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Use of Cloud Computing for Implementation of e-Governance Services

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Abstract- E-Governance enables use of Information and Communication Technologies (ICT) for smooth working of government by providing transparency efficient working in immediate response to end the citizens in cost effective manner. The exiting e-Governance is server centric and is not able to address all users including rural and urban citizens. Governments today are still facing challenges like lack of financial and technological resources, digital divide, poor IT infrastructure and lack of management in delivering core services to their citizens. Cloud Computing is a new way of delivering Services to the customer using pay-per-use model which not only involves less capital expenditure with minimum upfront cost, but is also more user and environmental friendly. This paper presents a cloud based model for implementation of e-Governance services. We found that the implementation of cloud-based e-government architecture cost-saving of Information and Communication Technology (ICT) investment in our country.

Keywords- E-governance, Cloud computing, IaaS Cloud, Service Oriented Architecture (SOA), Virtualization, Web Enabled Technology, Cloud datacenter

I. E-GOVERNANCE

Interactive services can be provided to the citizens and businesses through e-Governance, particularly in developing countries. It is the use of various information technologies like Networking, Internet and mobile computing by the government to deliver improved services to citizens, business and industry, employees and to other parts of government in a faster and reliable manner. Various categories of e-governance include [1,2,3,4,5,6]:

Government to Citizens or G2C: G2C are those activities where the government provides on-line information and services to citizens. Various services provided by government to its citizens include agriculture services, land records, rural services, municipal services etc.

Government to Business or G2B: Using G2B, the government deals with businesses using ICTs. Government is responsible for taxation, policy enforcement and entering into contract with various businesses.

Government to Employees or G2E: With the help of G2E, enterprises will be able to able to increase its effectiveness and efficiency, by improving employee satisfaction and retention.

Government to Government G2G: G2G deals with the activities that take place among various government organizations. Many of these activities are designed to improve the efficiency and effectiveness of overall government operations. These applications provide the interaction among various government departments and need large number of messages to be passed across them. Primary objectives of e-Governance are:

To improve the interaction of citizens with the government: A responsible government keeps the citizen well informed and allows frequent interaction ready to solve their problems promptly. This enables greater participation of individuals in the democracy. Using e-Governance, the government is able to collect the feedback from the citizens and gets awareness of the individual problems.

Cost effectiveness: Governments are under increasing pressure to deliver their services within tight budgets and resources. However, e-Governance doesn't require physical delivery of information thereby reducing the postage and stationery cost. This also reduces transportation and physical communication cost. The response time of government is also reduced substantially and citizens are able to get early solutions of their queries.

Increased accountability of the government: E-Governance brings transparency in the system, therefore, the government's accountability in solving citizens problems is also increased.

Urbanization: population of cities is rapidly growing. It is expected that in India by the end of 2050, 55% population of the cities will be urban as compared to current 30% urban population. Connecting more people to basic utilities such as

sanitation, water and electricity, or providing them a mechanism to report their grievances, the government has to allocated resources swiftly so that citizens get adequate services or the infrastructure is not over-loaded [7].

With the growth of web enabled technologies, government across the world have adopted electronic form of governance. However, the developing countries are still facing difficulties in its implementation leading to failures. India is a unique country with huge population with 29 states and 7 union territories and 693 districts/cities spread over thousands of vat areas consisting of square kilometres. Furthermore, this country has a vast area that is 3.287 million square km. The nature of central and state government agencies is spread in a vast geographical area. Maintaining the quality of various government services (G2G, G2B, and G2C) pose a greater challenge. These services still scattered among different government agencies resulting in overall declined in government performances and slow down in bureaucratic reforms. The reasons can be attributed to lack of synchronization, interoperability problems and wastage of resources. We are also facing difficulties in implementing e-Government initiatives generally due to barriers like lack of funds and resources, digital divide, lack of IT infrastructure and poor management.

With the rise in literacy and income, the socio-economic landscape of the country is changing resulting in the pressure on government to improve their services by enabling the electronic services. E-Governance practices improve the efficiency and quality of administration and education while confirming the government regulations. In India, various e-Governance services include: property Registration, Community Owned Kiosks, State Border Check Posts, etc. These e-Governance applications are facing problems of increasing budgets and increased data and storage requirements. It is challenging task to deliver the services to the citizens economically without compromising the outcome and quality. Currently, e-Governance services are using Information and Communication Technology (ICT) for improved the effectiveness, efficiency, transparency of the government. However, the existing e-Governance is based on Client Server technology and is not able to address all categories of rural and urban users due to inherent limitations of this technology [8].

