Optimized Resource Allocation in Cloud Environment Based on a Broker Cloud Service Provider

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Abstract- Cloud computing provides on-demand services with high performance in a flexible manner. Fast and easy deployment, scalability and service-oriented architecture are its main features. It promises substantial cost reduction together with flexibility than the traditional IT operations. Service provider's offers substantial amount of services with different performance characteristics. A broker cloud service provider (BCSP) is implemented, which provide its own services and also act as a broker redirecting the request to other cloud service providers. The BCSP gets payment from clients and provides an efficient service to them. In turn BCSP would pay other cloud service providers for using their services. An algorithm is implemented in BCSP based on client requests analysis that provides faster and cost-efficient of allocation resources for clients request. This technique provides an effective request-resource allocation based on various criteria.

Index Terms- pricing and resource allocation, performance attributes, performance and usage measurement, integrity, availability

I. INTRODUCTION

Cloud computing is an emerging field in the Information Technology circle. It is based on parallel computing, distributed computing and grid computing. It offers secure, quick, convenient data storage and net computing service computing [1]-[3]. It delivers three kinds of services.

Infrastructure as a service (IaaS)
Platform as a Service (PaaS)
Software as a Service (SaaS)[4].

These services are available to users in a Pay per-Use-On-Demand model. The main characteristics of cloud computing are virtualization, distribution and dynamic extendibility. Virtualization is the main feature [5]. Many factors such as IT resource, software, hardware, operating system and net storage can be visualized and managed in the cloud-computing platform. Some cloud-computing environments are based on utility computing model that is based on performance and usage measurement, which is similar to traditional utility services are consumed, whereas others bill on a subscription basis. Cloud architecture [6], is comprised of the systems architecture of the software systems involved in the delivery of cloud computing and multiple cloud components communicating with each other over application programming interfaces. The two components of cloud computing architecture are known as the front end and the back end. The front end is the part seen by the client, i.e. the computer user that includes the client's network (or computer) and the applications used to access the cloud via a user interface .The back end of the cloud computing is the 'cloud' itself, consisting of various computers, servers and data storage devices.Cloud computing is dependent on the service providers and its associated technologies.The advancement in virtualization may result in insufficient resource availability with virtually unlimited amount of computing power and storage capacity readily available on demand. Here we implement a broker cloud service provider (BCSP), which has its own services, more over redirect the user request to other service providers. BCSP based on pricing and resource allocation. The broker service provider gets payment from the clients and provides payment to the service providers for the resources it is using. Approaches have been implemented to find the best service provider for an application and mapping the service provider to that application [10]. Each cloud service providers can be characterized by using quality of services metric (QoS), which include static and dynamic parameters based in the part on web service model [10] [11].

Each cloud service provider (CSP) may offer different resources. The request for resources from client side may be different at different time. Section2 depicts the overall system architecture and structure of BCSP .At a particular instant more than one CSP is needed to satisfy the client requests. The BCSP analysis the requests from clients for a certain period of time and build a table based on type of resources needed and total resources of each type needed by the clients. This is depicted in section 3.A table based on cloud service providers, the resources they provide, quality of the cloud service providers (CSP) are explained in section 4.An algorithm that find the efficient resource allocation strategy based on client request is depicted in section 5.Section 6 depicts results. Section 7 provides the conclusion and discusses the future work

