

## **Cloud Computing Architecture and Its Effect on Enterprise Services in Terms of Security and Cost**

Mariam Chaudhary, Wajeeha Azmat, Ahmad Mateen

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**Abstract:** *Cloud computing is advanced infrastructure providing a service oriented architecture having flexible, authenticated and secure IT applications. Advancement and analysis in cloud computing filed is ensuring success in many companies to keep pace with their customer's needs of an affordable and usage-based services. However, there are still aspects related to this technology yet to be analysed. In this work, positive as well as negative effect regarding data security, data availability and cost are examined on cloud technology so it can effectively lessen the difficulties of users in terms of securing their own data. The research is made on targeted companies using any of cloud computing service models i.e. IaaS, SaaS, PaaS so the research can be effectively identify security challenges and cost effect for adopting cloud computing and solutions from real world for the challenge that do not have proper mitigation.*

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### **I. Introduction**

Cloud infrastructure service datacenter recently have a major role to provide services i.e. Amazon, Google Microsoft etc. Datacenter provide the services to the service provider that they compute the services and make transparent to the end user via internet. Services which are used by the end user is "Software as a Service" (SaaS) and the facilities which are delivered to the service provider via datacenter is "Infrastructure as a Service" (IaaS) (Reena, 2014).

The decision for usage and implementation of cloud computing of any enterprises should depend on advantages, disadvantages and the effect of cloud computing on their organization. The adoption of cloud computing is depend upon the lifestyle, technology and development of any organization. Shifting of a large organization on cloud computing is more complicated, it's essential for cloud computing to provide them actual infrastructure and real value rather than just a platform for simple project such as application checking out or product demos. For this purpose cloud provider should be well aware of the demand and level of services already use by stakeholders encompass technical, mission, operations and economic managers as well as the engineers who are going to be developing and assisting the man and women systems (Hosseini et al.,2010). How customers use the cloud services this is explained by the cloud service models. Cloud service models are the amalgamation of IaaS (Infrastructure as a Service), SaaS (Software as a Service) and PaaS (Platform as a Service). These models may be work with the communication of each other or may be independently. Three common cloud service models are offered to describe the cloud services. These are IaaS (Infrastructure as a Service), SaaS (Software as a Service) and PaaS (Platform as a Service) many others.

### **II. Related Work**

Cloud computing being a strong and effective infrastructure is studied and analysed by many researchers keeping in mind its various aspects. Foster et al.,(2008) on the basis of Virtual Computing Laboratory (VCL) technology produced a solution for security of cloud computing is an award-winning open source implementation of a assured production-level on-demand utility computing and services directed technology for wide-area approach to results based on virtualized resources, comprising computational, storage and software resources.

Jeon *et al.*, (2012) narrated about the Cloud Computing plus points and with these benefits there should be secure and sound infrastructure provided by cloud services provider to enterprises. It is not easy for any organization to shift on cloud infrastructure from their legacy environment. No doubt cloud computing have many advantages over legacy infrastructure like cost and hardware management and security management.

In another research conducted in Kaufman (2009) described that the Cloud Computing is transmuting actual environment of how businesses practice information technology. One essential characteristic of this prototype unstable is that data is being consolidated or subcontracted into the Cloud. From users perception, comprising together entities and IT initiatives, loading data distantly keen on the cloud in a malleable on-demand routine fetches alluring assistances respite of the affliction for loading supervision, collective records admittance through self-governing to graphical situations, and evading of center disbursement on hardware, software, and employees conservations.

Cloud computing infrastructure and analysing its security aspects, research is made by Kevin and Kantarcioglu (2010) and worked on a framework to secure cloud data, network and virtual machines. The

central impulse for this research is security issues in cloud computing (data security, application security, application security, middleware security and network security). They mainly focus on two layers data layer and storage layer. They discussed a method to secure 3rd party publications. They developed a secure document query processing system that used Google's Map reduce framework and Apache's Hadoop framework. First they discuss methods to secure publication of documents through third party and un-trusted publishers. The crux is to convert document in XML format. This XML document is protected by role base security using private keys and digital signatures to encrypt document. They stored data on cloud computers in encrypted forms using secure co-processors. These secure co-processors are built by IBM, also called cryptographic co-processors like IBM 4758. This is special hardware designed to that stores cryptographic data processing in its Memory and it is tempered resistant. If someone tries to temper the system its main memory will be clear. At the end they discussed how XACML may be implemented by using HADOOP.

