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360º Degree Requirement Elicitation Framework for Cloud Service Providers

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Abstract
Thisstudy addresses the factors responsible for cloud computing adoption in implementing cloud computing for any organization. Service Level Agreements play a major role for cloud consumer as well as for cloud provider. SLA depends on the requirements gathered by the cloud providers and they vary with the type of organizations for which process is being performed such as education, retail, IT industry etc. SLAs for cloud computing involves technical as well as business requirements which makes the gathering of requirements from stakeholders point of view the heterogeneous process. This research work proposes a 360 degree requirement gathering framework, which reduces the complexitiesduring the process of requirement gathering by cloud service providersas well as SLAs more reliant.

I. INTRODUCTION

Implementation of cloud computing is difficult task as cloud computing strategy has various characteristics, Models, and Routines due to which choice and fulfilment of requirements varyfor achieving the system. In this paper authorshave presented a short overview about cloud computing which awakes about the specialities of Cloud Services i.e. the applications delivered as paid or unpaid services over the internet, the hardware, and the systems. Basically cloudrepresents a standard for services for its consumers, which includes shared collection of computing resources like network, software and hardware storage, applicationsi.e. services which can be speedily arranged and delivered with least vigilance reciprocal action efforts or provider's interaction. Cloud computing promotes availability and it includes crucialcharacteristics, routine, and deployment models.In this work authors have proposed a 360 degree framework, which can be used or extended by cloud providers for gathering requirements and preparing SLAsfor any organization in a more reliable and specific manner.

II. BACKGROUND

The journey began to look at Cloud computing as a distinct subject as Ali[1] discussed about benefits and risks of migration of data center to amazon EC2 from the point of organization[1].Annie dissused tools,concepts &policies for better allignment[2].Axel took requirement engineering from software point and discussed about handling exceptions while gathering requirements along with goal oriented requirement engineering approach[3,4,5].Bashar disscused about technologies developed for specific requirement tasks[6]. Boehmdisscussed abut software risk management[7].Buyya took cloud networking including cloud bus for research[8].Chung discussed Non functional requirements along with software systems requirement engineering[9,10].Cloud security alliance proposed roadmap for prioritizing migration and transformation of cloud[11].Del took formal and analytical methods for system engineering [12].Easterbook marked term conflict consideration for both requirement elicitation and system design[13].Goguen discussed requirement engineering [14] and Johnson focussed task analysis in software engineering[15].Lutz discussed extension of software modelling[16].Modugno discussed about analysis of requirement specification[17].Pamela focussed on research in requirement engineering[18].Pearson targetted cloud privacy from point of legal compliance and also has proposed an approach for security of cloud computing[19,20].Vivek proposed optimization architecture for acheiving quality attributes for applications hosted in the cloud[21**].**The performance analysis has also been performed on diffrent bare metal hypervisors along with openstack integration [22,23]. Another work ralted to Cloud-ERP implementation for small & Medium Enterprises is also a step forward [24]. Smirti has proposed a framework to ensure data security for cloud environment [25]. Research work prevoiusly performed on cloud computing focusses on service discovery with run time techniques to inform and balance the selection e.g- self managed applications in the cloud,privacy in the cloud etcbut research on cloud acquiring and endorsement is required to made in future from cloud ratification engineering perspective under which study related to acceptance

processes for stakeholders and implementation processes needs to be performed.The need for such research is important as there is retrenchment of systematic methodologies which could help individuals to mantle, meet and moderate their requirements against cloud services provision.There has been a recent research on cloud migration but this research lacks any systematic approach for refining and elaborating user's requirements. The CSC cloud adoption assessment has nothing about the accord involved to conciliate various specifications.Researches related with requirement gathering have been performed for software functional,non functional requirement etc but no research has been performed from point of view of cloud service providers for gathering requirements from organizations for cloud computing implementation.

III. FUNDAMENTAL CHARACTERISTICS OF CLOUD COMPUTING

Cloud computing involves specific characteristics by which Providers of cloud routines can gather requirements. Stakeholders vary their requirements on the basis of features they require for their organizations and choice of required features varies due to following Reasons:

A. Stakeholders are provided with computing potential, such as time taken by Server and network storage as required without any human involvement with each service's provider.

B. Services taken by stakeholders and accessed through different standard client platforms

C. Cloud computing resources can be used by different person on the basis of multi-occupancy model where co-tenants are involved and invisible to one another but affect each other in equal or variable way with various sensible and not sensible resources.

D. Capabilities are quickly extensible and automatically have provision to scale out, and can rapidly release to scale quickly in.

