Cloud Migration Process
Case Study on Business Migration Process to the Cloud

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Abstract: Cloud computing has become a trend in the Information Systems (IS) field and provides an interesting prospect for the Information Technology (IT) industry. Main reasons why business are moving into the cloud is due to the opportunity for costs reduction, flexibility, and high automation. However, moving all business data into the cloud raises some security concerns. Hence, our work is to determine a business process for migration businesses to the cloud that adds transparency and clarify ambiguities of this move to small-medium business holders. In this paper we describe our approach to design a migration process for small-medium enterprises, therefore following process-oriented reference model in design science research. We present the migration process and underline various migration options and proven methods to increase its adaptation to business.

1 INTRODUCTION

Cloud computing describes a general movement within the IT industry towards delivering computational and storage capacities as services, with the facility to increase, or decrease capacity dynamically to match usage needs. This paradigm presents an attractive business model, allowing consumers to share the investment in infrastructure necessary to achieve their IT requirements. There are five essential characteristics in cloud computing: on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service (Mell and Grance, 2011). There are many reasons why businesses are increasingly moving to the cloud, such as reduced costs, agility, flexibility, highly automated, and quality (Grossman, 2009).

Cloud computing has become a hugely popular topic, many of the globe's largest technology providers look to cloud as a selling point for their hardware and software products. It is clear that cloud computing is a very important technological development; a lot of companies have started to use it in earnest, and will do so increasingly for the foreseeable future. Thus, strategies for migrating business to the cloud are of huge importance. Unfortunately, given the complexities of even the simplest business models, this is not an easy task. It can hinder small-medium enterprises from accessing the opportunities of the cloud which has a lot to offer. Thus, the knowledge on how to migrate to the cloud is a significant problem for the small and medium-size enterprises (Ambrust et al., 2010).

The reminder of this paper is organized as follows. We present our research methodology based on the process-oriented reference model (Ostrowski and Helfert, 2012). Then, the migration process is outlined.

2 DESIGN SCIENCE

Design science focuses on creations of artificial systems. It addresses research through the *building* and *evaluation* of artefacts designed to meet identified business needs (Hevner et al., 2004). Design is proposed as a research strategy to gain knowledge and understanding about the object under construction. Artefacts are understood as entities that have some separate existence (Goldkuhl, 2004). In our research, the artefact is a business process of migrating business models to the cloud. Hence, we built our artefact by following process-oriented reference model that guides design science researchers aiming at artefacts in a form of business

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processes. Figure 1 illustrates the reference model in the design science settings.

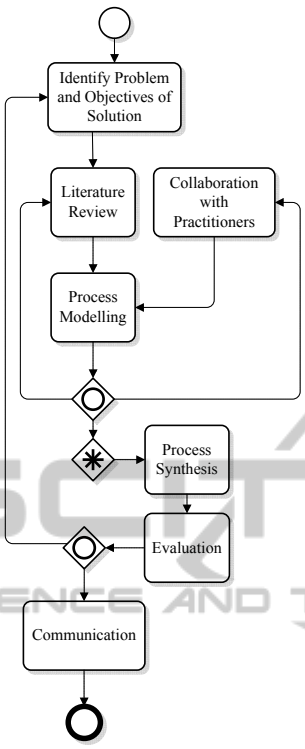

Figure 1: Overview of the Process Oriented Reference Model in Design Science Research (Ostrowski and Helfert, 2012).

3 THE MIGRATION PROCESS

The following case study describes the application of the above research methodology. In the period of 6 months, we have constructed a consolidated process and supporting methods to the migration of business models to the cloud. During the course of the research, we have applied the process oriented reference model.

The identification of process migration problem started due to requirements of an industrial research project. The research project was supposed to develop an application hosting scenarios range from on-premise solutions to private and public clouds for small and medium enterprises. In this context it became evident that a consolidated process of migration business models to the cloud was needed. Thus, the first idea for the research problem came from industry requirements.

Business migration to the cloud can be understood and approached from various angles. According to the Cloud Business Model Framework (Weinhardt et al., 2009), our migration process considers the migration at the *platforms in the cloud* layer. This layer distinguishes between development and business platforms. The former enables developers to write the applications and upload their code into the cloud. The latter enables the development, deployment and management of tailored business applications in the cloud. Our migration process focuses on the latter where development of the business cloud applications is in close cooperation with the cloud provider. At the high level the migration process consists of four activities: Plan, Development, Deployment, and Post-deployment (Figure 2).

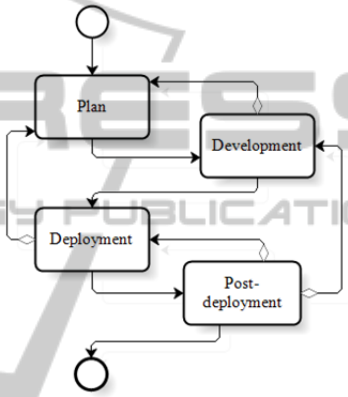

Figure 2: The high level view of the migration process.

3.1 Plan

The main goal of the Plan phase is to understand the business model and determine if the cloud make sense to the business and what impact the cloud may have on it. This is usually carried out by business analysts and industry experts. Their work covers three stages: assessment, analysis and planning of the process migration. These stages are optional components, which can be used in parallel to produce the foundation for migration. In the following subsections we describe them in more detail.

