



A STUDY OF CLOUD COMPUTING TOWARDS GOVERNANCE FRAMEWORK SECURITY LIFECYCLE

Diwakar Ramanuj Tripathi
Research Scholar Kalinga University
Dr.Rupak Sharma
Asst. Prof

ABSTRACT

The cloud computing paradigm provides a more efficient way in which to provide IT services, introducing on-demand services and flexible computing resources. The adoption of these cloud services is being hindered by the security issues that arise with this new environment. A global security solution, which deals with the specific particularities of the cloud paradigm, is therefore needed, and literature fails to report on such a solution. As a consequence, in this paper we propose a novel security governance framework focused on the cloud computing environment. Externally provisioned cloud services enable flexible and on-demand sourcing of IT resources. Cloud computing introduces new challenges such as need of business process redefinition, establishment of specialized governance and management, organizational structures and relationships with external providers and managing new types of risk arising from dependency on external providers. There is a general consensus that cloud computing in addition to challenges brings many benefits but it is unclear how to achieve them. Cloud computing governance helps to create business value through obtain benefits from use of cloud computing services while optimizing investment and risk. Challenge, which organizations are facing in relation to governing of cloud services, is how to design and implement cloud computing governance to gain expected benefits. This paper aims to provide guidance on implementation activities of proposed Cloud computing governance lifecycle from cloud consumer perspective.

KEYWORDS: Cloud computing governance, Governance Vitality Method, Open Group, Cloud computing governance lifecycle.

INTRODUCTION

Over the last decade, a number of governance frameworks for information technology (IT) have been developed. Commonly used IT governance frameworks are COBIT, ITIL, ISO 38500 and governance for service oriented architecture (SOA). Most of IT governance frameworks do not have any available guideline for their implementation in enterprise. Due to excessive complexity and scope of IT governance frameworks, many organizations do not fully implemented these frameworks or do

not implemented these frameworks at all. SOA Governance Framework helps organizations to define and deploy their own enterprise governance of SOA. SOA Governance Framework contains SOA Governance Vitality Method which is a cycle consisting of phases Plan, Define, Implement and Monitor. SOA Governance Vitality Method defines a complete method for establishment, monitoring and improvement of SOA governance model in particular organization. Cloud computing is a



model of delivering shared and configurable computing resources (eg. applications, storage, servers, etc.) as a service which can be rapidly provisioned over network on-demand without service provider interaction. Cloud computing has become highly demanded due to its benefits (eg. IT cost reduction) which are well known and widely recognized. Along with utilizing cloud services, a number of areas which require a careful consideration had arisen. These are mostly concerning data issues, legal requirements, auditing issues and long-term viability of cloud service provider. Governance in cloud environment helps to realize benefits resulting from the use of cloud computing services while minimizing risk, optimizing investments and ensuring compliance with legislative and regulatory requirements. It ensures oversight of qualitative parameters of cloud services such as performance or security which are needed to carefully monitor to ensure the creation of business value. Cloud computing and service oriented architecture (SOA) are related approaches which focus on services and thereby both cloud and SOA share some basic principles. SOA and cloud computing may coexist, complement and support each other. SOA can help create conditions for successful adoption and governance of cloud computing services. Common principles of both SOA and cloud computing represent a good predisposition for a unified governance system.

This paper proposes Cloud computing governance lifecycle which is based on SOA Governance Framework. SOA Governance Framework enables organizations to define and deploy their own SOA Governance model adapted for specific business environment. This paper shows what is needed in order to achieve effective implementation of cloud computing

governance. This paper adapts methodological components of SOA Governance Framework and extends them for governing cloud computing services. These methodological components, which are after their adaptation suitable for cloud computing governance, are part of proposed Cloud computing governance lifecycle and serve as a base of cloud computing governance. Their adaptation is based on scientific research and on practice in a large IT organization. The original contributions of this paper are:

- Adaptation and redefinition of SOA Governance Vitality Method (SGVM) for cloud computing environment taking into account structure of SGVM
- Definition of maturity level of cloud computing governance based on IT governance maturity level
- Adaptation and redefinition of SOA Governance Reference Model guiding principles for cloud computing environment
- Adaptation and redefinition of SOA Governance Reference Model governed processes for cloud computing environment
- Redefinition of SOA Governance Reference Model governing processes for cloud computing environment
- Adaptation and redefinition of SOA Governance Reference Model structure, roles and responsibilities for cloud computing environment
- Redefinition of SOA Governance Reference Model artifacts for cloud computing environment

