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DYNAMIC RESOURCE ALLOCATION USING PARTICLE SWARM OPTIMIZATION IN CLOUD COMPUTING

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Abstract: In Cloud computing, clients would like to pay fair price for the resources while providers would like to make profit for their services. The Cloud computing literature has been witnessing a lot of research efforts on resource virtualization, resource scheduling, data management and migration, security and many current on-going studies strive to provide seamless service to clients. The load balancing, resource pricing and scheduling are the main issues in cloud for both the provider and client. A Cloud Compute Commodity (C3) pricing architecture called CLABACUS (Cloud Abacus) to serve both parties. In Cloud computing, clients would like to pay fair price for the resources while providers would like to make profit for their services. The Cloud computing literature has been witnessing a lot of research efforts on resource virtualization, resource scheduling, data management and migration, security and many current on-going studies strive to provide seamless service to clients. The load balancing, resource pricing and scheduling are the main issues in cloud for both the provider and client.

Keywords: CLABACUS, Genetic algorithm, Particle Swarm Optimization,

1. INTRODUCTION

Cloud computing is a kind of Internet based computing. The cloud computing model allows to access information and computer resources from any user, anywhere if a network connection is available. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power. It is a model for enabling ubiquitous, on demand access to a shared pool of configurable computing resources. Examples of cloud services include online file storage, social networking sites, webmail and online business applications.

The heterogeneous services such as applications, servers and storage are delivered to an organization computer and devices through internet. It is called ubiquitous computing that can access anywhere anytime. The data stored in Cloud are simple to use and are paid for the usage and can be accessed over the internet. These services are provided as a service over a network and are accessible across computing technologies, operations and business models. Cloud enables the consumer technology to think effectively limitless, of minimal cost and reliable.

A pricing approach is becoming normal for sales and activity is comparatively rare in price. A systematic approach for pricing requires decision for an individual pricing situation should be generalized and codified into policy coverage of entire principal pricing problem. Policies should be tailored to various competitive situations.

1. Maximize profit
2. Earn target rate of return
3. Brings profit stability
4. Survive in a competitive field
5. Customers ability to pay

Discrepancy of the pricing may cause the consumer to purchase the product from another company. A consumer based pricing strategy can be advantageous because it goes inside the mind of intended consumer to predict the wiliness of consumer to pay for a product. Market research and attention to other elements of marketing mix help to determine the consumer ideal price.

Price strategy may be tied to the economic law of supply and demand. The law of supply and demand states that price should rise as demand for the product rises. The rise in price leads to a rise in profits and it allows the company to produce more products. The surplus product cause price to fall once more and the lower price lead to an increase in demand. Advantages of demand pricing include the ability to optimize prices using charts and mathematics that predict ideal prices. Demand pricing leads to revenue loss by failing to considering the production cost and consumer desired price.

2. RELATED WORK

The widespread use of cloud has made it realistic to upload and download data. Cloud pricing model and resource scheduling plays an important role while sending and receiving the data between provider and the client. Wassily Leontief et al. (2000) proposed a Dominant Resource Fairness Allocation of Multiple Resource types to extract the generalization of max-min fairness of multiple resource type by ensuring that every user is better, if resources are equally partitioned among them. Russell Shrieves et al. (2001) extracts the Current virtualization management tools for both commercial and academic to enable multiple virtual machines to consolidate few servers and other servers can be turned to save power.

Ramezanali mahdavinejad et al. (2007) provided the solution to a single processor job scheduling problem and solved by a heuristic algorithm based on the hybrid of priority dispatching rules according to an ant colony optimization algorithm. Young Choon Lee and Chen Wang (2010) calculate the cost of running data on cloud. The method investigates the performance cost tradeoff of different execution plans by measuring the execution time, amount of data transferred to cloud and amount of storage used.