E. Metrics are used to measure resource usage through which transparency can be provided on providers and consumer's usedservice.

F. 360 Degree implementation: Every field of universe whether Medical, Engineering, Life sciences etc. Concept of given framework can be can be implemented.

Flaws of implementation which stakeholders as well as final users need to take care of are as follows:

i. DataLoss: As data will be in bulk at every phase of implementation therefore meaning full data safety is required.

ii. Networking: New layers or models are required to be implemented so that security may begin itself from the beginning of the cloud implementation.Newly generated models can be combination of various existing layers or can be made with meaningful Data Logic.

IV. ROUTINE MODELS

Here routine term is pointing towards regular process to be followed for implementation of cloud, cloud services are implemented with the help of service models. Clarifying about models and services provided by models helps stakeholders to choose their services according to the need of their organization. Many models for cloud computing are available but three main models are as below:

A. CLOUD SOFTWARE AS A ROUTINE (SAAR) :

Here stakeholders use service provider's applications running on cloud. The applications are accessible from various client devices through a thin client interface such as a Web Browser. The stakeholders are not responsible for controlling, purchasing or software licensing the hidden cloud infrastructure or even individual application capabilities, with the possible restriction of specific application configuration settings.

B. CLOUD PLATFORM AS A ROUTINE (PAAR):

Routine intends to develop, deploy and maintain applications onto the cloud infrastructure. These applications can be designed by consumer orcreated using programming languages tools supported by the provider. In this model stakeholders not responsible for managing the underlying cloud infrastructure like network, storage and operating systems but has control over the deployed applications and hosting application environment configurations.

C. CLOUD INFRASTRUCTURE AS A ROUTINE (IAAR):

Stakeholders can perform processing,storage, control selected networking (e.g. Firewall hosting) components, and other fundamental computing by which stakeholders arecapable of deploying and can run inconsistent software, may also include operating systems and applications. Cloud provider manages `and controlsthe cloud infrastructure.

V. DEPLOYMENT MODELS

Deployment models in cloud computing play a major role as all characteristics, services completely depend on the type of deployment model used by the cloud providers for the fulfilment of stakeholder's requirements. Deployment models brief view is as below:

A. *PRIVATE CLOUD:*

Here cloud infrastructure is operated entirely for an organization. It may be executed by the

organization or a third party and may exist on choice of organization.

B. *COMMUNITY CLOUD:*

In this deployment model cloud is shared by various organizations and supports regarding project that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on or offbasis.

C. *PUBLIC CLOUD:*

Itis made available to the public or a large industry group and is owned by an organization selling cloud services.

D. *HYBRID CLOUD:*

In Hybridcloud infrastructure composition of two or more clouds which remain unique entities but are bound together by standardized or assistance technology which enables data and application portability.

VI. FRAMEWORK FOR CLOUD PROVIDERS

A. ***CLOUD RATIFICATION ENGINEERING***

Cloud ratification engineering examines the adoption processes for cloud computing in organizations, it brought together the relation between service level agreement and requirement gathering approach applied by the cloud provider for providing services in the specific organizations to implement cloud computing, study of cloud ratification engineering investigates the aspects that need to be considered for collection of requirements to implement cloud computing strategy in any kind of organization. Cloud computing endorsement cannot be recognized as incautious but instead it requires many intermediary steps to be taken by the cloud provider for delivery of required value to the customer. Company size and type are the aspects which cannot be underestimated for successful adoption of cloud computing in organizations therefore implementation of cloud computing depends on the expertise of human resource asset, operational factors and financial planning of the organization.

Anotherimportant aspect is the kind of industry, which rides the type of talent organizations hire, such as the quantum of hires for financial services corporations, employees are with backgrounds in finance and accounting.Therefore operational planning involves three aspects of a company's work: how work will be performed, who will perform the work and what resources are required to imperforate work in each business area therefore operational factors relate to working of any organization or plan. Financial aspects include acquiring the resources, investing amount on resources and management of resources. Hence, gathering of requirements from stakeholder's point requires very confident strategy to be accomplished which indirectly will support the cloud service level agreement. Mostly delivered systems of cloud do not fulfil requirements of organization due to lack of particular methodology to follow up for requirement gathering. Issues such as evolving requirements e.g. addition, deletion of requirements, fixing errors etc. brings inconsistency in requirements [5], furthersteps to be taken for modelling of data, domain etc. after such processes analysis of final requirements is performed. Hence processes which are performed in between takes long span of time and do not claim to be useful. Successful cloud computing acceptance must include areas of security, legal and compliance, integration, company size etc. It integrates these critical issues into each phase of strategy for successful cloud computing requirement gathering framework. Cloud providers can use this framework to address strategic issues at each stage of requirement collection for particular organization.

