Modified Cloud Service Broker Policy Using Hybrid Optimization Technique

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Abstract- *Cloud Federation is the place where cloud service providers can gather to share their resources and the cloud service consumers can buy those resources. The federation is either handled by one of the cloud service provider or a third party known as cloud service broker. The broker is solely responsible for providing services to the cloud consumers which are leased by cloud service providers. On-demand resource provisioning makes cloud computing a cutting edge technology. All cloud service providers offer computing resources with their own interface type, instance type, and pricing policy, among other service features. A cloud-based service broker provides intermediation to seek appropriate service providers in terms a suitable trade-off between price and performance. On the other hand, load balancing among cloud resources ensures efficient use of a physical infrastructure, and at the same time, minimizes execution time. This makes service brokers and load balancing among the most important issues in cloud computing systems. This thesis presents a set of novel market and economics-inspired policies, mechanisms, algorithms, and software designed to address the profit maximization problem of cloud providers.*
This thesis models and evaluates how the providers can manage the incoming request to changing environments for higher outcomes by means of a new brokering policy. This thesis defines and evaluates a brokering policies method that enforces providers to consider the impact of their decisions in the long term.

Keywords- Cloud Computing, Brokering Policy, Resource sharing, Availability, Cloud Analyst, Cloud Service Broker.

I. INTRODUCTION

A cloud broker aims at building a secure cloud management model in order to ease the delivery of cloud services to cloud clients; while it presents them the services a cloud provider can offer [1]. It mediates between clients, such as SMEs or larger scale businesses, and providers, by buying resources from providers and sub-leasing them to clients [2]. It is an entity that manages the use, performance and delivery of cloud services, and negotiates relationships between cloud providers and consumers [3]. Cloud broker plays a dual role in the context of cloud computing. When it interacts with a provider, acts as a client and it behave as a provider when interacting with a customer [4]. Cloud brokers are considered to be the key for managing hybrid IT environments [5]. Enterprises, brokers and providers agree at a Service Level Agreement (SLA) that specifies the details of the service, according to their requirements.

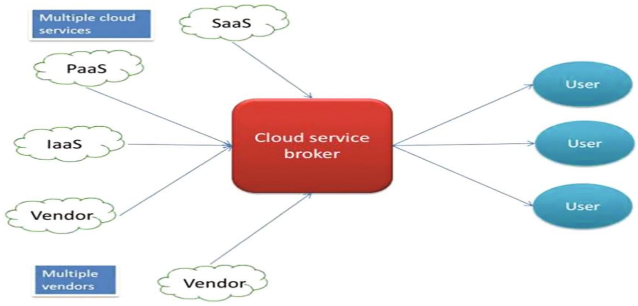

Figure 1.1: Cloud service broker model.

1.2 Cloud Broker Benefits: Businesses usually face difficulties in choosing the best provider based on service cost and other specified requirements, mainly due to lack of knowledge and time. It is also hard for clients to select services offered directly by providers, because there are no standards that can measure performance of different service providers. Every provider has its own standards, which are not necessarily widely acceptable [2]. Thus, they grant the authorization to a broker to decide on behalf of them [6]. The benefit of cloud broker for an enterprise can be realized by assisting a provider to choose the best framework, so that an enterprise can focus on its core business rather than being concerned about task deployment strategies, meeting its functional or non-functional requirements. Cloud broker offers not only the best provider but also integrates disparate services across multiple hybrid approaches. Furthermore, it helps providers adapt directly to market conditions and offer more efficient services [6]. It pioneers the integration of the entire cloud ecosystem, connecting hardware players such as IBM, HP, Dell; software players such as Microsoft, Citrix; PaaS, IaaS, SaaS providers such as Google, SalesForce, Amazon, and Rackspace, among many other prominent players in the IT and Telecom industry [7].

