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Energy Efficient Load Balancing Strategy for Better Cost of Multisite Offloading

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Abstract-Cloud computing is the latest paradigm for providing many types of facilities that are suitable to transfer the data or any other information from the resource constraint devices. It is the delivery of computing services. Various services are servers, storage, database, software, networking and analytics over the network.. A lot of frameworks have stated the features of mobile cloud computing and challenges faced during its operational activities along with the concept of load balancing and offloading. Computation offloading can reduce the load during mobile computing. Load balancing is a concept that is used in the well allocation of resources to provide complete satisfaction of user during the remote processing of the mobile application. They are saving a lot of energy and enhance the performance of mobile devices. A lot of research work has been carried out on a single site offloading, but there is a need to carry out work on cost minimization in multisite offloading.. This proposed work provides better cost in case of various information centres using Ant Colony Optimization (ACO).We used ACO algorithm to minimize the cost of virtual machines of different sites. Matlab Simulation Tool has been used to perform cost optimization using ACO and greedy algorithms considering the deadline. Both ACO and Greedy algorithm have been compared by simulation in MATLAB in order to optimize the costs. The proposed methodology has been evaluated on two cloud services namely Amazon and Microsoft Azure for cost minimization and the results shows that the ACO is better as compared to compare to greedy approach for minimization of cost.

***Keywords*: ** Mobile offloading, ACO, greedy algorithm, cost optimization.

I. INTRODUCTION

Mobile device [1] such as tablets, smart phones, smart watches and notebooks, has limited resources. Devices have limited computational capacity, battery lifetime and network connectivity. There is a rapid growth of power consumption of mobile devices. This has seriously influenced their battery life.

Power consumption has increased because more and more computation-heavy or energy-hungry applications are deployed on these hand held devices. The cloudlets [2] process responsiveness is another primary constraint for mobile systems. Mobile applications are becoming highly intensive and sophisticated. These applications require increasing amounts of computational capabilities. These applications are real-time and user-interactive. They must wait for a long time to obtain the results due to the limited processing speed of the mobile systems.

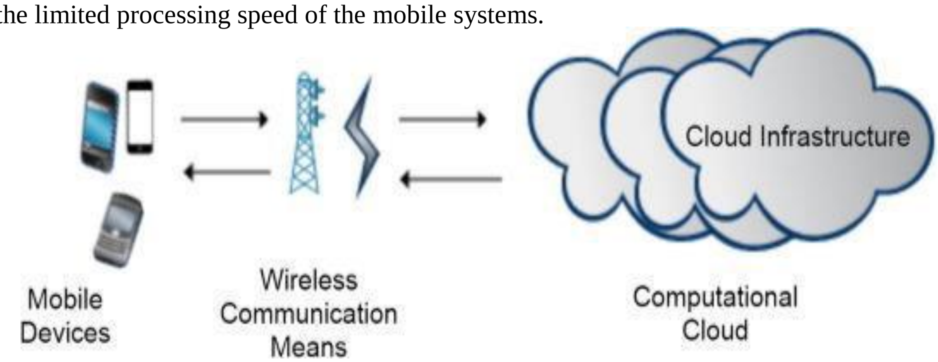

Fig 1: Mobile Cloud Computing

Mobile Cloud Offloading is taking advantage of abundant resources hosted by Clouds. It is becoming a promising method to solve several issues that are affecting mobile computing. Its main idea is to release [3] the mobile devices from intensive processing. Mobile Cloud Offloading can bring many potential benefits, such as improvement of performance in mobile applications.

- **OFFLOADING MOBILE APPLICATIONS IN CLOUD**

Recently cloud computing study has been motivated to how to make offloading [4] choices. There are several mechanisms to make offloading feasible. Offloading and parallelism are the two key features. These influence the system functioning. In this section, the existing frameworks are illustrated.

