Enterprise Architectures for Cloud Computing

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***Abstract*—In this paper we describe an approach to graphically externalize the cloud potential of a company, considering its architectural description. For this purpose it is shown how current architectural description can be extended, in terms of knowledge and graphical representation. The goal is to focus on the most important features and aspects to consider during the evaluation of shifting into a cloud environment. Even if each company has different strategies and approaches to its business activities, there are some domains related to the shift in a cloud environment that should be considered in any case. This paper shows how these main areas can be taken into account in order to extend the architectural representation of a company and express its cloud readiness.**

I. Introduction

Enterprise Architectures was born as an information technology discipline. Initially the purpose of Enterprise Architectures was to promote the strategic development of an organizations IT systems through the modelling of the organization, as well as the aligning of IT purchasing and development with business priorities [4]. In [1], an Enterprise Architecture is a strategic information asset base, which defines the mission, the information necessary to perform the mission, the technology necessary to perform the mission, and the transitional processes for implementing new technologies, in response to the changing mission needs. An enterpise architecture characterizes and models the enterprise throught a set of interrelated layers or views: strategy, business, data, applications, and technology.

A company which decides to shift into the cloud must have a mature and well formed understanding of the Enterprise Architecture on which is based and, thus, a clear view of components which concern it. This understanding is absolutely necessary for the enterprise to make meaningful decisions related to cloud computing.

The goal of this work is related with one main question: can companies use the existing Enterprise Architecture frameworks to understand if they have potential to go into the cloud? This means, understand if the architectural description given by one of the available Enterprise Architecture frameworks, is enough to evaluate the company cloud-readiness.

More precisely, the goal is to find out if the architectural description of the company already includes specific features. These are important characteristics to consider before deciding to go into the cloud.

There are many areas and related best practices which should be considered by a company that desires to move into the cloud. For example important recommendations identified deal with application security and encryption. Some recommendations concerning application security and encryption can be identified, e.g. [2] includes: 1) the management of application credentials is critical: they should be protected and secured; 2) it's important to use encryption to secure the storage of data in the cloud environment. In a similar way, data is protected by an encryption method during its usage within a cloud environment, as well as in an external system; 3) the chosen encryption system should conform to the existing industry and government standards; 4) keys used to encrypt data must themselves be protected when they are stored, in transit or backed-up; 5) check if the data are encrypted also during the transit inside the cloud provider's network. Cloud provider's network is more secure than the Internet but, anyway, it's shared between different customers; 6) it's possible that in IaaS scenario, also virtual machines files and temporary data need to be encrypted.

It can be hypotesized that possible consequences deal with the violation of private information. Without using an encryption method, the data used by the company are in clear. This means that, if they are stolen or retrieved in some way, they can be read, dealing to a loss of confidentiality. Integrity problems can appear if the data are modified by non-authorized people.

II. Representation Extensions

If Enterprise Architectures would be suitable for the evaluation of cloud readiness they would allow statements with respect to recommendations. Unfortunately Enterprise Architectures don't include any kind of information related to cloud computing issues. For example, Enterprise Architectures miss any kind of a description of service level agreement (SLA). Furthermore nearly any recommendation is hard to be determined in current Enterprise Architecture frameworks. This is the main reason why an extension to the architectural representation of the company is needed.

The representation extensions needed to describe the main issues related to the shift in a cloud environment are the knowledge representation and the graphical representation. The graphical representation helps to quickly and easily identify the main issues, for the company considered, related to the shift to a cloud environment. To be able to do that, it's necessary to close the gap between the generic recommendations and the graphical representation. This is done by describing these best practices in a more formal way (e.g. business rules), in order to automate them and to related them with specific symbols of the graphic representation.

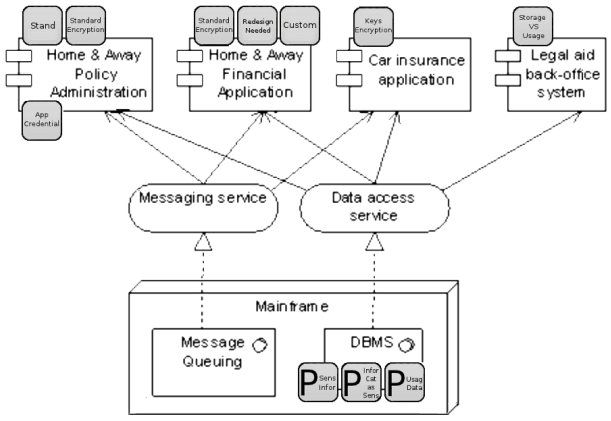

Fig. 1. Graphical representation of the technology level

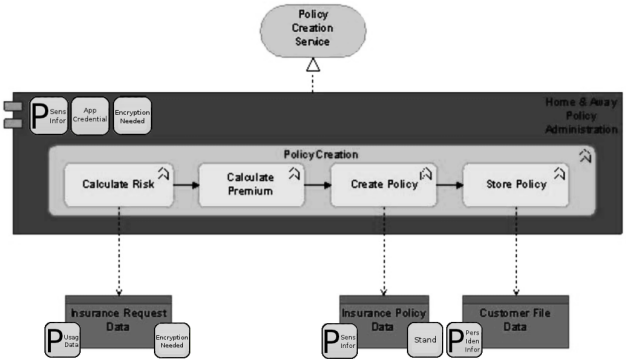

Fig. 2. Graphical representation of a structure of one or more applications or components

The graphical extension considers each level of a generic EA framework. In each layer, some icons are added each of which represents an issue related to the cloud readiness of the company. Figure 1 and Figure 2 show two examples how graphical representaions can be extended. In Figure 1 the presence of DBMS leads to the necessity to indicate that they manage data with different levels of privacy. Concerning the applications, in the current level, they just inherit their features described in the application level. All the symbols used to mark a specific application will be reported in this level. As explained later on, applications are tagged with icons expressing their level of standardization.

The main graphical extensions for application level in 2 deal with different issues. For example, considering the area of application security and encryption, each application should be marked in order to show if their level of security should be increased, in order to go into the cloud.

The knowledge representation allows to close the gap between the recommendations and the graphic representation. The knowledge representation considers the best practices and describes them in a formal way, in order to automate them. The formal description used for the knowledge representation is the business rules method. The formalization of the recommendations helps to link them to the graphical representation. In more detail, it helps to link the recommendations to a specific layer (or more than one) of the general Enterprise Architecture framework used and to a specific symbol.

The recommendations related to this domain, impact different views of the company. In particular, they deal with the applications, data and strategy perspectives.
Applications are affected by these best practices since they should use a method of encryption in order to safely manage the information. For this reason, it's important to define this need on the application level of the company description.
A proposal of some business rules, follows:

1) It is obligatory that each Credential *is* encrypted if Application *hasCredential* Credential.
2) It is obligatory that each File *hasEncryptionStorage* EncryptionMethod if Application *usesFile* File.
3) It is obligatory that each File *hasEncryptionUsage* EncryptionMethod if Application *usesFile* File.

III. Conclusion

Figure 3 shows the mapping between the knowledge representation, graphic representation and the affected best practices. For each recommendation area, the number of the influenced best practice is shown. The present paper is a short version of a technical paper [5].

Best Practice	Knowledge Representation	Graphic Representation
Application security and encryption		
1	Business rule 1	App Credential
2, 5, 6	Business rules 2, 3, 4	Storage VS Usage
3	Business rule 5	Standard Encryption
4	Business rule 6	Keys Encryption
Portability and		

Fig. 3. Mapping between knowledge representation, graphic representations and best practices affected

References

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