Cloud Computing Implementation in SME'S in Pakistan – An Empirical Study

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Abstract— Nowadays, Cloud Computing is becoming the major source of inspiration for the global world which is a system based on the Internet to facilitate low budget small and medium enterprises and associations across the world to get them benefits from the real fun of information technology. In cloud computing infrastructure, web is the primary source which is being used as a software service to merge different high peak technologies. The high impact of cloud computing is being recognized by Small and Medium scale Enterprises very rapidly. The Cloud Computing concept actually incorporates Software as a Service (SaaS), Web 2.0, Web infrastructure and some known emerging technologies, and is gradually being attracted by the industry and the researchers' community. In our paper, we described the experience and the lessons that we have learnt from the SME's environment in Pakistan, in construction of a Cloud Computing platform. Essentially, we have given the output of the results attained by a web based survey, which was carried out on www.kwicsurvey.com, for the feedback regarding the Cloud Computing implementation problems in Small and Medium scale Enterprises across the country. Specifically, we have discussed some practical issues for system implementation. Our paper is presenting an attempt to implement a domain specific Cloud Computing Service as a platform in Small and Medium scale Enterprises in Pakistan, with large scale web based implementation of the said technology. We hope that researchers across the globe will be got benefited from the Cloud Computing implementation in SME's when it is read.

Index Terms — Cloud Computing, Implementation in SME, Cloud Computing Platform, Empirical Study, Cloud Computing Infrastructure, SME Environment in Pakistan, Cloud Computing Framework, Map-Reduce Framework

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1 INTRODUCTION

IN this era of technology, business is being shifted to online as internet is becoming a Virtual-Human-Society platform, and demand of large scale parallel and distributed computing is being emerged [et al Foster, C. Kesselman, and S. Tuecke]. Many large web-based companies like Amazon and Google have already developed their sophisticated infrastructure to deal with large capacity of data and complex computation [Keesookpun and Hitoshi]. Just suppose this type of infrastructure as a virtual computer that can demonstrate many possibilities for a new type of computing model that will facilitate centralized data computation with the help of Super computers with massive storage capacity and beyond imagination computational power as well, known as the Cloud Computing [et al D. M. S. Daryl C. Plummer, David W. Cearley].

Most popular networks include social networks, email server, document sharing websites; gaming sites are now being hosted on Cloud Computers [et al R. P. Padhy, M. R. Patra]. Almost 50% of the employees of large Software companies like

Microsoft are working on Cloud Computing related products, in these days. Cloud Computing is everywhere and this type of service is very attractive when offered as a service, Cloud Computing related hardware purchase is also increased in recent years. Furthermore, it is expected that Cloud Computing will revolutionized the whole Information Technology arena in the coming years with the facility to provide Small and Medium scale Enterprises a better platform for information sharing [et al Samer Jamal Abdul kader, Abdallah Mohammad Abualkishik].

Cloud Computing is penetrating in Small and Medium scale Enterprises with broader range of latest technology and innovation at the same time, but still there is a confusion in understanding the Cloud Computing. Many old Information Technology tools are combined together in an evolutionary approach to entirely change the facet of technologies [et al Reza Sahandi, Adel Alkhalil, Justice Opara-Martins, Sean Carlin, Kevin Curran]. It contains distant located data centers, besides the local computers, or other traditional interconnected internet devices. Cloud Computing is for low budgeted organizations, those who can pay according to their budget, the amount of storage and computation power that is being consumed, at the same time. For past many years, researchers

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were trying to make this dream come true to use massive storage with great computational power computers at a low cost but still this technology is not mature enough to facilitate the low budget companies, until low-cost data centers' invention for SME's, specifically in developing countries like Pakistan [et al Reza Sahandi, Adel Alkhalil, Justice Opara-Martins].

Cloud Computing is a framework of mutual collaboration of different computing technologies including Web 2.0, Web infrastructure and many other modern Information Technologies [S. Pal, P. Kumar]. Cloud Computing creates different perspectives for different users. To understand this just think from the end-users' point of view who is thinking about to shift his/ her data on a remote server called A DATA-CENTER and he/she has the option the access his data from anywhere around the globe with getting large storage and high computational resources, at the same time. Beside end-users' perspective, the Cloud Computing Service Provider may be managing the storage and computational resources for the end-users. Infect, massive storage and high computational resources are the soul of any Cloud Computing Infrastructure [et al Wang, L., von Laszewski, G., Younge, A., He, X., Kunze, M., Tao, J. and Fu, C].