CLOUD COMPUTING MOTIVATIONS



The origin of computing started with “centralized computing” infrastructures and a long era of mainframes and mini computers survived in the IT markets (which are fully operational even today). The IBM mainframes run mission critical applications (i.e. banking or engineering control systems) even today. IBM still manages dedicated innovation centres for their mainframes and extends sale and support services of mainframe hardware to their clients. A large community of legacy IT experts still support centralized computing on mainframes as opposed to “distributed computing” on multiple low end hardware platforms. A legacy mainframe expert Kahn claims in light of IBM mainframes has celebrated 45th anniversary, it still delivers much better outcomes than any other computing platforms. Thousands of believers in mainframe systems still vouch for them but have been proved as minority against the huge community supporting distributed computing architectures. The distributed computing era has led to organisations hosting large number of low cost computers collaborating to deliver applications as per business requirements. However, this architecture resulted in reduced stability, increased cost, faster obsolescence (with poor backward compatibility), increased number of people to manage IT and above all too much of management time spend on IT issues (Khan 2009) . The corporations that have implemented mainframes may still be comfortable to continue with them but the ones owning distributed computing environments are looking forward to new innovative model.

CLOUD COMPUTING KEY CHARACTERISTICS

The current cloud computing initiatives in relation to software as a service and platform as

a service models. The authors investigated Cloud Computing key characteristics by evaluating the dominant models. The following sections describes these key characteristics.

- 1. Elasticity and Scalability:** From the consumers’ perspective, elasticity refers to the ability of the system to dynamically and fluidly scale up and down, and reallocate resources across consumers in a granular fashion. Automatic on-demand allocation and non-allocation of resources based on consumer requirements (person as consumer, or program as consumer) is at the heart of elasticity. Elasticity is enhanced where encoded rules, policies and algorithms drive resource allocation. Elasticity is undermined where human intervention or interpretation is required. Elasticity is necessary to support dynamic business models that are based largely on modes of revenue generation focused on rapidly changing interaction models. As needs change for the customers of an elastic service, the service can be scaled up, down, in or out to meet the need of the moment. Ideally, elasticity goes two ways. Scaling up a system to billions of transactions or millions of customers requires the ability to add system resources as you go, but you also need to be able to scale back on those resources should their need be obviated. Raw scalability of the service model is less important than elasticity of the service model.
- 2. Service Model:** A separation of concerns between provider and consumer is a fundamental characteristic of any “as a service” model. Separation



of concerns is particularly important for cloud computing, because it is an essential ingredient needed to deliver elasticity, support the economic model for cloud computing and encourage greater competition among service providers. The separation of concerns is focused on a service boundary that defines the interface between service provider and consumer. The boundary is defined by the service provider, and consists of a set of IT interfaces, such as menus or programmatic calls (not human interactions) to access, configure, manipulate, consume and/ or programmatically extend the service. The provider is responsible for optimizing everything below the service boundary hiding complexity from the consumer. The consumer does not own, control, specify, manage or interface with any enabling technologies or related best practices and methodologies used by the cloud service provider to build deliver and run the cloud service offering. The consumer does not need any on-premises hardware or software, except what is used to consume/use the cloud service (for example, a browser),

and only needs to care what a service does, not how it's implemented. Using the service as a foundation, the consumer is responsible for any additional development that might be necessary above the service boundary to create an application.

CLOUD COMPUTING GOVERNANCE LIFECYCLE

SOA governance simplifies definition and implementation of effective cloud computing governance. There is no unified definition of cloud computing governance. Cloud computing governance is supposed as specialized governance system for governing IT services in cloud computing environment where cloud service provider is external third party company which deliver its services to cloud service consumer. This paper assumes that cloud computing governance is specialization of SOA governance and extends SOA governance policies, processes, roles and responsibilities and other component on specific characteristics of cloud computing from the cloud consumer perspective. Figure 1 shows cloud computing governance and its relationship to SOA governance.

