

Survey on Use of Cloud Computing in Government/Corporation Sector

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Abstract - Any new technological advancement provides a key motive that things must be more and more streamlined such that convenience level of human beings increases. Cloud computing also comes with the same motive with more elastic features in comparison to the traditional way of working using cluster and grid computing, among others. Cloud computing has proved to be the most productive innovation by information and communication technology. In this paper various application areas are reviewed for areas where cloud computing is being used to the full extent, and depending upon the type, some other areas to implement cloud computing are explored. Cloud-based systems provide more benefits in terms of reliability, effectiveness, fault tolerance, scalability, and cost, among others. Certain challenges are explored for areas of further improvement.

Key Words: Cloud Computing, E-Governance, Benefits, Effectiveness, Applications

1. WHAT IS CLOUD COMPUTING?

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [1].

This cloud model is composed of five essential characteristics:

- I. On-demand self-service
- II. Broad network access
- III. Resource pooling
- IV. Rapid elasticity
- V. Measured service,

Three service models:

- I. Software as a Service (SaaS)
- II. Platform as a Service (PaaS)
- III. Infrastructure as a Service (IaaS)

Four deployment models:

- I. Private cloud
- II. Community cloud
- III. Public cloud
- IV. Hybrid cloud(NIST)

1.2 Virtualization and Cloud Computing

Virtualization is not cloud computing [2]. Cloud computing is not the same thing as virtualization; rather, it's something you can do using virtualization. Virtualization and cloud computing work together to provide different types of services. Although the two technologies are similar, they are not interchangeable, and the difference is significant enough to affect your business decisions. Virtualization provides the CC facilities like isolation, customization, security that are the basic requirements for delivering IT services to the client. Hardware, programming language virtualization are the techniques that are adopted in CC.

2. LITERATURE SURVEY

K.Sudhakar et al. in their paper [3] discussed the application of CC in the banking sector, various business models. Author had pointed out various troubles which are being faced by the banking industry for providing various resources to the customers. Through various case studies recommendations are given like banks must adopt the evolutionary approach for CC services, further depending upon the type of application like lower risk , higher risk core business functionalities can be included or excluded. Banking system will have to combine the services based on cloud along with the on-premise facilities distributed along with the grouping of public, private and hybrid clouds. Manoj Chopra et al. [4] discuss in their paper the basics of cloud computing and various ways through which an end user can take benefit of the cloud computing. Author have discussed why cloud based applications are more stable, efficient as certain kind of benefits like start-up speed , flexibility, cost saving etc. are there which bring the whole thing in to picture. Security issues related to the CC had also been discussed which

highlights certain areas to be focused for making CC more trustable. Anubhav Jain et al. [5] provides an overview of a technology in which the author includes the little bit of introduction to cloud computing, security issues related to it, TCG (Trusted computing group) , Remote Attestation, Roystonea pluggable interface etc. Given paper also try to explain the energy consumption related to the cloud systems, reader can get information related to assets spent on the cooling infrastructure. Yatendra Sahu et al. [6] points out the idea related to load balancing in cloud computing .Due to numerous benefits of CC every IT related task is being tried to shift to the cloud system, as a result various types of loads like memory load, network load, CPU load may arise .So author has advised to find the overloaded nodes in the given cloud system and then balance it for increasing the overall efficiency of the cloud system. Discussion of different types of algorithm's like Honeybee Foraging , Biased Random Sampling , Active Clustering, Compare And Balance are being done for the purpose of load balancing. Alain Tchana et al. focused in their paper [7] about FT in CC platforms and more precisely about automatic techniques for recovering from the occurrence of fault. Through experimental study author had highlighted the outcomes when either the CSP and customer operates in a collaboration manner or they work mutual exclusion to each other for handling FT in the cloud systems.