A number of questions have been addressed in this paper: i- what are the main factors that supposed to be under consideration while making decision to get the Cloud Computing facility as an ICT solution in SME? ii- Are the above factors specifically relevant to the SME's business process? Furthermore a survey has also been conducted to get the SME's ICT trend towards cloud computing. Besides of the above, few of the Cloud Computing adaptation models are also described with the major concepts associated with them. This paper also explains a methodological approach of some scoping review; this was selected as the most appropriate method while addressing the questions like "What" and "Why" [et al Rashmi, Dr. G.Sahoo, Dr.S.Mehfuz], the base of this paper.

2 SMEP: A CLOUD COMPUTING PLATFORM FOR SME'S

A brief introduction of the implementation of our components for the Cloud Computing platform is given here. We have named this implication approach as "SMEP". Following is the system's overview and later on is the detailed implementation of the system and few of the practical issues [16].

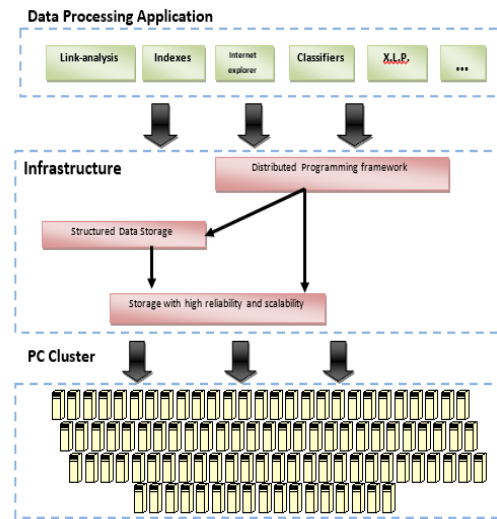Fig. 1 demonstrates the general framework system

FIG. 1 - THE SYSTEM FRAMEWORK OF SMEP

of the "SMEP", which comprises of 03-layers, i.e., PC bunch, base for distributed computing stage, and information handling application layer. The PC bunch layer gives the equipment and capacity gadgets for expansive scale information handling [et al I. Foster, C. Kesselman, and S. Tuecke, Sean Carlin, Kevin Curran.]. The application layer gives the administrations to the clients, where the clients can build up their own particular applications, for example, Web Information Investigation, Dialect Preparing, Bunch and Classification etc.

3 MAP-REDUCE IMPLEMENTATION

Map-Reduce framework is a real distributed computing stage's segment, and has pulled in more considerations as of late [et al Mpho Mohlameane and Nkqubela Ruxwana, Rashmi, Dr. G.Sahoo, Dr.S.Mehfuz]. The construction modeling of our usage is like Hadoop [et al D. M. S. Daryl C. Plummer, David W. Cearley], which is an average expert laborer structure. There are three parts in the framework: "Expert", "Laborer" and "Client". Expert is the focal controller of the framework, which is responsible for information apportioning, undertaking booking, burden adjusting and adaptation to non-critical failure preparing. Laborer runs the solid assignments of information preparing and reckoning. There exist numerous specialists in the framework, which bring the assignments from Expert, execute the undertakings and speak with one another for information exchange. Client is the customer of the framework, executes the Guide and Lessen capacities for processing assignment, and controls the flow of reckoning [Rajkumarbuyya].

4 PERFORMANCE EVALUATION ON MAP-REDUCE

Because of the absence of benchmark which can speak to the commonplace applications, execution assessment on Map-Reduce framework is not an unimportant assignment. We first use Penny Sort as the basic benchmark [Muhammad Adeel javaid]. The outcome demonstrates that the execution of transitional information move in the shuffle stage is the container neck of the framework, which really spurred us to advance the information move module in Map-Reduce.

