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Enterprise Resource Planning for e-Government in the Cloud

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Abstract— E-Government has long endured a myriad of problematic issues associated with traditional enterprise resource planning (ERP). Cloud computing is being lionized as a nascent platform that possesses the capabilities to reduce costs and drive radical innovations throughout all spheres of e-Government. One such low hanging fruit is that of Cloud ERP which is positioned as a revolutionary approach to the traditional ERP implementation. In this reflection paper, we use the 5-4-3 cloud stack layer model to identify value potential for particular aspects of cloud computing in ERP for e-Government provision.

Keywords: e-Government; cloud computing; enterprise resource planning; innovation; 5-4-3 stack model.

I. INTRODUCTION

During these recessionary times, organisations are turning their attention to emerging innovative low cost ICT solutions in order to parsimoniously achieve a competitive advantage over rival organisations. One such low hanging fruit is cloud computing which constitutes a nascent computing paradigm where hardware and software computing resources are provided as a service over a network from large scale data centres. Cloud computing represents a fundamental change in how information technology is provisioned [1] in that it enables computing facilities such “as storage compute power, network infrastructure and applications to be delivered as a metred service over the internet, just like a utility” [2]. Further, cloud computing is now being evaluated and considered for e-Government provision.

There is evidence to suggest that cloud computing has become a strategic direction for many government agencies, and has the capability to be employed in critical areas of the government’s IT infrastructure [3][4]. It has been argued that “the real strength of cloud computing is that it is a catalyst for innovation and in keeping with Moore’s Law, as cloud

computing becomes more cheaper and ubiquitous further opportunities for innovation will manifest” [5]. The motivation for this reflection piece is to explore the potential of cloud computing for e-Government as a viable alternative mechanism to traditional enterprise resource planning (ERP). We first discuss traditional ERP implementation, we then focus on public sector ERP, and examine how cloud computing can provide mechanisms for improved ERP in the public sector context.

II. FROM TRADITIONAL TO CLOUD ERP

An ERP system is an integrated software solution, typically offered by a vendor as a package that supports the seamless integration of all the information flowing through a company, such as financial, accounting, human resources, supply chain, and customer information. ERP systems are designed to solve the fragmentation of information over many legacy systems in large organisations. Traditional ERP has beneficial effects that remove the need for often disparate and unreliable end-user applications, standardise operating procedures and reporting; and optimise some of the key processes of the firm. However, traditional ERP can be extremely risky [6]. ERP systems were initially designed for private sector organisations; however governments and public bodies soon began to envisage the potential benefits that they too could derive [7].

A report by the Bookings Institution in Washington, “Building a Long-Term Strategy for Growth through Innovation”, highlighted how governments can save 25% to 50% in costs by moving applications to the cloud [4]. The main benefits associated with deploying a cloud ERP include low implementation, continuing, licencing and support costs; faster implementation of IT projects and increased agility allowing organisations to adjust to changing market environments [8]. As the cloud computing paradigm continues

to evolve the benefits and risks associated with selecting a cloud solution become more understood and accepted by potential adopting organisations. In Australia, the New South Wales Government's trade and investments department have selected SAP's *Business By Design* Software-as-a-Service (SaaS) ERP cloud solution for mission critical applications for a cluster of 16 agencies. The SaaS model is expected to accrue savings of AUD\$12.5 million per year across the department.

Microsoft's cloud ERP offering, *DYNAMICS AX 2012*, contains functionality that has been tailored specifically for use in the public sector. In the U.K., two local government authorities, serving a total of 214,000 combined residents, selected *DYNAMICS AX 2012* as part of a procurement process to be the cornerstone of their ERP infrastructure. The scalable infrastructure allowed the two local authorities to streamline their operations, reduce staff by up to two thirds and collate average savings of STG£3 million per year.

In order to fully comprehend the capabilities afforded by cloud computing it is necessary to explore the value potential across the cloud computing layers. In the following section we explore these capabilities in the public sector ERP context.

III. CLOUD COMPUTING LAYERS AND PUBLIC SECTOR ERP

A comprehensive and widely accepted definition of Cloud Computing is provided by the National Institute of Standards and Technology (NIST), who define cloud computing, 16th and final revision, as: "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.....[It] is composed of five essential characteristics, three service models, and four deployment models" [9]. It is this definition and delineation that we employ in this paper, in particular, what we term the *5-4-3 cloud computing stack model* [10] comprising of the essential characteristics layer, the deployment model layer and the service model layer (figure 1). We now apply the *5-4-3 cloud computing stack model* to identify those components and choices available to best effect value in public sector ERP implementation.

