A SURVEY ON SOFTWARE-AS-A-SERVICE(SAAS)

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Abstract**—**Cloud computing is currently emerging as an ever-changing, growing paradigm that models "everything-as-a-service." Virtualized physical resources, infrastructure, and applications are supplied by service provisioning in the cloud. The evolution in the adoption of cloud computing is driven by clear and distinct promising features for both cloud users and cloud providers. However, the increasing number of cloud providers and the variety of service offerings have made it difficult for the customers to choose the best services. By employing successful service provisioning, the essential services required by customers, such as agility and availability, pricing, security and trust, and user metrics can be guaranteed by service provisioning. Cloud computing systems enables pay-per usage pricing model for computing services delivered to users across the globe over the internet. Currently the demand for cloud services has increased as enterprises and individuals have now migrated to the cloud and cloud providers need to offer services based on the expected quality requirements. One of the challenges posed by cloud application is quality of service (QoS) management, which is the problem of allocating resources to the applications to guarantee service based on performance, availability and reliability. In this paper, we have presented a survey on the quality of service in cloud computing with respect to techniques used, advantages and disadvantages.

Keywords—*SAAA; Cloud Computing; Quality of service.*

I. INTRODUCTION

Cloud computing is a kind of distributed computing over the internet i.e. it can run a program or application on more than one computer at the same time. It is divided into three categories namely: (i) Infrastructure as a service (IaaS), (ii) Platform as a service (PaaS), and (iii) Software as a service (SaaS). Software as a service is a kind of service which provides many benefits to the service consumers. A customized quality model is necessary to evaluate the quality of SaaS cloud service.

Cloud computing includes sharing of resources like hardware, software and network. It involves delivering hosted services accessed through internet. It has three services namely: Software as a service (SaaS), Platform as a service (PaaS), and Infrastructure as a service (IaaS). The services are sold on demand either by a minute or hour and the customer can access services as their wish for a particular given time. The services are managed by the service provider or companies like Amazon, Google, and IBM etc.

Cloud can be public, private and hybrid. A public cloud sells everything over the internet. A private cloud is a data center or proprietary network which provides services to few people. Hybrid cloud is a cloud computing environment where organization gives and manages few resources internally and others externally. Software as a service is a type of cloud service which gives software services via internet. SaaS is generally used and it gives many advantages to service customers.

To realize these benefits, it is important to generate the quality of SaaS and Manage the higher level of its quality which depends on the generated result. So, the demand is high for producing a quality model to generate SaaS services. Software as a service, occasionally indicated to as "on demand software", is a software model in which software and related data are put on the cloud centrally. SaaS is typically gain access by users consuming a thin client through a web browser. SaaS has turn into a public distribution prototypical for several business applications, containing accounting, association, enterprise resource planning (ERP), invoicing, content management (CM), human resource management (HRM), customer relationship management (CRM)[1].

Advantages of the SaaS model have:

- Less difficult administration
- Compatibility.
- Less difficult collaboration
- worldwide accessibility

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II. CLOUD COMPUTING

Cloud Computing is a model for enabling ubiquitous, convenient, on-demand network access to shared resources (e.g. network, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [5]. Cloud computing can also be described as a systematically devised mechanism wherein the users can use the computing applications as and when they need and they are made accessible in „cloud" through a browser or any other web-based tools [6].

A. Cloud Models

The cloud model is composed of five essential characteristics which include three service models, and four deployment models [5].Currently, cloud model has extended to layers of Business as a Service (BaaS) and Governance as a Service (GaaS) using multidimensional and service-oriented architectural model [7].

B. Cloud Service Models

Software as a Service (SaaS): SaaS refers to a software distribution model in which applications are hosted by a vendor or service provider and made available to internet users through a browser. The cloud providers manage the infrastructure and platforms that run the applications. SaaS represents the potential for a lower-cost way for businesses to use software on demand rather than buying a license for every computer.

Platform as a Service (PaaS): PaaS is a paradigm for delivering operating systems and associated services over the internet without downloads or installation. The defining factor that makes PaaS unique is that it lets developers build and deploy web applications on a hosted infrastructure. PaaS allows customers to leverage the seemingly infinite compute resources of a cloud infrastructure. It provides development environment as a service to the users.

Infrastructure as a Service (IaaS): IaaS involves outsourcing the equipment used to support operations, including storage, hardware, servers and networking components. IaaS enables developers to avoid capital expenditure on hardware and human resources. IaaS delivers infrastructure as a service to the users.

