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Cloud Based E-Governance System : A Survey

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Abstract

The overwhelming success and the rapid growth of the Internet changes our lives; the way we interact, learn and work. Now a days most of the organizations including government deliver their services through internet. E-governance is the application of information and communication technologies to exchange information between government and the citizens, government and business organizations and between government organizations. Cloud computing is a new way of accepting and providing services over internet. Cloud based e-governance system provides many benefits to Government like reduced cost, distributed storage of data, availability of resources at lower cost ,manages security, scalability, accountability and modifiability. This paper gives a survey on clod based E-Governance system.

Key Words: Cloud computing; E-Governance; Distributed system; Service.

1. Introduction

The overwhelming success and the rapid growth of the Internet changes our lives, the way we interact, learn and work. Most of the organizations deliver their services through internet. Traditionally accessing government services is more difficult, as one needs to go through so many procedures and formalities. Hence the government across the world aims to deliver their services through electronic media under the name e-governance. The different users of the E-governance include government, citizens, and Businesses. With E-Governance, Government interacts with the citizens more easily and rapidly. An effective E-governance system should be cost effective, reliable and easy to maintain. Unfortunately current technologies are not enough to meet the overall requirements of E-Governance. Cloud computing provides a platform for efficient deployment of E-governance system. It leads to substantial cost savings.

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Cloud computing provides hardware, software and network as a service. It provides better technological solutions for E-Governance.

Cloud based E-governance represents an emerging paradigm for distributed computing of E-governance applications that utilizes services as fundamental elements in building agile networks of collaborating applications distributed within and across government boundaries. In such open distributed computing environments, security is of paramount concern.

1.1. E-governance

E-governance is the application of Information and communication technologies (ICT) to exchange information between the government and the citizens, government and businesses and between government organizations [1]. E-governance is used to improve the interaction between Government and Citizens, Government and Businesses by the application of some electronic means. It also employ electronic means in internal Government operations to simplify them. E-governance system helps to improve the productivity of Government and helps in decision making [2].

For developing an E-governance system first we identify different users of the system, they are Government, Citizens, Businesses and Enterprises. E-governance aims to deliver more reliable services to all these users. E-governance applications are classified into four broad categories.

- Government to Government (G2G) E-governance supports the exchange of information, decision making, fund transfer, shared services, revenue and law enforcement between the inter organizational Government departments.
- Government to Business (G2B) E-governance provides the services like registration, tax filing, transactions and payments. Businesses should aware and use the services provided by Government through a secure mechanism.
- Government to Citizens (G2C) E-governance supports the services like registration/land/revenue services, agricultural services, employment etc.
- Government to Enterprise (G2E) E-governance supports some enterprises like water board, electricity board etc are controlled by the government which where some policies and standards are to be enforced.

1.2 Cloud Computing

Cloud computing is a new way of accepting and providing services over internet. Cloud based E-governance system provides many benefits to Government like reduced cost, distributed storage of data, gets more resources at lower cost ,manages security, scalability, accountability and modifiability. Cloud computing can be treated as a future of computing [3].

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." Cloud computing provides every facility as a service. It provides infrastructure as a service, software as a service and platform as a service.

- Infrastructure as a service (IaaS) – In a cloud based E-governance system, cloud provides hardware, network and data storage as services. Cloud computing provides a common infrastructure to all application, so it is easy to use and deploy. E-governance applications requires huge amount of data. Cloud computing provides unlimited supply of cpu, storage and bandwidth for E-governance applications. So the designer has only focus on its features and usability.
- Software as a service (SaaS) – Cloud computing provides the use of complete applications, running on cloud to the consumers. Government departments may not want purchase the E-governance

applications , but they can request and use these applications from the cloud. Many of the applications can be provided as standard services. Some of them are

- Complaint Resolution System.
- Employee Management Systems.
- Attendance Resolutions Systems.
- E-police, E-court.
- Municipal Maintenance.
- Water Boards, Billing, Payment Systems.

- Platform as a service (PaaS) – Cloud computing provides a virtual developing environment to the developers. Cloud offers standard platform for E-governance developers. Some of the platform they provided are
  - OS provisioning.
  - Queuing Service.
  - Database Services.
  - Middleware Services.
  - Workflow Services.

