to be executed on the cloud suing the migration method. In [18] the division of the elastic applications at run time is recommended. In customary approach i.e. Virtual Machine base replica Cloud approach [15] is given in which the whole picture of running application is replicated at the cloud. It augments overhead by the replication of the complete image so the offloading becomes heavy. The approach adds the clone mechanism. Furtherrmore the process of offloading can be static where the decision is prior. It can be dynamic where the decision of the offloading is done at late time or run time. [6]. The key distinction among these approaches is that ACM is lightweight approach but the other us heavy weight approach as the complete task is migrated to the virtual machine. The cloud computing is a nascent and upward technology on which copious of investigation has been finished in the prior years. In the paper [1] the canvassers have proposed a framework in which the improved the security and quality of service in the resource allocation issue concerning cloud computing. The proposed work in [2] is related to the scheduling of the live migration of the virtual machines in the cloud scenario. In the research paper [3] a Berkeley view of cloud computing has been put

forwarded for recommendation. As per the researchers the cloud computing subject to deliverance of two things via internet. The first one is the deliverance of applications through internet network and the second one is making obtainable hardware as well as system software through the datacenters those are supplies the service. In [4] the canvassers introduced cloud computing and its fundamental architecture. They concentrated on creation of cloud environment with business or market oriented resource allocation by the influencing techniques such as virtual Machines (VMs). They also provided a in depth view on the strategies of the management of resources that are encompassing both i.e. client driven service management as well as computing risk administration to get superior resource provision or allocation compatible with the service level agreement (SLA). These researchers have also explored about some representing platforms that are being used in the business. As per the work done in [5] a cloud environment migration algorithm is recommended that reduces the execution time of the submitted tasks by 6 to 8 factors for the SMD. In [6] an approach is proposed by which the cloudlet selection is done on the basis of the utility. As per the researchers in [7] clod is a new era where applications and skills of computing are available by means of internet. As per them a mobile user have limited amount of power and energy and energy saving as a service can be provided to the intended clients via the cloud computing environment. They advised a low power design and a range of methods for computation offloading so that it becomes more striking. Mohd. Siraj et al [8] in their research proposed an active service migration framework concerning computational offloading to the datacenters in a cloud. This framework has a light weight method for deployment of run time distribution platform.

V. THE PROPOSED FET ALGORITM

In our proposed approach we are dealing with an approach to migrate the tasks. The approach is based on the length of the task means the count of instructions of the tasks. As for example our motive is to reduce the execution time of a task. It does not matter that where a task is to be executed either on the mobile device itself or the cloud. As we know that optimal execution time is a main issue. As for example we have 3 cloudlets and 2 VMs. the speed of execution of the first VM is 300 MIPS and the second VM is having 200 MIPS. So as far as the optimality is considered a task must go to high speed VM means the VM having the better speed. Basically compute intensive tasks are so heavy that they cannot be optimally executed on a mobile device. As a mobile device is having lot of constraints. But luckily cloud servers are there to solve this problem. These tasks can be sent over the cloud because there are huge resources as large amount of storage; facilities of computing etc. one more thing is there that execution of the compute intensive tasks are sometime not feasible so migration is required. The cloud oriented execution is fully beneficial because it can reduce the execution time. In migration lot of calculations as well as transfer of data is required.

a. Workflow

Here we recommend a 2 phase algorithm known as FET or finest execution time algorithm. The workflow diagram for the same is depicted in the figure.

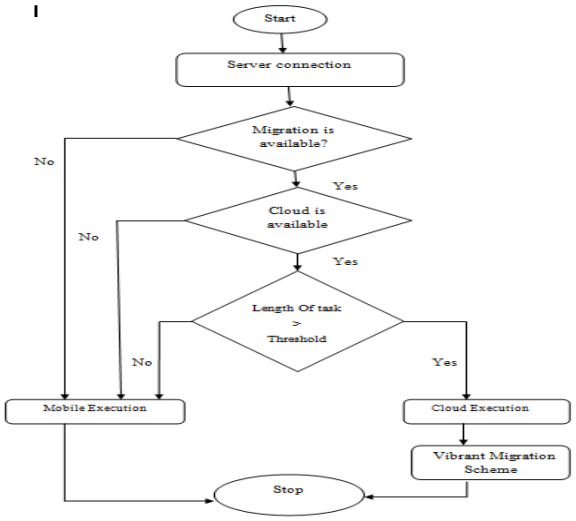

FIG 1.1 Work Flow for the Migration Decision Procedure

b. Algorithm For Migration At The Cloud

FET (Threshold1, Threshold2, Catalog_VM, Catalog_Tasks, Tot_Ex)

1. Catalog of Tasks at SMD with L_i i.e length of the i^{th} task
   here i = 1 L n (n € N).
2. for i=1 to n
   If Li > Threshold1
   Submit Task to Cloud
   else
   Submit Task to the Mobile Device
   End if else
   End for
3. Catalog of Tasks at cloudlet with L_i i.e length of the i^{th} task
   here i = 1 L n (n € N).
4. Catalog of VMs at cloud with VM_k i.e speed of the VM
   here k = 1 L m (n € *M*).
5. Organize the Virtual Machines in downward order of their execution speed
6. Organize the tasks in downward order of their size
7. for i= 1 to N

k= 1 to M
If $L_{i>}$ Threshold2
Submit the tasks to High Speed VM
Else
Submit the Tasks to Low Speed VM
End If else
i = i+1;
j= j+1;
End for

8. Total Execution Time $TE = \sum_{1}^{n} TE_i$

VI. Exploring the results

TABLE 1.1

SPECIFICATION CONCERNING THE CLOUDLETS

Cloudlet ID	Count Of the Instructions(Millions Instructions)	Count of the CPUs Required
Cloudlet 0	5000	1
Cloudlet 1	8500	1
Cloudlet 2	12000	2
Cloudlet 3	15000	2
Cloudlet 4	20000	2

This table shows the specifications of the cloudlets that are examined with the parameters id, length and the number of CPUs required. The second table 1.2 represents the available Virtual machines along with their speed and no. of cores available to virtual machine.