Business as a Service (BaaS): Many companies have migrated to the cloud and run their entire business in the cloud. Cloud computing present new economic models that companies can use to provision IT and services. More enterprises are now employing third parties to reuse their solutions rather than lock their valuable capital in sourcing hardware and software themselves.This model enables enterprises to get more.

C. Cloud Deployment Models

Private cloud: A private cloud is owned by a single organization. Private cloud enables an organization to use cloud computing technology as a means of efficient, lower cost and achieve business agility across channels, market and customer segments [8].

Governance as a Service: Cloud services governance is a general term for applying specific policies or principles to the use of cloud computing services. Governance is one of the important challenges for collaborative enterprises [9]. There is a need to remove policy enforcement from applications and platform and ascribe those responsibilities to an intermediate governance layer. Cloud service governance can be viewed as an extension of SOA governance. A single authority provides governance services to multiple heterogeneous administrative domains in which SOA-based applications enable business and collaborative service that supports end users who are producing and consuming data using software and infrastructure services [7]. Ideally, cloud services governance is integrated into existing governance processes and viewed as an ongoing process but not a product. Governance as a service layer reside in the background defensively governing content throughout the enterprise.

Private cloud: A private cloud is owned by a single organization. Private cloud enables an organization to use cloud computing technology as a means of centralizing access to IT resources in the organization. The actual administration of a private cloud environment may be carried out by internal or outsourced staff. This model has tremendous value from a security point of view.

Public cloud: A public cloud is a publicly accessible cloud environment owned by a third party cloud provider. The IT resources on cloud computing are usually provisioned and offered to cloud providers at a cost. The cloud provider is responsible for the creation and ongoing maintenance of the public cloud and its IT resources.

Hybrid cloud: A hybrid cloud is a cloud environment comprised of two or more different cloud deployment models. This deployment model helps business to take advantage of secured applications and data hosting on private cloud, while still enjoying the cost benefit by keeping shared data and applications on the public cloud. Community cloud: A community cloud is similar to public cloud except that its access is limited to a specific community of cloud users. The community cloud may be jointly owned by the community members or third-party cloud provider that provisions a public cloud with limited access.

III. CLOUD COMPUTING METHODS

Quality of Service (QoS) denotes the level of performance, reliability, availability offered by an application and by the platform or infrastructure that hosts it. QoS is fundamental to cloud users, who expect providers to deliver the advertised characteristics, and for cloud providers, who need to find the right tradeoff between QoS levels and operational cost [2].

Finding out the optimal tradeoff is not an easy decision problem because it involves Service Level Agreements (SLAs) which specifies QoS targets and economic penalties associated with SLA violations. Service providers need to comply with SLA contracts which determine the revenue and penalties on the basis of the achieved performance level[3].

Service Level Agreements (SLA‟s) are signed between the service provider and the Customer where SLA violation acts as major constraints. SLA violation is reduced through mechanisms involving monitoring [4].

Though QoS properties have received constant attention even before the evolution of cloud computing, performance and heterogeneity and resource isolation mechanisms of cloud platforms have significantly complicated QoS analysis, prediction and assurance. Thus, several researchers are investigating automated QoS management methods that can leverage the high programmability of hardware and software resources in the cloud [5].

P. C. Hershey et al. [10] proposed a SoS approach to enable QoS monitoring, management and response for enterprise systems that deliver computing as a service through a cloud environment. Enterprise Monitoring, Management and Response Architecture in Cloud Computing Environments (EMMRA CC) extended previous work to provide structure from which to identify points within the administrative domains where QoS metrics may be monitored and managed. A concrete example was provided for applying the new SoS approach to a real world scenario (viz, distributed denial of service (DDoS). The approach is very effective but it was not applied to federated clouds in real time.

M. Salam et al. [6] proposed a QoS-oriented federated cloud computing framework where multiple independent cloud providers can cooperate seamlessly to provide scalable QoS-assured services. The key elements for enabling cloud federation used were Cloud Coordinators (CC) and Federation Coordinators (FC). The distinct feature of the proposed federation framework is its QoS-orientation that can trigger the on-demand resource provisioning across multiple providers, hence helping to maximize QoS targets and resources usage, eliminate SLA violations and enhance SLA formalization. However, Complex services were not constructed using a mixture of services from different cloud providers and no provision was made for distributed denial of service (DDoS) attacks.