5 CLOUD COMPUTING IMPLEMENTATION IN SME'S

The importance of the SME section in the development of any country cannot be ignored. In Pakistan, SMEs constitute almost 87% of all the enterprises; employing almost 78% of the non-agricultural labor; and this is up to a total share of 40% the annual GDP, approximately. However, opposite to the large enterprises in the industrial sector, SME is constrained by financial and some other resources limitations [Keesookpun and Hitoshi]. This dependent attributes of an SME makes it vital that there should be a defined mechanism by which it may get certain support of business comprising technical up-gradation, financial, marketing, HRD (Human Resource training & Development) and use of hi-tech IT resources in different functions [S. Pal, P. Kumar, S. Pal, P. Kumar].

The major factors of Cloud Computing platform are the data storage and computation capability. These factors determine the infrastructure design and can provide services to the end-users as well [16].

During the Cloud Computing implementation, we also met few of the engineering and technical problems in SME's in Pakistan. Here we discuss some practical issues in our work. We took a survey onwww.kwicsurvey.com to estimate the possibilities and probability of implementation of Cloud Computing in SME's in Pakistan. Fifteen questions related to the implementation of Cloud computing were designed and forwarded to a number of SME's in Pakistan. The returned results are discussed below [et al Reza Sahandi, Adel Alkhalil, Justice Opara-Martins, R. P. Padhy, M. R. Patra] .

Sr#	Statements
1	Cloud Computing increases on-demand storage capacity?
2	Cloud Computing offers uninterrupted network connectivity to the systems?
3	Cloud Computing improves the overall computing performance?
4	Cloud computing is decreasing the investments in computer systems?
5	Cloud Computing ensures that the shared storage environment safeguards all the data?
6	Cloud Computing has scheduled data-backup and safe-storage of the backup media as well?
7	Cloud computing stringent access controls to prevent unauthorized access to the data?
8	Through cloud computing is targeted to provide better utilization of resources using virtualization technique?
9	Cloud computing provide workload on demand-basis?
10	Is organizational data appropriately segregated by using cloud computing?
11	Organization requires new mind set and new model to handle the use of Cloud Computing?
12	Cloud computing provide security of any data that is regulated for privacy and compliances?
13	Cloud computing enhance organization's speed to market?
14	Cloud computing has provided genuine advantages for small& mediumsized enterprises (SMEs) enabling them to compete with large firms?
15	Advancement of Cloud Computing System has encouraging businesses to take advantages of this technology?

TABLE 1.1- QUESTIONS FOR SME'S

Response type	Tag
Yes	Y
No	N
Don't know	D

TABLE 1.2 - TESTING CRITERIA

Q.#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Parpt															
1	Y	D	Y	N	Y	Y	D	Y	D	N	N	Y	Y	D	Y
2	N	Y	Y	Y	Y	Y	N	Y	Y	N	D	N	N	Y	Y
3	Y	Y	Y	Y	D	Y	Y	Y	D	Y	N	D	Y	Y	Y
4	Y	N	Y	Y	D	N	Y	N	D	N	D	Y	Y	D	Y
5	Y	D	N	N	D	D	D	Y	D	Y	Y	Y	Y	N	N
6	D	Y	D	Y	D	Y	N	Y	Y	Y	Y	N	D	Y	D
7	Y	Y	D	y	Y	Y	Y	D	Y	D	N	Y	D	Y	D
8	D	Y	Y	Y	Y	Y	Y	Y	Y	D	Y	D	Y	D	Y
9	Y	Y	N	Y	N	D	Y	Y	Y	Y	Y	N	Y	D	Y
10	Y	Y	D	N	Y	D	Y	Y	N	D	N	N	Y	N	Y
11	Y	D	Y	y	Y	Y	Y	Y	N	D	D	D	Y	Y	Y
12	Y	Y	D	Y	D	D	Y	Y	Y	Y	N	D	D	Y	N
13	D	Y	D	D	N	Y	Y	N	D	D	D	D	N	D	D
14	N	Y	Y	N	D	N	Y	D	Y	N	Y	Y	Y	N	Y
15	Y	Y	D	Y	N	D	N	Y	Y	Y	Y	Y	Y	Y	D
16	Y	N	D	D	D	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
17	D	D	Y	D	Y	Y	Y	D	Y	Y	D	N	D	Y	Y
18	N	Y	Y	Y	N	Y	N	N	N	D	D	D	Y	Y	Y
19	Y	D	Y	D	N	Y	D	Y	D	Y	D	Y	Y	Y	Y
20	Y	Y	Y	D	Y	Y	N	Y	D	y	Y	Y	D	Y	Y
21	Y	Y	Y	Y	Y	D	N	Y	Y	Y	Y	Y	Y	Y	N
22	Y	Y	D	D	N	D	Y	Y	N	Y	N	D	N	Y	D
23	Y	Y	N	D	D	D	Y	Y	D	N	Y	D	D	N	Y
24	Y	Y	Y	Y	N	N	N	Y	D	Y	y	Y	Y	Y	Y
25	Y	N	D	N	D	D	Y	Y	D	Y	Y	D	Y	Y	N

