The Role of Cloud Computing Standards and Architectures in framing a good e- Governance

Preet Navdeep
Research Scholar, PTU, Jalandhar
preet.sra@gmail.com

Prabhjot Kaur
Department of Computer Application
CGC, Landran
bca.prabhjot@gmail.com

Abstract
With the e-governance initiatives across the world especially in India, the expectation of citizens and organizations from government has increased. Government also is vigorous in this new area and is planning new ways of interacting and improving services to its citizens and businesses through e- Governance. Implementation of these e-Governance projects requires huge budget. But, today most of the countries are facing financial crises and as a result they are cutting extra spending and as a result governments are shrinking ICT budget. The use of cloud based e-Governance will help the governments in providing best possible services to the citizens and businesses, and to reduce the costs because cloud based e-Governance will not require purchase and installation of ICT equipments on their own premises. In this paper, analyses of cloud computing and its applications in the context of e-government will be discussed. Further, it discusses the security issues and challenges of using cloud computing with e-governance projects.
Keywords: e-Governance, ICT, Cloud Computing

Introduction

The world has noticed a technological revolution in the early 90s.This revolution has given new communication methods and ways to different organizations. This new way of communicating is known as internet. Later, internet became World Wide Web (WWW) and a new technology comes into place known as Web Technologies. After that, all organizations began to own their place on web, which have all the information about them in a more advanced form. Organizations started to do transactions online and idea comes out to be e-Business, e-Commerce and e-Governance. e-Governance means delivering government information and services to the citizen (G2C) and businesses (G2B) using modern information and communication technology in order to improve the performance of public sector organizations and to facilitate citizens and businesses. This also increases the effectiveness and efficiency of the public sector organizations. The key point is if the governments spend huge amount of money in creating e-government system then it should be effective in terms of reliability, ease of maintenance, cost efficiency, and satisfaction of other non-functional properties[8]. However e-government is facing challenges like budget shrinking for ICT by the governments, increasing demands for information and service by the citizens and continuous advances in technology which puts governments under pressure to be innovative. In order to overcome the above mentioned challenges governments should be innovative and willing to adopt new computing technologies. In the light of current economic situation where

governments are under pressure to cut extra spending as a result they are shrinking ICT budget. In such a situation, it is difficult to continue with traditional e-government model. One solution to above problems is the use of cloud computing services for e-Governance.
This paper discusses about e-Governance and cloud computing in its second section. In third section, Cloud vision for e-Governance is given. In fourth part, various e-Governance initiatives taken up in India are discussed. In the next section, various benefits of using cloud computing for e-governance projects are discussed and then, various challenges faced are discussed and last, conclusion is stated.

e-governance and Cloud Computing

e-Governance

e-Governance can be defined as the use of information and communication technologies (ICTs) by governments to augment the collection and quality of information and services provided to citizens, businesses, society and other government/non-government agencies in an efficient, cost-effective and effective manner.
There are four models of e-Governance framed based on the services provided by it.

1. Government to Citizens (G2C)
2. Government to Employees(G2E)
3. Government to Government (G2G)
4. Government to Business (G2B)

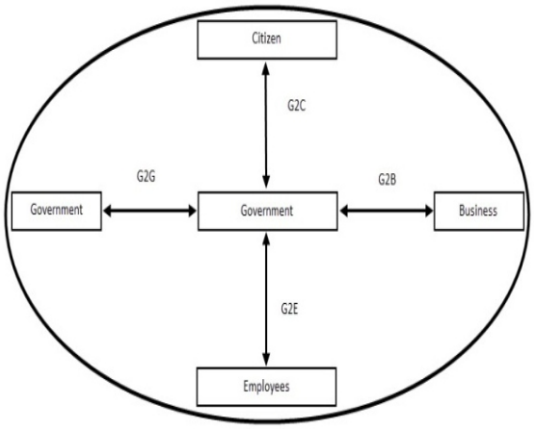

Fig.1 Four Models of e-Governance

Accordingly and for the purpose of this study E-government can be defined as:
1) E-governance refers to new ways being used to reinvent the business of government, includes making the information accessible on the web, and delivering all the services on the web too in an easy fast and reliable way regardless to the distances and time.
2) It is also transforming the nature of governance by affecting the relationship and responsibility between the state and its citizens [10].