Hosseini *et al.*, (2010) presented that Cloud engineering represents agitate gone from engineering as a set that is purchased, to engineering as a function that is delivered to consumers over the net from large-scale collection centers or 'clouds'. This cover discusses whatsoever of the search challenges for Cloud computing from a project or organizational appearance, and puts them in discourse by reviewing the latest body of literature in cloud technology. Various search challenges relating to the masses topics are discussed the organizational changes brought nearly by cloud technology; the economic and organizational implications of its program asking interpret; the assets, lawful and seclusion issues that cloud engineering raises. Deyan (2012) explained that cloud computing has various benefits, but there are many problems that must be solved. According to the survey, Gartner revenue cloud computing market size for the public and hybrid cloud is 59 billion, and will reach US \$ 149b in two years with an annual compound growth rate of 20%. Revenue estimate implies that cloud computing is a promising industry. But on the other hand, present threats in the cloud model will increases the threats in contradiction of pirates. According to service delivery models, deployment models and necessary features of cloud computing, data security and protection of privacy are the central problems that is requisite to be solved as soon as possible. There are issues of security and confidentiality of data at all levels of service delivery models in SPI and at all stages of the data life cycle. Kangchan (2012) stated that in any cloud service (IaaS, PaaS, SaaS) the end user and services provider should control secure access on resources and services which are provided and user by could provider and user. Enterprises should provide authorized access to cloud resources and unauthorized user should not access any cloud services and access to the infrastructure.

### **III. Methodology**

In this research the Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and other services of Cloud Computing will consider because many enterprises using it. This research will focus on some areas of the information system and will be choose after first interview with the target companies and will not examine the entire data system of the enterprise, which is using cloud computing technology.

In this work, research is made to analyse which aspects of cloud computing are proving to be helpful for organizations according to their types and needs. Also it will determine the factor of security implications and loopholes faced by each organization. Research viewpoints involving around socially concerned parameters, with help of connecting human behaviour explanation and well-structured recitations are necessary for social research perspectives. For continuing this work, we have made an initial study regarding basic implementations of cloud computing in general and then implementations and continuity of this technology on organizational level. After gaining a clear perspective, to put focus on particular organizations which are considered in this research work and mapped these technological perspectives on concerned organizations.

This initial study has given a clear idea of prerequisites in favour of further processing. Also it has put focus on strength and weakness of each method and tool that is going to be used in work and also preferences of techniques. Various methods of data collection can be used while data collection including personal interviewing, telephone interviewing, mail survey and the internet survey. In this work, research design was made more interactive with combination of personal observations so our targeted aspects of cloud services can be visualized. For that purpose, two survey methods combined, were followed in this research; questionnaires surveys and personal interviews. These techniques were implemented to 100 companies revolving around different cloud computing requirements. Data gathered from collaboration of these organizations is then subjected to statistical analysis for further investigating cloud technology impacts. Universe of the gathered data is selected in the form of organizations having broad usage and applicability of cloud services (Chen, 2014). In this work, cloud services were examined in two districts of Punjab. So the universe of the present study was comprised of the cloud services in two districts of Faisalabad, and Lahore. The cloud services at each organizations are considered to be set of individuals or objectives having common observable characteristics at a particular organization which have made them population of the universe. Companies of Lahore and Faisalabad

using cloud services which were taken into consideration are population in this research work. Afterwards, sample is created as a portion of all the elements in the respective organizations’ population so that it can be used to obtain information about the entire population. . The factor of time, security, cost and physical limitation usually play an important role in research and therefore it is more economically efficient to base studies on a sample rather than to study the entire population. (Adnan *et al.*, 2014).

#### IV. Implementation

This survey involved 100 companies which are using cloud computing from the following sector: education, ITC, telecommunication, production, research and development, health, banking and financial services, real estate, insurance, media, civil society organization and government institutes. Before the start of statistical work, interview schedule is developed for the collection of data. This technical procedure has enabled this work to get the accurate information as by interacting to stakeholders of cloud services. The study was conducted in two districts Faisalabad, and Lahore. Multi-stage sampling technique was used for the selection of respondents 100 respondents are selected as a sample. It is mentioned earlier that two data collection method, questionnaire surveys and personal interviews were used based on respondents’ contribution to organization and interaction with cloud services. Table 1 shows each company’s survey method used in this research.

**Table 1:** Sector specifications of companies

Company Sector	Survey Method Used	Responses Frequency	Percentage
Education	Interview Survey	35	35%
ITC	Questionnaire	11	11%
Telecommunication	Questionnaire	4	4%
Production	Questionnaire	3	3%
Research and development	Questionnaire	2	2%
Health		6	6%
Banking and financial services	Questionnaire	6	6%
Real estate	Interview Survey	1	1%
Insurance	Interview Survey	4	4%
Media	Interview Survey	1	1%
Civil society organizations	Interview Survey	3	3%
Other	Questionnaire	24	28%