Cloud broker is a trusted and reliable advisor for businesses, as organizations mistakenly think that the choice of cloud services is similar to the selection of web services. However, this choice is in fact different, because there is no standardized representation of cloud providers' properties. The broker is bound to provide the guaranteed resources [2] and it also forms Service Level Agreements with the providers because the SLAs of the providers often vary in format and content, causing confusion to the non-aware clients. The model of cloud broker also provides budget guidance to businesses and assists them to adopt a cost effective solution, satisfying budget requirements. It usually achieves better discounts, reduces capital costs and accesses more information from providers. Some of the world's largest technology companies offer cloud services, including Google, Amazon and Microsoft. Since cloud providers deliver many services it is almost impossible to manage each customer individually, therefore providers need the intermediate cloud broker in order to promote their services to the clients [8]. They cooperate with independent cloud brokers in order to empower their relationship with enterprise customers, because customers seek for credible brokers [9].

There are numerous disadvantages in the current techniques for secured stockpiling in cloud computing which are clarified as takes after.

1. Issues identified with expense and variance of expense at various times makes it unsatisfactory for clients.
2. It is conceivable to demonstrate its execution just by the use of certain infections and henceforth there are no overhauled forms to adapt it.
3. Absences of various assortment of pay and utilize technique for service picking furthermore absence of reasonable region for finding the proper region for cloud the service.
4. Inability to permit the other party examiner to use the information without client's opportunity and models. Existence of security issues are there. Every one of these issues can be corrected by utilizing our proposed strategy.

The organizations which rend services from cloud providers are facing problem with low quality of service. How these organizations can choose better cloud providers among multiple cloud providers. In this context, the better cloud provider means the providers who will provide acceptable level of quality of service with respect to bandwidth, availability, and security etc. We need a cloud Service Broker who can select the best Cloud service providers to satisfy the requested organizational needs. Most of the reviewed approaches in this thesis considered a cloud computing architecture which consists of three common entities. Those are Cloud Service Requester (CSR), Cloud Service Provider (CSP) and Cloud service Broker (CSB). The responsibility of each entity is as follows:

Cloud User (CU): Those who want to access cloud for different applications. The requester may be an individual or an organization. For example if an organization needs some resources then instead of buying those resources the organization will take resource from the cloud on pay per use basis. The requirements of the requester have to be specified in a proper manner.

Cloud Service Provider (CSP): Those who will provide services to the requesters. There are different cloud service providers in the market who offer different services at different prices. The provider has to specify the available services along with the conditions.

Cloud Service Broker (CSB): Broker is an Agent who acts as a mediator between Cloud Service Requester and Cloud Service Provider. The Broker is responsible for accepting requests from CSR, searching for suitable providers by mapping the requester requirements with the provider offering services, allowing the requester and provider to communicate through a secured interface and manage the total process.

II. LITERATURE SURVEY

2.1 Architecture of Brokers for Heterogeneous Cloud Resource Management: According to Gartner, cloud service brokers (CSBs as shown in Figure 1.6) are one of the top 10 strategic technology trends in 2014 [10]. There are many companies to serve CSBs and their roles are mainly selecting the best services of multiple clouds, adding monitoring services and managing metadata services, and providing Software-as-a-Service (SaaS). Liu et al. [11] classified these services as three forms: service intermediation to improve services by adding new value-added features, service aggregation to combine and integrate services into new services, and service arbitrage to arbitrage and aggregate service with not fixed services. In addition, there are many variations of those. A reservation-based cloud service broker (R-CSB) [12] executes applications on behalf of CSCs (Cloud Service Customer) or provides SaaS using VMs leased from CSPs (Cloud Service Provider). A profit of the R-CSB is made by an arbitrage between CSCs and CSPs, and service fees from CSCs. To increase the profit, the VM leasing cost of the R-CSB should decrease and we solve it via cost-effective VM reservation and allocation. The VM reservation is based on the following facts. The resources provided by CSPs are generally divided by OVMs (On-demand Virtual Machine) and RVMs (Reserved Virtual Machine). The OVMs and the RVMs refers to VMs which are leased in comparatively short BTUs (Billing Time Units, e.g. an hour) and long BTUs (e.g. a month, a year), respectively. Prices of RVMs per unit time is set to be cheaper than those of OVMs and the VM reservation can reduce the VM leasing cost. However, because BTUs of RVMs are much longer than those of OVMs, the VM leasing cost can rather increase if utilizations of the RVMs are low. Therefore, the R-CSB should lease an appropriate number of RVMs. Moreover, the VM allocation decreases the VM leasing cost via increasing average VM utilization. Generally, demands vary by time. If the number of leased RVMs is greater than or equal to the current demand, it is sufficient to allocate applications to them and the OVM leasing cost is not imposed. Otherwise, an additional OVM should be leased to allocate the application. Therefore, increasing average VM utilization decreases the number of OVMs and results in decrease of the VM leasing cost.