Cloud Computing

Cloud computing is a revolutionary concept for many businesses, governments and citizens. According to Gather, by 2012, 20% of businesses will adopt cloud services and own no IT assets [12].

According to the IEEE Computer Society Cloud Computing is:"A paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, entertainment centers, table computers, notebooks, wall computers, handhelds, etc."[8]Cloud computing is the collection of scalable, virtualized resources, which is capable of hosting application and providing required services to the users and can charge as per the uses like utility. The basic model of cloud computing is shown in fig 2.

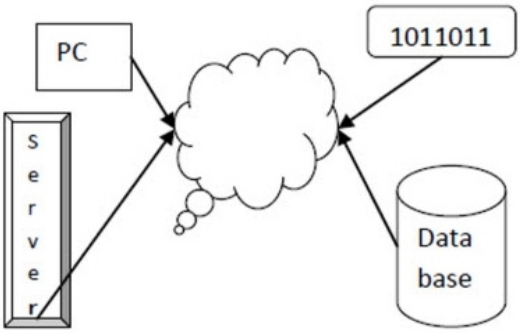

Fig 2. Basic Model of Cloud Computing

The main goal of cloud computing is to provide ICT services with shared infrastructure and the collection of many systems. In cloud computing every facility is provided in terms of service. It provides infrastructure as a service, software as a service, platform as a service, network as a service, and data storage as a service.

The services in the cloud can be thought in layer architecture where various resources are available in different layers. For individuals, cloud computing means accessing web based email, photo sharing and productivity software, much of it for free. For organizations, shifting to the cloud means having the ability to contract for computing services on-demand, rather than having to invest to host all the necessary hardware, software and support personnel necessary to provide a given level of services. And for governments, the value proposition of the cloud is especially appealing, given both changing demands for IT and challenging economic conditions. According to the concept of cloud computing, instead of purchasing hardware or software, a user purchases remote access to them via the internet.[3] There are three levels of cloud computing as shown in fig 3:

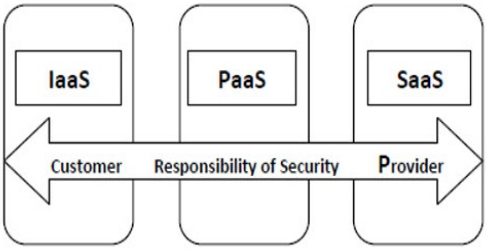

Fig 3. Levels of cloud computing

- Infrastructure as a Service – IaaS
- Platform as a Service – PaaS
- Software as a Service – SaaS
- ***Cloud Software as a Service (SaaS):*** Cloud consumers use software applications, but do not control the operating system, hardware or network infrastructure on which they are running.
- ***Cloud Platform as a Service (PaaS):*** Cloud consumers use the platform upon which applications can be developed and executed.
- ***Cloud Infrastructure as a Service (IaaS):*** Cloud consumers use basic computing resources such as processing power, storage,networking components or middleware on demand.

Cloud computing is upcoming area with three main features namely service availability, pay as per services, scalable feature [4]. It is based on service oriented architecture and the model could be categorized as follows:

a) **Public Cloud** – it is a type of cloud where third party will provide services to client via internet. Each user will have its access mechanism provided by the third party. Public cloud is a cost effective method to provide services.

b) **Private Cloud** – private cloud has many benefits over public cloud depending upon the service required. In addition in private cloud data and processes are managed by organization itself. It provides better and controlled infrastructure for security.

c) **Community Cloud** – Community cloud provides services to a community within organization. Members of community can access data on community cloud. Communities are formed by grouping of people with shared interest.

d) **Hybrid Cloud** –it is a combination of private, public and community cloud. It has maximum functionalities as compared to all cloud and non critical information is handled by public cloud while critical information and processing is done on organization controlled private cloud. Figure 4 illustrates the different layers of cloud computing for E-Governance.

