Methodology for Information Management and Data Assessment in Cloud Environments

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ABSTRACT

The emergence of cloud technologies has affected the service computing ecosystem introducing new roles and relationships as well as new architectural and business models. Along with the increase of capabilities and potentials of the service providers comes the increase of the information available and issues to efficiently manage it. In this paper, an architectural approach is presented that involves a combination of a cloud-enabled data model, the monitoring infrastructure and the establishment of assessment mechanisms which are based on factors such as trust, risk, energy and cost (TREC factors). This architectural model discusses the monitoring features as well as the how the assessment functionalities can work together with other components to produce a self-reliant cloud ecosystem preventing any fails during the service lifecycle. This paper elaborates on how the self-management, by using decision-making processes, can maximise business level objectives of the providers. The results presented in the paper show how the suggested architecture can help develop efficient cloud architecture.

Keywords: Architectural Model, Cloud Computing, Cost, Data Model, Energy, Information Assessment, Information Management, Monitoring, Risk, Trust

1. INTRODUCTION

Cloud computing is continuously evolving and becoming one of the most challenging paradigms of Information Technology with various business models to target the needs of users and enterprises (Buyya et al, 2008). Cloud providers are forming broad cloud ecosystem to meet the rising demands. In this paper, two types of cloud providers are discussed particularly the
Service Providers (SPs) which ask for a service to be executed, and the Infrastructure Providers (IPs) which actually execute the service on their infrastructures.

With the rapid evolution of the cloud, together with the new emerging needs of customers, cloud environments are becoming very complex in terms of dimension and management. These systems are composed of various entities, such as stake-holders with different interests such as users or providers, Service Level Agreements (SLAs) contracts agreed between two parties, virtualised resources, to name a few. Thus cloud service models, whether being Platform as a Service (PaaS) or Infrastructure as a Service (IaaS), have huge amounts of information that needs to be collected, managed and evaluated for successful completion of the services. Therefore there is a need to define a consistent cloud-enabled data model which represents multiple entities and their interrelationships managing these efficiently. The virtualisation technology, in cloud environments, offers a manner to autonomously manage IT (cloud) entities allowing dynamic resource allocation that, based on accurate monitoring information, enables the appropriate enactment of cloud-related features like elasticity of services or high availability of resources.

Monitoring information can range from application-related metrics, such as web-based service response time, to infrastructure-related metrics like power consumption or resource capacity and utilisation. This information should then be assessed in order to provide the business-level parameters (BLPs) like trust, risk, ecological efficiency and cost metrics related to the service as a decision-making process.

Self-management of cloud systems should be governed by certain business-driven management policies which embrace the needs of both stakeholders: (1) users, who typically specify several constraints in SLAs, also known as Service-Level Objectives (SLOs); and (2) providers, who have their own Business-Level Objectives (BLOs) to fulfill such as saving costs and energy. This multi-purpose approach may lead to significant trade-offs, which must be solved by proper management policies. For instance, maximising the eco-efficiency of a cloud provider’s infrastructure is possible through the consolidation of several virtual machines in the same physical host. However, the performance of the services running in those virtualised resources may be diminished leading to the agreed SLAs being violated.

The assessment of high-level parameters, such as trust, risk, ecological efficiency and cost, are crucial inputs for these management policies driven by the business aspects in order to efficiently guide the operation of cloud providers in terms of the BLOs fulfillment.

To address the research challenges mentioned, this work contributes in several aspects:

- A generic cloud-enabled data model, which represents all involved entities in typical complex cloud environments and their interrelationships presenting an efficient way to collect, aggregate and store monitoring information from cloud infrastructures.
- Several assessment tools that process monitoring information and are aimed to assist in the self-management of the cloud focusing on trust, risk, ecological efficiency and cost factors (Ferrer et al, 2012).
- Management entities for service (SP) and infrastructure (IP) cloud providers guided by decisions based on assessment tools.
- A policy-related approach driven by both customer needs and provider BLOs. This involves efficient information management and determining the most convenient management action(s) when IT-level events (expected or unexpected) take place.

Addressing the above mentioned points, this paper is organised in the following manner: in Section 2 the related work is presented with the technologies regarding information management in cloud environments. Section 3 introduces the cloud data model of the approach discussed in this paper, with Section 4 discussing the collection process of the information. Section 5 elaborates on the assessment processes within the cloud environment analysing the...
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