A VM reservation module is to determine the number of RVMs to be leased by time. The VM reservation strategizing in the VM reservation module is designed to perform based on demand monitoring and prediction. RVMs leased by the VM reservation module and OVMs additionally leased are managed in a VM pool management module and used to allocate applications. We divide the VM pool into two kinds: VM pools which contain VMs whose status are idle (an idle VM pool) and VMs on which the applications are executed (an active VM pool). For application execution requests of CSCs via a user interface, the R-CSB parses the application execution requests and profiles the applications if the profiling isn't done before. The applications are scheduled and allocated to appropriate VMs in the idle VM pool and VM scaling is performed if it is empty. Then, the application execution module starts to execute the applications via a cloud interface.

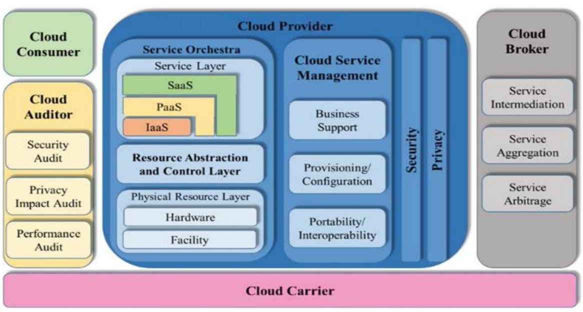

Figure 2.1 A conceptual reference model of cloud service brokers in NIST [13].

2.2 Cloud Brokering Open Challenges:

The computer science community enthusiastically welcomed the concept of cloud brokering. In the same way that it has created many business opportunities, cloud brokering has contributed new problems and challenges to investigate and solve. Cloud brokering research focuses on the development of brokering and multicloud platforms, and on the optimization of the offer presented by the broker to its customers. From the resource allocation perspective, a CSB can act as an intermediary in the process of workload submission. From this perspective, cloud brokering is the process of matching service requests from multiple users to the offers of multiple clouds. The type and granularity of requests depend on the cloud delivery model (for example, applications for SaaS or virtualized resources for IaaS). This approach can further extend the responsibilities of CSBs, which might need to ensure interoperability between clouds [14].

The first challenge to be addressed by the research community is to create a framework that could practically exploit a wide range of cloud services. Such frameworks could be based on a toolkit (for example, Optimis [15]), middleware (such as mOSAIC [16]), or even an open source cloud broker and facilitate the use of multiple clouds by users. With the support of such solutions, CSBs can focus on their core business—that is, supporting the relationships between CSPs and CSCs. CSB resource management problems are combinatorial problems related to the mapping problem. The price of the resource allocation is the first objective, but quality-of-service (QoS) objectives (such as response time and user satisfaction) are also important. Keeping in mind additional user requirements, such as security, reliability, and privacy, we can conclude that the problem is multiobjective. The CSB problems are typically NP-hard, similar to the mapping or bin-packing problems. As a result, they can't be optimally solved in a reasonable amount of time. In the simplified case of IaaS, where CSPs feature standard infrastructures and theoretically have no limit on used resources from the users' perspective, the CSB's problem consists of selecting a CSP and a virtual machine type for each user task. Such a problem is relatively simple when only a single objective is considered, but realistic scenarios often require more. Valid and good quality solutions can be found by tools such as evolutionary computation, including genetic algorithms, simulated annealing, and particle swarm optimization. During a stochastic process, candidate solutions are modified. The selective pressure of the environment, driven by the objective function, leads to convergence toward the best solution. To perform evolutionary computation, it's necessary to provide a common encoding of a solution. In practice for the mapping problem, a candidate solution is encoded as a vector. Each position of the vector corresponds to tasks. The value of each position determines the selected virtual machine type [17]. An alternative approach to solving NP-hard problems is to use problem-specific heuristics [18].