Client

Layer III

Layer II

II. SYSTEM OVERVIEW

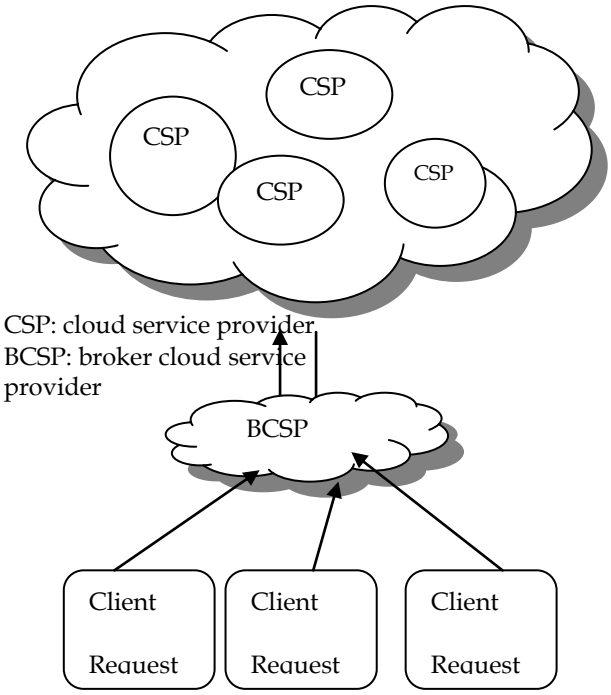

Fig1.System architecture

The clients send request to the broker cloud service provider. If BCSP can provide the resources, it directly satisfies the request. Otherwise it maps its request to other service providers, which in turn allocates the requested resources.

Fig 1 depicts the system structure where the client request is transferred to the BCSP, if the BCSP in turn transfer the request to other CSP's .If the BCSP provide the requested resource then without further forwarding it satisfies the request. Client may have different request for resources at different time. Here the BCSP may provide keep a log of more frequently needed resources. The log is maintained by the evaluation of an algorithm that finds all those resources that are optimal based on the analysis of client requests for a certain period of time. The algorithm is working based on analyzed data and collected data from service provider regarding their quality of service and distance with respect to the broker cloud service provider

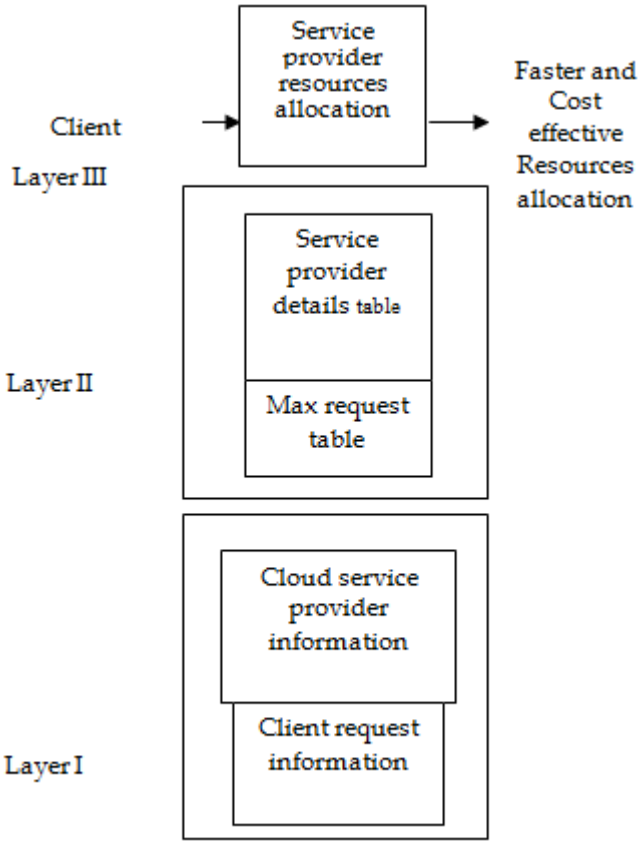

Fig2.Broker component in BCSP

First layer is the information gathering .The broker component of BCSP is depicted in figure2. The broker component is divided into three layers layer, consisting of client request information and service provider information. Second layer is the layer on which the proposed algorithm works. This layer comprises of service provider details table and max request table. The topmost layers consist of the details of fast and cost efficient recourses and service provider allocation. Based on cloud service provider information and client request information service provider request table and service providers details matrix cost i.e. the service providers that provide the request at minimum cost are calculated .The algorithm is implemented in the mentioned tables to find services providers that satisfy the requests at minimum cost .The cost evaluation is based on many factors including the distance of each service provider