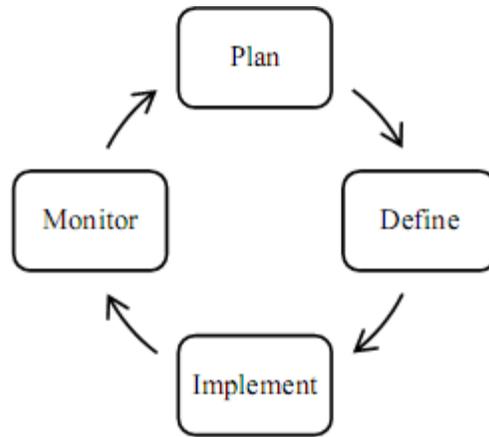


Fig. 1- SOA Governance Vitality Method

Due to specialization relationship between SOA governance and cloud computing governance, definition of cloud computing governance may be derived from definition of SOA governance. Because SOA governance is a set of components and relationships between these components, cloud computing governance is a set of policies, guiding principles, processes, roles and responsibilities extended for cloud computing environment which focuses on effective use of cloud services while minimizing costs and risks, so that cloud services produce the expected business value in accordance with business needs. It implies that cloud computing governance must not stand in isolation but it must be part of the overall governance structure in organization. Proposal of cloud computing governance lifecycle is based on SOA Governance Framework and fully reflects its

structure and its methodological components. SOA Governance Framework is methodological framework created by the Open Group to govern and manage service oriented architecture (SOA). SOA Governance Framework enables organizations to define and deploy their own SOA Governance Model adapted for specific business environment. SOA Governance Framework consists of SOA Governance Reference Model (SGRM) and SOA Governance Vitality Method (SGVM) which is a process that deploys and improves SGRM. SGVM is carried out in a cycle consisting of four phases which are plan, define, implement and monitor (see Figure 2). SGVM is a continuous process based on gradual iterations which helps to continuously increase efficiency of SOA Governance.

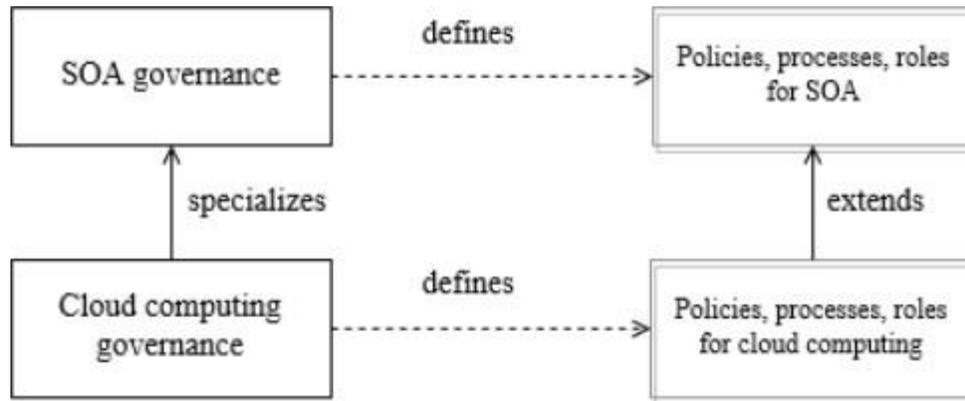


Fig. 2. Specialization and extension relationship between cloud computing governance and other governance systems in organization

As SOA governance, cloud computing governance can be implemented in a number of activities carried out in a cycle consisting of planning, definition, implementation and monitoring (as shown in Figure 3) with the aim to establish and improve cloud computing governance model. This cycle called Cloud computing governance lifecycle enables individual adjusting of cloud computing

governance model to meet specific business needs as well as a gradual improvement of level of cloud computing governance. As well as SOA Governance Framework, Cloud computing governance lifecycle defines guiding principles, processes, roles and responsibilities and artifacts extended for governing of cloud computing environment.

