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DYNAMIC LOAD BALANCING IN CLOUD AD-HOC NETWORK

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ABSTRACT

Cloud computing is a latest technology and it is also known as 'on-demand computing'. Cloud is introducing tremendous social, scientific, and business benefits. Because of its benefits, number of users of cloud is increasing day by day, so to serve their requests on the basis of pay per use cloud server performs an important task called scheduling. Due to number of tasks submitted to cloud and availability of number of resources to execute those tasks there arise a need to perform scheduling in cloud, which will improve cloud efficiency. Hence our project exploits concept of load balancing in cloud ad-hoc network. Submitter will submit the tasks through smartphone to cloud and cloud will schedule those tasks to available volunteers (Volunteers can be different devices for example computers, laptops, mobile phones etc.) depending upon their capabilities. For scheduling, cloud server uses K-means as clustering algorithm and Linear Programming as optimization algorithm. Due to this system executes number of tasks under time constraints given by submitter along with minimum cost. Depending upon the amount of data processed, cloud will pay the volunteers.

Keywords: Cloud Computing, Cloud Server, Cloud Scheduling, Linear Programming, K-Means.

1. INTRODUCTION

Smartphones have brought out a massive change in human's life. Smartphone plays a vital role in offering users a great platform for communication. Reason behind smartphones popularity among people is the applications they offer to the users, such as gaming, navigation, video editing, augmented reality, and speech recognition. Smartphones are becoming more prominent at the same time its capabilities (GPS, Wi-Fi, cameras, gigabytes of storage, and gigahertz-speed processors) are increasing. So to improve these capabilities developers are building more convoluted operations. Smartphones applications require more computational power and energy; also to keep pace with performance hardware upgradation is required. Hence there is a need to offload mobile application task to cloud [1].

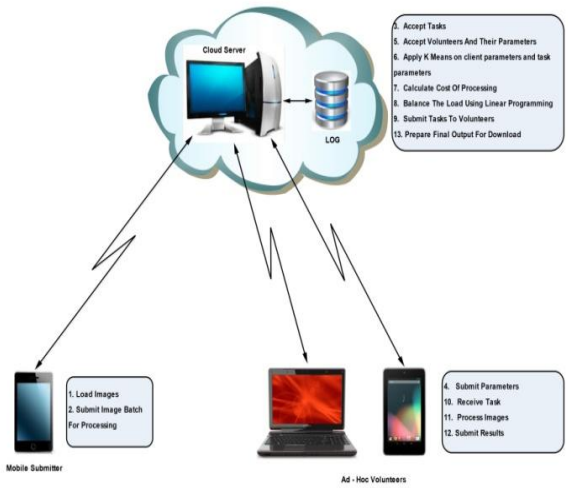

Fig 1: System Environment

Since number of users to cloud is increasing, scheduling is an important and most critical part of cloud [5][6]. Proper scheduling will lead to efficient use of resources in cloud environment. Hence cloud server will perform tasks scheduling to address issues and make proper utilization of resources, power saving and load balancing [2][5][8].

Considering issues of smartphones, in this paper we proposed the system where submitter (user) will submit batch of tasks (images for processing) to cloud server. Cloud server will schedule task optimally with minimum cost and time requirement using linear programming and K-means algorithm. Since security is one of the important aspects [4], we have adopted SHA1 algorithm at server side.

Remaining of this paper is arranged in following sequence. Section 2 provides some related work in the area of cloud task scheduling. Section 3 gives proposed architecture and description of algorithms used in this architecture. Then section 4 mentions conclusions. And finally section 5 states further possible enhancements to the proposed system.

II. RELATED WORK

Sokol Kosta, Andrius Aucinas, Pan Hui, Richard Mortier and Xinwen Zhang ThinkAir: Dynamic resource allocation and parallel execution in cloud for mobile code offloading. IEEE, 2012.

ThinkAir takes the best of MAUI and CloneCloud i.e. addresses lack of scalability and adopts online method-level offloading. Parallel execution can be exploited much more efficiently on the cloud than on smartphone. Divide-and conquer method is used, allowing sub-solution computation to be parallelized. But minimization of cost and time is not addressed [1].

