A Novel Meta-Information Management System for SaaS

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ABSTRACT

Cloud hosts numerous services with various underlying business logic and data stores. In this multifaceted and distributed environment locating or updating SaaS services is a crucial task. Researchers proposed various mechanisms for this purpose, which involves accessing or altering the meta-information of the services, its underlying business logics. Thus, management of meta-information is crucial for SaaS services. It demands efficient categorization and cataloguing mechanism by preserving semantic-relationships among interrelated services, business processes and data sources. This article proposes a flexible and scalable meta-information management system for SaaS, capable of maintaining dependencies among various SaaS resources. It is useful towards identification of interrelated business processes, services and data sources and facilitates incremental update of meta-information. The proposed system is implemented using Hadoop and a series of experiments have been carried out, which shows that it can efficiently scale and effectively categorize and catalogue different SaaS resources.

KEYWORDS

Map-Reduce, Meta-Information Management, Meta-Information Searching, R+ Tree, SaaS

INTRODUCTION

In general, a SaaS application consists of a set of atomic or composed services, their underlying business processes and business rules to support the services operations and data sources (Mandal et al., 2013 and Papazoglou et al., 2008). A cloud can host numerous services of different types. Thus, the supporting business processes and data sources are also varied to a great extent. Again, a service can be created by combining multiple existing services with different business logic and data sources (Figure 1). Thus, in a large and distributed environment like cloud, locating the compatible service is a crucial task. To address this issue numerous researchers proposed various service discovery, service selection and service composition mechanism. However, almost all of these mechanisms require accessing the meta-information of the services and their underlying business logics to determine the compatibility of the constituent services in the composition. Moreover, in this service-oriented environment, if a service is updated or changed then it may require changing the other services, which are composed...
Figure 1. A generic SaaS architecture

of it. Thus, efficient management of meta-information is taking on much more important role in the service ecosystem (Xue et al., 2015; Kong et al., 2011). This demands an efficient categorization and cataloguing of meta-information for SaaS (Bin et al., 2010) to facilitate the discovery, selection, composition and change management by enabling tracing. This helps in determining how services, business processes or data sources are used across different applications. It also provides the capability to authenticate whether the properties and metaphors accurately reflecting the business goals (Smit et al., 2012). Without it, the data intensive cloud applications cannot be utilized fully the value of automation due to the lack of essential characteristics like, transparency and auditability intrinsic to a non-metadata driven approach (Kong et al., 2011).

An efficient metadata management mechanism will provide the foundation for harnessing the vast amounts SaaS resources from different repositories before they become unmanageable (Zhu et al., 2015; Schissel et al., 2014). The knowledge contained in it will help in understanding service offerings, relationships among different components of the SaaS services, and processes to implement operations on offerings as well as service related constraints and rules (Deng et al., 2011, Gupta et al., 2016). It will also help in determining the content and context of different SaaS resources, thus utilization can be greatly increased (Fu et al., 2008; Forrester Research, 2013). However, in a dynamic and heterogeneous service-based environment like SaaS managing meta-information is challenging task from the technical as well as operational perspective. The technical challenges include: (i) Providing capabilities to enable all stakeholders to discover, understand, and consume services, business processes and data sources (Manasrah et al., 2017). (ii) Enabling a unified view for heterogeneous types of meta-information (Yu et al., 2016; Dev et al., 2016). (iii) It should be dynamic flexible and scalable to accommodate any future changes, as meta-information in cloud changes frequently (Anjanadevi et al., 2014; Cura et al., 2014; Xiao et al., 2014). (iv) It should also capable of mapping original meta-information to the updated one (Shengqi et al., 2012; Liu et al., 2012). Again, from the operational perspective the meta-information management system should ensure:
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