3. Facilities Provide By Cloud Computing

Cloud Computing provides lots of benefits to the IT industry which helps in development of the applications which can be deployed in the various departments some of these advantages are as follows:

- I. Cost related to development of applications is drastically decreased with the help of cloud computing. Now small scale industries can easily enter into the market by offering services based on cloud systems earlier it was a game for only big IT firms.
- II. Cloud based applications can be easily extended from a few users to a thousands of users i.e scaling is one of the major advantage of shifting of the enterprise based applications to the cloud based applications.
- III. Cost related to hardware requirements is also decreased a lot using cloud computing if the increase in number of users is temporary, for handling these traffic spikes the service provider didn't need to purchase new hardware. Cloud computing provides the service of pay as you use facility using which we can decrease the hardware cost alot.
- IV. It is providing a new kind of experience for the users which are reliable, flexible, efficient, fault

tolerant, quickly respondable. Cloud based applications are more fault tolerable, upto some extent they are having capability of self healing, that's why it is said that cloud based applications are more reliable and can provide services 24x7.

4. APPLICATIONS OF CLOUD COMPUTING

Based upon the benefits/ services being offered by the Cloud Computing, lots of areas can be explored in which such services can be used Some of these are as follows :

4.1 Commercial Banks and Financial Institutions

Cloud computing capabilities have much benefited the Banking and Financial Institutions [3]. To meet their everyday business operations banks are using innovative Cloud apps. Customers make use of technology in driving new business models. Banks have to react accordingly to meet customer expectations by applying new business models and operations. Cloud computing can provide number of advantages to banks and financial institutions including Usage based billing, Business Continuity, Green IT, Business Agility, Cost Savings etc. But banks have to consider issues related to confidentiality, Security, Quality of services before moving to the cloud.

4.2 Telecommunication

Cloud computing plays important role in telecommunication [8]. Multitenant cloud architecture which is providing multi-services to multi-users has telecommunication network as a central part. It is providing these services with optimal resource allocation and high quality of service. Both operational and technical aspects of telecommunication can be considered in cloud computing. The operational aspects of telecommunication include Operation and maintenance, Network control, User Experience and Customer Relationship, Cloud Intermediary, Trusted Partners. The technical aspects of telecommunication includes high speed transport technology that provide hassle free access to the cloud computing service, Network technology that enables virtualization feature of cloud computing, technology that enables eco-friendly cloud computing, new network technology that automatically collect mass censor information.

4.3 E-Governance

Government can primarily change the way IT services are delivered and consumed by adopting cloud based IT strategy [9]. At the same time government can also consider the operational and financial benefits like reduced cost, transformation in service delivery, improved

organizational agility. Because of the Everyday complexity and expansion of e-government the size of their computational data is increasing daily. To achieve user satisfaction and system efficiency a suitable model is required to implement e-government. Use of cloud computing as service oriented architecture and grid computing it can process large quantities of data using clusters of computers. The operational and business benefits of cloud computing are relevant to both public and private sectors. In public cloud model the storage and applications are available to general public over the internet. In private cloud model the agencies and organizations develop their own standardized cloud computing environment and allow the various departments to use secured, shared, automated cloud ready infrastructure which has been designed to deliver SaaS, PaaS or IaaS.

4.4 Cloud Based Applications Related To Tourism

Cloud computing make strong offerings to the travel Industry [10]. The tasks for travel purposes like plan, book, and effect payments can be done over the internet. But cloud computing opened the opportunity to use real time information. Cloud helps travelers to find suitable accommodations, routes and companies which means travelers are developing and growing as the technology expands. Firstly the travelers can assemble their own trips and compare flight prices using online booking services. Secondly the real time information, universal connectivity and mobiles are brought together using digital disruption. More and more travelers use their mobiles to search information like instant reservations and bookings, check-in, check-out, attractions and destinations, products, services and giving feedback.

4.5 IT Consolidation

There are number of reasons for what organizations chooses to adopt cloud computing. After doing lots of surveys government agencies has realized that operational efficiencies can be increased to much greater extent using IT consolidation [11]. By consolidating their server footprints through cloud and virtualization efforts the government agencies are reducing the cost of IT ownership. With the help of cloud computing it becomes feasible for the government to consolidate the data centers which helps alot in reducing the hardware, energy consumptions to many fold.