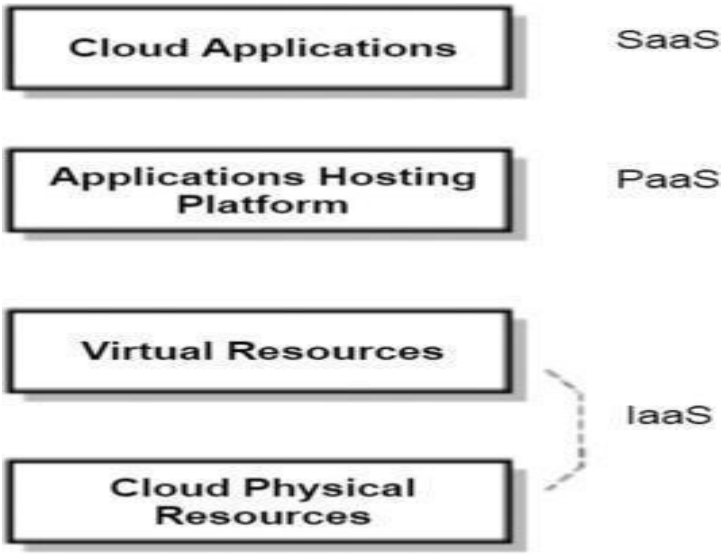

Fig 2: Offloading Mobile Applications in Cloud

Offloading: The process of shifting computations to servers accessible on the cloud is called offloading.
Offloading [5] choices may be done in two ways. 1) Automatically using tools. 2) Manually by the developers.

- **OBJECTIVE**
  - To study the existing computation offloading strategies/framework[8].
  - To propose an improved energy efficient load balancing technique for MCC.
  - To implement and compare the proposed technique with the existing framework.
  - To get best cost in case of different data centers using ACO and GREEDY ALGORITHM.

II. RELATED WORK

- **C-A Chen**, et al.[13] focused on the energy-efficient Load-balanced Heterogeneous Mobile Cloud. Mobile methodology & traditional cloud computing get expanded with abundant computation. It expanded storage sources in cloud. Conclusion of research has that ability of the end user were enhanced with its expansion. The designs of that research worked on remote cloud services. Those were working until remote cloud facilities were unavailable.

- **Mukherjee** et al. [9] discussed the concept of low power offloading strategy for Femto-cloud mobile network. Different issues of MCC are also discussed in this work. It is a complicated issue such as network latency and power consumption due to communications. It checks whether to offload or not. If application part is an offload then result is low power consumption of the mobile devices and also deadline generated that part is offload. After this it has been described that femtocell purpose has to reduce the power consumption by Bss and by this the pressure of large cells while serving a huge number of mobile users get reduced. It had coverage of approximately 10-20m. The reason is select Femtocell high security and power efficiency.

- **Kumar** et al.[6] presented the results related to energy savings in cloud computing. There analysis were that cloud computing could help in saving energy for mobile users. It was considered that all applications are not energy efficient during migration process in cloud. Author stated that mobile cloud computing services were varying from cloud services in case of desktops. That was because desktops were offering energy savings mechanisms. That type of services has been considered energy overhead in case of privacy and reliability. After the advent of offloading concept the issue of energy overhead got reduced.

- **M.Shiraz** et al.[10]Proposes the distribution of intensive resource that reduces the cost in computational offloading by minimizing the size of data in cloud datacenters. Analysis of the results shows that resource reduced the cost at the time of data transmission by 84% and energy cost was reduced by 64.4% in EECOF (energy efficient computation offloading framework).same as work of Yang[12] L. Yang[15]but he used eDorS policy to reduce the energy utilization and compress transmission time. He solve eDorS problem by use of three sub algorithms CLOCK frequency, offloading selection &transmission power allocation.

- **M .Barbera** et al.[16] A feasibility of cloud seems to alleviate battery consumption of mobile computation and data stored in the backup. That paper made the use of two clones, one is off-clone (sometimes offloading) and another is back-clone(communication between the real device and cloud).**K. Kumar**[17] It was argued that offloading computation is better than others. He offloaded mobile code which means that it parts the programs and offload the part program through which energy is saved. They studied the network availability (Wi-Fi, LAN) by paying the cost of transfer the network. He used the tool ASIMS that store the application and setting, integrated and managed the scheme of the mobile device to synchronize them to the internet.

  Reszelewski et al. [18] discussed the use of resource optimization in Mobile Cloud Computing. According to research mobile cloud computing structure got into account with the use of power and storage. It evaluated resource usage and cost of executing device. An assumption was that there is only one virtual device.