Another line of research focuses on the brokering market environment. In these works, the different actors in a brokering scenario are modeled as agents [19]. The optimization of the brokering is achieved by negotiations between agents [20] and auctions among vendors to offer the best price. Agent models can be interesting for CSBs, as they inherently include distribution of control and market theory or game theory elements, such as models of rationality and iterative decision making. An important area of research is multiagent organizations, in particular the direction of dynamic and online reorganization, which is necessary in real-life CSB environments. The state-of-the-art research addresses many challenges that aren't yet implemented in industrial and commercial solutions. On the other hand, researchers often neglect particularities of real problems, which can require further specialization and additional efforts at the implementation level.

2.3 Existing mechanism: Since the main goal of the service brokers is to direct the user requests to the best DC with optimal performance, the service broker policy has to efficiently select the best data center for the job considering many factors such as time, cost, and availability. Based on existing three different broker algorithms that are proximity-based routing, performance optimized routing and dynamically reconfiguring routing. The Proximity-based routing selects the closest region depending upon the least network latency and from that region it selects the data center randomly. However, this policy has many limitations that affect the response time and may lead to overwhelm a certain data center.

Many researchers aim to overcome these problems. For instance, Instead the random selection of the data center Kapgate [21] proposed round robin algorithm, this approach improve the resource utilization by selecting DC among all DCs available in single region in round robin manner. However, since the processing speed of DCs may vary, this approach may lead to resource starvation by chosen the fast DCs more often than slow DCs.

Mishra et al [22] in his work similarly used the round robin algorithm instead of random selection but with considering the DC priority, he presented a priority-based round-robin service broker algorithm that distributes requests depending on the DC priority, which enhances the performance comparing to original random selection. Other works focus on improve the cost in the current policy like Limbani et al [23] that present approach that focus on the cost, they modify the proximity-based routing policy to select the low-cost DC it considers VM cost alone) if the region contain more than one DC. This policy is efficient in selecting the lowest cost data center, but it has no consideration for other important factors such as the response time, the workload and the bandwidth.

Chudasama et al [24] in his work similarly presented policy that lower the cost by modifying proximity-based routing policy to select the DC that having less cost if more than one DC located in same region, this approach has good impact on the cost but the response time and load balance still giving poor results, So in order to reduce the response time and the overall load on DC, Kapgate [25] implemented a predictive service broker algorithm based on the weighted moving average forecast model. Sunny et al [26] proposed weight-based algorithm to remove the random selection, the weights assigned to each DC depending on the physical characteristics of the data center. This policy helps to distribute the load appropriately among the DCs, the response time was improved comparing to the proximity based policy, but this improvement was not so sufficient. Sarfaraz et al [27] to avoid overloading certain DC showed proximity-based routing policy that rout the traffics to the neighbouring DCs in the same region, but this routing was not considering the physical characteristics of the data centers, which may affect the response time. Vibhavari et al [28] describes policy that eliminates the sequential selection of inter region data center with improvement in overall performance and the data center with less number of users is selected when network latency is same for all data centers. Semwal et al [29], proposed a new policy to select the data center with the highest configuration. The main goal of this policy is to optimize the response time.

From the routing of the user requests it is quite evitable that many of the issues arise while: Selecting the appropriate data center: And this is the responsibility of the broker policy, we have multiple polices that have major effect on the performance. Choosing appropriate data center by applying appropriate broker policy is an important step toward providing better performance. Presenting appropriate broker algorithm is the work of research. Selecting appropriate VM: After selecting the data center it's important to select appropriate VM, this selection will affect directly the load balance within the data center. Various load-balancing techniques are present and proposed to enhance the cloud performance. The problems may arise from applying some broker policy that may route all the requests to only one data center. As a result, only one data center is highly loaded and others are not. The situation may arise that all the requests may go to only one data center. As a result, only one data center is highly loaded and others are not. This scenario may happened if the used policy was proximity based policy that route the user request to the closet data center, but if there are more than one Data center in the same region, the request directed to a random data center.

A. Service Proximity Based policy: In order to explore the limitation of this algorithm we will present how it's work, the following steps show how Service Proximity Based handle the user request:

1) Service Proximity Service Broker maintains an index table of all Data Centers indexed by their region.
2) When the user request is received the Service Proximity Service broker retrieves the sender geographical region and queries for the region proximity list for that region from the Internet Characteristics.
3) The broker then route the sender request to the first earliest/highest region in the proximity list. If more than one data center is located in a region, one is selected randomly.

