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A Survey of Techniques in Cloud Brokerage

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Abstract: ***Cloud computing creates a virtual model for sharing of files and services over a scalable network of nodes. It has been appreciated as the next logical step after Grid computing on the way to utility computing, where computing resources are obtained as subscription based service just like water and electricity. From business viewpoint, it is seen as an economical model for leasing technical resources. As Cloud computing make available an on-demand, pay-as-you-go computing resources. Service Level Agreement (SLA) between customer and provider becomes a key aspect. The matching of SLA template is required to be dynamic and continuous observing of Quality of Service (QOS) is necessary to enforce SLAs. SLA includes many parameters such as resources (physical memory, main memory, processor speed) and properties (availability, response time etc.). This paper describes the concept of third party entity between cloud user and provider, known as cloud broker and how broker is helpful to minimize SLA violations.***

Keywords: Cloud Computing, Cloud Brokering, SLA, QOS.

I. INTRODUCTION

Cloud computing has also been defined as a type of parallel and distributed system providing virtualized resources through internet on pay-as-you-go way. Cloud Computing is a model for supporting suitable, on-demand access to a common pool of configurable computing resources. These resources include servers, infrastructure, storage, applications, platform, networks and services that can be quickly obtained and released with least management effort or service provider interaction. Five necessary characteristics that are common to all cloud computing services include: On demand self-service, resource sharing, wide-ranging network access, scalability and metered service. Cloud computing is constitute of three service models and four deployment models [7]. The best-known service models are Software-as-a-Service, Platform-as-a-Service, and Infrastructure-as-a-Service — the SPI model. Service model determines what kind of services is offered. The deployment models provide the information about where the cloud is located and for what purpose. These are public cloud, private cloud, hybrid cloud and community cloud. Based on scale and functionality of the services, cloud users can choose either a commodity cloud [9] in which services are billed per hour basis with public access to their servers, or enterprise cloud in which charges are made on a monthly basis with private access to servers that may or may not be accessible to the public. This selection is made by consumers when they require higher service levels from the cloud providers. Service model and deployment models are described in detail below:

Software as a Service: SAAS provides organization with ready to use applications, the use of combination of cloud based compute and storage services. In basic terms it allows users to run existing online applications. Examples of SAAS software for end-users are Google Gmail, spread sheets, word, and presentation, Google Earth, Google Map and Calendar, QuickBooks online.

Platform as a Service: Platform as a Service also known as PAAS, it allows users to create their own cloud applications using specific tools and languages. PAAS provides an organization the platform or run time environment to create, design, develop, and deploy new applications. In addition to the creation of applications, it also provides support for testing and hosting. Examples of PAAS are Google App Engine platform provided by Google, force.com by Salesforce.com and window azure by Microsoft.

Infrastructure as a Service: Infrastructure as a Service also known as IAAS, allows users to run any application they please on cloud hardware of their own choice. Another term for this type of computing is Everything-as-a-Service. It is also known as HAAS (Hardware-as-a- Service) because it provides servers, software, racks, memory, storage, network equipment, hardware for firewalls, routers, load balancing CPU cycles and also eliminates the need to pay for datacenter. One of the most prevalent is Amazon Elastic Compute Cloud (EC2). Another player in the field is Go Grid. Other companies that provide IAAS are Microsoft, Rackspace, and Google etc. Four types of deployment models are:

Public Cloud: Public clouds are those in which services are available to the public at large over the internet. The public cloud infrastructure is available for a large industry group.

Private Cloud: Private cloud functions only for one organization on a private network and is highly secure. A private cloud environment is used by those customer for whom data security and privacy is usually the primary concern. Private clouds may be either on or off premises.

Hybrid Cloud: Hybrid cloud is combination of private and public cloud deployment models. In hybrid cloud specific resources are run or used on public cloud while other resources are used on premise in private cloud. This provides increased efficiency.

Community Cloud: A community cloud is one where the cloud has been organized to serve a common function or purpose. It may be for single or multiple organizations.

The structure of the remaining paper is as follow: Section II presents the Literature Survey on the topic of pricing models in the cloud and its significance to the cloud brokering services. Section III covers cloud brokerage model. Section IV addressed tools for cloud computing. Sections V includes conclusion of this article.

