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A Review on Cloud Service Brokering: Optimization in Provision of Autonomic Cloud Services

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***Abstract*— Ideas and standards of cloud organization, and cloud handling, fall in the normal developmental way of the distributed computing biological system. Nonetheless, the standards and ideas of cloud handling furthermore, cloud organization are free, and incongruous, to one another in some utilization cases. This research is an endeavor to bring these two free ideas together in a genuine situation whenever an enormous government association starts the progress of its organized assets into the cloud worldview to offer consistent, effective and organized administrations utilizing the cloud provisioning model. The proposed cloud handling system - BroCUR, or the Broker for Common Usage of Resources, handles expediting of server farm assets inside a cloud organization. Cloud expediting is dealt with at an algorithmic level, utilizing the joined methodology of a concurred together SLA and nearby server farm level trigger-activity edges. Framework level enhancement is taken as the general goal. [1].**

I. INTRODUCTION

Cloud Computing is a term that describes the present evolutionary development of many existing technologies and approaches to computing that at its most basic, separates application and information resources from the underlying infrastructure and mechanisms used to deliver them. In addition, it also provides an elastic scale and the utility model for allocation of the resources available on a virtual platform. Out of several definitions that exist in literature on what the cloud is and how it can be summarized, perhaps the most apt one is the one provided by NIST where it characterizes Cloud Computing as "Cloud computing is a model for empowering helpful, on-request network admittance to a common pool of configurable processing assets (e.g., networks, servers, capacity, applications, and administrations) that can be quickly provisioned and delivered with insignificant administration exertion or specialist co-op cooperation [1]." This service model defines the way entities interact with each other and the way components are associated.

At the hardware level, the Cloud describes the use of a collection of distributed services, applications, information and infrastructure comprised of pools of computer, network, information and storage resources. To qualify as a cloud environment, these components should be provisioned to be rapidly orchestrated, provided, carried out and decommissioned utilizing an on-request utility-like model of allotment and utilization. This ability of the cloud is what differentiates it from the erstwhile computing models like Parallel Computing, Distributed Computing, and off late, Grid Computing. [3]

2. MOTIVATION

The motivation for attempting this research was an actual use case scenario that was experienced while the researcher was managing cloud based data centers and the requirement arose to emulate a service provider that is enabled to offer services with differentiated, dependable and adjustable SLAs, and could negotiate SLAs with (individual or groups of) organizations in an automated manner.

3. RESEARCH GAPS

Due to the proliferation of cloud offerings in recent years, and the availability of specific niche services that they offer; or at least advertise that they can offer, a better service than others in the market, the cloud ecosystem is becoming very complex. The differentiation between the cloud provider and the cloud user is thinning as the criticality of providing strict SLA based solutions and desired QoS for the end user has become paramount. The cloud provider often tends to become a cloud service user when the inherent resources available in the private data center are exhausted and there is an emergent need to ask for more resources. Vendor lock-in issues and the lack of common cloud interoperability standards hinder the provider experience and lead to non-optimized solutions. This is proving to be a major obstacle to the growth of Cloud computing. Thus, today the cloud user is facing a challenge in selecting the appropriate cloud offers that facilitates or ensures a viable solution.

4. REVIEW OF LITERATURE

Cloud Definitions

Since 2007, the term Cloud has become one of the buzz words, both in the IT industry and academia. A significant amount of research has tried to define cloud computing from different application aspects. The definitions were varied and colored. Among the many definitions, the ones which have been more widely quoted are as follows:

4.1 Definition by Gartner: "A way of registering where adaptable and versatile IT abilities are offered as a

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support to various outside clients utilizing Internet innovations." [13] Tie is an IT counseling organization, so it analyzes characteristics of distributed computing for the most part according to the perspective of industry. Useful qualities are underlined in this definition, for example, whether distributed computing is versatile, flexible, administration offering and Internet based.

4.2 Definition by NIST: "Cloud computing is a model for empowering helpful, on-request network admittance to a common pool of configurable figuring assets (e.g., networks, servers, capacity, applications, and administrations) that can be quickly provisioned and released with minimal management effort or service provider interaction." [1] Compared with other definitions available in academia, U.S. National Institute of Standards and Technology gives a somewhat more goal and explicit definition, which characterizes cloud idea in general, yet additionally determines fundamental attributes of distributed computing and conveyance and arrangement models. The NIST Definition of Cloud Computing records five fundamental attributes of Cloud Computing. It is reasonable to assume that missing any of these fundamental attributes implies a help or processing ability can't be considered as Cloud Computing.