Hyun Jin Moon et al. (2010) proposed a SaaS model transform the traditional license and allows customers to access applications over the Internet without software and hardware to guarantee Quality of Service (QoS) for customer satisfaction. Thomas Henzinger et al. (2010) focused on network file system designed for low bandwidth networks. LBFS consumes over an order of less bandwidth magnitude than traditional network file system. MassimoMaz zucco et al. (2011 analyzes available data from a sizable multipurpose cluster.

Bhanu Sharma et al. (2012) proposed a design to develop and simulate cloud resource pricing model satisfies the dynamic ability of model Financial option theory treat the cloud resources as underlying assets to capture the realistic value of cloud compute commodities to map cloud parameters with financial economic model.

Bhanu Sharma et al. (2015) proposed a genetic algorithm used for the natural selection of solution from the possible solutions to allocate the resources, but genetic algorithm takes more time to rank the workloads and resources. The above mentioned methods are not sufficient for pricing the data in cloud server. Particle Swarm Optimization algorithm is an efficient method to allocate resource for scheduling, load balancing and pricing schemes in cloud server.

3. GENETIC ALGORITHM

The Genetic algorithm is used to select the best heuristics technique for Resource Selection to Dynamic Workload Heuristics and it is represented as Chromosomes.

Key terms of the Genetic Process in the Best Cloudlet selection

Individual	- Any possible Solution	
Population	- Group of possible Solutions	
Search Space	- Group of possible Solution Chromosome	- Class of the individual
Genome	- Collection of Chromosome	

Initial population is the set of all the individuals and used in the Genetic Algorithm to find out the optimal solution. Every solution in population is called an individual. Every individual is represented as a chromosome to make it suitable for genetic operation. From the initial population the individuals are selected and some operations are applied to form next generation. The matching chromosomes are selected based on specific criteria. Initially many individual solutions are randomly generated to form an initial population and the size depends on the number of Workloads.

The Selection Process is based on roulette wheel principle an individual selection is based on the Fitness value. The probability of being selected is directly proportional to their fitness value. The fitness Representation based on Cloudlet Configuration and Workloads are used to index and rank the resources. Solutions are selected to form new offspring according to their fitness function. Single Work or task represents two individual cloudlets are taken to reproduce the offspring and it is mutated randomly.

Reproduction is carried out through crossover (single point Cross Over) and mutation to generate a new population based on the same characteristics of initial population. Two Individual cloudlet reproduce the offspring and it is mutated randomly. It produces more Chromosomes and heuristic to execute workload in resource.

Crossover operation can be achieved by selecting two parent individuals and then creating a new individual tree by alternating and reforming the parts of parents. Hybridization operation is a guiding process in genetic algorithm and it boosts the searching mechanism. The chromosomes are broken randomly to select crossover point.

Mutation is a genetic operator to introduce genetic diversity in population. Mutation takes place, if the population tends to become homogeneous due to repeated use of reproduction and crossover operation. It occurs

during evolution and mutation probability. It alters one or more gene values in chromosome from its initial state and produce new gene values added to the gene pool. The genetic algorithm produces the better solution.

Termination point of the iteration depends on the number of generation. Population of the individuals depends on the fitness level. Fitness value is used for termination condition and the number of individuals (Resources or Cloudlet generated as per the Task) generated by selection process and Cross over process.

Scheduling process in cloud can be generalized into three stages namely:

1. Resource discovering and filtering
2. Datacenter Broker discovers the resources present in the network system and collects status information related to them. Target resource is selected based on certain parameters of task and resource. The deciding stages are task submission and task submitted to resource selected.

Pricing Cloud Resources Algorithm

Get the input Cloud parameters
IC total=Compounded Moore (T, IC initial)
Kest=Compounded Moore (T, θ)
σest= Compounded Moore (Tres, θ)
Map Cloud parameters to option parameters
S<=IC total
K<=Kest
r<=rq
t<=T
σ<= σest

There are five parameters pertinent to pricing Cloud resources.

1. Capital Investment(IC) gives the Cloud service provider expenditure per year. For example, a service provider might buy a resource X, each year according to the Compound Moore's law for a given investment duration, the provider will reap more processing power at a constant price and the service provider will pay fewer amounts to buy the same resource X for next year with less amount in subsequent years. The time pricing resource for Client perspective is estimated initially to incur and install their resources.

