

Cloud Computing

Design of a Management Model for Service Migration using ITIL as Knowledge Manager

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Abstract: Nowadays, the IT departments face numerous problems which considerably affect their performance. Several factors such as technological obsolescence that shortens the useful life of equipment, amount of data that demands storage (Anaya, Díaz, y Bárcenas, 2017), the high equipment costs, skilled labour as well as the timely update of the IT infrastructure, endangers the information. (Vega, 2012). To solve the problems, mentioned before Cloud Services were developed due to the boom in terms of use and ease of access to the technology they promote, as well as flexibility in storage capacity, ample deployment of resources and security in case of recovery in the event of loss of continuity of service. All this based on an optimization or reduction of costs for companies, thus allowing a great competitive advantage at a technological level. (Ávila, 2011). The present study, through the analysis of security standards with several subprocesses of the ITIL V3 reference framework and an analysis of infrastructure costs "On-Premises versus IaaS", allowed the development of a Methodological Proposal to migrate Services to the Cloud, based on the use of good practices, optimizing resources according to the needs of each organization.

1 INTRODUCTION

Today, the offered services and applications published on the web have made the average speed of Internet connection at the end of 2016 grow to 7 Mbps worldwide, which represents 26% more than 2015 (Belson, 2016). Given this, Cloud Computing Services currently appear, which provide a very complete and customized technological infrastructure, adjusting to the constant change of companies, as well as a planned scalability (Ávila, 2011).

The constant development of ICT makes the technology investment progressively grow, so today the top management of several organizations expect to make their investments profitable to achieve a more efficient position in relation to the competition (Marulanda, López, y Cuesta, 2009), where the cost-benefit analysis defines the way to follow (On-Premises Versus The Cloud) taking into account factors such as: technological obsolescence, preventive and corrective maintenance of

infrastructure, support and specialized skilled labor, constant and uninterrupted continuity of services.

The present study is aimed at developing a Methodological Proposal to Migrate Services to the Cloud as a managerial technical level tool that helps in making decisions efficiently in all affairs raised within a migration project.

2 REVIEW OF THE RELATED LITERATURE

2.1 Cloud Computing

According to the National Institute of Standards and Technology (NIST), is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources like networks, servers, storage, applications, and services (Mell y Grance, 2011).

The providers of Cloud Computing basically offer three service models: Infrastructure as a Service

(IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS)

2.2 Infrastructure as a Service (IaaS)

The IaaS services provide the client with storage space, memory, network connectivity, and direct administration of the operating systems so that the user can deploy applications. It also allows to modify the resources according to the client's needs (Mell y Grance, 2011).

2.3 Platform as a Service (PaaS)

The PaaS model enables the client use applications in the Cloud as well as tools, services, and development environments which are created by the provider and deployed in his infrastructure. The client cannot manage these resources including network resources, servers, operating systems, etc. However, he does have the possibility to deploy data, manage applications and settings obtained in the cloud. (Mell y Grance, 2011).

2.4 Software as a Service (SaaS)

This service is defined as a software that is owned, delivered and managed remotely by one or more providers. Software-as-a-Service is typically accessed through clients as a web browser, or a smartphone. The infrastructure is administered by the provider who is completely responsible for availability and quality assurance. (Hernández y Florez-Fuentes, 2014).

2.5 Gartner Magic Quadrant for Cloud Service Providers

The Gartner Magic Quadrant is a research method designed to monitor and evaluate the progress and positions of companies in a specific, technology-based market which is analyzed in a certain moment. That is why Gartner, as a consulting and research company of Information and Communication Technologies, is dedicated to the continuous analysis of aspects that will define or evidence the market leaders. This information can be used as a reference source for decisions makings when choosing the best alternatives, in August 2016, Gartner published the last analysis about cloud services (Leong, Petri, y Dorosh, 2016). regarding the market leader providers as it is shown in Figure 1.



Figure 1: Gartner Magic Quadrant.

