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Profit Maximization for Cloud Broker in Cloud Computing

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Abstract— Today's world cloud computing becoming so popular because of an effective and efficient way to provide computing resources and services to customers on demand. Cloud computing being an information technology paradigm enables access to shared pools of configurable system resources and higher-level services often over the Internet. The objective of providers is to maximize profits by their price schemes, while the main purpose of clients is to have quality of services for a reasonable price. Thus the vital aim is to maximize the profit for service providers get quality of service at best price for the client. Because of cloud computing development, choosing cloud services can be complicated time-consuming for customers. To facilitate cloud service delivery, the authors propose a cloud service broker who provides automated selection of suitable cloud services, assure the best performance, reliability, cost efficiency.

Keywords— Cloud Computing, Cloud Broker, Quality of Service, Efficiency, Reliability, Profit Maximization.

I. INTRODUCTION

There is no universal definition of cloud computing. However as far as our research is concerned, the most apt definition of cloud computing can be quoted as: "computing as a utility". In our day to day life the most common utilities are electricity, water, gas, heat, postpaid mobile services etc. Similarly in cloud computing, computing resources (like CPU, memory, storage, network domains, virtual desktop) are rented to users based on their demand. From user's viewpoint, it eliminates the need of an upfront investment as an user can pay based on the amount of resources it has used. This is termed as "pay-per-use" or "pay-as-you-go" model. Therefore, resource scaling is the most fundamental aspect of cloud.

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The cloud service broker, which simplifies, consults on, and accelerates the adoption of cloud services, represents the middleware between customers and CSPs. As a third party, the cloud service broker needs to purchase cloud services from multiple CSPs and then resell them to customers on the basis of the customers' requirements. Therefore, the cloud service broker assists customers in the selection of cloud services by helping them to evaluate, select, and compare cloud service solutions. With the employment of a cloud service broker, customers no longer need to pick among multiple CSPs. Instead, they just exposure their demand information to the cloud service broker, and the cloud service broker provides the most suitable approach for each customer. Hence, customers and CSPs do not have to contact each other directly, and the cloud service broker can be used to manage the efficient work of multiple clouds.

II. RELATED WORK

Literature survey is the most important step in any kind of research. Before start developing we need to study the previous papers of our domain which we are working and on the basis of study we can predict or generate the drawback and start working with the reference of previous papers.

In this section, we briefly review the related work on Profit maximization of cloud broker and their different techniques.

In this paper, the author presented a revenue management framework to tackle the problem of optimal capacity control for allocating resources to customers. The main challenge is that the provider must find an optimal capacity to admit demands from the reservation market such that the expected revenue is maximized. The future direction of this work involves the extension of the revenue management framework with overbooking strategies.[1]

This paper shows what cloud computing is, the various cloud models, and the architecture of cloud computing. This research will define the security risk and challenges occurred in these technologies. Various issues defined in this projects like: Platform Management, Data Encryption, Interoperability, Cloud Data Management and security, SLA (Service Level Agreement) and so on. Limitation: Security is one of the major issues which hamper the growth of cloud. [2]

This paper presents a review on the cloud computing concepts as well as security issues inherent within the context of cloud computing and cloud infrastructure. Location transparency is one of the prominent flexibilities for cloud computing, which is a security threat at the same time – without knowing the specific location of data storage, the provision of data protection act for some region might be severely affected and violated. Trust is another problem which raises security concerns to use cloud service for the reason that it is directly related to the credibility and authenticity of the cloud service providers. [3]

The paper aims to provide an overview of CSB research status, and give suggestions on how CSB research should proceed. This paper provides two key contributions to the research community. First, it provides an overview of the CSB research community on how they are evolving. Second, it highlights areas that future research contributions in the CSB are required. CSB is complex software system, in Computer Science and Information Systems, such as economics (e.g. profit maximization), and law (e.g., service level agreement are required. [4]

