A Novel Cloud-Based Multi-Tenancy Architecture with Efficient Hybrid Authentication Mechanism for Enhanced Security and Resource Optimization

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ABSTRACT

This paper is presented as part of a collaborative research project to develop a complex Cloud Service Delivery Platform (CSDP). The aim of the project is to develop a new disruptive approach for service provision to enable the creation of new value chains via Cloud Technology. This paper is primarily concerned with designing and implementing a novel Multi-tenancy architecture which supports a proposed hybrid authentication mechanism for greater resource optimization with enhanced security. The contribution of this paper is three-fold. First, it provides the reader with a concise classification of security concerns together with some developed concepts namely; Security-Aware cloud platform and a Cloud Adoption Model. Second, it proposes a hybrid authentication approach, coupling Single-Sign-On (SSO) with multi-factor authentication to enable improved security for Cloud federated access. Third, is to design and implement an integrated architecture enabling this hybrid authentication solution in a multi-tenancy setting. To the best of the authors knowledge, this work has not been attempted before and is unprecedented.

Keywords: Adoption, Cloud Computing, Cloud Federation, Cloud Resource Optimization, Cloud Security, Multi-Factor Authentication, Multi-Tenancy, Security-Aware, Single-Sign-On (SSO)

DOI: 10.4018/ijcac.2013070103
1. INTRODUCTION

Cloud computing is widely expected to bring dramatic and disruptive change to the whole business environment as organizations change the way business processes are designed, managed and delivered (Callewaert et al., 2013). Cloud Computing describes a new way of delivering IT services based on Internet protocols, and it typically involves provisioning of dynamically scalable and often virtualized resources. Cloud services offer great benefit to organizations by eliminating complexity of service designing, deploying and configuring. Cloud Computing enables the delivery of services through the on-demand service-provisioning model to end users on a pay-as-you-go basis over a network such as the Internet (Tak et al., 2011). In addition to this, consumers and organizations are asking their suppliers to price their services on a demand model so that pricing is about the value delivered to the customer rather than the cost of the effort to provide it (Ranjan et al., 2012). This inspires efficiency and innovation to find the next opportunity to increase the quality of the experience and life of consumers and at the same time create the conditions for economic growth. The move to cloud computing is related to a global shift towards technology inspired innovation (Ranjan et al., 2012 & Norta, & Kutvonen, L. 2012). Organizations have learnt that exploiting the connectivity of relationships offers many rewards. Key to this is the delivery of information across the technological divide to the fingertips of the user wherever they are, whenever they need it and for a range of different purposes. The ability to take a holistic approach to the management of of the business delivers the ability to monitor quality across the board, measure efficiency and monitor distribution of various aspects of the business (Hassan et al., 2009). For example, real-time on demand delivery of products and services, business intelligence, marketing, sales, automated device connectivity, should be responsive to demand and charge on a demand led basis, reduce time to market and most importantly collaborate with customers, partners and potential new customers and partners (Hassan, M.M et al., 2009; Ferguson, & Hadar, 2010). Using the Cloud, companies can drive a more efficient, effective, and consumer led product that helps them continually reinvent and transform the way they do business, focusing on what makes sense from a business delivery, consumer satisfaction and growth model (Wei, & Blake, M.B, 2010).

Despite the huge potentials of the Cloud, security is the most cited challenge. This paper is touching on the authentication aspect of security, but in a federated environment and Multi-Tenancy setting, which makes it even more challenging. Furthermore this paper is organized as follows: Section 2 outlines the cloud adoption model. Section 3 discusses the cloud security and privacy challenges, In Section 4, describe secure authentication settings for cloud federation. In section 5, introduce the proposed hybrid authentication with multi-tenancy with real world implementation settings. In section 6 we describe the future prospects of the proposed solution.

2. CLOUD: THE ADOPTION MODEL

Despite the huge investments in marketing the Cloud technology, and despite the huge potentials in revolutionizing the current service provisioning approach, and creating substantial business growth and savings, the technology has only been partially exploited and the adoption rate is still much lower than anticipated.

Several industrial and research surveys and reports have been published analyzing the situation in an attempt to understand the reasons behind the slow adoption of the Cloud technology and act upon them in order to attract more businesses to the technology. There are many reasons why Cloud business services delivery is not widely exploited (Cloud Security Myths and Strategies Uncovered 2011). Security comes on the top of the list of concerns on all of these surveys and reports (Buyya, R. et al.,...
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