4.6 Shared Services

Cloud computing provides us the facility of sharing the IT services as a result business processes are more efficiently going on as large amount of overheads can be decreased a

lot[11]. Fraud & threat prevention and detection programs, management of assets these are the key federal programs which are looking for IaaS and SaaS based services by cloud computing. These models provide more flexibility to execute various government applications with the elastic competence. As a result government is able to make programs more agile and quick to respond to the varying business requirements.

4.7 Rapid Urbanization

Government in the well urbanized areas make use of IT to accomplish their various functions like loan sanction, procurement etc As more and more people are shifting to urban areas it becomes difficult for the city planners to deal with this growing city populations [12]. Around 50 percent of the global population lives in urban areas according to United Nations survey. Careful planning, preparations and resources are required to deal with this rapidly growing population. So it becomes the responsibility of the government in housing development to plan the resources in such a way so that it can minimize wastage and at the same time gives maximum benefits to the common man. To meet the demand of urbanization it would be better for the government to move their information technology to the cloud. The tasks that are performed manually for the maintenance can be automated using cloud computing models. Government can save lot of human resources and time by moving to the cloud.

4.8 Aeronautical/ Space Operations

Cloud based systems found lots of applications in the space missions [13]. As these systems are much efficient and reliable well renowned research centres are making use of them with full confidence. For example recent Mars mission the images send by the Curiosity rover are not only used by National Aeronautics and Space Administration but also they were make available to the other research centres with the help of cloud based applications. All this sharing of resources results in better understanding of the various complex problems and reach to a common most accurate solution.

4.9 Security Advantages Using Cloud

Before the development of cloud the government agencies were sharing the public data via same networks as the private data for them[14]. This can result in the various security issues related to the cloud. With the cloud development the public data is being shifted to an external cloud. As a result the exposure of internal sensitive data

can be reduced as private and public servers doesn't assemble nearby. Multifactor authentication, security patching, physical security, security certifications are some of the unique security benefits that came along with the cloud based applications only.

4.10 Continuity Of Operations (Coop) And Data Recovery (Dr)

COOP and DR the most expensive issues related to the application platforms and networks in all the agencies[15]. Because of the applications developed in cloud with the help of virtualization it becomes easier for better handling the redundancy and backup. The numbers of government agencies are making use of storage area networks (SANs) across multiple disk drives, virtual machine replication, and multiple redundant data centers thus COOP and DR are handled more efficiently.

4.11 Million-user cloud for Defence operations

For the purpose of sharing of data among number of colleagues who are across the far-flung especially during the various defence operations, the cloud based application are proved to be very efficient [11]. For eg. An enterprisewide cloud based application known as defence enterprise E-mail is being used by the US army for efficiently communication among the soldiers under operations.

4.12 Efficient Citizen Services

As the government is providing the number of services to the citizens like [11] monitoring their energy, water consumption, assessing the status of various service requests like applications, loans, and medical records. The government can make use of cloud based applications so that all these services can be provided to the citizens 24x7 basis without any redundancy. These cloud based applications will be more reliable which can support more number of users without any trouble.

4.13 Cloud Computing in Medical Fields

The cloud based systems in hospitals helps in more efficient way of information sharing between different number of users of different departments [16]. As every department can host all the data on the same place and number of doctors are using this as per the requirements. Although traditional applications were performing these

similar tasks but they were not so much efficient. Constraints like fault tolerance, unexpected traffic spikes, temporary extra hardware requirements were not easily to handle. *Electrocardiogram* (ECG) is the example where services of CC are being taken for providing services to the patient. In this procedure a wearable computing outfitted with ECG sensors checks the heart beat of patient and the patient's information collected is send to the Cloud- hosted web services for analysis through the patient's mobile device. Thus patient doesn't have to report to the hospital for ECG and then to the doctor, merely sitting at the home with the help of cloud based systems all these things can be performed in an efficient manner.