  R. Beraldi et al. [19] had discussed a new scheme for Edge Computing Resources which was cooperative load balancing. Their main goal for edge computing was computing facility. It was with a low service blocking. It also involved slow latency. Computing resources in edge computing were limited. In that they suffered with its limitation. This enables cooperation between data centers. These data centers installed at the edge of the network. Cooperative load balancing occurred when one of them was not overloaded permanently. Request was transferred when one data center is full. It served through that information center as it was using its CPU cycles.

  Orsinia et al.[20] proposed the pervasive computing in mobile systems. Additionally, expectation of the respective application in mobile system has been enhanced. It has been found that mobile devices would be limited related to performance. There is always an issue of computation, storage & battery life while operating mobile device. That offers context adaptation for e.g. intermittent connectivity. Those have scalability, heterogeneity & security aspects. The solution to cover disadvantages is called computation offloading. Moreover, this research has considered the challenges in mobile cloud computing

III. METHODOLOGY

- We proposed a strategy to minimize the cost of virtual machine using multisite offloading for efficient load balancing technique for MCC.
- Then compared the proposed work use two different datacenter, Amazon EC2 and Microsoft Azure.
- First use ,Ant colony optimization(ACO) used for better cost of multisite offloading within deadline.
- Second use, greedy algorithm for comparison which is best ACO and greedy.
- The evaluation ACO is best on multisite offloading.

IV. TOOLS AND TECHNIQUES

The two methodologies Ant colony optimization and Greedy algorithm have been used in this research for cost optimization. The implementation of these algorithms has been made on following hardware and software platforms.

Hardware Requirements:
- Processor: Pentium Dual Core or Higher
- RAM: 4 GB or Higher
- Hard Disk: 160 GB or Higher

Software Requirements:
- Windows
- Matlab

V. PROPOSED WORK

According to proposed work the cost of cloud has been considered from AMAZON and Microsoft azure. Then the Ant colony optimization and greedy algorithm are applied on them. The best cost in both cases has been compared there after.

This equation minimize the cost

$$minimize\ cost = \left(\sum_{v\in V}\sum_{i=0}^{k} e_{v_i}\,\xi_{v_i} + \sum_{(u,v)\in E}\sum_{i=0}^{k}\sum_{j=0}^{k} e_{u_i v_j}\,\xi_{u_i}\,\xi_{v_j} \right) \quad ....(1)$$

$$\forall v : \sum_{i=0}^{k} \xi_{v_i} = 1$$

Here, e_{v_i} is energy cost of component, "v" is a component which needs to be executed on offloading q site, ξ_{v_i} is a decision variable, ξ_{u_i}, ξ_{v_j} is a variable indicating the different sites.

$$st.\ \sum_{v\in V}\sum_{i=0}^{k} t_{v_i}\,\xi_{v_i} + \sum_{(u,v)\in E}\sum_{i=0}^{k}\sum_{j=0}^{k} t_{u_i v_j}\,\xi_{u_i}\,\xi_{v_j} \le T_{delay} \qquad (2)$$

The equation (2) represents the constraint that the mobile application needs to be carried out within deadline, T_{delay}. Here, t_{v_i} is total time cost of component, v, if executed on site q_i, $t_{u_i v_j}$ is communication time spent on these edges.