Gaochao Xu, Jungie Pang and Xiaodong Fu A Load Balancing Model Based on Cloud Partitioning for the Public Cloud. Tsinghua Science and Technology, 2013 [2].

Public cloud is divided into several cloud partitions. Main controller is the cloud which chooses the suitable partitions for arriving jobs and the best load balancing strategy is choose by the balancer for each cloud partition.

Prabavathy.B Priya.k, Chitra Babu A load Balancing Algorithm for private Cloud Storage. IEEE, 2013.

Data placement, load rebalancing and data migration are the algorithms proposed to achieve load balancing in private cloud storage. Data placement receives the status of the storage cluster and the chunks; load rebalance is responsible for periodically checking whether the storage nodes are lightly or heavily loaded and data migration balance the load across the storage cluster. But minimization of time and cost is not addressed [3].

Rene Leistikow and Djamshid Tavangarian Secure picture Data Partitioning for cloud computing Services.IEEE, 2013.

Privacy and data security are main issues in Cloud Computing. Data can be sensitive data or non-sensitive data, sensitive data must be prevented. Hence using face recognition and stripping algorithms sensitive data remains with the cloud server [4].

Nitish Chopra, Sarbjeet Singh Deadline and Cost based Workflow Scheduling in Hybrid Cloud.IEEE,2013

Initially task is performed on private cloud, on shortage of resources public cloud is meet. Hybrid cloud is the merge of private and public cloud. The output must be achieved before the given deadline else the output would be of no use. Hence workflow scheduling for cost optimization within deadline in hybrid cloud is proposed [5].

Shivani Dubey, Vismay Jain, Shailendra Shrivastava An Innovative Approach for Scheduling of Tasks in Cloud Environment. IEEE, 2013.

This paper discusses task scheduling in cloud computing environment. The main focus of this work is to minimize the overall completion time for an application to execute in a heterogeneous environment by eliminating the communication cost between dependent tasks by assigning them to the same processor. The results are compared with Task duplication based scheduling Algorithm for Network of Heterogeneous systems (TANH) and the conclusion is that the proposed scheduling algorithm yield less completion time then TANH Algorithm. But the cost is not minimized [6].

Just-in-Time Code Offloading for Wearable Computing. Zixue Cheng, Peng Li, Junbo Wang, Song Guo.

In this paper, three layer Architecture has been proposed consisting of wearable devices, mobile devices and a cloud for code offloading. But again time and cost minimization is not addressed [7].

Since none of the above proposed paper minimizes the cost and time required for the overall execution we have adopted K-means and Linear Programming. Due to which our system will execute batches of tasks with minimum costs under time constraints given by submitter.

III. DESIGN GOAL AND ARCHITECTURE

3.1. K-Means Algorithm

K-means is the most common and simplest clustering algorithm. Clustering is the Classification of objects into different groups; these groups are known as clusters.

Data in each group or cluster share some common characteristics. K-means aims to partition n observations into k clusters in which each observation belongs to the nearest cluster.

Euclidean distance between observation and cluster centers is used to determine nearest center for given observation.

Algorithmic Steps:

Let X = {x1,x2,x3,……..,xn} be the set of data points and V = {v1,v2,…….,vk} be the set of centers.

1) Decide the value of k i.e. number of clusters.

2) Initially randomly select value for cluster centers.
3) Take each data point from given set (i.e. X) and compute Euclidean distance between data point and cluster centers.
4) Assign the data point to the cluster center whose distance from the cluster center is minimum of all the cluster centers.
5) Recalculate the new cluster centers by taking mean of values or data points in formed clusters, by using:

$$v_i = (1/c_i) \sum_{j=1}^{c_i} x_i$$

Where, 'c_i' represents the number of data points in i^{th} cluster.

6) Repeat from step 3) for new centers, if newly formed cluster is same as that of previously formed cluster then stop.

Advantages:

1) Fast, easy and simple to understand.
2) Works best when given data set are well separated.

Disadvantage:

1) Highly overlapping data cannot be handled.
2) For different representation of data it gives different results.
3) Euclidean distance is not much effective.
4) Random selection of center cannot lead to useful or effective solution.
5) Applicable only when mean is defined.

3.2. Linear Programming Algorithm

Linear programming is a technique used for a purpose to optimize objective function [8]. It is most widely used method of constrained optimization. Optimize means either maximize or minimize that particular objective function. For each objective function, some set of constraints are given. These constraints limit the value of x and y in objective function.