TABLE 1.3 - RESPONSE OF THE PARTICIPANTS

Q.#	YES	NO	DON'T KNOW
1	18	3	4
2	17	3	5
3	13	3	9
4	13	5	7
5	11	6	8
6	12	4	9
7	17	5	3
8	17	3	5
9	13	4	8
10	13	6	6
11	11	7	7
12	12	5	8
13	14	3	8
14	17	4	4
15	16	4	5

TABLE 1.4 - RESPONSE COUNT

Response Type	%age
Yes	57%
No	17%
Don't know	26%

TABLE 1.5 - RESPONSE PERCENTAGE

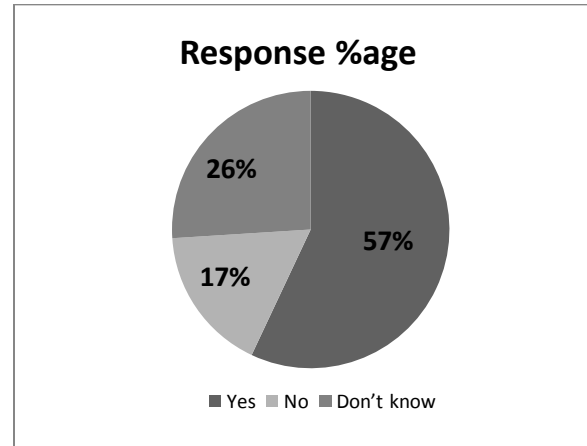Response %age

26% 57% 17%

■ Yes ■ No ■ Don't know

FIG.2 - RESPONSE PERCENTAGE GRAPH

6 INTERPRETATION OF THE ABOVE RESULTS

The above results show that 57% of the respondents tend to "Yes", which is a good sign for Pakistan that there is an opportunity and staff availability, the people who know how to implement and use Cloud Computing in SME's. These results show that more than 50% of the people have deep knowledge about the cloud computing and they also know the advantages, disadvantages and the impact of Cloud Computing in SME's in Pakistan. On the basis of above results, we may assume that the future of Cloud Computing in Pakistan is very bright and the Pakistani people may be get benefited of this technology in the coming years.

Almost 26% of the people related to SME's in Pakistan have little or no knowledge about this technology and 17% of the respondent were perhaps get tired or they have bad conception about Cloud Computing, especially for SME's in Pakistan.

7 SYSTEM DESIGN CRITERIA

In the framework outline, our motivation is to add to a framework which is versatile, strong, elite and simple to be kept up.

For the most part, we mull over three noteworthy criteria for framework plan: 1) for a certain arrangement, what is bottleneck of the method which may worsen the framework execution? 2) Which arrangement has better adaptability and flexibility for future change? 3) Since system data transmission is the rare asset of the framework, how to completely use the system asset in the usage?

In the Map-Reduce framework, adaptation to internal failure can be directed by either ace or laborers [et al D. M. S. Daryl C. Plummer, David W. Cearley, Mpho Mohlameane and Nkqubela Ruxwana]. Expert takes the part of worldwide controller, keeps up the data of the entire framework and can without much of a stretch choose whether a fizzled undertaking ought to be rerun, and when/where to be rerun. Specialists just keep nearby data, and assume responsibility of reporting the status of running errands to Ace [et al Rashmi, Dr. G.Sahoo, Dr.S.Mehfuz]. Our configuration joins the benefits of these two components. The laborers can rerun a fizzled errand for a specific number of times, and are even permitted to avoid some terrible information records which cause the disappointment. This disseminated method is more powerful and versatile than brought together system, i.e., just re-calendar fizzled errands in the Expert side.

