

# Cloud Broker: Bringing Intelligence into the Cloud

## An Event-Based Approach

Stella Gatzju Grivas, Tripathi Uttam Kumar, Holger Wache

Institute for Information Systems

University of Applied Sciences Northwestern Switzerland

{stella.gatziugrivas, uttamkumar.tripathi, hogger.wache}@fhnw.ch

**Abstract**— *Handling changes of business processes, and making sure systems are up and running after a change in the business process with minimum downtime is something which has been of interest to researchers for long and there have been several approaches proposed for it. With Cloud computing becoming increasingly popular businesses require a strong system for cloud based implementations which can handle change management of processes. In this paper we propose a change management approach for cloud backed business process models.*

**Keywords**— *component; business process evolution, events, cloud computing, cloud broker*

### I. INTRODUCTION

Cloud computing has emerged as a technology becoming quite popular among companies and business. Consequently, the paradigm of managing business models and business processes in particular is rapidly evolving.

In past, there have been several studies and approaches of handling changes in a business process model which impacts IT systems [1], [2]. However several new factors and parameters come into play while handling agility of a process using cloud services.

In this short paper we would present briefly a tailored event-based approach towards handling more efficient changes in a cloud supported business process model. We would present the architecture for such a system and would conclude by talking about next steps

### II. HANDLING PROCESS AGILITY

In today's dynamic market environment business processes are always by necessity evolving. There are several reasons which require the evolution of business processes like achievement of maturity over the time, handling of new state regulations, adapting to competition etc. Companies must to be agile and react to changes in its environment otherwise they stand the risk of perishing.

On the other hand, cloud computing facilitates business and IT agility because through it a user can change the IT environment (infrastructure, platform and application) quickly and easily. For example to scale up and scale down - the more expedient the business moves, reducing costs or driving revenue. This means that agility and evolution of the IT environment is a crucial aspect of cloud computing.

It is a necessity to consider how the business process evolution affects the agility in a cloud environment. The goal of our current work in cloud computing is to handle the

known evolution of business processes as described in [1] while making sure we leverage the key features of cloud computing:

- Ability to scale
- Marketplace of several providers giving similar services at different prices and/or SLAs.

We propose a central Cloud Broker component responsible for the management and the governance of the cloud environment as supported today in many systems [4]. Our contribution is an extension of the functionality of Cloud Broker, which now has the intelligence to react to the changes of the business processes in order to change the cloud configuration (to scale up and scale down or to choose a new provider).

The Cloud Broker has knowledge about:

- The supported business processes. We use for the representation of the business process BPEL[3]. Our Cloud Broker is able to understand BPEL-artifacts.
- The existing service offerings from the marketplace, which are used in the current cloud instantiation.
- The current relations between the business processes and the cloud services. We talk here about a "binding" between services and processes.
- The offerings in the marketplace. We assume that the Cloud Broker manages a repository of all providers and services (including all information) which are relevant to the value chain of a company. This allows the Cloud Broker to change the cloud configuration when necessary (because of the process evolution). We are currently working on a framework/language to describe the different cloud services.

Fig. 1 shows how the Cloud Broker operates during the lifetime of the cloud environment. During the evolution of a business process all business process changes (like the new process -red box in the figure-1) are monitored and propagated to the Cloud Broker in form of atomic events like "Add\_Process(A)", "Delete\_Process(B)", "Add\_Before(A,B)" etc. [6], [7]. Together these messages are called *change alerts*. We support complex event representations as well (through a sequences of business process changes) as proposed in [5]. Based on a set of rules which the broker follows, it decides how to react to a particular change and then takes the required action, e.g. with a new service binding (S3 in our example).