II. IMPORTANCE OF CLOUD COMPUTING

The primary objective of e-Governance to is to simplify and facilitate the functioning of the government for the convenience and easy access to its citizens. The discrimination of geographical and language barriers can be levelled by using the state-of-art developments in technology e.g. cloud computing. The cloud technology standardizes and collects IT resources to automates many of the maintenance activities otherwise performed manually under conventional or client/server model of computing. It offers a great advantage in terms of immediate as well as long term cost savings for governments. As the model offers services based on a "pay-as-you-go" and "pay-per-use" basis, there are no upfront costs involved in buying IT equipment. The savings can allow cost effectiveness come in these financially-challenging times. Cloud computing can be the backbone on which governments can create a more trusting environment for e-governance and provide the benefits of cost savings, efficiency, improve delivery mechanisms etc [2].

Cloud computing is based on concept of virtualization [8, 10] where the experts at data centres manage resources in a grid. It is technology for data center implementation that abstracts the processing, storage and networking devices from the underlying hardware. Major component of the datacenter architecture is VMM or the virtual machine manager that guarantees optimal datacenter operation by scalable, secure and effective management of virtualized infrastructures. The Cloud Operating System synchronizes the deployment of virtual resources and manages the infrastructures. It manages various components so that they achieve desired result. The operating system also provides federation capabilities for accessing and deploying virtual resources in remotely located cloud infrastructures. Various components of the cloud OS are virtual machine (VM) manager, network manager, storage manager and information manager [4,5].

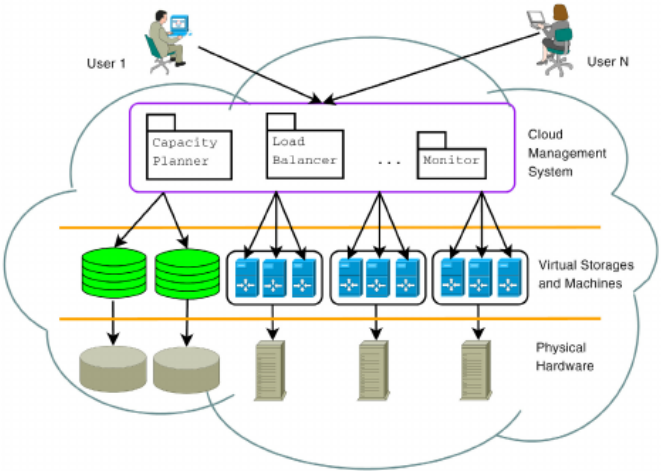

Figure 1. Proposed Cloud Architecture

Cloud computing provides a new service consumption and delivery model that is based on Internet Services. Cloud computing framework for e-Governance can lower the costs while improving the service quality. Cloud computing has several advantages over traditional IT solutions. It is more flexible and efficient, that provides better collaboration among departments and organizations of a government. The Commonly cited benefits of using the cloud model for ensuring e-Governance services are:

- Resource pooling: The service provider is benefited by economies of scale as the workload from multiple clients is onto the same physical machines. ICT spending's are reduced by sharing software applications across the clients.
- Rapid elasticity allowing dynamic capacity management: Resources are also available on demand. The resource may include processors, memory, secondary storage, network bandwidth which are customized for the client. This reduces unused (wasted) computing capacity.
- Extreme scalability using the virtualization: The resources may be configured quickly.
- Agility: Agility refers to increased speed of deployment i.e. faster to market". This is necessary for on-demand self-service.
- Elimination of capital expenditures: User or business organization need not maintain the IT infrastructure and buy expensive servers, storage and network devices. Cloud service providers maintains the distributed datacentre and charges on the basis of pay for what you use model. Thus, the services are billable with minimum downtime and data loss. Latest technology is also available to the client at no extra cost.
- Reduced in-house IT staffing: This reduces operational expenditures

However, the adoption of Cloud Computing causes a number of risks and challenges. Commonly Cited Risks of Cloud Computing are:

- Increased delegation to third-parties
- Increased data security risks
- Reduced ability to limit physical access
- Reduced control over compliance (privacy and regulatory laws, export restrictions)
- Fear of increased overall costs
- Fear of reduced control over performance
- Fear of reduced availability
- Concerns of integration with in-house legacy systems
- Risk of vendor business failure
- Risk of vendor lock-in and lack of portability