III. MAX REQUEST TABLE

The requests for resources are analyzed for a certain period of time and max resource table is constructed. Let R1, R2, R3, R4 are resources requested at a certain period of time say T1

Table1.Request table

Resources	Quantity
R1	100
R2	20
R3	200
R4	300

Let R1, R2, R3, R5 are resources requested at a certain period of time say T2

Table2.Request table

Resources	Quantity
R1	95
R2	20
R3	180
R4	230

Let R1, R2, R3, R4 are resources requested at a certain period of time say T3 .The resources requested at time T4 are given in the next table and it is continued for a certain amount of time.

In this way the resources quantity allocation for a certain period of time is analyzed. Based on the study of the client request maximum request for each resource is found

Table3.Request table

Resources	Quantity
R1	120
R2	25
R3	200
R5	30

Based on the analyzed data max request table is constructed by adding a constant amount to maximum amount of each resources.

Table 4.Max request table

Resources	Quantity	Constant added
R1	120	D1
R2	25	D2
R3	200	D3
R4	300	D4
R5	30	D5

D1, D2, D3…. are constant added to maximum quantity requested. The selection of D1, D2, D3…. is based on the variation in quantity requested. A constant value D1, D2…is added to max request of each type of resources in perception that the total resource request may change up to a certain limit in future. [7]-[11]

IV. SERVICE PROVIDERS DETAILS TABLE

To find the faster and cost effective resource allocation service provider's details matrix is constructed. The various details that are considered are the quantity of each type of resources owned by the service provider, average distance of each service provider/resource, energy consumption of each service providers, and quality of each of service provider and overall good will and quality of services provided by the service provider. The details regarding the service provider are tabulated and an algorithm is implemented in tabulated data to find the most optimal set of service providers who can provide services at least cost to the client with the lowest risk.

Table5.Service provider details table

Service provider	R1	R2	R3	R4	R5	d	c	q
CSP1	100	20	40	150	30	3	3	2
CSP2	50	10	20	25	15	2	2	2
CSP3	120	26	150	40	25	4	1	1

d- Indicates distance of the service providers, distance are in hundreds of kilometers

c- Depicts utility cost. Cost may in crores. For the ease of evaluation and simulation small values are taken.

q- Depicts quality of services. The quality of services depends upon various criteria [12].

Table6. Performance Attributes list for CSP

A1	Integrity
A2	Security
A3	Average IO response
A4	Availability
A5	CPU utilization
A6	Energy consumption

The Table 6 shows the attributes based on which the quality of the CSP is evaluated

Table 7.Attribute Table

	CSP1	CSP2	CSP3
A1	1	1	5
A2	2	2	4
A3	1	3	4
A4	3	3	3
A5	4	3	3
A6	1	2	3

The table 7 shows the attribute table for the available CSP's. Based on this table Quality factor table is constructed. The maximum value for the each describing attribute is taken as 5. The attribute A6 is evaluated using the formula that is depicted in [11]

Those services providers with average of quality values for all attributes greater than or equal to three are said to be first quality service provider's with q =1 and for those service providers with average between 1 and 2 q is taken as 2 and for those with value between 0 and 1, q is taken as 1 and so on. In this manner the quality factor for each service provider is evaluated. Using the values evaluated the table 8 is constructed. [13]

Table 8.Quality factor table

CSP	Quality factor
CSP1	2
CSP2	2
CSP3	1

In this way quality is assigned for every resource of each service provider. Table 8 shows the quality value assigned to each cloud service provider

V. PROBLEM FORMULATION

Those set of optimal service providers with faster resource allocation are found from the complete the set of service providers based on an algorithm. This algorithm is implemented in Broker cloud service provider and works based on the service provider details table and max request table stored on the BCSP .The final outcome of the algorithm is the set of servicer providers and resources with minimum cost and faster response.