4.14 Cloud Computing in Education

Cloud Computing has bring revolution in the way education system was going on. Now even remote locations can take benefit of the urban way of education as the cloud based applications helps in making arrangements for the virtual mentors. Better collaborations, discussions, sharing of the research ideas can be done by the research scholars based upon the cloud applications. An institution can share their resources with the large number of users like students, faculty, research scholars, offsite locations in an more efficient manner. For example renowned institution IIT Delhi has developed its own new cloud computing environment known as Baadal for high performance computing. Which is providing the services to the lots of knowledge seeker's.

4.15 Biology: Prediction of Protein structure

Biological study requires extensive amount of computing power along with number of I/O operations [17]. As a result cluster computing, supercomputing are extensively used .One of the most crucial facility of cloud computing on demand service plays comes into picture here. The computation power required for prediction of protein structure can be now acquired on demand from Cloud Service Providers. There will be no requirement of the cluster computing or parallel and distributed computing .Example *Jeeva* is cloud project based on *Aneka* used by scientists for prediction of protein structure.

4.16 Biology: Cancer Diagnosis

In order to understand the biological expressions levels those are being started by thousand of genes requires extensive computation power[18]. Further extending this

classification of the gene-expression data samples into different classes for detection of tumors also requires extensive computation power. Cloud-CoXCS is cloud project based on *Aneka* to solve the classification problem in parallel, compose their outcomes and thus help in retrieving accurate and exact results in shorter due of time.

4.17 Media Applications

Multimedia applications also includes very high computationally intensive tasks and CC is very efficient for handling tasks because of its features like effective fault tolerance, multithreading, fault prediction etc. *Animoto*, *Maya Rendering with Aneka*, *Encoding.com* (video encoding on the cloud), *Multiplayer Online Gaming* are some of the examples of media applications applied using cloud services.

5. CHALLENGES/ISSUES IN CLOUD COMPUTING

The amount that CSPs (Cloud Service Providers) is charging to the CSCs (Cloud Service Consumers) depends on the quality of service (QoS) expectations of CSC. Some of these constraints has produce certain challenges for the system administrators, system and application developers, engineers, and service providers. So that quality of services can be provided at minimal cost. Some of these challenges are:

- I. Securing the computation and data that is on the virtual machine (VM) which is further managed by the Cloud Service providers.
- II. Managing the life cycle of the VM.
- III. Upto what extent of replication of application components and data is required to deliver perfect delivery of services.
- IV. For making application services more scalable and portable what kind of standards and interfaces are required.
- V. Role of the third party service provider i.e. upto what extent there contribution must be taken into consideration.
- VI. Selection of the most suitable data centers to reduce the operational cost, energy consumption etc.
- VII. How do Service Level Agreements (SLAs) can be more efficiently managed so that SLA violations are minimum?
- VIII. How to respond to the trust requirements and user's privacy.

6. CONCLUSIONS

Because of numerous amount of reliable services provided by the cloud computing, cloud based applications are gaining more popularity day by day. With the help of the supporting technologies like virtualization now it becomes more efficient way to utilize the system more efficiently a single machine can act as multiple machines working independently to each other. Self healing properly of the cloud based systems based upon the fault tolerance techniques used are gaining much interest of the commercial sectors. More and more government departments are leaning towards the use of cloud based systems as the ease of replication of data, automatic dynamic load balancing among servers, operating systems virtualization facilities are provide by the cloud based systems and thus common man will ultimately be able to more smoother use of the services provided by the government. Although lots of services are being provide through the CC still there are number of improvement areas which requires intention from the CSP like security of customer's data, decreasing operational cost, more easy to use of the cloud based systems, etc. So we can conclude that Cloud is the future through which all of the us will able to take benefits.

