

Chapter 7.5

Quality of Cloud Services

Anette Weisbecker

Fraunhofer-Institut für Arbeitswirtschaft und Organisation, Germany

ABSTRACT

Cloud Computing has become the predominant paradigm in information technology for the use of distributed resources. It enables the Internet of Services where different providers offer services and compose services to new value added services. For the emerging service value chains the quality the services plays an important role. Therefore, beside software engineering methods aspects like quality of services, business models, and the interaction with the customer have to be considered during the development of cloud services. This chapter describes how these aspects can be integrated in the development process by combining software and service engineering methods and considering quality as a critical success factor in the design time.

CLOUD COMPUTING

Cloud Computing has become the predominant paradigm for the use of distributed resources like computing power, storage capacities, data and software applications. But still there is no uniform definition of cloud computing. One reason why the term cloud computing is difficult to capture is the missing classification with regard to other approaches like grid computing, software as a

service, platform as a service and infrastructure as service.

In the last years, *grid computing* is being widely accepted when the distribution of high performance computing is needed in virtual organizations. Research on *grid computing* started in research when the need for high performance processing and management of a great amount of data became necessary in disciplines like high energy physics, climate research, astrophysics, engineering, medicine and life science [Schwiegelshohn 2008]. From research grid computing went to industry. This leads to additional requirements

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like specified availability and performance, scalability and beside high performance computing also the support of transactional processing. Also, the type of users changed. In the first grid application developer and user were mostly identical. In industry, the user is normally not the developer of the application. The users expect a user friendly and task appropriate user interface in order to perform their tasks efficiently on the basis of a grid. Hiding the complexity of the infrastructure is therefore a basic requirement for acceptance. The transition from research to industry implicates the change from specific high performance application areas to multipurpose infrastructure for business application. This transition advances *cloud computing*. Beside the characteristics which apply for grid as well as for cloud computing like virtualization, security, scalability, and reliability some other characteristics play an important role for cloud computing. These include usability, multi-tenancy and businesses models in form of pay-per-use models. Furthermore, the quality of services is an inherent feature of cloud computing.

According to [Vaquero et al. 2009] *cloud computing* can be described as follows: “Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service Level Agreements.”

Depending on the type of the provided capability the cloud service can be arranged in three different levels according to the layer of a service-oriented architecture. *Infrastructure as a Service* (IaaS) provides resources like computers and storage as a service. Examples are the Amazon Web Services Amazon Elastic Compute Cloud (EC2) and Simple Storage Service (S3). *Platform as a Service* (PaaS) stands for a platform upon

which applications and services can be developed. Examples of such platforms are the development platform Force.com by salesforce, the Google App Engine or the Microsoft Azure Service Platform. Applications and services on top of the infrastructure and the platform which are used according to a pay-per-use model are summarized in the term *Software as a Service* (SaaS).

The development of cloud services demands more than merely software engineering methods. Aspects like quality of services, business models [Laudon, Traver 2006] comprising value proposition, revenue models, market opportunities, competition environments, as well as the interaction with the customers have become more important. This chapter describes how these aspects can be considered during the design of a service. Therefore, methods applied in service engineering as a part of the research field service science are used to bring in the user perspective in the design of a service. Furthermore, different perspectives of the quality of cloud services are discussed and a possibility is shown how quality as a critical success factor for cloud services can be considered very early in the design of a service.

SERVICE ENGINEERING FOR CLOUD SERVICES

The research field of service science evolves as the significance of services has grown and a systematic way to develop services has become necessary. Service science deals with the use of resources of one or more systems for the benefit of another system in economic exchange [Spohrer 2008]. Service science comprises many areas of research like service management, service marketing, service economics, management of service innovation, service supply chains, and contracting.

Service engineering is the specialist discipline which focuses on the systematic development and design of service products with the aid of appropriate procedures, methods and tools [Spath et al.

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