3 ITIL V3 FOR CLOUD

ITIL (Information Technology Infrastructure Library), is a set of concepts and best practices regarding the management of IT services, and describes in detail an extensive set of functions and processes designed to help organizations achieve quality and efficiency in IT operations (León, 2014). The latest version of ITIL, is structured in the following 5 processes with the objective of consolidating the "service lifecycle" model: i) Service Strategy, ii) Service Design, iii) Service Transition, iv) Service Operation and v) Continuous Service Improvement as shown in Fig 2.



Figure 2: ITIL Service Lifecycle.

Next, the most relevant subprocesses of ITIL are presented, which allow to guarantee the entire transition to contract services in the Cloud, beginning

from its hiring, to then validate an optimal implementation, ending with an adequate operation.

3.1 Service Portfolio Management

Sub process that belongs to the service strategy process, which will help the company to know what services and systems are currently available within the organization's platform (Ríos, 2017). Once you have the detail of IT systems and services, you can verify the migration of one or more of these aspects to the cloud.

3.2 Availability Management

It is part of the Service Design Process. ITIL availability management is used to guarantee application systems stay available. This usually means making sure everything is up for use under the conditions of service level agreements (SLAs) (ITeratum, 2011). The fulfilment of the supplier's availability management serves as support in the resolution cycle of incidents associated with the availability that allows the identification, diagnosis and resolution of incidents, in addition to supporting the prevention of future measures (ITeratum, 2011).

3.3 Service Validation and Testing

The IT client and provider should follow the process of validation and tests performing the verification of the items to be tested, constructing the test scenario, performing the tests themselves, validating the data obtained by conducting the tests and transmitting the results before the deployment of cloud services to the production environment (ITeratum, 2011).

3.4 Knowledge Management

It is highly recommended for both, the client and the provider to do the knowledge management during the migration process helping you and your team make decisions throughout the service process by controlling and managing the flow of information. Improving the quality of information prepares employees to make effective decisions, and the end result is a more efficient team (ITeratum, 2011).

3.5 Service Desk

The management of incidents through the Service Desk of the service provider, works first in the generation of a case assigning a priority of attention. As a first contact with the user, the person who

generates the case tries to solve the incident if possible, in addition, the individual can escalate the incidents or requests to other areas within the provider and once the case is resolved, it is closed. Finally, he conducts surveys to determine the degree of user satisfaction (ITeratum, 2011).

3.6 Access Management

Access Management aims to grant authorized users the right to use a service in the cloud. The administration roles of the platform should be delivered to the client, who will appoint a platform administrator. This person should create roles for the services that are obtained in the cloud as well as issuing these credentials to the users of the IT services (ITeratum, 2011).

4 SECURITY AND CURRENT LEGAL REGULATIONS

In the context of Cloud Services, Ecuador was considered to verify security and contracting issues, which are regulated by state agencies. Therefore, we have the following rules:

4.1 ISO/IEC 27017

It is used with the ISO 27001 norms and gives the providers and clients the controls of the cloud services. As opposed to other related norms, these allow to clarify functions and responsibilities between both parts so that the Cloud Services keep safe as well as the data of a certified information management system (Fernández y Recio, 2015).

4.2 ISO/IEC 27018

The ISO norms define a practice code which can be used as a standard for the privacy acting as processors of personally identifiable information. Additionally, it establishes commonly accepted control objectives, controls and guidelines for implementing measures to protect Personally Identifiable Information where the client can manage the published data in the cloud, however, the provider is the one who keeps the data according to the client's guideline (Fernández y Recio, 2015).

4.3 Executive Order 1515

In 2013, the president of Ecuador decrees to issue

contracting provisions for the acquisition and lease of goods and the rendering of services, that meets the principle of technological validity.