REFERENCES

- [1] "The NIST Definition of Cloud," <http://csrc.nist.gov/>. [Online]. Available: <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>. [Accessed 30 December 2015].
- [2] "Virtualization vs. Cloud Computing: What's the Difference?," PURCH, [Online]. Available: <http://www.businessnewsdaily.com/5791-virtualization-vs-cloud-computing.html>. [Accessed 30 December 2015].
- [3] K. Sudhakar, G. K. Vinay and L. S. Rani, "A View on Cloud Computing in the Banking Sector," *International Journal of Computer Science and Information Technologies*, vol. 5, no. 3, pp. 3305 - 3308, 2014.
- [4] M. CHORPA, J. Mungi and K. Chopra, "A Survey on Use of Cloud Computing," *International Journal of Science, Engineering and Technology Research*, vol. 2, no. 2, pp. 480-488, 2013.
- [5] A. Jain, M. Kumar and A. Lambha, "An Overview and Trends in Cloud Computing," in *IJCA Proceedings on International Conference on Advances in Computer Engineering and Applications*, IMSEC, GZB, 2014.

- [6] Y. Sahu and R. Pateriya, "Cloud Computing Overview with Load Balancing Techniques," *International Journal of Computer Applications*, vol. 65, no. 24, pp. 40-44, 2013.
- [7] A. Tchana, L. Broto and D. Hagimont, "Fault Tolerant Approaches in Cloud Computing Infrastructures," in *International Conference on Autonomic and Autonomous Systems*, St. Maarten, Netherlands Antilles, 2012.
- [8] "International Telecommunication Union," Government, [Online]. Available: https://www.itu.int/dms_pub/itu-t/opb/fg/T-FG-CLOUD-2012-P7-PDF-E.pdf. [Accessed 30 December 2015].
- [9] M. Pokharel and J. S. Park, "Cloud computing: future solution for e-governance," in *international conference on Theory and practice of electronic governance*, Montevideo, Uruguay, 2010.
- [10] "BMI Cloud Solutions," [Online]. Available: <http://www.bmicloud.com/uncategorized/travel-industry-to-benefit-from-cloud-computing>. [Accessed 30 December 2015].
- [11] C. Wilson, "http://www.wired.com/," WIRED, [Online]. Available: <http://www.wired.com/insights/2013/09/why-the-u-s-government-is-moving-to-cloud-computing/>. [Accessed 27 December 2015].
- [12] "How governments can benefit from cloud computing," The HINDU, [Online]. Available: <http://www.thehindu.com/todays-paper/tp-features/tp-opportunities/how-governments-can-benefit-from-cloud-computing/article4552817.ece>. [Accessed 29 December 2015].
- [13] "The Top 10 Cloud Innovations In Federal Government," FORBES, [Online]. Available: <http://www.forbes.com/sites/oracle/2013/06/24/the-top-10-cloud-innovations-in-federal-government/>. [Accessed 28 2015 December].
- [14] D. Tayade, "Mobile Cloud Computing ;," *International Journal of Computer Science and Information Technologies*, vol. 5, no. 5, pp. 6635-36639, 2014.
- [15] "Cloud Computing by Government Agencies," IBM, [Online]. Available: <http://www.ibm.com/developerworks/cloud/library/cl-ind-govcloud/>. [Accessed 30 12 December].
- [16] S. Pandey, W. Voorsluys, S. Niu, A. Khandoker and R. Buyya, "An Autonomic Cloud Environment for Hosting ECG Data Analysis Services," *ScienceDirect*, pp. 14-154, 2012.
- [17] C. Jin, J. Gubbi and R. Buyya, "Jeeva: Enterprise Grid Enabled Web Portal for Protein Secondary Structure Prediction," in *Advanced Computing and Communications*, Chennai, 2008.
- [18] M. Abedini, M. Kirley, X. Chu and R. Buyya, "Gene Expression Classification with a Novel Coevolutionary Based Learning Classifier System on Public Clouds," in *e-Science Workshops*, Brisbane, QLD, 2010.