Architecting Software as a Service for Data Centric Cloud Applications

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ABSTRACT

Software as a service (SaaS) is a new software development and deployment paradigm over the cloud. It offers Information Technology services dynamically as “on-demand” basis. The related application data are stored in the data centers managed by the Cloud Service Providers. Many enterprises are facing a major research challenge due to the unavailability of generic cloud architecture for designing, developing and deploying of cloud services. In this paper a flexible architecture for SaaS has been proposed, specifically for data centric cloud applications which may have access to heterogeneous types of databases. The architecture is composed of several layers, which are interacting with each other through the dynamically selected access points of the corresponding layers interfaces. The paper also enlisted the crucial features for SaaS architectural model. Moreover, a detailed comparative study has been done among the proposed SaaS architectural framework and other existing similar proposals based on the listed features.

Keywords: Access Point, Control Flow, Data-Centric Applications, Layer Interface, Quality Features, SaaS Architecture, Scalability, Software as a Service (SaaS)

INTRODUCTION

Computing technologies are continuously evolving, resulting changes in hardware technologies, software systems and business processes. Evolution of hardware technology passes through mainframe systems to personal computers, and mobile devices. Most recently virtualization allows hosting multiple systems within the same IT infrastructure. Changes in software technology followed a similar trajectory it started with batch oriented mainframe applications and moved through client server models to highly distributed service oriented architectures (SOA) and web services. Whereas business processes changes from highly focused
centralized back office support systems to widely distributed and collaborative business operations. The pervasive computing paradigm has recently resulted from these technology evaluations and where cloud computing is the essence of that paradigm. Cloud Computing has evolved as a key computing paradigm which enables elasticity of resources that include infrastructures, middleware and applications. Where cloud architecture can be defined as architecture of the system which is responsible for the delivery of the cloud services. This allows access to large amount of computing power in a fully virtualized manner, by aggregating resources and offering a single system view.

NIST (2011) defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. The cloud model is composed of three service models which are Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). IaaS offers infrastructure services like network, servers, storage etc. In PaaS model programming platforms and tools are offered as a service. When the applications are delivered as a service it is known as SaaS. Through SaaS model, users get their applications as on-demand basis over the internet. The most important feature of SaaS is dynamic provisioning of resources in response to changing requests. SaaS technology evaluated from completely isolated applications for each user like Application Service Provider (ASP) to the totally shared applications (Gold et al., 2004). One of the key benefits of SaaS is the ability to deliver the technology needs of a business as-a-service.

Software as a service is a service delivery model over the cloud. Besides several advantages cloud computing also offers some serious challenges which must be handled efficiently in order to establish SaaS as an effective service delivery model. The challenges that SaaS brings is not like “new technology brings new problems”, but that it offers new spins on the problems that already exists. These challenges can be categorized into Business challenges, Operational Challenges and Technical Challenges. Business challenge includes revenue model, payments, market, customer stickiness and business models on SaaS. In Operational domain service level agreement (SLA), trust and quality of services are major concerns to be resolved.

However, the most critical challenge for SaaS is the technical one. A cloud application needed to be architected with reference to a standard SaaS architectural framework; but there is no common consensus in industry or academia on design and deployment of the cloud services. A SaaS application should be scalable (Espadas et al., 2008; Kang et al., 2008), so that it can be scaled up or down as per the requirements without any degradation in performance (Pervez et al., 2010). Inside SaaS, the flexibility (Tasi et al., 2011; Liu et al., 2010) means the ease with which new services can be added or removed within a system without affecting the other services. This is important for the reason that currently a business environment of software lives in constant change and evolution. A cloud service should be portable (Jing et al., 2010) across the different service providers and it also adaptable (Jing et al., 2010) to any platforms or infrastructures. Moreover, one cloud can contain several applications therefore they needed to coexist (Tsai et al., 2011) in a fully shared environment. Now, it is a common practice that an application is required to integrate with a third party application on-premises or hosted and there must be some mechanism to support it. Moreover, data on cloud can be related to transactional or analytical system. Also, it is possibly required to support SQL (Curino et al., 2011; Kiefer et al., 2011; Hui et al., 2009) and NoSQL (Cooper et al., 2008; Chang et al., 2006) databases as demanded by the applications. Therefore data modeling is also an important issue to be resolved. Beside these challenges business modeling is also a difficult task. As SaaS is a service delivery model for the business therefore it should be
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