The different deployment models for cloud computing are as follows:

- Private cloud – The cloud infrastructure which is operated and used by a single organization. It may be managed by the organization or a third party. and may exist on premise or off premise.
- Community cloud – The cloud infrastructure which is shared by several organizations and supports a specific community that has shared concerns. It may be managed by the organizations or a third party and may exist on premise or off premise.
- Public cloud – The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.
- Hybrid cloud – The cloud infrastructure is a composition of two or more clouds such as private, community, or public that stands as unique entities but are bound together by standardized technology that enables data and application portability.

2. Cloud based E-governance System

Cloud based E-governance represents an emerging paradigm for distributed computing of E-governance applications that utilizes services as fundamental elements in building agile networks of collaborating applications distributed within and across government boundaries**.**

2.1. E-governance Challenges and Cloud Benefits

E-governance faces some challenges like technical, economical and social challenges. Interoperability between the existing and current hardware and software are major technical issue. Some legal aspects like security and privacy issues are important. Social challenges like technical illiteracy is also a major challenge. The initial installation cost, implementation cost and maintenance cost are the economical challenges faced by the E-governance system.

Cloud computing can be capable of resolving several issues in E-Governance. Cloud computing offers several benefits to E-governance [4], some of them are

1. Data Scaling – E-governance applications deals with large data over the years, so the databases should be scalable. Relational databases ensure integrity of data at the lowest level, where as cloud databases can be scalable at any level and used for E-governance applications. Cloud databases must be

considered if the foremost concern is on-demand, high-end scalability – that is, large scale, distributed scalability, the kind that can't be achieved simply by scaling up.

2. Auditing and Logging – E-governance services must be monitored and any change in information content must be traced. By keeping the providers of services accountable, Corruption in Government organizations can be controlled. Security audits and process audits must be done periodically to ensure the security of the system. Cloud computing help to analyze the huge volume of data for detecting fraud. It helps to provide defense mechanisms to enhance the security of the system.
3. Rolling out new instance , Replication and Migration – Typically E-governance applications works for departments of different states and municipalities and hence take more time, resources, effort and budget. Cloud architectures offer excellent features to create an instance of application for rolling out a new municipality. Cloud can reduce the time to deploy new application instances.
4. Disaster Recovery - Natural disasters like floods, earthquakes, wars and internal disturbances could cause the E-governance applications not only loose data, but also make services unavailable. The Cloud offers tools and technologies that make disaster recovery simple and easy. Cloud helps to increase the number of resources dynamically to maintain quality of service intact even at the times of high load, which generally happens in E-Governance.
5. Performance and Scalability – The technology and architecture used for implementing E-governance applications should be scalable and common across delivery channels. It is required to meet the growing number and demands of user . With cloud architectures, scalability is inbuilt. Typically, E-governance applications can be scaled vertically by moving to a more powerful machine that can offer more memory, CPU, storage. A simpler solution is to cluster the applications and scale horizontally by adding resources.
6. Reporting and Intelligence – For better utilization of resources the factors like Data center usage (CPU, storage, network etc), peak loads, consumption levels, power usage along with time etc are monitored and reported. This minimizes the cost and plan. Because of its sheer size and capabilities Cloud offers better Business Intelligence infrastructure compared to traditional ones. Cloud computing offers seamless integration with frameworks like MapReduce (Apache Hadoop) that fit well in cloud architectures. Applications can mine huge
volumes of real time and historic data to make better decisions to offer better services.
7. Policy management – For dealing with citizens Government policies must be adhered and implemented in E-governance applications. Along with the infrastructure and data center policies has to be enforced for day to day operations. Cloud architectures help a great deal in implementing policies in data center. Policies with respect to security, application deployment etc can be formalized and enforced in the data center. With cloud, E-governance applications can manage the policies well by providing security and adoptability.
8. Systems Integration and Legacy Software – Applications that are already deployed and providing services are to be moved to the cloud, and that are integrate with applications deployed in the cloud. The Information Technology helps to co-relating the data across applications and pass messages across different systems to provide faster services to the end users. Cloud is built on SOA principles and can offer excellent solutions for integration of various applications. Also, applications can be seamlessly easily moved into cloud.
9. Migration to New Technologies – Technology migration is the biggest challenge. Moving to different versions of software, applying application and security patches is the key to maintaining a secure data center for E-Governance. Cloud architecture efficiently enables these kind of requirements ,by co-existing and co-locating different versions and releases of the software at the same time. Once these applications are tested, they can be migrated into production with ease.