W. C. Chu et al. [7] proposed a formal model to assist not only the ECC services design and construction through SaaS, PaaS, IaaS but also the simultaneous monitoring and dynamic analysis on the QoS factors for the promises from QoS service providers and the service level agreements (SLA) for multiple ECC consumers. Based on the formal model, analysis model and testing model was generated to support automatic testing as well as runtime monitoring to assure the satisfaction to the requirements/SLA constraints. This work had some limitations such as not adapting the features and solutions of IOT into the framework as well as the field experiment.

M. M. Hassan et al. [8] studied and tested the workload of Big data by running a group of typical Big data jobs on Amazon cloud EC2. They created a large simulation scenario and compared the proposed method with other approaches. Though, the proposed approach was cost effective, performance metrics such as delay, delay variable and throughput were no taken into consideration.

R. Karim et al. [9] proposed a mechanism to map the users‟ QoS requirements of cloud services to the right QoS specifications of SaaS then map them to the best IaaS service that offers the optimal QoS guarantees. The end-to-end QoS values was calculated as a result of the mapping. They proposed a set of rules to perform the mappings process. The QoS specifications of cloud services was hierarchically modelled using the analytic hierarchy process (AHP) method. The AHP based model helped to facilitate the

IV. RESEARCH ISSUES AND CHALLENGES

This section presents several important open issues and research challenges as well as research directions for successful service provisioning deployment and implementation. Service availability becomes more important in a dynamic environment. Applications require intensive interaction between the end-user and the cloud service. Hence, service disruption, network congestion, poor signal, and node failure are highly undesirable in service provisioning. When a node moves frequently within the network or changes its point of attachment, many mobile cloud applications demand optimal service through the most suitable node. Again, the scalability of services is a challenging aspect of distributed application processing in cloud computing. Remote application processing is deficient in the centralised management of the distributed platform.

A challenging issue in local distributed application frameworks (APFs) is the unavailability of centralised resources. When a remote service provider is unavailable, remote services become inaccessible, which hinders the objectives of availability of services in a distributed computing paradigm. In addition, the QoS requirements are also evolving with the evolution of the cloud, and therefore service provisioning requires highly reliable good service quality. Similar services and functionalities are provided by the different CSPs, which makes it difficult for customers to select the best and most appropriate service.

Optimal provider selection based on predetermined quality of service (QoS) requirements becomes vital. Moreover, the users' past experiences are exploited in a ranking-based approach to accumulate and identify the preferences between pairs of services to obtain a service ranking. Thus, this approach gets benefits from past user experience. However, user response does not always reflect true feedback. It is necessary to adjust and justify the feedback using statistical techniques to make it as error-free as possible. Furthermore, SLAs are legally binding for both parties, recognised as the terms and conditions of using the service. Because of the fastgrowing number of promising service offers and the lack of a standard specification of services, manual service selection is an expensive task, preventing the successful implementation of ubiquitous computing on demand. Therefore, automatic methods for matching SLAs are essential. Finally, several mathematical and statistical methods and model-based issues are proposed and validated. Service provisioning requires a precise and efficient artificial intelligence learning mechanism, and in the planning stage the number of variants, resource constraints, bandwidth limitations, and properties should of course be considered with respect to run time, hardware, and software.

V. CONCLUSION

Cloud computing is currently an emerging paradigm that envisions a new paradigm of “everything-as-a-service,” hence, virtualizes physical resources, infrastructure, and applications which are being provided through service provisioning in the cloud. The growing adoption of cloud services suggests clear and distinct promises within the cloud industry. Due to the increasing number of cloud providers and the variety of service offerings, it has become difficult for new customers to choose the best provisioned services. Therefore, we have clearly identified service provisioning techniques, mechanisms, and several approaches that must be understood to evaluate the provisioned services in terms of user requirements and costs. Hence, continuous service provisioning that satisfies the user requirements is a mandatory feature for the cloud user and vitally important in cloud computing service offerings. Therefore, we reviewed the state-of-the-art service provisioning objectives, essential services, topologies, user requirements, necessary metrics, and pricing mechanisms. In addition, we synthesized and summarized different provisioned techniques, approaches, and models through a comprehensive literature review. Moreover, a proposal of the thematic taxonomy of cloud service provisioning is presented.

Finally, open research issues are categorized and identified for future research directions.

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