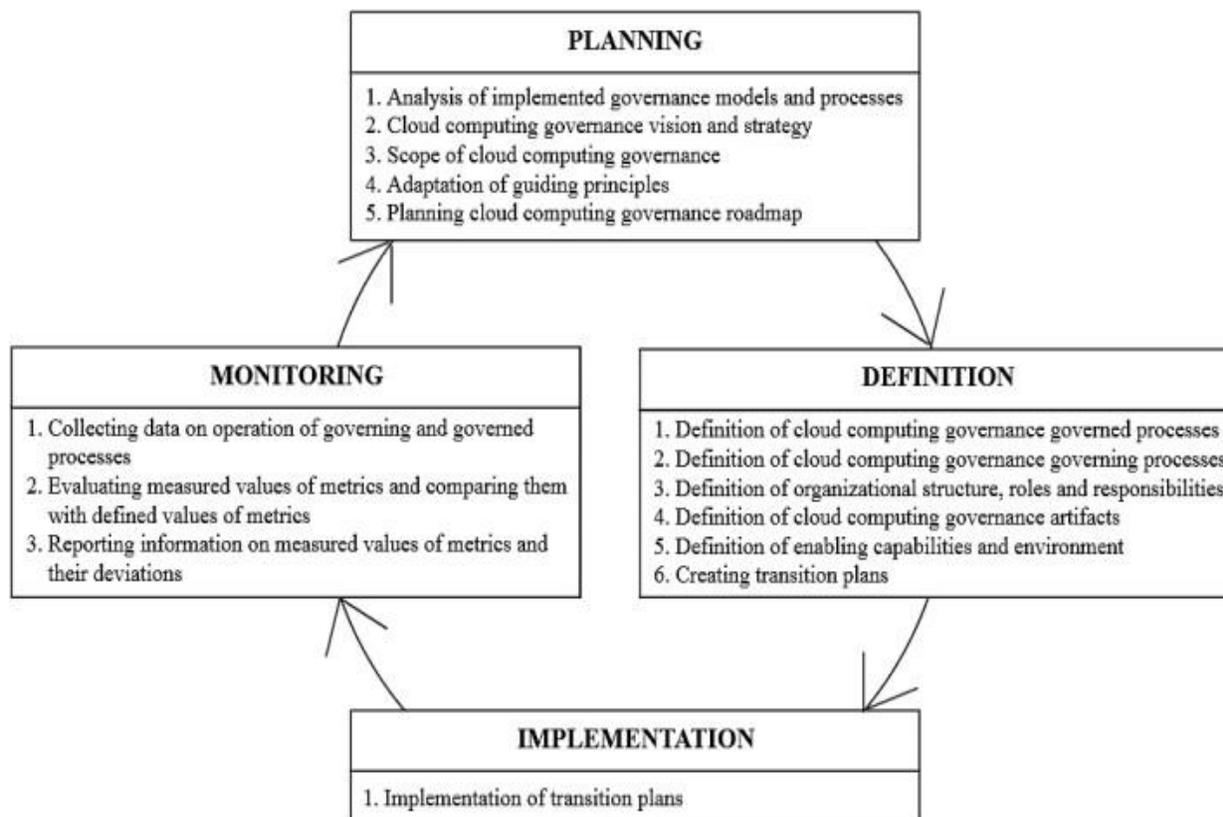


Fig. 3. Cloud computing governance lifecycle

CONCLUSION

Cloud computing governance has a great significance in helping to meet business requirements through using of cloud services. As cloud computing continues to increase its importance it is essential that organizations understand how to meet business objectives through utilizing of cloud computing services and achieve a higher level of business IT alignment, how to obtain benefits from cloud computing services and how to optimize cloud investments and related risks. Although there is no accepted framework for cloud computing governance, organizations can to adapt principles and processes from existing frameworks such as COBIT 5 or SOA

governance to govern cloud computing services. The question remains how to adapt these frameworks and which principles and processes are relevant for cloud computing. However, a problem arises in their implementation as well. Proper implementation of cloud computing governance has a great impact on business value creation and on level of gained benefits from cloud services utilization. There are some difficulties that organizations face while deploying cloud computing governance such as integrating cloud computing governance into existing governance structures in organization, planning cloud computing governance roadmap, designing effective cloud computing governance



structures or lack of consistent governance processes. Guidance on implementation of cloud computing governance helps to overcome these difficulties and facilitate deployment. This paper proposed Cloud computing governance lifecycle as a partial result of research in the field of governing public cloud computing services from cloud consumer view. Cloud computing governance lifecycle is based on SOA Governance Vitality Method and on literature reviews on SOA and IT governance frameworks. Starting point of cycle is by first assessing both governance structure in organization and maturity level of cloud computing governance if implemented, and then putting effort to define where the organization wants to be in the meaning of cloud computing governance vision, strategy and its scope. Part of planning cloud computing governance must be planning roadmap to implement strategy into praxis. In definition phase, an overview of cloud computing governance governed processes, governing processes, organizational structure with should be established along with cloud computing governance, roles and their responsibilities, needed technology and artifacts are provided. Definition phase is ended by creation of transition plans which must be implemented in a next step. Last part of cycle is monitoring deviations from claimed parameters which has a potential to start cycle from the beginning.

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