When we graph a given constraints, their solution space usually forms a closed region which is called as feasible region.

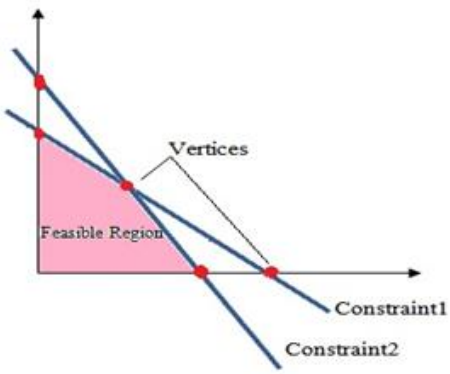

Fig 2: Linear Programming Graph

As we can see in above diagram, there is infinite number of points in feasible region, but it is impossible to decide which one optimizes the objective function.

However, linear programming says that maximum and minimum values of objective function will occur at (x, y) values that are one of the vertices (corner points shown in above diagram) of the feasible region, so we only have to calculate vertices and by putting those values of x and y in objective function we can decide which point optimizes objective function.

3.3. System Architecture

There are three main components in our proposed system:

1. Cloud Server
2. Task Submitter (client)
3. Volunteers

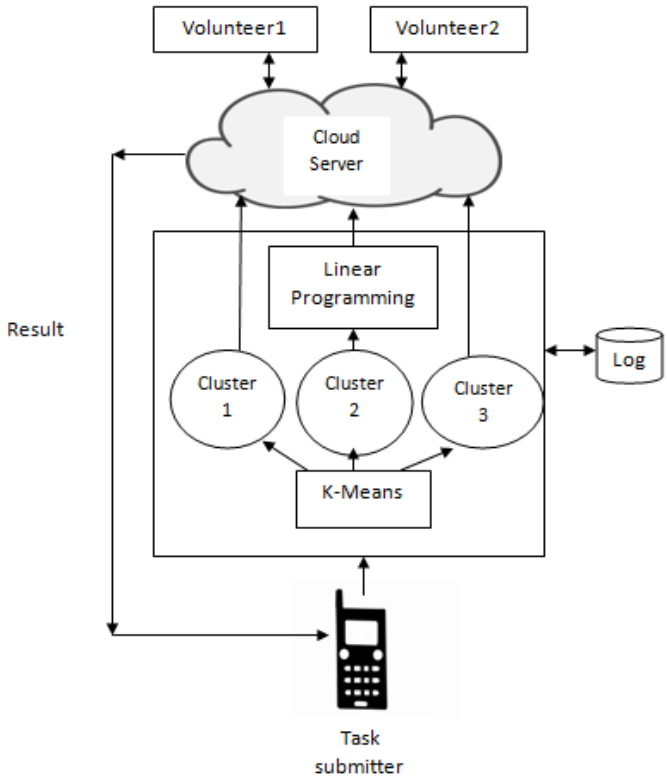

Fig 3: System Architecture

Initially task submitter (client) will submit a bunch of tasks (i.e. number of images) to cloud server.

On receiving images from client, server will schedule those tasks to volunteers, using K-means and linear programming algorithm since client can send images which may differ in various sizes, so scheduling plays an important role in improving cloud efficiency and processing images under time constraints. K-means algorithm will form three clusters, in which first cluster will consist of small size images and third cluster will consist of large size images and as second cluster contains mixed size images, linear programming algorithm will be performed on it to perform profit and to reduce time required.

Then volunteers will process tasks allocated by server and submit results to server. On the basis of amount of data processed by volunteers server will pay them. Now server will combine and arrange results received from volunteers and send those results to submitter (client).

IV. CONCLUSION

Load balancing arises as a need in cloud computing. Hence we have adopted a framework which will perform dynamic load balancing using K-means and linear programming algorithms. Along with that we have included various constraints i.e. cost and time optimization. SHA1 algorithm is used to allow access to authorized user.

V. FUTURE SCOPE

Reduction of cost under time constraint submitted by the submitter (client) has been adopted in our proposed system. Various parameters such as virtualization, adding more number of resources and use of public cloud can be considered for further improvement.

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