8 DISCUSSION ,CONCLUSION & FUTURE WORK

Small businesses with less than 25 employees that are not specifically involved in Information Technology (as, say, Internet startups are) seldom have or can readily afford in-depth Information Technology talent in-house. Even middling-small businesses with up to 100 employees and revenues up to Rs.100-million or so cannot. Very small businesses with 10 or fewer employees hardly ever can.

So for the dominant part of compositional and building firms; for neighborhood eateries, retail locations, daily papers, manufacturers, construction companies & architects; and for all whatever remains of the wide range of the little organizations that on the whole utilize more than 70% of the non-agrarian work constrain in Pakistan, distributed computing as virtual IT stages and framework is of just peripheral interest and utility.

So for little organizations with 100 workers or less distributed computing is significant just seeing that it offers less demanding, more financially savvy approaches to acquire required IT capacities that don't require complex in-house IT skill. Generally, this is a matter of programming and programming applications offered as an administration. It is not so much obscure but rather more justifiable structures that distributed computing is most important to little organizations, as opposed to the more intricate offerings that require considerable specialized aptitudes to utilize effectively. There are three keys to effectively picking and actualizing distributed computing administrations for little business: 1. Be clear about what you truly require and can utilize; 2. Comprehend what a proposed cloud administration can accomplish for you and what will be its effect on your business; and 3. Acquire impermanent master specialized counsel and help with assessing and actualizing the item from somebody who as of now has some involvement with it.

The encounters of SMEs putting resources into creative innovations, for example, Distributed computing, ought to give extra confirmation concerning examples of reception [Levy 2009]. It gets to be evident from the Review completed beforehand that the developing frameworks of Distributed computing can possibly reproduce the profitability, productivity and gainfulness of little scale ventures. Be that as it may, a few SMEs stay hesitant to profit themselves of broadband administrations, or consider the conceivable focal points of Distributed computing, because of observations (or misinterpretations) with respect to conceivable capital venture, apprehension of unpredictability, absence of comprehension of the potential advantages, and absence of specialized assets. Others are all the more ready to test broadband or Cloud applications, yet don't see it as a major aspect of a bigger procedure [Jayakar et al. 2010]. Confirmation is additionally developing to recommend that even vast organizations (in spite of tried and true way of thinking) are really grasping Cloud administrations. Thusly, an expanding number of small & large organizations are starting to see some genuine esteem in utilizing the Cloud [Sultan 2010]. There are numerous open doors and focal points for SMEs in Pakistan in utilizing Distributed computing, for example, chances to test new programming, assess outsider applications, build assets on interest to fulfill regular or impermanent request and offer programming to the clients as SaaS. Different advantages incorporate time spared managing innovation issues, permitting staff to concentrate on center abilities. A significant number of the same capacities can be performed quicker and all the more effectively by utilizing advanced IT base and programming than conventional set up server farms. Subsequently, Distributed computing is prone to be an alluring alternative for some SMEs in Pakistan, especially in the current worldwide financial emergency, because of its adaptable expense structure and adaptability. Cloud Computing may fits specifically SME's needs in Pakistan as follows: 1. Off –the-shelf availability; 2. User friendly; 3. Low priced; 4. A list of options to choose a suitable for you;5. Support and feedback; 6. 24/7 available staff to maintain the system; 7. Customizable ERP (Enterprise Resource Planning); 8. Easy availability.

In the particular instance of SMEs in Pakistan, access to Cloud administrations is turning into a basic component for their intensity and effectiveness. On the other hand, absence of access would infer that the SME area in Pakistan won't accomplish its maximum capacity. By and large, Distributed computing administrations give an open business stage to everybody, all around, for each nation, for each organization, for each association and for each sort of business and new open doors for cooperation and interpersonal interaction between business accomplices, by empowering access to wellsprings of data that are time and separation free. In this sense and for future research, a SWOT examination is suggested, when contemplating the blend of interior and outer components concerning the reception of Distributed computing by SME's in Pakistan.

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