B. ***FRAMEWORK FOR REQUIREMENT GATHERING***

The necessity of cooperation between stakeholders and service providers cannot beoverstated as successful implementation of cloud computing depends on cooperation between them .Proposed Model involves complete determination of organization for implementation of cloud computing which signifies 360 degree coverage.This framework proposes sixphases in the requirement gathering ofcloud computing project. These are Business plan Analysis, Review of HOF factors,Cloud services,cloud type,Risk factor reasoning and proof of concept. In Figure.1 below the basic view of phases chosen in the model are shown on the basis of all important factors to be covered for any organization and is known as Basic framework.

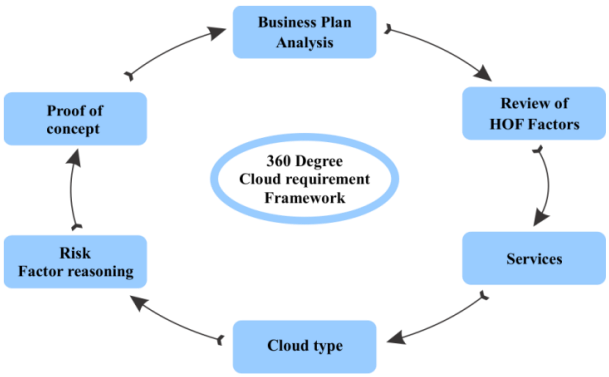

Fig. 1: 360º Cloud requirement gathering Basic framework

Here Figure.2 explains moderate framework where input phases of model along with the output

obtained at the end of each phase works as input of next phase .

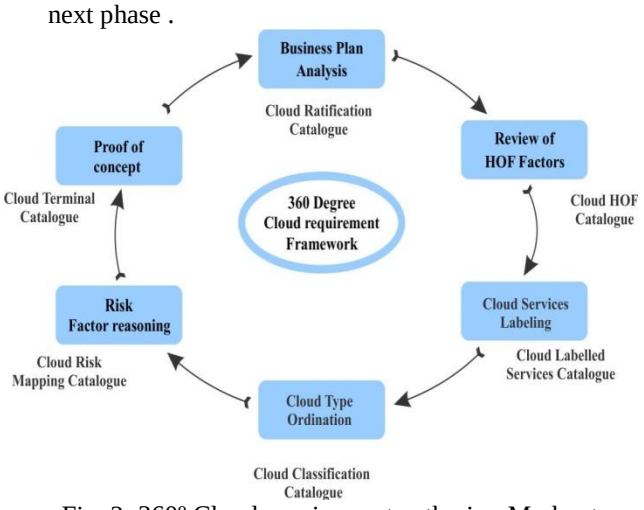

Fig. 2: 360º Cloud requirement gathering Moderate framework with outputs

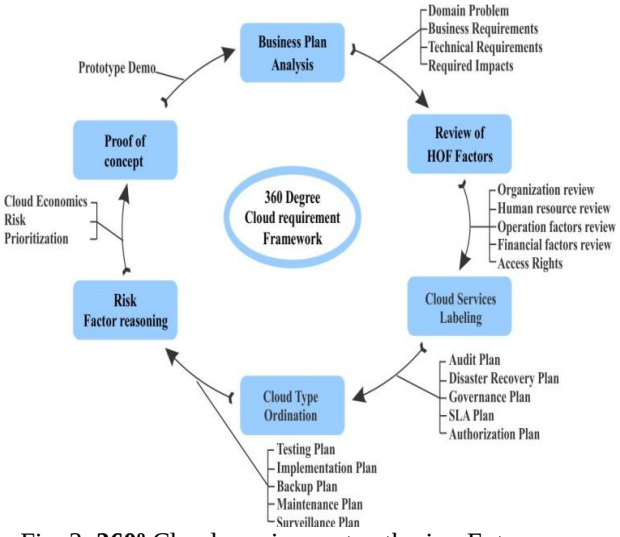

Fig. 3: **360º** Cloud requirement gathering Extreme framework

In Figure.3 Final framework is obtained and shows complete research diagramaticaly. Therefore, 360 degree framework comprises of Basic, moderate and extreme model containing all facts. The framework phases are as follows:

A.*Business planAnalysis:*Here an analysis of the required system, applications, business processes, return on investment, flexibility, customer satisfaction of organization, payment model is performed in order to ascertain the directions. This phase identifies the strengths and weakness of the existing systems, business process, and impact of moving to cloud.As an output this phase produces Cloud ratification catalogue (CRC) which will contain all the details analysed at this phase.