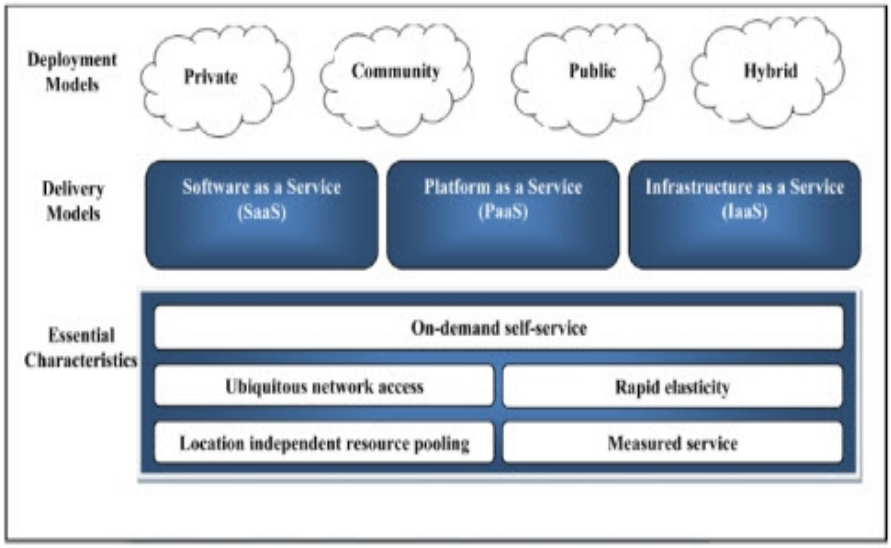

Fig 4. Layers of Cloud Computing

Cloud Vision for E-governance

This section performs a selection of elements for the cloud which is useful for implementing the cloud based e-Governance.

1) **Internet over Cloud:** Most of services on internet are dependent on cloud 70% of the internet users are also using cloud in various applications.

2) **Distributed Data Centers:** Individual information systems are vulnerable to risks such as outside attacks, intruders, environmental risks etc. Distributed data centers provide protection from these types of threats [5]. Distributed data centers facilitate the E-Governance application usage and management by providing support for communication and real time platform. Data is distributed among different centers so single ownership on data is eliminated and it provides more security to information related to citizens.

3) **Data Center Operation:** Main aim of Data center operations is to facilitate availability and continuity of services. Cloud computing uses cost effective hardware for setting data centers and the same data center can be shared in various E-Governance application. Use of same hardware setup is used for various e-government applications. It increases the resource utilization and provides scalability to the e-Governance system. On the basis of resource consumption future plan could be built for e-governance applications.

e-Governance Initiatives in India

The vision of e-Governance [2] is to "Make all Public Services accessible to the common man in his locality, through common service delivery outlets and ensure efficient, transparent and reliable information at minimal costs. The main intent of e-Governance is to fulfill five major objectives [3]:a policy framework, enhanced public service, high quality and cost-effective government operations, citizen engagement in democratic processes and administrative and institutional reform. In India, National e-Governance Plan (NeGP) [10] has been formulated by Department of Electronics and Information Technology (DeitY) and Department of Administrative Reforms and Public Grievances (DARPG). According to NeGP, over 1000 e-Governance services have been accessed through NeGP. The e-taal (Electronic Transaction Aggregation and Analysis layer) is the government web portal that provides statistical of transactions done electronically by citizens with e-Governance projects. According to e-taal, Indians have done over 2 billion e-transactions in last one year [1].