II. LITERATURE SURVEY

Hossain et al. [6] proposed refundable service technique that increases customer satisfaction and decreases cloud service providers worry for continuing the business. This technique allows cloud consumers to refund unutilized services only. Unutilized services consist of those services that are degrading quality of service (QOS) by violating service level agreement (SLA) or that lack fairness in pricing. A third party entity called cloud broker is used to handle all of the business instead of provider, thus reducing cloud service providers headache. Buyya et al. [1], described cloud computing as a model for delivering cloud services similar to utilities such as electricity, telephony, gas and water to clients without regard to where these services reside. Cloud computing providers are offering applications (software), platform, hardware (Infrastructure) as services to users with service level agreement (SLA) promises for their services. These services are based on pay as you use. Different providers offer variable prices with respect to the quality of service (QOS) expected by customers. Also surveyed, market oriented cloud architecture influenced by VMs, resource management strategies that include service management and risk management to hold SLA. Ning et al. [12] discussed various pricing models of cloud storage based on different pricing strategies. As cloud storage model has become the focus of cloud vendor and user to earn profit. Cloud storage models exist in different categories such as public cloud storage, internal (Private) cloud storage and Hybrid cloud storage. Profit earned form the private cloud is not clear. Zhou et al. [14] used dynamic virtual resource renting method to dynamically select the virtual resources according to price distribution and task urgency. Using novel rental decision making algorithm, the most appropriate profitable resource is selected from that set. Proposed method was evaluated using normal distributed price dataset and Amazon EC2 spot price dataset. Final results demonstrate the more effectiveness in proposed method. Le et al. [8] proposed a new benchmark framework to compare and evaluate brokers for cloud services. The proposed benchmark is called cloud broker challenge (CBC) which describes cloud service providers and cloud service consumers complexities and is used for fair evaluation and comparison of cloud brokers. Fayek et al. [5] proposed a genetic model [4] for pricing in cloud computing service delivering scenario. Both parties negotiate until service level agreement met. Genetic algorithm [10] approach is used to calculate the most suitable price depending upon the status of demand. Genetic algorithms use profitable pricing function to maximize the profit.

III. CLOUD BROKER MODEL

Cloud Service broker is a person or company that consults, arbitrate and negotiate for the selection of cloud computing resources on behalf of an organization. As shown in fig. 1 cloud broker provides an interface through which the organizations can share and manage resources across multiple clouds. A cloud broker is a software application that simplifies the distribution of work among different cloud service providers. This type of cloud broker is also known as cloud agent. The primary role of broker is to reduce the purchaser time by researching services from different vendors and providing information about how to achieve business goals efficiently. Broker provides set of APIs (Application program interfaces) and UIs (User interface) to customers that hides the complexity details and allows customers to use services that are purchased from single vendor.

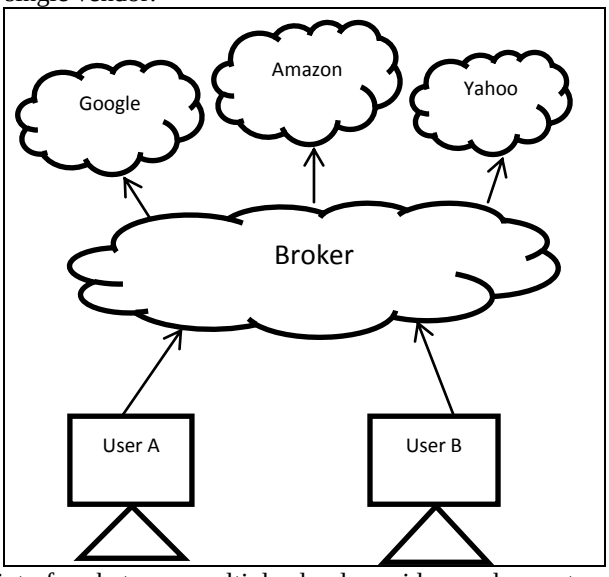

Fig. 1 Broker acting as an interface between multiple cloud providers and users to provide better SLA options.

Cloud broker offers the following capabilities:

- Provides an interface for interaction with multiple clouds
- Provides flexibility to transfer cloud resources from one cloud to other i.e. from public to private cloud or vice-versa.
- It identifies cloud failure and reacts in appropriate way to recover those failures.
- Broker operates outside the cloud to control and monitor multiple clouds.

The functional components required by the broker to offer cloud services are specified in Fig. 2:
Cloud API [11] is an interface through which consumers interact with the cloud broker for performing cloud related actions containing creating and managing cloud resources like compute and storage services.
Deployment Service unit switches the deployment of services offered by cloud provider to the cloud consumer. For example using this function broker informs the cloud provider to start a virtual machine so that users can use for compute or storage purpose.