2. Contract time (T) wants to lease the resources from the Cloud service provider. The client contract time relates to the actual use time of the resources for pricing.

3. Rate of depreciation (θ) at the infrastructure of service provider is expected to lose its value for both financial and technological. The pricing policies of service provider make profits on their initial investments before the clients no longer want to lease these resources. This information generally may not be available to the clients.

4. Quality of service (QoS) (rs). This is the quality assurance from service provider to the client. QOS includes turnaround time, accuracy of results, data privacy and contingency plans etc. QoS is the primary criterion for pricing the resource services between the provider and clients.

5. Age of resources (Tres). It represents the age of a particular resource and the service provider is leasing to the client. The start time of a particular task in a resource is conjunct with the age of the resource affect the price for the services.

The steps for Genetic algorithm are:

STEP 1: Create a login page for an admin.
STEP 2: Create a new user registration form.
STEP 3: Admin interact with the user and provide authentication to new user to upload and download the files.
STEP 4: The user uploads some files and details of files are stored in admin.
STEP 5: The Genetic algorithm is used in the existing system for scheduling and load balancing to allocate the resource.
STEP 6: Create VM to different Datacenter according to computational power of physical server in terms of cost, processing speed, memory and storage.
STEP 7: Allocate cloudlet length according to computational power.
STEP 8: VM Load Balancer maintain an index table.
STEP 9:Admin provides space to particular user and VM allocates the matching resource based on specific criteria.
STEP 10: User upload the file to the allocated space.
STEP 11: User types their secret key to download the file.

Here there is a long scheduling delay for dynamic workloads. Service capacity Management power reduces resource Scheduling process and machine lifetime.

4. PARTICLE SWARM OPTIMIZATION ALGORITHM FOR PRICING CLOUD DATA

The HSS problem can be formulated by using an M x N machine-part incidence matrix, A = [aij], where aij is a binary variable that takes the value of 1 if part j requires searching on mobile sensor i, and 0 otherwise. The problem is equivalent to decomposing A into a number of transverse blocks of sub matrices, where each diagonal block represents a mobile node. The effectiveness of the decomposition can be determined by a normalised bond energy measure denoted as α in

$$\alpha = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N-1} a_{ij}\, a_{i,j+1} + \sum_{i=1}^{M-1}\sum_{j=1}^{N} a_{ij} a_{i+1,j}}{\sum_{i}^{M}\sum_{j}^{N} a_{ij}}$$

The objective is to provide bond energy for searching and provides quality of communication within the nodes, so as to maximize the energy measure of the frequency matrix. In the next section, a new method to solve the HSS optimization trouble is described.

The new method adopts the Bees Algorithm as it has proved to have a more robust performance than further intelligent optimization method for a range of complex problems.

The PSO algorithm works simultaneously to maintain several candidate solutions in the search space. The candidate solution is evaluated by objective function being optimized to determine the fitness of solution in each iteration. The individual best fitness value is achieved during the operation of the algorithm.

The PSO algorithm maintains the global best fitness value achieved among all particles in the swarm and the candidate solution is achieved the fitness through global best position or global best candidate solution. The PSO performance measures such as utilization, speedup, and efficiency.

New velocity

Vi(k+1)=vi(k)+ γ1i(pi-xi(k))+ γ2i(G-xi(k)) Eq (1)

New position

Xi (k+1)=xi(k)+vi(k+1) Eq (2)

i=particle index

k - discrete time index

vi - velocity of ith particle

xi - position of ith particle

Pi - best position found by ith particle (personal best)

G - best position found by swarm (global best, best of personal bests)

g(1,2)i - random numbers on interval [0,1] applied to ith particle

PSO learned from the scenario and used it to solve the optimization problems. In PSO, each single solution is a search space. All particles have fitness values and fitness function evaluation to be optimized; velocities direct the flying of the particles. The particles fly through the problem space by following the current particles. The Figure 1 represents fitness through individual best position or individual best candidate solution.