- **PROCESS FLOW OF PROPOSED WORK**

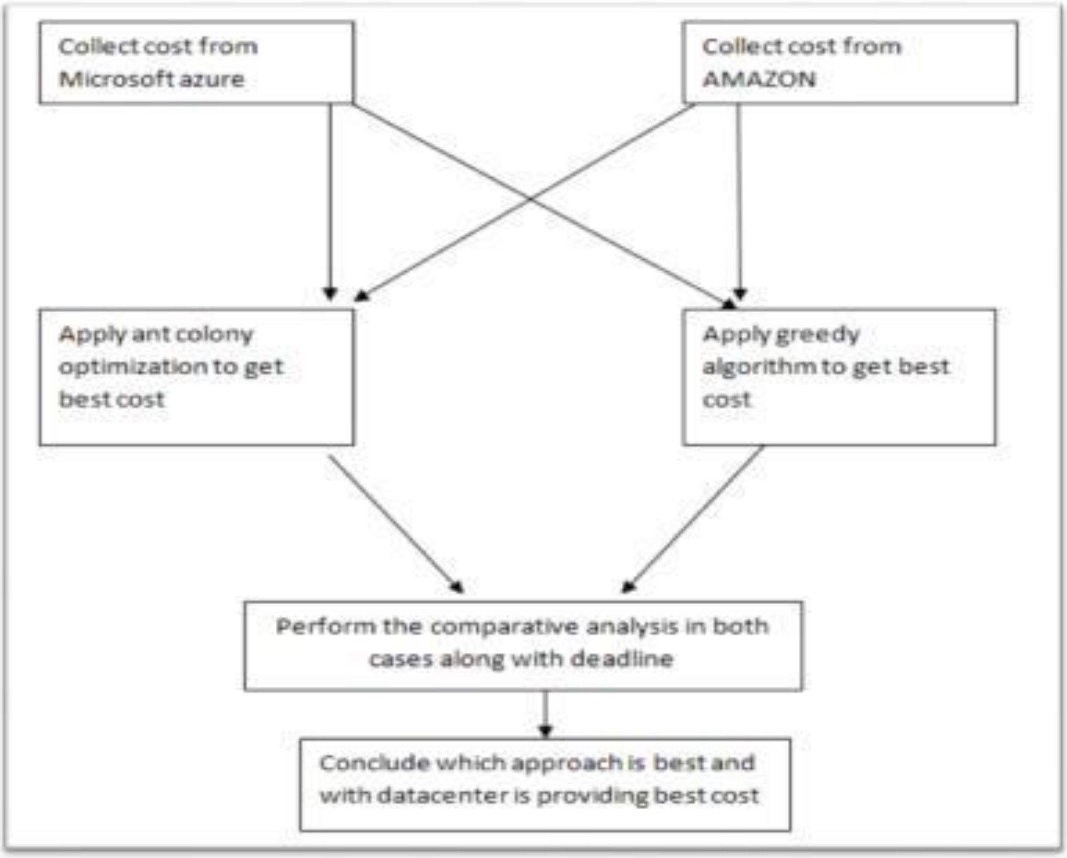

Fig 3 : Process flow of proposed work

VI. RESULT AND DISCUSSION

Fig 4. The collection of data of cloud cost from Amazon and Microsoft azure has been made and ant colony optimization is applied on it

ACO output

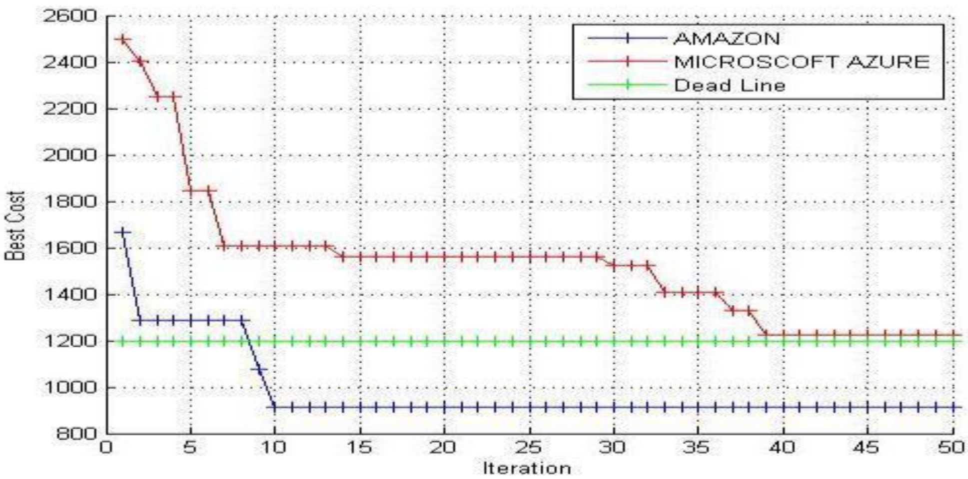

Fig 4: ACO Based comparison

COMPARISON RESULT BOTH AMAZON AND AZURE

Representing the cost of virtual machine in case of amazon and azure.

Amazon result

Fig 5 window is representing amazon result individually.