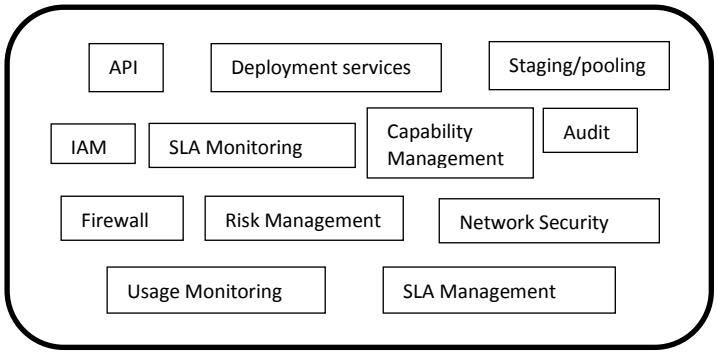

Fig. 2 Functional components of cloud broker.

Staging/Pooling Service ensures the ability of the cloud broker to provide scalable resources for the various cloud actions requested by the customer. Since Cloud services are offered on pay-as-you-go basis and are highly scalable. In case, if the cloud provider is unable to offer the extra demanded resources, the staging and pooling unit finds out another suitable match for requested resources from the pool of underlying cloud providers.
Identity and Access Management unit play a vital role as it keeps record of all cloud users such as enterprise details, assigned cloud providers, type of service - storage or compute. Moreover, the classification criteria that broker select with users is also stored in this unit. Cloud management entity forwards a storage or compute request to the broker on behalf of users. Identity and access management unit then creates a one-time token according to classification criteria.
SLA monitoring unit frequently observes all the SLAs negotiated by the SLA management. It checks to see coming SLA violations in future and take the specified protective measures.
Capability Management and Matching unit checks all the capabilities provided by the different cloud providers such as delivery and deployment model, security mechanism, fee structure and other IT functionalities. When user interacts with broker for various services, this unit matches the users functional and SLA requirements with services offered by each cloud provider and select the most suitable match.
Audit Unit periodically reviews broker's platform as soon as possible using capabilities provided by the cloud provider. Audit is done to determine the validity and reliability of data and to provide an assessment of internal controls.
Firewall blocks unwanted traffic to and from the various modules exposed by the interfaces of the cloud broker service.
Risk Management unit classifies, evaluate and arrange risks on the basis of their effects on events. It objective is to reduce, monitor and control the possibility of such unfortunate events.
Network/ Platform Security unit manages the overall security of the broker's policy. Provisions and strategies are adopted to prevent illegal access, misuse, amendment or denial of network resources. It provides protection at boundaries of the platform by keeping out intruders or hackers to protect data from bugs.
Usage Monitoring unit observes the usage of services by the cloud users, and generates monthly bills for them.
SLA Management module controls all SLAs in between the broker and consumer.

IV. TOOLS FOR CLOUD

There are several tools available for development of cloud and operations of service. Some tools are free and other take slight amount from the user. There exist two categories of cloud tools: 1) Development tools and 2) Simulation tools. In this paper we have discuss one from each category. Examples of development tools are Google App Engine, Microsoft Azure, Amazon, Ubuntu and many more [13]. CloudSim is simulation tool used in this proposed work.

CloudSim
CloudSim[2] is defined as the library of java classes that can be extended or replaced for simulation of cloud computing scenarios. In other words, it is a toolkit or extensible simulation framework to perform simulation and modeling of cloud applications. Simulation provides controlled or repeatable environment to examine limitations or bottleneck of proposed work. Simulation environment eliminates the need to build whole cloud infrastructure which is very time consuming.

Benefits of using CloudSim

- It is open source and free of cost.
- CloudSim opens the possibilities of evaluating the proposed algorithms, parameters and suppositions in simulated environment instead of practically running the application.
- It provides test environment to run, debug cloud applications which is very expensive and time consuming task to run or implement practically.
- ClouSim makes available large scale cloud infrastructure, including data centers on a single physical machine.
- It also provides support for virtualization engine to create and manage multiple independent and co-hosted virtualized services on a datacenter node.
- Provides basic classes for data centers, virtual machines, applications, users, computational resources and classes for scheduling and provisioning policies also.
- CloudSim is used to study the behavior of an application under different workload conditions.
- CloudSim tool kit is also used to evaluate the estimated finishing time of an application which is helpful to improve Quality of service.

V. CONCLUSION

The above paper concludes that broker acts as an interface to match vendor's services/supplies with user requirements and offers most suitable match in terms of better SLA. Cloud broker can profit in number of ways. Our next step is based on to generate maximum revenue by minimizing SLA violations. This paper also addresses two categories of cloud tools such as development and simulation tools. CloudSim provides a simulation environment for testing validation of cloud system and its service, it is very much useful for researchers to evaluate and optimize the cloud system.

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