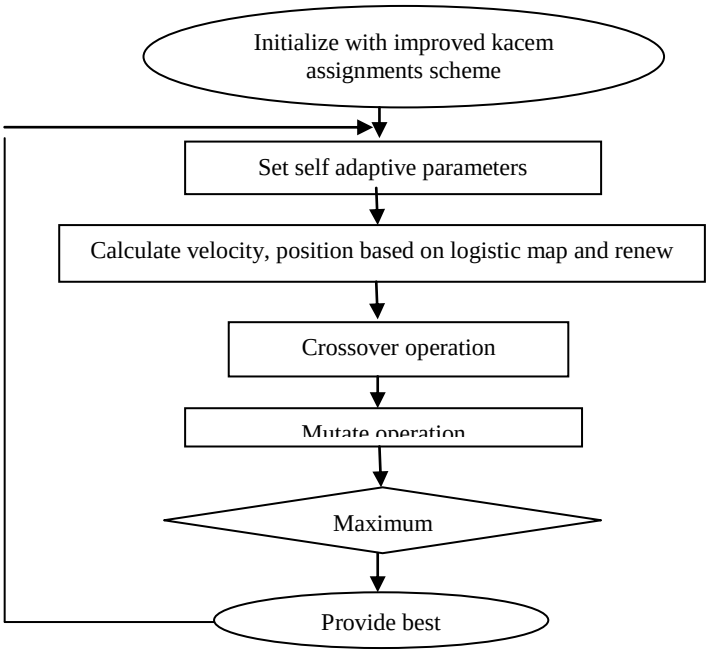

Figure 1. Flow chart of PSO algorithm

PSO is initialized with a group of random particles solutions searching for optima by updating generations. In every iteration, each particle is updated by following two best values. The first one is the best solution has achieved. This value is called pbest. The best value is tracked by particle swarm optimizer to obtain particle in the population. This best value is a global best and called gbest.

The pseudo code of the PSO algorithm is given below:

STEP 1: Fitness function f(x) x=(x1 x2 ...xD)).

STEP 2: The constant parameters are c1, c2, and w - inertia weight, number of maximum generation M.

STEP 3: For each particle, initialize particle position and velocity.

STEP 4: For each particle (a) Compute fitness value;

(b) If the fitness value is better than the best fitness value (pbest) in history then set current value as the new pbest.

STEP 5: Find the particle with best fitness value among the entire particles and set it as gbest.

STEP 6: (a) Compute the particle velocity by utilizing (1).

(b) Update particle position according to (2).

STEP 7: WHILE maximum generation or minimum tolerance criteria are not attained.

The benefits of Particle Swarm Optimization algorithm are

1. Cost Effective model for data Provisioning and Energy Management.
2. Scheduling Delay is low.
3. Resource Wastage is less.
4. Dynamic Resource Provisioning in CPU and Memory Intensive Process.

5. IMPLEMENTATION AND RESULTS

The purpose of system implementation is to make the search efficiency in cloud environment. The implementation is used to allocate resources for the customer with moderate price. The Particle Swarm Optimization algorithm is to balance the price allocation between client and provider. The system implementation is to allocate the space with moderate price to sacrifices the needs of both parties.

The logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language is used to create a database. The Table 1 shows the new member register for users.

Name	User name	Pass word	E-mail id	Data type	Server name	Encryption key
Guest	Guest	guest	guest@gmail.com	100 KB	Partition 2	23435d
Shanmu	Shanmu	manik	mani@gmail.com	1GB	Partition 3	1556230
vaidi	Vaitheki	vaitheki	Vaidi72@gmail.com	3GB	Partition 2	daa6af
Pavithra	Pavithra	Pavi	Pavi22@gmail.com	5GB	Partition 3	1894f7d

Table 1 Member Registration

The Table 2 shows the upload file consist of filename, upload date and length.