The Executive Order 1515 in its Art 1, establishes the scope of action for compliance with the Technological Validity for the entities dependent on the Central Government of Ecuador and the agencies dependent on the Executive Function, as well as the goods that will benefit from this validity: computer equipment, printing equipment, vehicles and medical equipment. For the acquisition of these equipment in the field of public procurement in Ecuador, preventive maintenance, corrective, technical guarantees and replacement of purchased goods must be ensured (Sercop, 2013).

4.4 Código Ingenios (Ingenios Code)

The Article 146, Data Localization, norm to the entities of the public sector when contracting services that involve the location of data, where it is specified that it must be done with suppliers that guarantee that “The data must be found in computing centers that meet international standards in protection and security” (ASLE, 2016).

5 TOTAL COST OWNERSHIP

Total Cost Owner, is a financial estimate intended to help buyers and owners determine the direct and indirect costs of a product or system (Ellram, 1995). The use of this method in the present analysis allows the clients to compare the Cloud Services and On-Premises, identifying the costs that can be optimized in phases of implementation operation, support, maintenance and training of the staff required, focused for any type of IT service. Nevertheless, other factors may be considered as necessary for each type of business or company.

Next, the calculation of TCO is presented, focused on two providers that lead the Cloud Services according to Gartner: Amazon and Microsoft (Leong, Petri, y Dorosh, 2016). (See Fig.1). Furthermore, they have TCO calculators, taking as a reference a period of 3 years, two servers to host an Application and a Database with the following characteristics shown in Table 1:

When entering the data in the Amazon calculator, according to the requirements, the following results are obtained (See Fig. 3).

Table 1: Server Specifications.

APPLICATION	Operative system	LINUX
	RAM Memory	32 GB
	CPU	8 CORES
	Hard disk space	400 GB
DATA BASE	Operative system	LINUX
	RAM Memory	140GB
	CPU	20 CORES
	Hard disk space	1000 GB

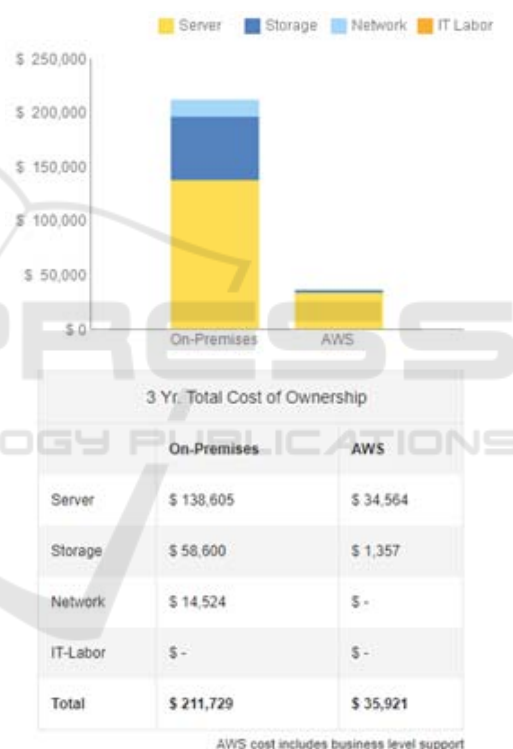


Figure 3: TCO Amazon.

Now, entering the same specifications of the two servers to the Microsoft calculator we get the values detailed in Fig. 4 below:

Estimated On-premises cost (3 year(s))	
Compute cost	\$99,108
Data center cost	\$11,207
Networking cost	\$14,703
Storage Cost	\$5,460
IT Labor Costs	\$2,365
Total on-premises cost over 3 year(s)	\$132,843
Estimated Azure cost (3 year(s))	
Azure compute cost	\$13,028
Azure data center cost	\$0
Azure networking cost	\$0
Azure storage cost	\$4,424
IT Labor Costs	\$1,077
Total Azure web direct cost	\$25,824

Figure 4: TCO Microsoft.

In the two scenarios, the On-Premises is analyzed by comparing IaaS with a 3-years projection based on the following parameters: i) Server Cost; ii) Accommodation in the Data Center; iii) Connectivity; iv) Storage; v) Technical Staff. Comparing the costs, the values detailed in Table 2 are obtained:

Table 2: Server Specifications.