This paper presents that, various users shift their sensitive data on the cloud. To get a cloud service, they have to contact cloud service provider. Now, huge number of providers are available in the market. To locate a perfect provider who can fulfill their need is a skillful job. This job can be accomplished by cloud service broker. The selection of Quality based Cloud service provider is a complicated task in this paper. [5]

This paper has proposed a novel Double Quality Guaranteed renting scheme for service providers. This scheme combines both short term renting and long term renting, which can reduce the resource waste greatly and adapt to the dynamical demand of computing capacity. Further, we improving the user interface, by having graphs for profit and time taken for handling service request. Profit maximization problem is a heterogeneous cloud environment. [6]

In this paper, cloud computing allowed multiple providers to offer basic computational resources to consumers as a digital service with the benefits of 'on-demand' and 'pay-per-use' characteristics of cloud. Cloud services offer a range of economic benefits to their users and to the economy as a whole. This paper summarizes how the cost estimation occurs in the cloud computing environment. Here estimating cost is a biggest challenge for software developers, when the application has quality of service requirements. [7]

This paper, aims to achieve the minimum response time through considering the communication channel bandwidth, latency and the size of the job. The proposed service broker policy can also reduce the overloading of the data centers by redirecting the user requests to the next data center that yields better response and processing time. Improving the financial cost and power consumption is still to be researched and improved if possible. [8]

In this paper, the authors suggests & propose a Cloud Brokering Framework that supports all the brokering steps along with proposed profit optimization consideration. The simulation scenario is carefully generated to show the effectiveness of algorithm. As a future scope of work, the framework can be extended with more effective policies at each level of lifecycle. The work can be extended for evaluation of Service Level Agreements (SLAs). [9]

In this paper, the author consider the case of a single cloud provider & address the question how to best match customer demand in terms of both supply and price in order to maximize the providers revenue and customer satisfactions while minimizing energy cost. To model this problem as a constrained discrete-time optimal control problem, used Model Predictive Control to find its solution, proposed solution achieves better net income and minimizes the average request waiting time. Further, we are also interested in conducting more extensive experiments using workload datasets that contain price information. [10]

III. METHODOLOGY

Problem Statement

In the existing system, the problem is that if many customers request a large number of cloud services simultaneously, the cloud service broker cannot purchase sufficient cloud services from CSPs to satisfy the demand of all the customers. Then, a peak-demand problem arises in which customers cannot complete their work. Hence, dynamic conditions not only could result in economic problems but also could have a negative impact on the work of customers.

Proposed Method

In the proposed system main focus on guaranteed the service quality of all requests, reduce the resource wastage, provide more security and optimize profit maximization. All jobs are scheduled by the job scheduler and assigned to different VMs in a centralized way. An optimal configuration problem of profit maximization is formulated in which many factors are taken into considerations, such as the market demand, the workload of request, the SLA, the rental cost of services, and so forth. In the proposed work we are going to use Queuing theory. Queuing theory is the mathematical study of waiting lines/queue. This technique provides basis of decision making about the resources needed to provide a service.

1.Algorithms

1.1.1 **Advanced Encryption Standard:**

The more popular and widely adopted symmetric encryption algorithm likely to be encountered nowadays is the Advanced Encryption Standard (AES). It is found at least six times faster than triple DES.

A replacement for DES was needed as its key size was too small. With increasing computing power, it was considered vulnerable against exhaustive key search attack. Triple DES was designed to overcome this drawback but it was found slow.

The features of AES are as follows −

- Symmetric key symmetric block cipher
- 128-bit data, 128/192/256-bit keys
- Stronger and faster than Triple-DES
- Provide full specification and design details
- Software implementable in C and Java

Operation of AES

AES is an iterative rather than Feistel cipher. It is based on 'substitution–permutation network'. It comprises of a series of linked operations, some of which involve replacing inputs by specific outputs (substitutions) and others involve shuffling bits around (permutations).

Interestingly, AES performs all its computations on bytes rather than bits. Hence, AES treats the 128 bits of a plaintext block as 16 bytes. These 16 bytes are arranged in four columns and four rows for processing as a matrix.