3.1.1 Assessment

The goal of the assessment stage is to select and determine applications and processes in which they are involved for the migration purpose. The stage consists of four consecutive activities. Firstly those applications that exist within the business are identified, and those that are not suitable, in general, for migration are eliminated. Secondly, applications that are external to the business process are

identified and partitioned from those that are solely internal to the business process. Next, evaluation of feasibility of the selected applications to the cloud is undertaken. The evaluation is carried out from three perspectives: *business:* What is the business benefit of migration this application to the cloud? *technical:* How technically feasible is it to move this application to the cloud? *risk:* What risk is involved in moving this application to the cloud?

During the evaluation, there are different methods for making decisions or ranking the scores of assessment result, such as analytic hierarchy process (AHP), multi-criteria decision analysis (MCDA), solution alignment workshop (SAW). Finally these results are fed into an assessment result document. This document is tailored for the specific business process involved.

3.1.2 Analysis

The analysis stage involves understanding the customer's business requirement and analysing those requirements from several perspectives: c*ost*, b*enefits, time, and strategy.*

The aim of this stage is to get the deep knowledge about the way the business operates and how the business works. This is achieved by running workshops with each organization units to comprehend their daily work-flow, and determine how migration can fit in. The outcome of the analysis activity is a blue-print of the business processes along with possible solutions that the cloud provider has to offer. This enables the business to determine their detailed requirements.

3.1.3 Planning

This stage can be viewed from two perspectives: success criteria and capability. The success criteria define what a successful migration looks like, while the capability defines what the technical requirements are for a successful migration.

For a successful migration the success criteria must cover: metrics, milestones, type of migration and its manual and automated parts. There are also capability perspectives that determine: the types of technology needed to achieve a successful migration, required skills and tools, how to leverage existing knowledge within the company.

After the planning stage, both parties are clear about the deliverables and the agreed time-frame illustrates how the cloud provider will interact with the on-going business.

3.2 Development

At this phase the cloud applications and technical environment for the business scenarios to move to the cloud are developed. During the development, varieties of tests are performed, such as functionality, unit testing, and user scenarios that checks how the infrastructure handles the business scenarios. These tests ensure data integrity across the business processes.

Generally, we can distinguish six stages of the development process through which each cloud application goes. These are described below.

Developing Business Architecture. At this stage the Cloud provider tries to accommodate the work environment and the current core technology of the business to accommodate business scenario in cloud environment. The idea is to keep as much of the business infrastructure including the applications working with sensitive data and business processes intact.

Building Cloud Infrastructure. The key part of this stage is to map Cloud architectural environment to business scenarios and processes. The environment may include network design, directory design, messaging topology, application topology, development methodology, development process, and operations process.

Developing the Cloud Technical Environment. At this stage, the cloud provider installs the technical solutions and cloud applications for each component of cloud infrastructure, such as the net-available bandwidth for network, the authorization or identity management software for directory, antivirus applications for messaging system, database servers for data exchange and storage.

Testing and validating each Migrated Component. After installing and configuring the software, the next stage is to run the simple initial test that validates the software installation and functionality. Its goals are to verify the Cloud components meet requirements.

Attaining Client approval. To attain business approval, the Cloud provider generates a set of reports of the performance and Quality of the Cloud Service (QoS). These reports show the outcome of the testing stage and describe each migrated component.

Milestones. This refers to the state when one functional part of the business has been migrated successfully, and the business can start make use of it. At the same time, it gives the Cloud provider a closed case which they can refer as a wok well done for future reference (e.g. white papers).

3.3 Deployment

After developing the cloud applications and technical environment, the cloud provider is ready to move a business component to the cloud. This usually involves plugging the application to the business database. There are three main aspects to be considered here: specification of the plugged cloud application, a data backup, and documentation of the migration.

3.4 Post-deployment

Most cloud providers claim that their cloud products are user-centric or customer-oriented, which means customer satisfaction is one of the key considerations. Ensuring that customer receives value for money and their satisfaction with the product is decent are the main goals of post-deployment. Generally, Cloud providers combine questionnaire (manual method) and monitoring metrics (automated method) to measure or evaluate customer satisfaction, which can help to improve the quality of services and usage rate.

In terms of monitoring metrics, cloud providers offer their customers monitoring services or applications in order to help them to maximize the utilization of cloud products and resources. The automated tools can generate advanced reports to visualize and monitor resource utilization, which can help to improve user experience, as well as customer satisfaction. The goal is to ensure the businesses that they pay for what they have used.

5 CONCLUSIONS

In this paper we presented a process of migration business to the cloud based on insights gathered from IT Cloud consultants and IT cloud solutions providers. By business we understood small and medium enterprises (SMEs) willing and being suitable to move their business components to the cloud. The business process is addressed to SMEs that are the users of the cloud applications rather than providers of IT solutions to the cloud.

The process also demonstrates a successful application of the process–oriented reference model in design science settings.

Further research could look into the infrastructure and application layers of the cloud migration. The migration process for IT business solution providers differs significantly from the IT business users which we presented in this paper. IT would be also beneficial to have a set of methods that could help maintain and encourage collaboration with practitioners for the research purposes in for the long term.

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