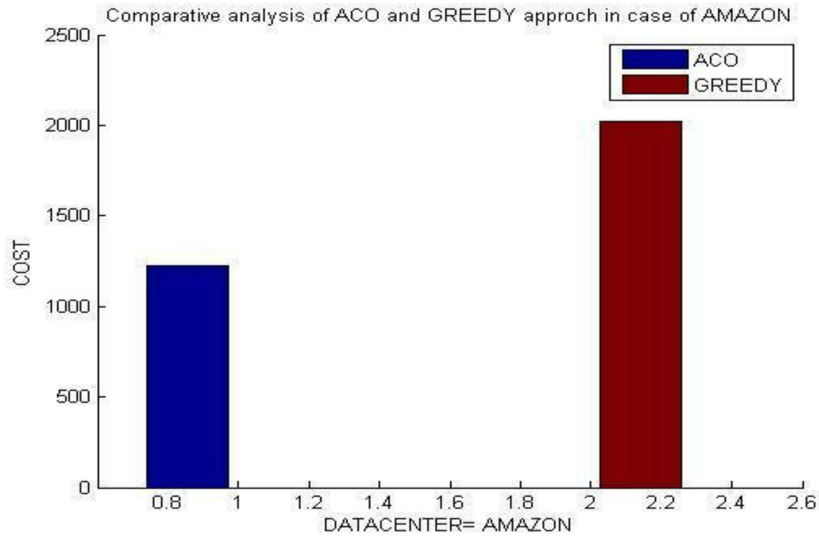

Fig 5: Amazon comparison using ACO AND GREEDY

Microsoft azure output

Fig 6 graph represents the comparative analysis of ACO and GREEDY in case of azure.

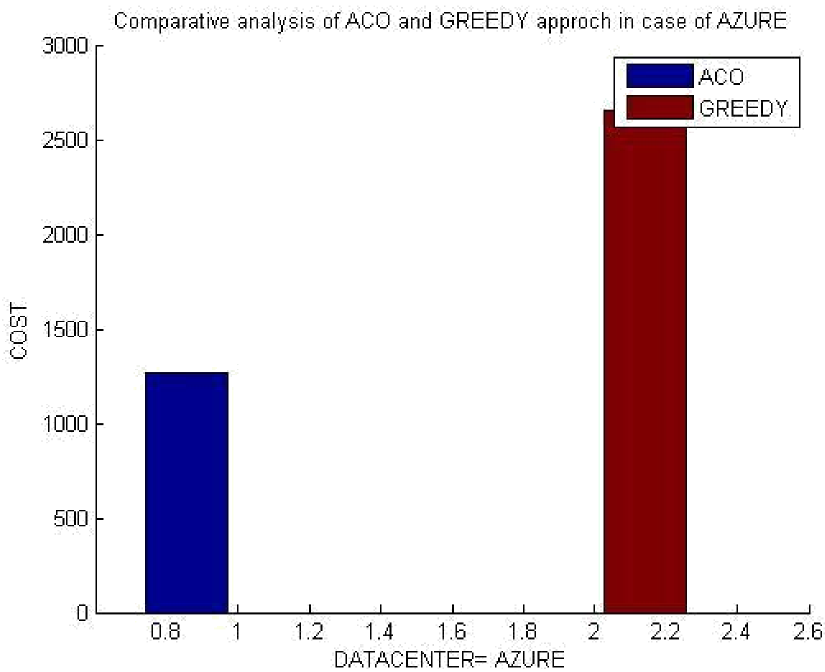

Fig 6: Azure comparison using ACO and GREEDY

VII. CONCLUSIONS AND FUTURE SCOPE

A lot of work has been carried on a single site offloading, but there is a need to carryout work on cost minimization on multisite offloading. In order to counter this issue a selection of best cloud datacenter has been done for best cost. The cost of data center has been optimized using two best cost finding mechanisms. The applied algorithms are ant colony optimization & greedy algorithm with deadline. Result shows that cost in case of Amazon is less as compared to Microsoft Azure. Such device would be beneficial in order to get optimized cost. In this research it has been concluded that ant colony optimization is best to find cost as compare to greedy approach.

VIII. FUTURE SCOPE OF RESEARCH

This work can be extended to the organization of the data center in the geographical reason. This would be required the knowledge base users location. Furthermore, this work can also be extended to balance the load in data centers. It would require changes in the VM initialization polices of the server.

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