Unlike DES, the number of rounds in AES is variable and depends on the length of the key. AES uses 10 rounds for 128-bit keys, 12 rounds for 192-bit keys and 14 rounds for 256-bit keys. Each of these rounds uses a different 128-bit round key, which is calculated from the original AES key. The schematic of AES structure is given in the following illustration −

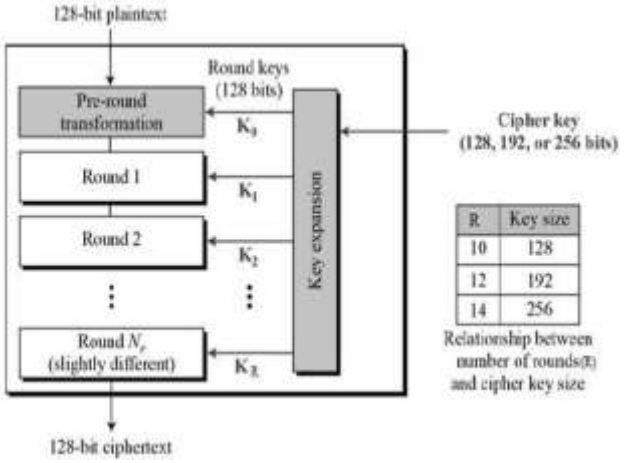

Fig 1. Operation of AES

A. **Encryption Process**

Here, we restrict to description of a typical round of AES encryption. Each round comprise of four sub-processes. The first round process is depicted below –

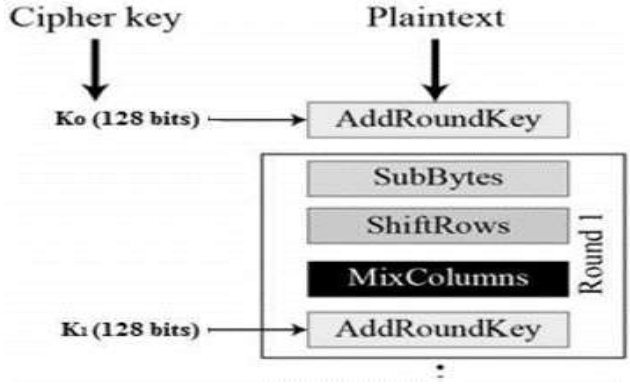

Fig 2. Encryption Process

Byte Substitution (Sub Bytes)

fixed table (S-box) given in design. The result is in a matrix of four rows and The 16 input bytes are substituted by looking up a four columns.

Shift rows

Each of the four rows of the matrix is shifted to the left. Any entries that 'fall off' are re-inserted on the right side of row. Shift is carried out as follows −

- First row is not shifted.
- Second row is shifted one (byte) position to the left.
- Third row is shifted two positions to the left.
- Fourth row is shifted three positions to the left.
- The result is a new matrix consisting of the same 16 bytes but shifted with respect to each other.

Mix Columns

Each column of four bytes is now transformed using a special mathematical function. This function takes as input the four bytes of one column and outputs four completely new bytes, which replace the original column. The result is another new matrix consisting of 16 new bytes. It should be noted that this step is not performed in the last round.

Add round key

The 16 bytes of the matrix are now considered as 128 bits and are XO Red to the 128 bits of the round key. If this is the last round then the output is the cipher text. Otherwise, the resulting 128 bits are interpreted as 16 bytes and we begin another similar round.

Decryption Process

The process of decryption of an AES cipher text is similar to the encryption process in the reverse order. Each round consists of the four processes conducted in the reverse order −

- Add round key
- Mix columns
- Shift rows
- Byte substitution

Since sub-processes in each round are in reverse manner, unlike for a Feistel Cipher, the encryption and decryption algorithms need to be separately implemented, although they are very closely related.

AES Analysis

In present day cryptography, AES is widely adopted and supported in both hardware and software. Till date, no practical cryptanalytic attacks against AES has been discovered. Additionally, AES has built-in flexibility of key length, which allows a degree of 'future-proofing' against progress in the ability to perform exhaustive key searches.