4.2.1 On-demand Self-Service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

4.2.2 Broad Network Access: Capacities are accessible over the organization and gotten to through standard systems that advance use by heterogeneous flimsy or thick client stages (e.g., cell phones, tablets, PCs, and workstations).

4.2.3 Resource Pooling: The supplier's registering assets are pooled to serve numerous customers utilizing a multi-inhabitant model, with various physical and virtual assets powerfully allotted and reassigned by buyer interest. There is a feeling of area autonomy in that the client for the most part has no control or information over the specific area of the gave assets yet might have the option to indicate area at a more elevated level of deliberation (e.g., nation, state, or datacenter). Instances of assets incorporate capacity, handling, memory, and organization data transmission.

4.2.4 Rapid Elasticity: Capacities can be flexibly provisioned and delivered, now and again consequently, proportional quickly outward and internal similar with request. To the shopper, the capacities accessible for provisioning frequently seem, by all accounts, to be limitless and can be appropriated in any amount whenever.

5.2.5 Measured Service: Cloud frameworks consequently control and streamline asset use by utilizing a metering capacity at some degree of reflection fitting to the kind of administration (e.g., capacity, handling, data transmission, and dynamic client accounts). Typically this is done on a payper-use or charge-per-use basis. Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

The understanding about Cloud computing is more prevalent now with players like Elastic Compute Services (EC2) from Amazon [14] and the first worldwide commercial computing Cloud, and its storage Cloud - the Simple Storage System (S3) [15]. It allows storage of data on Amazon's hosted computing and storage infrastructures. Other examples include Eucalyptus [16], OpenNebula [17] and Openstack [18].

The NIST cloud architecture is presented in the figure below and has been accepted as the framework for understanding Cloud Computing in this thesis. The NIST model has found most accepted status in industry as well as academia and is a comprehensive definition of the cloud computing ecosystem as it exists today. There are however some reservations emerging today on the security of the model proposed and the utility of the cloud auditor as an actor. The cloud broker as an actor has seen renewed research in recent years.

Another popular and widely quoted definition of the Cloud ecosystem is from Wikipedia which defined the Cloud as "Cloud computing is a computing term or metaphor that evolved in the late 2000s, based on utility and consumption of computer resources. Cloud computing includes sending gatherings of far off servers and programming networks that permit various types of information sources be transferred for continuous handling to create figuring results without the need to store handled information on the cloud. [19]." This is a practical definition of the cloud and is cited by several industry papers due to its generic nature.

5. CLOUD ARCHITECTURE & BROKERING

Cloud Architecture and Cloud Brokering

The aspect of cloud brokering services to the end user is finding refereed status since 2012 [20], [21]. Most authors have converged on the definition of a cloud broker, using the NIST [22] definition as a baseline, which generically defines a cloud broker as an element that deals with the utilization, execution and conveyance of cloud benefits and arranges connections between cloud suppliers and cloud consumers.

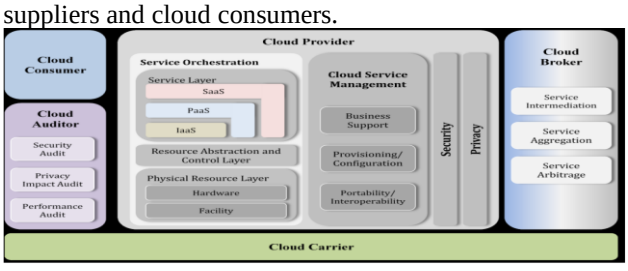

Fig. 1 Cloud Architecture

6. RESEARCH METHODOLOGY

One of the major factors behind evolution and improvement in any subject is "Research". However, research is a difficult task and requires deep knowledge and keen dedication from the researchers. In this chapter, various steps that approach towards research, have been discussed, which helps the computer science researchers to start their research. Although this

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methodology can be adopted for any research field. Following steps have been adopted during this research:

- Select subject area. First of all, researcher must select research area according to his own choice rather than following someone else advice. Accordingly, the scheduling in cloud computing was selected as the subject area.
- Search relevant database and search engine. In most of cases, people prefer "Google" as a search engine to search their relevant data or information. Most of the time, people also prefer encyclopedia such as Wikipedia, Yahoo etc for the search. But while choosing a search engine, one must consider the trustworthiness. It is recommended that researchers must search with relevant "keywords" using scholarly search engines like Microsoft Academic Search, Google Scholar, ACM Digital Library, DBLP (DataBase systems and Logic Programming), ScienceDirect, Scopus, IEEE etc. While considering these factors, the literature was searched from various search engines.
- Sort scholarly research and articles. Research papers can be classified into "analytical" and "argumentative" papers. An author logically analyses and provides his personal perspective regarding the topic in analytical research, whereas in argumentative research, on the basis of logical evidence, the author provides the arguments regarding the topic.