Various E-Governance projects in India include:

1) Land record Management Projects: Maintains millions of land records and helps citizens in providing reliable and useful information in shortest time related to it .e.g. Bhoomi (Karnataka), Gyandoot (Madhya Pradesh), Land records Management system State government of Punjab, Devbhoomi(Uttarakhand).

2) **Local Information Projects:** Citizens can look for local information such as loan rates, prices of seeds , fertilizers etc using the following E-Governance services like E-JanSampark (Chandigarh), Prajavani (Andra Pradesh, E- Samadhan (Himachal Pradesh).

3) **Agriculture:** Following are the projects used in agriculture GYANDOOT (Madhya Pradesh), AGMARKNET and SEEDNET (Department of Marketing and Inspection, Ministry of agriculture and Government of India).

4) **Disaster Management:** Managing Disasters is a very challenging job for the government as it is naturaland unpredictable. To handle such disasters, state governments have started e-governance services like Project **Chetana** started by state government of Bihar to deal with natural disasters like floods and earthquakes.

5) **Registration of Birth/Deaths**- Services provided by this e-Governance service are Issue of Birth/Death certificate, rural water supply and sanitation, conducting various Welfare schemes for the poor and needy people. Projects performing the above services are-E-GramViswa Gram project (gujrat), RajNidhi (Rajasthan), Raj-SWIFT (Rajasthan State's Department of Information Technology.

6) The biggest application of e-Governance in India is UID Aadhaar. It is one of the prestigious projects of Indian government where Biometric Card with Unique Identification Number are issued to every citizen. UID Aadhaar is a unique identification project undertaken by the Unique Identification Authority of India (UIDAI) established in 2009.The authority maintains a database of residents containing the biometric and other data. All these numbers are stored in a centralized database and linked to the basic demographics and biometric information such as photograph, ten finger prints and iris of each individual. In India this is the biggest source of Big data. As of 15 October 2015, over 92.5 crore (925 million) Aadhaar numbers have been issued in the project [6].

All these projects produce a large amount of data referred to as Big data which cannot be handled by traditional e-Governance hardware and storage devices. In managing such big data, Cloud Computing is used.

Cloud Computing Benefits for E-Governmence

E-government service platform based on cloud computing takes advantages of cloud computing environment providing the following benefits to citizens and government.

Availability and Accessibility

The main aim of e-Governance is to provide information and services online to its citizens effectively and without any delay. In cloud computing applications and information are provided online, therefore, it has high availability and citizens can use them at anytime and from anywhere. One of the main aims of the government in providing the governmental services online is that citizens and businesses can access these services around the clock.

Cost Saving

In cloud based e-Governance, public organizations do not need to purchase and install the ICT equipments and software on their own premises, which normally they do in traditional e-

Governance. The public sector organizations use applications provided to them by the cloud service providers which eliminates the upfront capital expenditure. The cost of ICT services for public organizations and individuals also reduces in cloud based e-Governance because they lease ICT resources and services according to their needs instead of investing in these resources [18]. The cloud computing 'pay-as-you-go' approach also reduces the operation costs for the public sector organizations.

Efficiency

Providing public services efficiently and effectively to citizens and businesses is one of the main benefits of e-governance. The use of cloud based e-governance projects makes the task easier for the government in order to improve e-services delivery. Also in such a system it is also possible to create new solutions which are not technically and economically feasible without the use of cloud services.

Flexibility

Different cloud deployment models ensure that the cloud based e-governance projects implementations can be aligned closely with business needs and ICT strategies of the organizations. Public sector organizations can easily choose hybrid cloud computing model and get benefits from both private and public cloud models.

Scalability

One of the main stakeholders of e-Governance projects is citizens. With the passage of time citizens are attracted more and more towards e-Governance. As a result demand and load on the e-government system is increasing day by day. Therefore technology adopted for e-Governance should be scalable which meet growing numbers and demand of citizens. Cloud computing is considered a scalable technology because it can dynamically add extra hardware such as CPU, servers, hard drives etc to accommodate growing number of users (citizens).