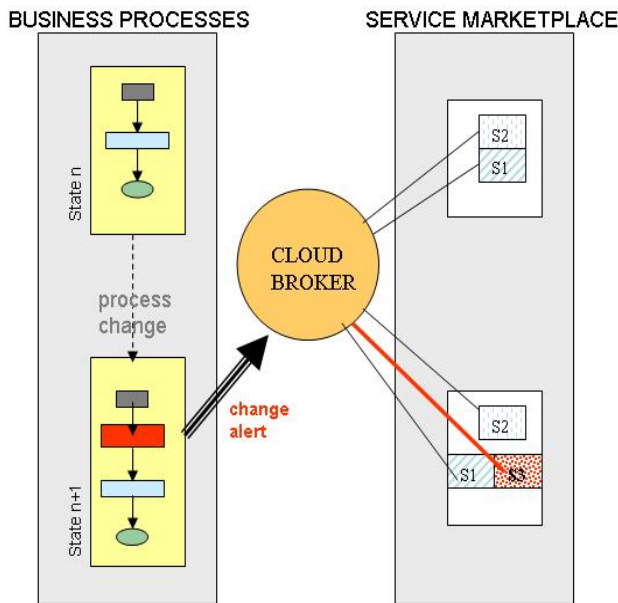


Figure 1: Describing how changes are handled by the Cloud Broker

#### THE CLOUD BROKER

In this section we describe the different roles/tasks our Cloud Broker performs during the business process' lifecycle:

- Discovery and binding of services to the process model when the model is set-up for the first time
- Understanding business process changes
- Deriving non-explicit changes (triggered by process changes)
- Carrying out changes on the service binding side.

##### A. Discovery and binding of services

During the *set up* and *build of the cloud*, the cloud provider and the appropriate cloud services are selected and the integration with business processes takes place. We understand it as a "binding" of the various service interfaces of the business process to the cloud service offerings available. For this purpose, the Cloud Broker comes pre-loaded with a set of offerings already available in the market (like details of providers offering computational services). Cloud broker identifies the set of service providers which suit the business' requirement and completes the binding.

##### B. Understanding business process changes

When a business process changes, the new BPEL process is published. At the same time an alert is sent to the cloud broker about the modification of the business process. This alert is followed by a sequence of change event messages which describe the overall change in atomic steps.

These changes logs help the cloud broker develop a sketch of new services that are required, old services which might be deleted and services which might be replaced by new ones.

##### C. Derive non-explicit changes (triggered by process changes) which can make the business more efficient

Sometimes a change in the business process when analyzed can result in service bindings which can add value to the business (but these are not a part of original changes triggered by the business process).

For example let us consider an online retailer X which changes his business model (and in accordance changes the business processes) and focus on customers placing orders from their homes in the evening (may be through some promotional scheme). This change can implicitly cause more traffic to the retailer's website during evening hours. We assume that there is a capacity service provider which charges less compared to current provider of the retailer X during those hours.

Our Cloud broker is designed to analyze and detect these types of non-explicit changes over a period of time and make changes at service binding level to adapt to them.

##### D. Carry out service binding changes

This step happens similar to step A described above. Based on the new service bindings required as per the changes triggered cloud broker removes service bindings not required anymore, creates new service bindings and replaces the bindings as needed. After the completion of this step the new business process is up and ready to continue running.

### III. NEXT STEPS

We are still in the phase of comprehensive architecture design for the cloud broker. We investigate on an event language and on a language/description for the offering in the cloud marketplace. Once the cloud broker is ready we plan to have a pilot study done for several common types of business process models which are frequently used by companies carrying out their businesses using the cloud.

For identifying these business models we are carrying out a survey (and gaining knowledge from earlier surveys) to figure out which industries and companies have had considerable success and highest adoption for cloud based IT systems.

#### REFERENCES

- [1] U.K.Tripathi, K. Hinkelmann, "Change Management in Semantic Business Process Modeling," 8th International Symposium on Autonomous Decentralized Systems, pp.155-162. IEEE Computer Society, Washington, 2007
- [2] <http://www.fit-project.org/Documents/D8.pdf>
- [3] <http://docs.oasis-open.org/wsbpel/2.0/wsbpel-v2.0.pdf>.
- [4] <http://www.datacenterknowledge.com/archives/2010/01/22/cloud-computing-brokers-a-resource-guide/>
- [5] K. R. Dittrich, H. Fritsch, S. Gatzu, A. Geppert, Anca Vaduva "SAMOS in hindsight: experiences in building an active object-oriented DBMS", Source Information Systems Volume 28, Issue 5, July 2003, pp. 369 - 392
- [6] S. Rozsnay, R.Vecera, J. Schiefer, A. Schatten, "Event Cloud - Searching for Correlated Business Events, 9th IEEE International Conference on E-Commerce Technology, 2007
- [7] A. Hinze, K. Sachs, A. Buchmann, Event-Based Applications and Enabling, Technologies, DEBS, July 2009