Production Environment - 3 years			
Amazon		Microsoft	
On-Premises	IaaS	On-Premises	IaaS
\$211,729.00	\$35,921.00	\$132,843.00	\$25,824.00
Difference	\$175,808.00	Difference	\$107,019.00
Saving	83.03%	Saving	80.56%

Therefore, it can be observed that more than 80% is saved by migrating the Services to the Cloud, when compared with buying and managing On-Premises. Additionally, support costs, preventive or corrective maintenance and updates must be considered as well as having trained staff during the technological period that is proposed for 3 years.

By graphically representing the costs provided by Amazon and Microsoft with the On-Premises Scenario and the Cloud Service, we can see what is shown in Fig. 5 below:

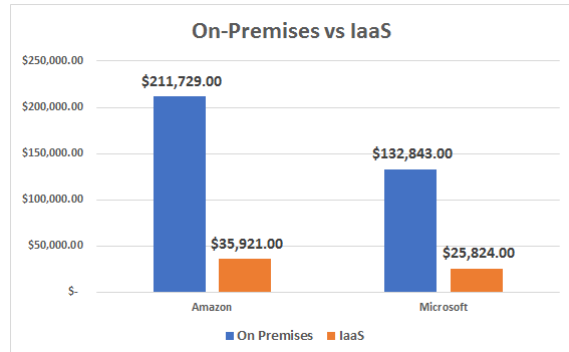


Figure 5: On-Premises versus IaaS.

6 RELEVANT EVALUATION OF PROVIDERS

Based on the analysis of the Total Cost of Ownership - TCO, the Current Legal Regulation, Security Certifications by providers and other benefits that the Cloud can present to improve processes in a company, it is important to have minimum points to make the decision about a provider which can add value, in the improvement of the business (ITeratum, 2011).

The factors analyzed are synthesized in detail in Table 3 that describes the aspects to be evaluated when selecting a provider.

7 MANAGEMENT MODEL FOR MIGRATION

Considering the main aspects of ITIL, we can determine models that allow to improve the Management of Cloud Services, as well as improving the hiring phase, execution and administration to guarantee high-quality services. Next, the phases that have been proposed for the present study are presented (ITeratum, 2011).

Table 3: Aspects to Evaluate in a Provider.

Business and Experience	
Organization and Administration.	It is important to request the administrative structure, clear guidelines in case of risk, and the road map with a general overview of what processes are carried out to provide the requested products or services (Fleitman, 2008).
Reliability	It is important to get a provider with experience in similar projects, as it will give confidence to the company that hires the services. This is achieved by verifying the supplier's background with other customers (Fleitman, 2008).
Knowledge	The provider must have the necessary technical staff and aligned with the requirements of the company in order to obtain clear objectives and goals to be met. (Fleitman, 2008).
Administrative Support	
Current Legal Regulations	It is necessary for the company to identify its scope of action, public or private and apply the current legal regulations to which they must comply in order to know if they can hire foreign, local suppliers, or if any restricts them (ASLE, 2016), (Ministerio de Justicia, 2004).
SLA – Service Level Agreement	The provider must be able to guarantee a minimum level of service according to the requirements (ITeratum, 2011).
Configuration Management	There must be the necessary controls so that the provider and the hiring company can supervise, or monitor the services it offers, by means of early alerts, in order to make timely decisions (ITeratum, 2011).

Technical Processes	
Implementation Processes	It is important to know if the provider has mechanisms that ensure the implementation, administration and update in Software or Applications that are required (ITeratum, 2011).
Change Management	It is recommendable to have documentation, formal processes, registration, approval and tests to accept changes if required (Leong, Petri, y Dorosh, 2016).
Service Desk	The provider must have a channel to report incidents or requirements that may arise during the render of the service in order to have a timely response, and a record of the events (ITeratum, 2011).
Security	
Security Infrastructure	The provider must have integral security for the services offered in the cloud, as well as all levels to guarantee the information (Leong, Petri, y Dorosh, 2016), (Ministerio de Justicia, 2004).
Role Administration	The changes that are made in any service or configuration must have the respective authorization through the management of roles in the accounts, prior to an authentication (ITeratum, 2011).
Backups and Data Retention	The provider must implement policies and procedures that ensure integrity in the data of each client, as well as options for backing up and downloading.