After reading abstract of any research paper, researchers can easily identify the relevance of particular paper for their research. Then, you can differentiate the relevance or non-relevance of research papers.

7. RESEARCH TOOL

7.1 CloudSim

In previous years, grid was developed to provide a platform to deliver high-performance services for data-sensitive and computing applications. For researching and developing new ideas, various simulators were proposed to test grid elements, its middleware and different policies. For that reason, GridSim was proposed, which was based on event-driven simulation, extensively simulating the network including network traffic and machines. Another simulator named as GangSim was developed for grid and simulated virtual resources only.

7.2 CloudSim Architecture

The cloudSim upper layer of simulation stack contains User Code that reveals the functionalities related to the host i.e. host configuration and VM count and so forth, applications with tasks count with their concern, users count with their service type, scheduling policies for broker.

Next layer contains real cloudSim layer containing personalized methods such as user interface structure (user's tasks with their management), VM services (real execution of tasks/cloudlets with VM management), various cloud services with resources allocation and networking (management related to network e.g. topology and message passing.

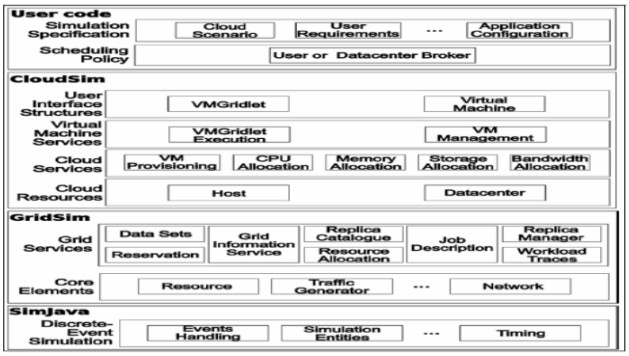

Fig. 2
Cloud Sim Architecture

Comparison 1

The conceptual design and implementation of a generic multi-Cloud service broker framework. In order to automate the sending and the board of simple and composite IaaS Cloud services in a multi-Cloud environment, we propose a generic architecture of a fully functional multi-Cloud broker framework. The main purpose of the broker is to match the user requirements to current Cloud providers and manage the service provisioning and execution on behalf of the user. In addition, the framework contains components for interacting with the underlying Clouds, delivering Cloud information, managing SLA issues, and authenticating users. The interoperability between the broker and the Cloud providers is assured using an abstract Cloud Application Programming Interface (API), which interacts with multiple provider specific gateways offering standardized monitoring and management interfaces for the broker. Furthermore, the broker supports the execution of multi-Cloud workflows by offering scheduling and data management capabilities.

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Table 1 Comparison between our SMS and other reviews

Reference	Review Type	Studies	Search Spaces	Time Interval	Considered Topic/Sub-Topics
[33]	Survey	NM	17	2012-2015	Aggregation Customization Intermediation Arbitrage
[38]	Survey	47	37	2013-2018	Pricing Multi-Criteria Quality of Services Optimization Trust
[39]	Survey	34	30	2010-2017	Decision Support Resource Monitoring Policy Enforcement SLA Negotiation Application Deployment Migration API Abstract VM Interoperability
Our SMS	SMS	496	171	2006-2019	Service Composition & Integration Service Discovery Service Selection Energy Management SLA Management Resource Allocation Pricing Recommendation Service Allocation Monitoring

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8. CONCLUSION

This research has proposed the BroCUR framework as a medium for creating an optimal strategy to migrate from a networked entity era to a cloud ecosystem. The experiments conducted over the last four years have suggested that the approach of 'volunteer-metrics offering' in a cloud federation is a plausible one when engaging with non-greedy cloud centers. The framework also incentivizes the non-greedy nature of data centers by giving a local human over-ride over global availability. The approach to use a combination of threshold and trigger based SLA mechanisms is a novel to this framework. However, this research was not without its own set of challenges. The chapter highlights the results of the experiments conducted and analyzes them in detail. It then discusses some of the research challenges experienced during the course of the research. It also proposes a future scope of work on the research that might be taken to improve and further optimize the BroCUR framework.

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