Challenges of using Cloud Computing Services for E- Governance Projects

To fully embrace the benefits of cloud computing, governments need a high level of confidence in virtualization and cloud computing as a service delivery strategy. Government agencies need assurance of a secure and reliable cloud computing strategy to manage user and citizen information before they commit to change. With IT costs spiraling and budgets decreasing, any commitment of funds must show measurable return on investment (ROI).

More than just the high–level benefits, governments need to understand how cloud-based technology can optimize IT infrastructures while providing new capabilities and services. Additionally they need confidence that vendors have the technology based on industry standards, and the industry expertise and strategic partnerships to support the transition to cloud computing.

Governments need to identify all potential opportunities for switching from existing computing arrangements to cloud services and ensure that in-house infrastructure complements cloud-based services. Virtualization will be a key element of a compatible infrastructure.

Governments must also develop a cost/benefit and risk-evaluation framework to support decisions about where, when, and how cloud services can be adopted. Along with a roadmap for optimizing the current ICT environment for cloud services, it is important to identify and secure in-house competencies required to manage effective adoption. Designating a cross-functional team to monitor cloud computing services, providers, and standards, and determine if they affect the roadmap will add to the benefit.

Conclusion

The concept of cloud computing is widespread popular because it offers all-in-one solution and can satisfy the e-Governance needs that grow all the time. In the current economic situation where governments around the world are under pressure to cut extra spending so as a result they are shrinking the ICT budget as well. In this situation cloud based e-Governance is a good option in which governments do not need to purchase ICT equipment. Instead, they lease ICT resources and services according to their needs .Capital costs are replaced by operational costs for the resources used by government organizations. Moreover, Cloud Computing is online which can help in providing e- Governance services to its citizens anytime and anywhere. As it becomes more mainstream, issues such as guaranteeing privacy, optimization, establishing standards and governance, and continually improving the tools and technologies would gather attention. Cloud Computing has the ability to change the landscape of e-Governance projects like how data is generated, maintained. So, the use of cloud computing services should be encouraged as they can prove to be helpful in further improvement in providing effective and efficient information around the clock to its citizens.

References

[1] A.G. Picciano,"The Evolution of Big Data and Learning Analytics in American Higher Education", Journal of Asynchronous Learning Networks, pp 9-20,2012 http://searchvirtualdatacentre.techtarget.co.uk/news/1510117/Cmunity-cloud-Benefitsand-drawbacks.

[2] Abdulelah Awadh Al-Rashedi," E-Government Based on Cloud Computing and Service-Oriented Architecture", International Journal of Computer and Electrical Engineering, Vol. 6, No. 3, June 2014

[3] Alshomrani,Qamar," Cloud Based E-Government: Benefits and Challenges ", international journal of multidisciplinary sciences and engineering, vol. 4, no. 6, july 2013

[4] Dr. R.Siva Rama Prasad,Veera RaghavaRao Atukuri," Cloud Computing Technology for Effective e-Governance", (IJCSIT), Vol. 3 (1) , 2012,3241-3244

[5] Kalbande, Deshpande, Prof. Popat,"Review paper on use of Big data in E-Governance of India", International Journal for Research in emerging and technology", Vol. 2, pp.395-402, March, 2015

[6] Kostandina , Violeta ," E-Government Based on Cloud Computing", Journal of Emerging Trends in Computing and Information Sciences, Vol. 4, No. 4, April 2013.

[7] IEEE Computer Society: Definition of Cloud Computing.

[8] National Institute of Standards and Technology (NIST)

[9] NeGP Website. "About NeGP".NeGP Website. Retrieved 17 July, 2014
[10] Padhy, Patra, Satapathy," Cloud Computing: Security Issues and Research Challenges ",IRACST, Vol. 1, No. 2, December 2011.
[11] Šuh, Vujin, Barać," designing cloud infrastructure for big data in e-government",Journal of Universal Excellence, March 2015, year 4, number 1, pp. A26–A38.