B. *Review Of HOF Factors:*In this phase Review of organisation structure is performed which involves human resource factors, operational factors, and financial factors.Human resource factor includes personal and access rights, training and awareness of human asset of organization which requires development of policies and standards and it will provide reliable and reasonable activities after cloud implementation, To develop capabilities and operation procedures for opearations which organization performs for its customers.At last financial budget of payment for cloud is inspected.Cloud HOF catalogue is the final output of this phase.

C. *CloudService Labelling:*Here we discuss about services to be offered to the organization softwares,hardwares,guidelines and mandates for information security,governance structure i.e auditability and accountability between cloud provider and cloud consumer, assurance for infrastructure being properly protected, Guidelines for security management, authorization and authentication procedures for IT resources and data,procedures for reporting security events and problems,disaster recovery planning, agreement conditons for down time, data processing priorities in service level agreement and for legal and security standards policies and best practices.At last of this phase Cloud classification catalogue will be generated.

D.*Cloud Type Ordination:*In this phase decision about cloud deployment model to be implemented is decided according to the results of previous phases. Advantages and disadvantages of cloud type will directly impact the organization structure therefore result of this phase affects the required product.This phase produces Cloud Classification Catalogue i.e. C cube on the basis of which Testing plan, back up plan, surveillance plan ,maintenance plan and implementation planning is done.

E. *Risk Factors Reasoning:* Cloud computing always prioritize fulfillment of business requirements over technical requirements. Therefore comparison among advantages, risks, business requirements,technical requirements,services to be provided, cloud type and cloud economics will be performed then mapping is done among them through which a scanning can be performed to prioritise business requirements fulfillment over technical requirements and risks.At

the end of this phase cloud risk mapping catalogue(CRM) is obtained.

F.*Proof of Concept:* Here Prototype demonstration of finalized IT facilities to be provided will be shown as proof by the cloud vendor to cloud consumer.Therefore it is most important for successful implementation of cloud computing that choosencloud providers must have stong market position and have successfully implemented projects concerning to with cloud in their past.Cloud terminal catalogue(CTC) will be received by the stakeholder and at last union catalog can be generated containing all kinds of records including details such as design, location of data etc in online library form ,union catalog should be with both cloud provider as well as cloud stakeholder.

VII. CONCLUSION

Cloud computing convinced many organisations and individuals for moving their computing operations, data, and/or commissioning their e-services to the cloud.The acceptance of cloud computing is gaining push because most of the services provided by the cloud are of low cost and instantly available. The intent of research is to develop requirement gathering framework which will enable successful implementation of cloud computing by cloud providers and acceptance by stakeholders.The major advantage of proposed research work includes easy implementation for cloud providers,i.e. assures 360 degree security and error proof configurations, more reliable service level agreement for cloud stakeholder and outputs obtained at each phase makes the implementation, more reliable and robust.

VIII. FUTURE SCOPE

Cloud computing as a computing standard has existed for just a short period of time. Thereforethe scope for further research is broad, There is need for more case studies to evaluate the framework and case studies from both acknowledged and unsuccessful projects will help to improve the framework.Impact of framework on cloud providers as well as on organizations are the areas which are required to work upon.Service level agreements for cloud providers and for cloud consumers need to be focussed .

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REFERENCES

[1] Ali Khajeh-Hosseini, David Greenwood, Ian Sommerville (2010). Cloud Migration: A Case Study of Migrating an Enterprise IT System to IaaS. In Proceedings of the 3rd International Conference on Cloud Computing, Pages: 450-457, ISBN: 978-0-7695-4130-3, CS Press.

[2] Annie I. Anton and Colin Potts. (1998). The Use of Goals to Surface Requirements for evolving systems. In Proceedings of International Conference on Software Engineering. Pages: 157-166, CS Press.

[3] Axel van Lamsweerde. (2000). Handling Obstacles in Goal Oriented Requirements Engineering. In IEEE Transactions on Software Engineering. Vol. 26, No. 10, Pages: 978- 1005, October 2000.

[4] Axel van Lamsweerde. (2004). Goal-Oriented Requirements Engineering: A Roundtrip from Research to Practice. In Proceedings of 12th IEEE International Requirements Engineering Conference. Kyoto.

[5] Axel van Lamsweerde. (2001). Goal-Oriented Requirements Engineering: A Guided Tour.

[6] Bashar Nueibeh and Steve Easterbrook (2000). Requirements Engineering: A Roadmap. In The Future of Software Engineering. Pages: 35-46, ACM Press.

