Enterprise Architecture Frameworks for Enabeling Cloud Computing

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***Abstract*— Cloud computing has emerged as a strong factor driving companies to remarkable business success. Far from just being an IT level support solution cloud computing is triggering changes in their core business models by making them more efficient and cost-effective. This has generated an interest for a lot of companies to try and adopt cloud computing for their existing and new business process. In this research we present an approach which a company can use to analyze if its operations can be positively impacted by moving to the cloud. Further we describe our approach using which the company can make that transition to the cloud.**

Keywords-Enterprise Architecture Frameworks, Business Models, Comparing Models

I. INTRODUCTION

A common business process classification model distinguishes management, core and support processes (e.g. [1]). Generally, IT is found amongst the support processes, which implies that it is largely governed by the requirements of the core processes.

At first glance, one would thus assume that Cloud Computing is simply a new way of implementing a support process by outsourcing resources and services. However the decision to adopt cloud computing can actually have a large impact at the sustainability and growth of the business - especially for companies in startup stage or those aggressively entering new fields of activity. Growth requires two distinct capabilities:

- Ability to scale when it comes to execution of current business processes.
- Ability to evolve in terms of either adoption of existing processes or creation of new ones.

By leveraging key advantages of Cloud Computing like virtualization, load balancing and cost per use through a cloud computing service, scalability can be ensured almost completely. We are thus no longer talking about outsourcing resources and services on the support process tier, but outsourcing of a whole management process.

When a company starts with the evaluation of the usage of cloud computing, knowledge in form of best practices about processes, infrastructure components is highly valuable. Best practices describe how other companies implemented cloud computing, reports the experiences, and give hints for a successful implementation. Such knowledge can be systematically gained by case studies, usage reports and classified according to predefined dimensions which are relevant for cloud computing. However the question is how to describe the dimensions of a best practice? And how to describe the current situation of a company who want to implement cloud computing? In this research we propose that models from an enterprise architecture framework (like the Zachman framework [2]) are excellent starting points. In such a framework the dimensions are defined according to customer business model, processes, IT Landscapes and organizations, industry sector (telecom, logistics etc.). Further the (graphical) models do not only allow the adequate representation of business knowledge; but the semi-formal nature of the models supports a tool-enabled alignment of current business with best practices. Both aspects are going to be discussed in more detail now.

II. MAKING A COMPANY CLOUD-READY

When a company wants to investigate if it should use cloud computing, it needs to analyse the management processes concerning the growth as well as the supporting processes concerning the existing IT infrastructure. Unfortunately there exists no (consolidated) knowledge like well-accepted guidelines or business patterns which can support this analysis and provide a constructive way to change the processes in order to implement cloud computing. In the current situation - and for the next couple of years before the consolidated knowledge would become accepted - a company could only rely on some best practices and try to adapt to them.

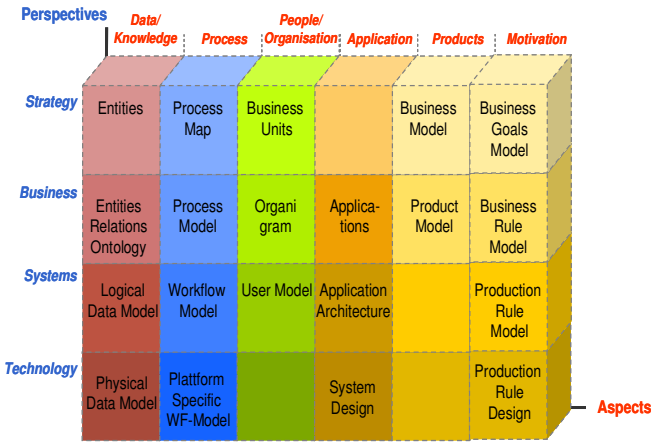

Figure 1. Models associated to perspectives and aspects [4]

The best practice provides experiences of how a company should change its processes for a successful implementation of cloud computing. Probably a company may use a blend of several best practices to suit its specific use case. Using best practices needs a description of them and a repository where these best practices are collected.

A. *Graphical Models for Describing Best Practise*

For the description of best practice and the current situation of a company many different forms are possible. But a framework which wants to support the comparison of the current case with a set of best practice the description needs to be at least a form which captures all knowledge, presents it adequate way to the user and support the user when comparing the descriptions. We believe that a format like graphical models would greatly support the alignment. They are more knowledge-oriented than informal text, easy to understand by humans as well as understandable by tools in some way. In fact there are graphical models for describing different business purposes available including business processes, organisational structures as well as the IT infrastructure. Further these graphical models constitute the right abstraction level where business users are able to express their knowledge. On the other hand these graphical models provide a good starting point for the comparison because they are at least semi-formal. The Zachman framework [2] provides a set of graphical languages where different aspects of the business as well as the IT can be described and aligned. However for this purpose the modelling languages of the Zachman framework may be too detailed. Instead we propose a simplified framework for modelling languages for the Business -IT alignment which also incorporates other approaches for enterprise architecture modelling (e.g. [3]) and can be used as well for this purpose to describe the best practices and the current case. It classifies different existing modelling languages according to their aspects for which they are able to represent that knowledge and perspective where one can distinguish if this models is more concerned with the business or IT level. The framework is described in more detail in [4].

B. *Comparison of Graphical Models*

The current situation of a company has to be aligned with best practices. The more closet one may constitute a solution how to implement cloud computing. However the comparison includes, that models needs to be compared, which are represented in different modelling languages. They may differ in their aspects as well as in their perspective.

The comparison of such models in semi-formal, graphical modelling languages needs to address two different dimensions. The first dimension is concerned with graphical elements of the modelling language itself. A graphical element has a specific meaning. The comparison should only compare elements of different languages which share the same (or similar) meaning. The second dimension includes the meaning of the models itself which comes with the labels of the graphical elements.

For our framework we propose to transform these two dimensions in different ontologies. There are a group of ontologies for the first dimension for the graphical elements, the modelling language ontologies (MLOs). Another group of ontologies considers the second dimension, the domain ontologies (DOs). During the comparisons both dimensions needs to be considered. The comparison of the graphical elements may be performed with the help of syntactical transformation rules on top of the MLOs. The transformation rules defines how graphical elements in MLO_1 are converted into graphical elements in MLO_2. With the help of these rules a model in language wrt. MLO_1 can be converted into a model in language wrt. MLO_2.

For the translation of the domain we annotate the model with terms from probably different DOs. Then these DOs need to be aligned. For this task we propose to use existing ontology matcher. But first experiments outlined that ontology matchers need to be restricted and for the alignment the graphical elements needs to be considered as well.

III. NEXT STEPS

The proposed framework allows representing all aspects and perspectives of an enterprise. However we think that not all models are important for the purpose enabling companies for cloud computing. One next step is to elaborate which models are required and which models might be optional and in which modelling languages they are represented. We already started with a small set of best practices but a valuable repository needs more cases.

Another next step is concerned to the comparison of the models. First prototypical services are implemented which transforms graphical models into ontologies and connect them to MLOs and DOs. Services for the comparison are identified. Currently we are going to implement them.

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