3. Related Works on Cloud Based E-governance System

According to Pokharel et al [5] cloud computing is the future solution of E-Governance. Traditional E-governance faces many challenges from development to implementation. Some of the prime features like scalability, low risk, reliability, availability and low cost of cloud computing play the significant role in e-government system. Cost is one of the prime challenges in E-governance system. Cloud computing can solve this problem. E-Government system requires entities like, software, hardware, service, management, network, business, policy, security etc to survive and function properly. Unfortunately current approaches or technology is insufficient to manage all these entities. Cloud computing which treats all these entities as a service can be used in e-government system. Cloud computing can handle the above mention challenges and finally address global challenges of e-government system.

According to Mukherjee et al [6] proposes a future frame work for E-governance based on cloud computing. The proposed E-governance framework consists of three layers, they are Knowledge base, inference engine, and user interface. The knowledge base includes a series of facts and rules about the particular problem area from which the system draws its expertise. The inference engine can scan facts and rules, and provides answers to the queries given to it by the user. Through the User interface user communicates with the system using human understandable languages. Cloud consists of grids of commodity machines and a software layer called Hadoop, which is responsible for distributing applications data across the machines, parallelizing and managing application execution across the machines, and detecting and recovering from machine failures. Hadoop would play a major role to give a new look of intelligent E-governance web service. The proposed frame work is shown in figure 1

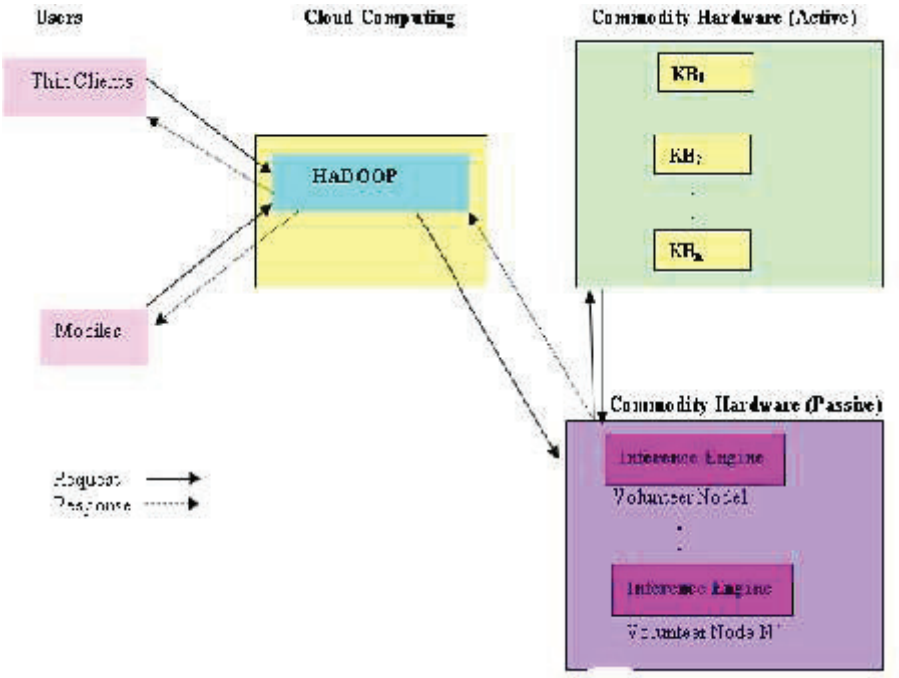

Figure 1. Framework for cloud based E-governance

According to Sharma et al [7] analyses the cloud computing and examines its application in E-Governance. Cloud computing is a new form of computing can solve various problems like cost , un

availability of infrastructure like hardware , software and network , untrained workforce and software applications on user end and it may lead to significant cost savings with a infrastructure less model for e-Governance. The implementation phase of E-governance services will become faster by the application of cloud computing. Significant Cost Reduction, Increased Flexibility , Access anywhere, Elastic scalability and pay-as-you-go, Easy to implement, Service quality, Delegate non-critical applications, Always the latest software, Sharing documents and group collaboration, Data Recovery, Distributed Data Centers are benefits provided by cloud computing to E-Governance.