Table 4: Management Model for Migration.

	Activity	Description	Responsible	To Be Hand In
STRATEGY	To define operational and management processes	It is important to get to know both the processes and the company in order to have a clear idea of what is going to be migrated.	Customer	Process Diagram

Table 4: Management Model for Migration (cont.).

	Activity	Description	Responsible	To Be Hand In
STRATEGY	Service portfolio management	Identify the systems or services to be migrated, according to their criticality.	Customer	List of systems and services
		Get the data of the current infrastructure in which the system or service reside.	Customer	On-Premises Resources Chart
	Review of current legal regulations	It is important to analyze the competences and the action scenario to use the right regulations.	Customer	Report of compliance with applicable regulations
	Demand management	Validation of the capacity required and calculate a future projection.	Customer	Current capacity study required and future estimation.
DESIGN	Management of availability, continuity and level of IT service.	SLA review for the services to be contracted.	Customer and provider	Service Level Agreement (SLA)
		Guarantee in the fulfillment of the level of availability for the contracted services	Provider	Service Levels Table
	Capacity Management	Verification of the required capacity or on demand that the provider can provide in the future.	Provider	Documents that prove the capacity.
	Information security management	Revision of certifications that a provider must have.	Customer and provider	International Norms Certifications.
	Budget Estimate	A cost calculation is made based on the requirements analyzed, it is recommended to make the Total Cost of Ownership (TCO)	Customer	Total Cost of Ownership and price analysis
	Provider selection	Make a comparative study about the potential providers to render the required service	Customer	Providers' Comparative Chart
MIGRATION	Change Management	Make a chronogram and planning in a documented manner of the changes to be executed, including configuration files.	Customer and provider	Change Control
	Validation of service tests	The new management model in the cloud will involve new procedures and operational processes in the IT staff, it is recommended to carry out tests of the entire process	Customer and provider	Quality Control and Testing

Table 4: Management Model for Migration (cont.).

	Activity	Description	Responsible	To Be Hand In
OPERATION	Management of incidents or requirements	The provider must educate about how to manage the Service Desk. It is also important to know what requirements are a self-service type.	Provider	Manuals and Management Training on the platform.
	Access Management	Define the processes for the creation of accesses and new role.	Customer	Make a Checklist.

8 CONCLUSIONS AND FUTURE WORK

The revision of the Current Legal Regulation in Ecuador made it possible to identify that there are more restrictions for contracting Services in the Cloud for the public sector, because they want to protect public goods and economic resources and in most cases, they require the use of services that are kept locally to protect the information, giving priority to the state's telecommunications company, while for the private sector it is optional, and as future work, regulations of other countries must be analyzed.

Among the main data that correspond to the demand and administration of On-Premises, it can be concluded that everything acquired is never used at its maximum capacity or performance. Most of the time there are oversized resources, obtaining high initial costs. Therefore, by using Cloud Services, you optimize costs because you only pay for what is consumed and, what is more, is aimed at big or small companies, including all types of final customers.

The use of the ITIL V3 reference framework contributed significantly to the development of the present methodological proposal, seeking an orderly migration, improving the analysis, design and implementation of the entire process to be executed, thus efficiently evaluating global or local providers that support effectively with the requirements of the company.

The use of Cloud Services allows a business reorganization by automating processes, optimizing staff time to focused on new projects, thus improving their productivity.

When hiring service in the Cloud, the data is outside the corporate network, even outside the country, which can be contravened by laws and local regulations for data protection, creating mistrust in several potential customers.

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