III. E-GOVRNANCE USING CLOUD COMPUTING

The Cloud Computing challenges have a major effect on migration decisions. Therefore, it is necessary to cautiously handle these challenges and concerns. Various activities involved in handling these challenges are training, contract negotiation, and vendor management etc. Cloud computing can be appropriate model for implementing e-Governance to improve user satisfaction as well as efficiency. Cloud computing can be useful in increasing the efficiency and reliability at reduced cost thereby improving the government functioning. Cloud computing also provides environmental friendly computing with cost effective technology. Enabling technologies needed to successfully implement a cloud need high speed wide-area networks, powerful, inexpensive server computers, and high-performance virtualization [6, 7]. The proposed cloud architecture is shown in figure2.

Cloud computing also supports Cloud federation which is a system of interconnected cloud service providers based on open cloud standards. The federation provides decentralized computing model suitable for e-Governance and is determined by agreements in a multi-provider infrastructure. This allows to dynamical collaboration and sharing of workload among different departments/ organizations of the government to provide a better quality of Service (QoS) based on service oriented architecture (SOA), resource utilization, increased reliability and cost efficiency. Many cloud federation can also provide legislative services regarding location of data storage for the applications having legislative constraints to the users [11, 12].

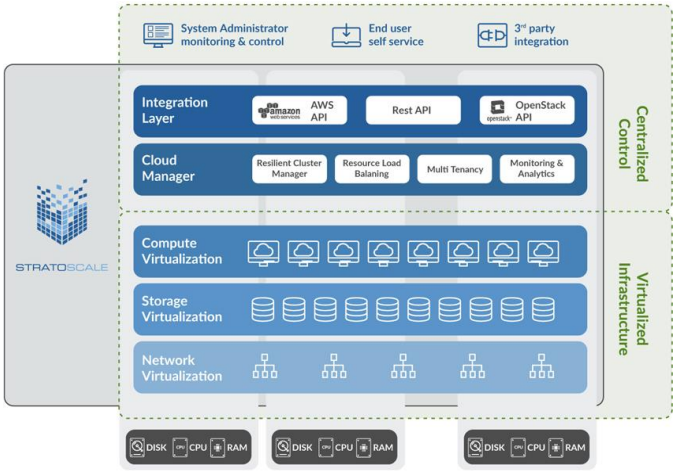

Figure 2. Architecture of E-Government Based on Cloud Environment

Advantages of Distributed Data-Centres in Cloud [9]

- Users get improved response to their requests.
- Data-centers of cloud can be build cheap commodity hardware rather than expensive scale up architecture and the same resources can be used for various applications.
- Entrepreneurs may form local data-center on their existing.
- As against centralized data centres, distributed data-center require less power consumption, air conditioning etc., thus helping in creating a green computing environment.

Suitability of Distributed Data-centers in e-Governance

- As nature of government functioning is distributed, distributed data-centers are suitable for effective e-Governance implementation.
- For e-Governance Master data-center may be formed in central location e.g state capital and slave data-center may be formed at remote places like division, district or block offices places.
- For improving bandwidth optical fiber cable may be used to connect direct through to the local data-center.
- Existing IT infrastructure may be used to create local data-centers by the Governments for their Clouds.
- Revenue may be increase by the government by hosting services on their own Clouds and enforcing tax deduction at source for all business transactions.

IV. CONCLUSION

Developing countries like India are still facing many problems in implementing e-Governance using conventional ICT techniques. In order to improve this situation, there is a need to change the technology paradigm in providing e-Government services. Cloud computing has emerged as a computing paradigm that provides opportunities for delivering a variety of e-Governance services in a efficient and cost effective way. Cloud environment offers many benefits than traditional client server model. It offers a variety of choices that can be carefully evaluated to ensure that all e-Governance users obtain the maximum benefits from this technology. Cloud computing offers services on a "pay-per-use" basis and there are no upfront costs involved in buying IT equipment. Even the infrastructure maintenance is the responsibility of the cloud service provider. It is more flexible and efficient, that provides better collaboration among departments and organizations of a government. This paper highlights the factors and reasons which make such an approach particularly suitable for e-Governance projects. The paper also proposes architecture for implementing e-government based on cloud computing.

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