5.1 Algorithm

Let c_i be the payment cost that should be made to each service provider, $_{qi}$ be the quality of services provided by the service provider di denote the distance of each service provider. R_{ji} be of number resources of type j that taken from ith cloud service provider, C_i is the cost of taking various resources from service provider (i) Let Ck be the cost of taking resources from a particular permutation of service providers

. If R_{ji} =0 then R_{ji} is taken as 1
. $T_j=R_{ji}+T_j$
. If $T_j > R_j$ max then R_{ji} is taken as 1
.Cik= $\sum_{i=1}^{n}(\prod_{j=1}^{m}(Rjicji)$di qi$)$
.k ranges from 1 to n!
.n denotes the number of CSP's
.m denotes the number of resources requested
In this way C_k is calculated for each k th permutation of the n! permutations of n service providers
. $C_{min}=min\ (C_k)\ 1<=k<=n!$

Cmin is the minimum cost that can be calculated by satisfying the entire clients request and accessing the resources from the service provider at the minimum cost. The permutation pattern k that gives the minimum cost is taken as the cost efficient and faster method of allocating all the resources .In the way best set of service provider for satisfying the client request is selected.

VI. RESULT

The maximum requests for each type of resources are analyzed for a certain period of time and max request table is constructed. Constant values D1, D2 are added to max request of each type of resources in perception that the total recourse request may change up to a certain limit in future. The QP table is constructed and based on the table the quality factor of each service provider is analyzed. Using the QP table the quality factor is found for each service provider. Based on Quality factor table and service provider details table cost for each permutation of service provider is found

Table9. Min cost table

permutation value(k)	Permutation	Cost Cik
1	CSP1,CSP2,CSP3	64x108
2	CSP2,CSP1,CSP3	38x107
3	CSP2,CSP3,CSP1	19x108
4	CSP3,CSP2,CSP1	18x108
5	CSP3,CSP1,CSP2	27x108
6	CSP1,CSP3,CSP2	27x108

The combination CSP2, CSP1,CSP3 gives better result compared to other combinations. The BCSP allocate resources in the order with permutation value k. There may further reduction in cost, since payment is made by BCSP to CSP based on the resources it use. All resources of all CSP's are not taken by the BCSP; therefore payment can be made to only those resources it uses. In this way there will be a considerable reduction in the cost.

From the Table 9, it can found that the minimum cost for resource allocation can be obtained using the permutation with k=2.That is for the permutation CSP2, CSP1, CSP3.
Figure 3 depicts the plot for table9. Here permutation is plotted across x-axis and permutation is plotted across y-axis. From this figure it can be inferred that minimum cost is obtained for permutation value k=2.

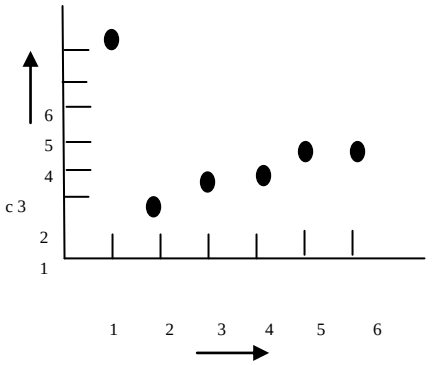

Fig3. Permutation cost graph

VII. CONCLUSION

By using the above algorithm in the BCSP the minimum cost permutation of the available cloud service providers and the resources can be found. Thus BCSP can provide faster as well as cost optimized service to its clients. Initial installation cost of the BCSP may be very larger. But as time proceeds the BCSP may seem to be very cost effective. The BCSP can offer its clients with set of resources at an optimal cost. The payment made by the clients may be monthly or yearly or may be based on utility model. Using this method the BCSP can ignore certain service providers of high cost and low quality services.

The method is not static in nature. The algorithm should be refreshed after a certain interval of time as the number clients as well as Cloud service providers' change. The period for refreshment may be once in a month or twice a month. The period of refreshment is still in consideration.

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