However, just as for DES, the AES security is assured only if it is correctly implemented and good key management is employed.

1.1.2 Queuing Theory:

It is the mathematical study of waiting lines/queue. This technique provides basis of decision making about the resources needed to provide a service.

Reason to study Queuing theory:

- To find out the cost of offering the service.
- To find out the cost incurred due to delay in offering service.
- To allocate the resources.

Practical concept of this theory includes two important parts upon which the whole concept is based are:

- Customer
- Service Provider
- Calculate Arrival time of a client.
- Estimate Service rate to the client.
- Calculate Utilization rate.

Calculate Arrival time of a client.

Defining λ as the arrival rate into the system, that is, the number of customers arriving the system per unit of time, it can be shown that

$L = \lambda W$

$Lq = \lambda Wq$

$Ls = \lambda Ws$

L = average number of customers in the queue at any given moment of time assuming that the steady-state has been reached.

Lq = the average number of customers waiting in the queue.

Ls = the average number of customers in service.

Since customers in the system can only either be in the queue or in service, it goes to show that

$L = Lq + Ls$

W = the average time a customer spends in the queuing system.

Wq = average amount of time spent in the queue itself

Ws = average amount of time spent in service.

As was the similar case before,

$W = Wq + Ws$.

Estimate Service rate to the client:

Average/Expected or Mean Service rate (μ).

The rate at which customers are served by the service provider.

Calculate Utilization rate.

Utilization rate means how much capacity is used by the service provider to provide the services to the customer's.

$B = \lambda/\mu$.

3 different possibilities of Utilization rate:

$\lambda > \mu$

$\lambda = \mu$

$\lambda < \mu$

IV. ARCHITECTURE

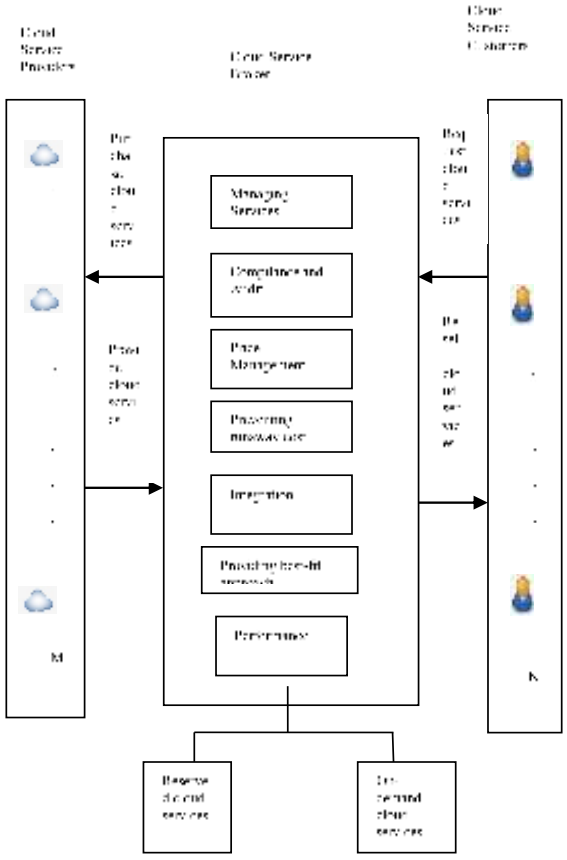

Fig 4. System Architecture

V. CONCLUSION

In this paper, we focus on the profit maximization problem of cloud brokers. A cloud broker is an intermediary entity between cloud service providers and customers, which buys reserved instances from cloud providers for long periods of time and outsources them as on-demand VMs for a lower price with respect to what the cloud service providers charge for the same VMs. Due to the lower service price compared with the public clouds, the cloud broker can save much cost for customers. This paper tries to guide cloud brokers on how to configure the virtual resource platform and how to price their service such that they can obtain the maximal profit. Develop a robust track and trace mechanism to help the distributors the retail pharmacist and the patient. This mechanism should be easy to implement by all manufacturers.

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