**Table 2:** Interview Questions

Question	Response	Frequency	Percentage
Knowledge about cloud computing?	I Know what is cloud computing	45	45%
	I have some knowledge about cloud computing	29	29%
	I have no knowledge on cloud computing	27	27%
Uses of cloud computing	Yes	42	42%
	No	44	44%
	No, but we plan to start doing so	14	14%
Internal usage of cloud computing	For internal needs of the company	54	54%
	For third parties	1	1%
	For both	44	44%
Specifications of internal need	For e-mail	45	45%
	For web hosting	5	5%
	For data base	25	25%
	Other	26	26%
Third parties intention about cloud computing.	direct users (legally called personal data controllers)	53	53%
	Companies that then offer it to direct users	16	16%
	Both	32	32%
Services provided to external parties	Software as service (SaaS)	57	57%
	Platform as service (PaaS)	41	41%
	Infrastructure as service (IaaS)	51	51%
	Other	16	16%
Data Storage	Safe	72	72%
	Not safe	7	7%
	I don't know	20	20%
Relationship of legislation and cloud computing	Yes, I know the Law regarding cloud computing	18	18%
	yes, the Law for personal data protection also covers this subject	20	20%
	I don't know	62	62%
Evaluation	Yes, we are evaluating it now	10	10%
	Yes, we have plans to evaluate in the next 12 months	34	34%
	Yes, we have plans to implement in the next 12 months	25	25%
	Yes, we have plans to implement in 2-3 years	23	23%
	No, we have no plans to evaluate or implement it	8	8%
Expectation from cloud computing	Enterprise application software (CRM, ERP)	15	15%
	Business Application - word processing/spreadsheet etc	13	13%

	Email	20	20%
	Collaboration tools (conferencing, wiki, sharepoint)	12	12%
	Data storage	17	17%
	Utility management (anti-virus/spam/back-up)	7	7%
	To sell software to your clients	7	7%
	For collaboration with other companies	7	7%
	Other	2	2%
Cost Reduction	Less than 10%	34	34%
	10-30%	25	25%
	30-50%	10	10%
	More than 50%	8	8%
	No cost savings anticipated	23	23%
Saving	Reduced hardware and infrastructure costs	24	24%
	Reduced software costs	18	18%
	Reduced staff costs	20	20%
	Reduced security	16	16%
	Reduced training costs	17	17%
	Other	5	5%

In this work, questionnaire survey and interview were first pre-tested on 5 respondents from rural communities before going for actual data collection to test its validity and workability. After pre-testing, response is checked and modified both survey patterns according to research needs, in the light of given responses and order to receive better responses from respondent's side. Finally, the interview schedule was accepted for fieldwork. The pre-test provides means of catching and solving unforeseen problems in the administration of the interviewing need for additional questions or collimation of others.

In conducting questionnaire survey, a well structure questioner pattern is followed and making each question easily comprehensive, answerable and non-conflicting. The question were written in English but were asked in Urdu or Punjabi. Questions were carefully translated into Punjabi and Urdu so that the sentences did not lose their actual meanings. Keeping in view the importance of the objectives of the research, some organization and need of research required interview survey method, so a well-designed interview schedule was developed to collect required data. Interview schedule refers to a number of question formulate according to requirement and conducted (Saleem et al., 2014). Interview survey was used because the respondents might not be aware about the topic. Also it was necessary in order to convey the true meanings of the questions to the respondents, the researcher could explain certain questions that may not be easily and properly apprehended by the respondents.

## V. Analysis and Results

This research work in conducted by involving 100 companies as mentioned. 35% respondents from education department respond that cloud computing is best for the cost and the security, 11% from the ITC department respond that cloud computing reduce their cost and increase the security, From the telecommunication department only 4% respondents responds that cloud computing is best in term of cost and security, 24% other departments believe that effect of cloud computing is good for enterprises in term of security and cost also represented in Table 1.

After collecting the data, it is clear from results that, SaaS is the most commonly used type of cloud computing 35%. Internal cloud's share is marginal 7%. It must be noted that many interviewees feel that there is confusion regarding the terminology between internal cloud computing, private cloud computing and virtualization. As it can be seen from Table 2, from the respondent companies that are included in survey, 75% companies respond that data stored in the cloud system is safe. They believe that cloud services can secure their data more than any other services. 7% companies respond that data is not save in cloud services while 20% respond that they have not any knowledge that the stored data is secure or not. Furthermore, correct answer that the Law on personal data protection is the one that covers the issue of cloud computing is known to only 20% of respondents. 62% don't know that such Law exists, and 18% believe that there is a special law covering this issue. Many under survey companies were also respond in terms of evaluation of cloud computing. From the respondents 10% companies evaluating cloud computing now. 34% have plan to evaluate cloud services in next 12 months. 25% have plan to implement cloud services in 12 months 23% have plan in 2 to 3 years and 8% have no plan for evaluate it yet.

## VI. Conclusion and Future Work

The aim of the present study is to explore the effect of the cloud computing services in enterprises in term of security and cost. Enterprises use the cloud computing for the implementation and control of their information structure. For effective and efficient practice of cloud computing, such implementation should keep in mind the constituents of cost and data security while formulizing cloud services. In this research the Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), services of cloud

Computing will consider because many enterprises using it. This work is done to well evaluate and identify existing cloud computing security and cost challenges and their solutions from complete data collected by regarding companies. Also this work revolves around to recognize the dares that have no mitigation strategies defined. Assemble results/strategies/rehearses from organizations, for a dare with additional references but no mitigation strategies offered (identified in literature).

However, this research will focus on some areas of the information system and will be choose after first interview with the target companies and will not examine the entire data system of the enterprise, which is using cloud computing technology. In future, this work will lead to provide more effective solution to cope with enterprises issues facing to implement cloud computing in terms of fault tolerance, quality of services and other business aspects with use of more services models environments.

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