File name	Upload date	LENGTH
Document 1	**2016-3-15**	**10**
Img 20156 was.jpg	**2016-3-17**	**10**
Data	**2016-3-20**	**20**
Document 2	**2016-3-23**	**25**
File	**2016-3-25**	**500**

Table 2 Upload File

The Figure 2 represents the new user registration details and database administrator.

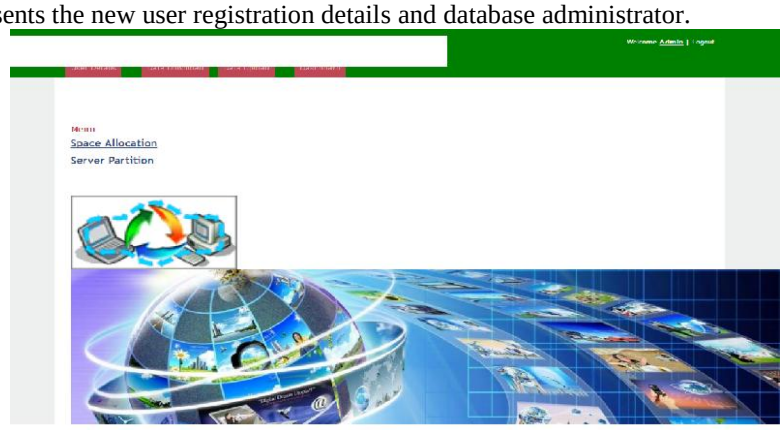

Figure 2. Admin login

The Figure 2. represents administrator to allocate the space for user to upload a file.

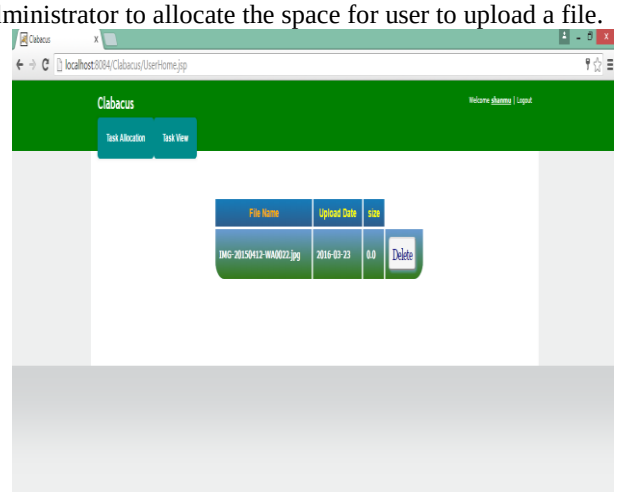

Figure 2. Space allocation

The Figure 3. Shows the performance ratio of uploaded files.

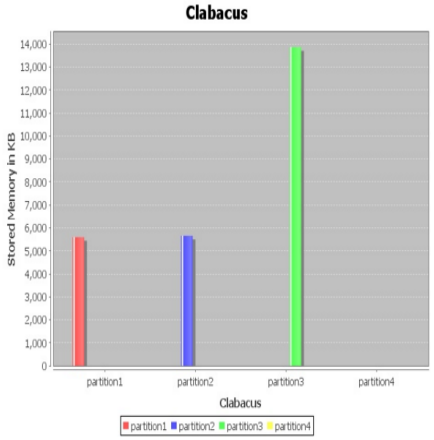

Figure 3. Performance ratio

CONCLUSION AND FUTURE SCOPE

The design and implementation of a Dynamic capacity provisioning is based on consideration of machine and task heterogeneity for reducing price consumption in cloud data centers. In existing work, a key challenge is the heterogeneity of workloads and physical machines. To design a characterization of workload and machine heterogeneity resource, the genetic algorithm is used as heterogeneity aware framework dynamically adjusts the number of machines to strike a balance between pricing and scheduling delay. The performance of Particle Swarm Optimization is to save large amount of space and cost, but the execution speed is low because the VM allocates the resource randomly in the surrounding areas.

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