According to Cellary et al [8] discuss about E-Government Based on Cloud Computing and Service-Oriented Architecture. Cloud computing allows E-Government solutions to cover the whole country, independently of divergence of local administrative units. Service-oriented architecture facilitates provision of compound services covering whole customer processes. Service-Oriented Architecture (SOA) is a new way of designing and developing IT solutions with service as the primary building block. Web service technology, Software components technology and REST technology are technologies used to implement a service. There are eight main design principles in SOA they are Standardized Service Contract, Service Loose Coupling, Service Abstraction, Service Reusability, Service Autonomy, Service Statelessness, Service Discoverability, Service Compos ability. Figure 2 represents an example of a mix service composed of services provided by both government and business entities.

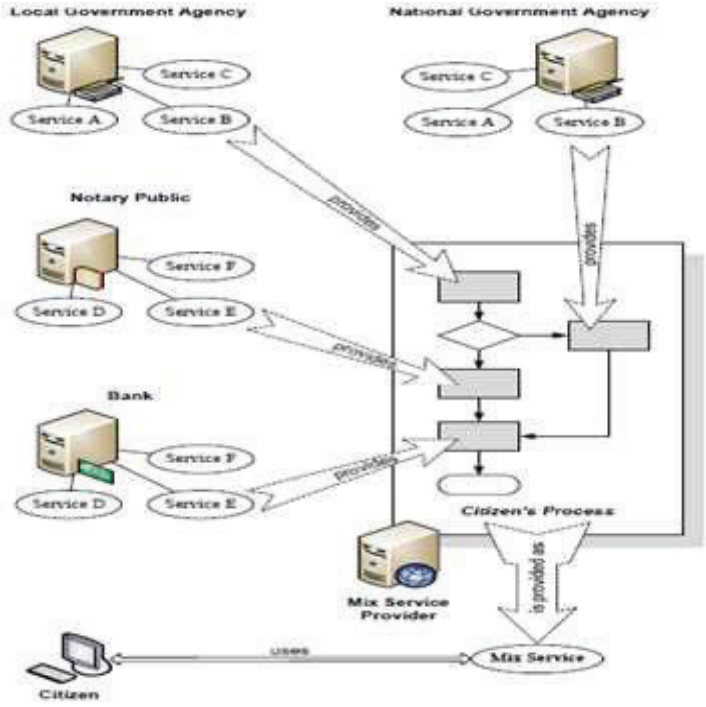

Figure 2. SOA in public sector

According to C.Yeh et al [9] presents an e-government system that can take advantages of cloud computing to change its function towards service, promote the industrial upgrading and push forward the green technology . The Government moves from the current E-governance platform to cloud computing environment creates the values like Beneficial for serving the public, Promoting cooperation with enterprises, Promoting the public construction, Raising the utilization rate of resource, Improving administrative efficiency, Reducing the budget, Robustness. Reducing the initial capital investment,

Promoting the transformation of industry, Scientific study supply are the values created by the cloud based E-governance system to the society. The cloud computing also produces some issues to the E-governance system they are Security and privacy, Reliability, Management, Laws.

4. Future Research Directions

E-governance will become more popular around the world in next few years. Most of the countries are in the early stage of development of E-governance system. Security is the one of the crucial issue in E-governance system. As the number of services provided by the E-governance system to the users increases a high level of E-Government security is required. Security of information is concerned with the properties like confidentiality, integrity, authentication, availability and reliability. Authentication of information identifies the actual author of the information. Secure electronic authentication is important in an E-Government system. Different authentication methods are available ranges from software solutions like use of passwords to hardware solutions like use of smartcards. Confidentiality of information means the information is to be confidential, only the authorized person can view the information. Confidentiality is the prevention of unauthorized information disclosure. Integrity of information means unauthorized person cannot alter or tamper the message stream of the information. Information should be available at all time and there is no delay or denial of service attacks.

In an E-governance system databases contain all the government information so that they should keep very confidential. Databases connected to the web contain critical and private information. So that there are different threats occurs, someone can masquerade as a legitimate user and reveal private and costly information.

5.Conclusion

E-governance with cloud computing offers integration management with automated problem resolution, manages security end to end, and helps budget based on actual usage of data. At a global level, Cloud architectures can benefit government to reduce duplicate efforts and increase effective utilization of resources. This paper discusses the benefits provided by cloud computing to E-Governance. This paper presents a brief summary of various works in cloud based E-governance system.

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