MDE Approach for the Establishment of a Service Level Agreements Monitoring by Trusted Third Party in the Cloud Computing

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ABSTRACT

Establishing and monitoring SLA violations in real-time has become a critical issue for Cloud Computing. In this paper the authors investigate this issue and propose a model to express the SLA contract requirements using Model Driven Engineering (MDE), as a mean for establishing service level agreements between a cloud provider and cloud customer in the context of a particular service provision. The participation of a Trusted Third Party (TTP) may be necessary in order to resolve conflicts between prospective signatories, likewise to monitor SLA violations in real-time in the goal to ensure online monitoring cloud services and provide better than best-effort behavior for clouds. The main focus of this work is firstly to use MDE technology for the creation of the SLA contract and then to integrate TTP that should be able to apply an advanced penalty model that guarantees the performance and the reliability of the Cloud.

Keywords: Cloud Computing, Domain Specific Languages, Metamodel, Model Driven Engineering, Service Level Agreements, SLA Monitoring, Trusted Third Party

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INTRODUCTION

Currently, Cloud computing (CC) is being promoted as the latest outsourcing solution of the new century. CC represents the evolution of IT towards an Internet-based computing model explicitly designed to enable the transition from inside-out to outside in organizations. It consists to provide IT services as a service on-demand, accessible from anywhere, anytime and by anyone. Through this new computing paradigm, we can now eliminate the need for organizations to build and maintain expensive data centers, moreover we can access to computing resources hosted on the network and benefit from processing capabilities and storage as on-demand services (Maarouf, Marzouk, & Haqiq, 2014). It enables organizations to build up new systems quickly and easily, and has thus become a platform for innovation. With the CC, we can provide elastic resources that allow applications to scale as needed in response to market demands. It increases business continuity by providing inexpensive disaster-recovery options. Along with the development of computing clouds service, an important element that provides some degree of assurance to both users and providers of these cloud resources is the Service Level Agreements (Udoh & Hsu, 2013).

Actually, Service Level Agreements (SLAs) play a pivotal role in CC. The revolutionary technology of CC offers a scalable and flexible paradigm where infrastructure, platform, and software are offered to users in the form of services. The provisioning of these computing services by Cloud providers are regulated by SLAs (Leff, Rayfield, & Dias, 2003).

Service Level Agreements are one of the most common approaches for specifying some form of mutual understanding about business transactions between a Cloud provider (seller) and a Cloud consumer (buyer) in the software and telecommunications domain. Thus, an SLA represents functional and non-functional properties of services and serves as a way for controlling and managing these properties. Typically, an SLA is a bilateral binding statement signed between prospective signatories, over the agreed terms and conditions of the given service (Stanojevska-Slabeva, Wozniak, & Ristol, 2009). SLAs contain Quality of Service properties that must be maintained by a provider, generally defined as a set of Service Level Objectives (SLOs). These properties need to be measurable and must be monitored during the provision of the service that has been agreed in the SLA. An SLA also sets out the remedial action and any penalties that could take effect if performance falls below the promised standard (Mandal, Changder, Sarkar, & Debnath, 2014).

We believe that a differentiating element between CC environments will be the QoS and the SLA provided by the cloud. This raises the following questions: (1) How to describe the SLA terms between cloud providers and cloud customers, such as service levels, penalties in case of SLA violation, etc. (2) How to provide guarantees on cloud QoS and provide better than best-effort behavior for clouds?

We investigate this issue and propose a model for defining a SLA contract using Model Driven Engineering (MDE) approach in CC domain. MDE provides some means of addressing this problematic by considering models as first class items. Another important concept in the MDE is the idea of having domain specific modeling language (DSML) that are used to describe specific behaviors to a domain in a brief and concise manner (Maarouf, Marzouk, Haqiq, & El Hamlaoui, 2014). According to this, every model must conform to a specific metamodel; similar to how a program conforms to the grammar of its programming language. In MDE, it’s common to have a set of transformation engines and generators that produce various types of artifacts. Practitioners can take advantage of transformation engines to obtain source code, alternative model descriptions, deployment configurations, inputs for analysis tools, etc.

In this context, our idea is to use Model-Driven Engineering to express the SLA contract requirements, as a means for establishing service level agreements between a cloud provider and
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