[7] Boehm, B. (1991). Software Risk Management: Principles and Practices. *IEEE Software*, 8(1): 32-41.

[8] BUYYA, R., YEO, C. S., et al. (2009) Cloud computing and emerging IT platforms: Vision, Hype, and reality for delivering computing as the 5th utility. Future Generation Computer Systems, 25, 599 - 616.

[9] Chung, L, Nixon, B., Yu, E. & Mylopoulos, J. (2000). *Non- Functional Requirements in Software Engineering.* Boston: Kluwer Academic Publishers.

[10] Chung, L. (1993). Dealing with Security Requirements during the Development of Information Systems. *5th International Conference on Advanced Information Systems Engineering (CAiSE'93),* Pads, France, 1993, pp. 234-251

[11] Cloud Security Alliance. (2010). CSC trusted Cloud services Get Started on Your Cloud Journey. Paper published on the web,http://assets1.csc.com/cloud/downloads /0717_11_Cloud_CAA_Brochure_v3. Pdf

[12] Del Gobbo, D., Napolitano, M., Callahan, J. & Cukic B. (1998). Experience in Developing System Requirements Specification for a Sensor Failure Detection and Identification Scheme. *3rd High-Assurance Systems Engineering Symposium*, Washington, DC, USA, 13-14 November 1998.

[13] Easterbrook, S. M. (1991). Resolving Conflicts between Domain Descriptions with Computer-Supported Negotiation. *Knowledge Acquisition: An International Journal,* 3: 255 -289.

[14] G0guen, J. & Jirotka, M. (Ed.). (1994). *Requirements Engineering: Social and Technical issues.* London: Academic Press.

[15] Johnson, P. (1992). *Human-Computer Interaction: psychology, tusk analysis and software engineering.* McGraw-Hill.

[16] Lutz, R., Helmer, G., Moseman, M., Statezni, D. & Tockey, S. (1998). Safety Analysis of Requirements for a Product Family. *3rd 1EEE International Conference on Requirements Engineering (ICRE '98),* Colorado Springs, USA, 6-10 April 1998, pp. 24-31.

[17] Modugno, F., Leveson, N. G., Reese, J. D., Partridge, K. & Sandys, S. D. (1997). Integrating Safety Analysis of Requirements Specifications. *3rd IEEE International Symposium on Requirements Engineering (RE'97),* Annapolis, USA, 6-10 January 1997, pp. 148- 159.

[18] Pamela Zave. 1997. Classification of Research Efforts in Requirements Engineering. In ACM Computing Survey (1997), Vol. 29, No.4, Pages: 315-321.

[19] Siani Pearson and Andrew Charles worth. (2009). Accountability as a Way Forward for Privacy Protection in the Cloud. In Lecture Notes in Computer Science, Volume 5931/2009, Pages: 131-144, DOI: 10.1007/978-3-642-10665-1_12. Springer-Verlag

[20] Siani Pearson. (2009). Taking Account of Privacy when Designing Cloud Computing Services. In Proceedings of the ICSE Workshop on Software Engineering Challenges of Cloud Computing, Pages: 44-52, ISBN: 978-1-4244-3713-9. CS Press.

[21] VivekNallurand Rami Bahsoon. (2010). Design of a Market-Based Mechanism for Quality Attributes Tradeoff of Services in the Cloud. In Proceedings of the 2010 ACMSymposium on Applied Computing. Pages: 367-371, ISBN: 978-1-60

[22] Deepak Arora, Varun Kumar, Prabhat Kumar Verma, AMQ Protocol Based Performance Analysis of Bare Metal Hypervisors, IJERA,2014, ISSN : 2248-9622, Vol. 4, Issue 6 (Version 4), June 2014, pp.59-64

[23] Deepak Arora,,Varun Kumar, B. Jagdeep, PrabhatVerma, Proposed Model For Virtual Labs Interaction With Openstack Integration Using KVM Hypervisor, International Journal of Scientific & Technology Research VOL. 3, ISSUE 7, JULY 2014 ISSN 2277-8616

[24] VaibhavVerma, Deepak Arora, Cloud-ERP Limitations and Benefits with Special Reference to Small & Medium Enterprises, IJERA, 2014, ISSN : 2248-9622, Vol. 4, Issue 6 (Version 3), June 2014, pp.170-174

[25] Smriti, Deepak Arora, Ensuring Data Security for Secure Cloud Hybrid Framework, International Journal of Engineering Research and Applications, Vol. 3, Issue 4, ISSN: 2248-9622, pp.2217-2221, Jul-Aug 2013,