B. Service Proximity Based Drawbacks: The main problem with service proximity-based routing is the random selection of data center when there are more than one data centers present in a particular region with low latency; the results are different even though configurations are kept same. In addition, there is a high probability that the resources that are present are not utilized to their deliverable capability. Also it is possible that the selected data center will increase the response time or might have higher workload or may be of greater cost as compared to those available in same region. The aim of this study is to remove the random selection of the data center if there is more than one data center in the same region, because this random selection is the major problem that leads to all drawbacks.

III. PROPOSED SYSTEM

3.1 Proposed System

There are a lot of resources available in data centres of cloud for providing services to user requests. User requests are generated from various user bases. Cloud service broker is responsible for selecting appropriate data centre for providing service to a request. Efficient service broker policy is required for reducing response time and increasing efficiency. Proposed system develops a new method that uses cuckoo search inside ant colony optimization. Proposed system reduces time taken in local search as compare to ant colony optimization. Proposed system overcomes the drawback of ant colony optimization has by using cuckoo search, that is in ant colony optimization ant moves in the random direction for search of food source around the colony. Pheromone is deposited along the path. While trying to solve the optimization problems it lures the ants and hence to perform the local search time taken is considerably more.

3.2 Proposed Method

Step 1: Initialization
Heuristic information, pheromone trails, number of nests, random initial solution.
Step 2: Iterative loops
Starting jobs are determined by the colony of the ants,
For each and every ant schedule is constructed.
Step 3: Repeat
For next processing job to execute apply the transition rule.
Complete schedule is constructed for every ant.
Step 4: Statement
Till the complete schedule being constructed do the following,
Cuckoo search is processed for local searching.
Trail of Pheromone is updated.
Process global updation rule.
Step 5: Termination
If non-local search, local search and pheromone updation completed.
Termination the process,
Else
go to step 4.

Local search function (Cuckoo search)

Step 1: **Initialization**
Initialization of nests and random initial solution.
Step 2: **Evaluation**
Get the current best nest.
Step 3: **Loop construction**
While (fmin > Max generation)
Get the cuckoo value by random walk, if not replace it by Levy's flights.
Step 4: **Evaluation**
Evaluate the quality fitness .
Randomly choose nest among n, say j.
Step 5: Condition
If(Fn_i>Fn_j)
Replace j value by new solution.
End
Step 6: **Solution construction**
Retain the best solution and nests.
Rank the solution and nests to choose the best.
Pass to next generation.
End while, else go to step 2.
The Flowchart of the proposed algorithm is shown below:

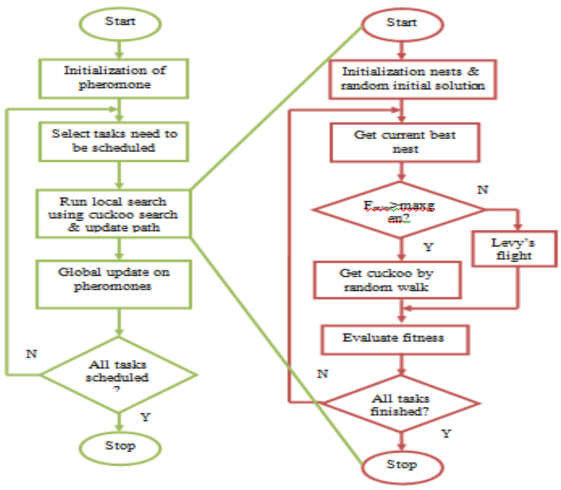

Fig 3.4: Flowchart of proposed algorithm

IV. PERFORMANCE EVALUATION

Performance of proposed method will be evaluated on the basis of following parameters:

- Overall response time
- CSP processing time

Performance has been tested for 5 CSP, 25 users & 8 CSP, 25 users. Configuration of simulator remains same in all cases. Table below shows the performance evaluation of **average overall response time (in ms)** for CDC, RDL & proposed method.

Configuration	Service Broker Methods		
	CDC	RDL	Proposed
CSP-5, CU-25	72.72	78.04	**74.24**
CSP-8, CU-25	51.08	52.95	**50.18**

Table4.1: Performance according to average response time.

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