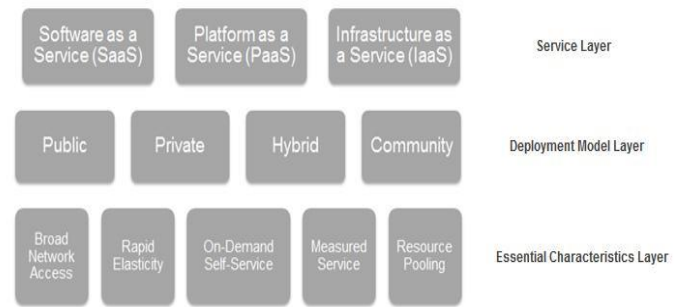


Figure 1. 5-4-3 Cloud computing stack model

A. Essential Characteristics Layer

The bottom layer contains 5 well-described components that underpin the mantra of cloud computing. Certain components such as elasticity provision and resource pooling are provision-dependent. All components would be present in a cloud-based ERP implementation, but the manifestation of these 5 characteristics in an organisation or public sector is largely dependent on the deployment model implemented.

B. Deployment Model Layer

The middle (deployment) layer comprises four cloud deployment models, public, private, hybrid and community. Value rests with the cloud deployment model that best fosters an innovation process that promotes a greater focus on increasing core competencies while balancing this focus with the cost of cloud-based services. In the public service context, and considering pressure on e-Government initiatives to facilitate easily-accessible systems for the public, and with value a stakeholder concept, an increased value may be gained through leveraging public and community-based cloud deployment.

C. Service Model Layer

The top layer comprises the 3 well-established cloud computing service models commonly referred to as the SPI (Software, Platform, Infrastructure) model describing each as a service [9][11][12]. Value can be facilitated by channelling various outbound services through one of the SPI components, and is dependent on the business focus of organisations or bodies. In the public service context, service layer choices reflect those in organisational and other private contexts, with provision needs indicating the appropriateness of choice. However, considering the relative strengths of public or community deployment models, public service bodies and agencies have an increased emphasis on ensuring a secure overall architecture.

IV. E-GOVERNMENT CLOUD ERP ADOPTION STRATEGY: LEVERAGING THE CAPABILITIES OF THE 5-4-3 STACK MODEL

Despite the unwavering advocacy by cloud computing evangelists and acolytes regarding the many benefits associated with cloud ERP for e-Government, demand has been stagnated somewhat by the age old chicken-versus-egg dilemma. Governments have been wary of cloud solutions due to a lack of research and case studies in a public sector arena, while vendors have been slow to furnish cloud solutions due to a lack of demand.

One possible avenue for e-Government to leverage the capabilities afforded by the *5-4-3 cloud computing stack model* would be, on a trial project basis (figure 2), to transition and consolidate the disparate departmental systems of a number of public sector agencies into a single ERP project in the cloud. This “cluster” of agencies could perhaps implement a ‘vanilla’ ERP cloud SaaS solution on a hosted platform to support finance, payroll, procurement and human resources functions. The benefits of implementing a ‘vanilla’ solution include rapid deployment, minimal configuration and the capability to support standard processes. The overall aim of this trial project would be to deliver prerequisite minimum capability and depending on the results of the trial could provide the foundation for the aligning of public sector legacy systems on a mass scale (figure 3).



Figure 2. Trial “cluster” systems alignment



Figure 3. e-Government systems alignment

V. CONCLUSION

According to [4], all levels of government should “move aggressively to cloud computing in order to achieve service improvements and cost efficiencies.” In this reflection paper, we utilised the *5-4-3 cloud stack layer model* to identify value potential for particular aspects of cloud computing in ERP for e-Government provision. The *5-4-3 cloud computing stack model* is combinatorial, in that choices are made at each layer, with higher layer choices dependent upon those below. In this reflection piece, we identified particular aspects of the *5-4-3 cloud computing stack model* of direct relevance to public sector cloud-based ERP. We also presented an adoption strategy that e-Government could trial prior to mass deployment. Further research is warranted to explore the relative importance of the model’s layer components in the context of cloud ERP.

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