TABLE 1.2

SPECIFICATION CONCERNING THE VIRTUAL MACHINES

VM_ID	Speed of execution	Count of the CPUs Available
VM0	150	4
VM1	250	7

VII. Performance scrutiny

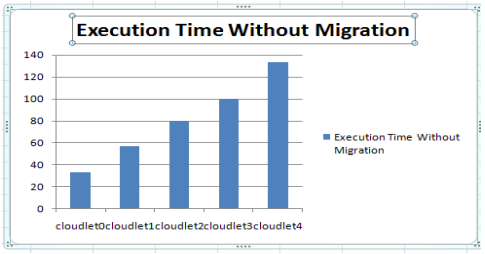

Figure 1.2 Exection Time Without Migration

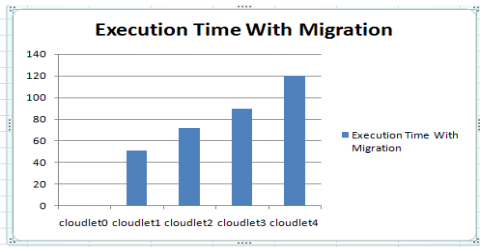

Figure 1.3Execution Time Without Migration

TABLE 1.3

EXECUTION TIME USING WITHOUT MIGRATION

Cloudlet ID	Executed On	Execution time in seconds
Cloudlet 0	VM1	33
Cloudlet 1	VM1	56.68
Cloudlet 2	VM2	80
Cloudlet 3	VM2	100
Cloudlet 4	VM2	133.33

TABLE 1.3

EXECUTION TIME USING WITH MIGRATION

Cloudlet ID	Executed On	Execution time(Sec.)
Cloudlet 0	VM1	0
Cloudlet 1	VM1	51
Cloudlet 2	VM2	72
Cloudlet 3	VM2	90
Cloudlet 4	VM2	120

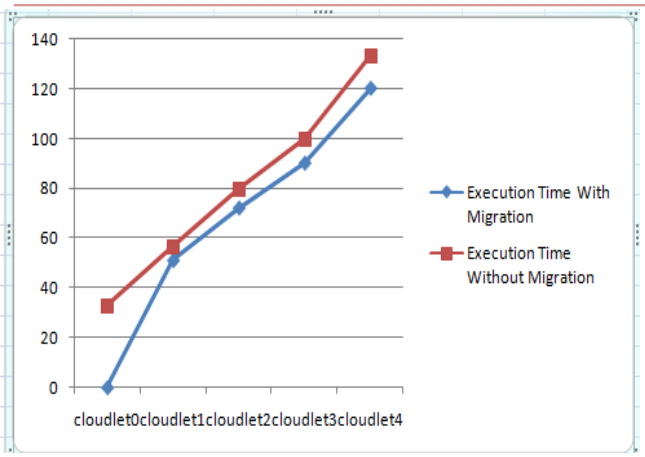

Figure 1.4Comparision Graph

Here we have taken 5 tasks as shown in the table 1.1 and 2 virtual machine as shown in table 1.2. Table 1.2 and 1.3 shows our reults that we have taken via using Cloudim in simulation on Eclipse IDE. We can see that there is difference of 10 to 14 percent means the total exection time is improoved up to the factor of 10 to 14 percent. The Comparison is presented in the figure 1.4.

VIII. CONCLUSION AND UPCOMING WORK

In this section we are going to discuss about the end that we have concluded and the future efforts that can be done in the same dimensions.

a. Conclusion

In our work we have recommended an algorithm to called FET or finest execution time that is fully based on the length of the tasks. In the area of mobile and cloud computing we deal with tasks those are simple means not heavy and the tasks those are very heavy in terms of computations. SMD is the devices those are bounded by lot of restrictions like memory, storage as well as power and many more other factors. So the executions of the compute intensive tasks are not feasible on the SMD itself. As for example scientific applications, banking transactions are so compute intensive. Our approach first divides the task required to be done on the SMD in 2 parts. This division is on the basis of the length of task. The tasks those are having length greater than a threshold value are submitted to the cloud and the tasks those are having less length than the threshold are expected to be finished by the mobile device itself. When the tasks are received by the cloud there again the process of filtration is applied that means again we take a threshold value of the length and divide the tasks in 2 parts. The tasks those lengthy than the threshold are submitted to a high speed VM and the tasks those are not lengthy than the threshold are submitted to a low speed VM. This migration policy improves the execution time of the tasks. it reduces the execution time by a percent of 9 to 13. We have compared our work with existing approach and we have proved that our work is better than the previous researches.

b. Future work

There is a possibility of extension in our approach in the following dimensions.

1. Power aware virtual machine consolidations can be done. In the case the cores not in use will be off and the cores those in work will be on. Here sensor network and dynamic software for shut down and switch on will be required.
2. Bandwidth aware our can also be done to increase the throughput of the tasks.
3. Priority based task scheduling can also be done on the cloud with reduction in the execution time.
4. The approach can be extended for the assorted surrounding also.

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