

## Gov-Cloud: E- Governing body in Cloud

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### **Abstract—**

*Two main trends related with e-government are currently observed: constant development of computer infrastructure, and constant increase of users skills and knowledge of operating computers and the Internet. Public sector should take advantage of those improved conditions for development and deployment of e-government solutions. A way to do that is cloud computing that should be applied in the public sector. Cloud computing is the future of next generation of computing. It is a new and emerging concept in the field of computing. There are many concepts involve in cloud computing but the major are Software, Hardware and Network. The collective, shared and integrated nature of all these entities is known as the Cloud. The subject of cloud computing is currently in the very early stages of development and there is a lot of scope to do research in this area. In this paper, we analyze cloud computing and examines its application in the context of e-Governance. As existing e-Governance projects in India are facing many challenges, from development to implementation. We propose the use of cloud computing in e-Governance model, as a new and ideal solution to face these challenges in future.*

**Keywords-***component; Cloud, ICT, Cloud computing, e-Governance, IaaS, SaaS, PaaS, Data centers.*

### **I. INTRODUCTION**

Nowadays main trend in the area of information technology which influence e-government is constant development of computer infrastructure which becomes more powerful and less expensive and constant increase of user skills and knowledge of operating computers and the internet. These trends enhance possibilities of providing electronic services both in the public and the private sector. The private sector notice that chance of development of e-economy and e-business is accelerated. The studies conducted by the European commission show the variation in the percentage of companies conducting services electronically to that of the percentage of the companies ordering supply online and companies enabling customers to order services online by 2009/2010 is as follows in Fig.1. Hence we see that the percentage of companies ordering supply online and the companies enabling customers to order services online both have experienced a significant e-business growth since 2007, when the total share of e-business was about 15-20% in these markets. [1]

Public sector should also take advantage of those improved conditions for development and deployment of e- government solutions. A way to do that are new architectures which is cloud computing that should be applied in the public sector.[2]

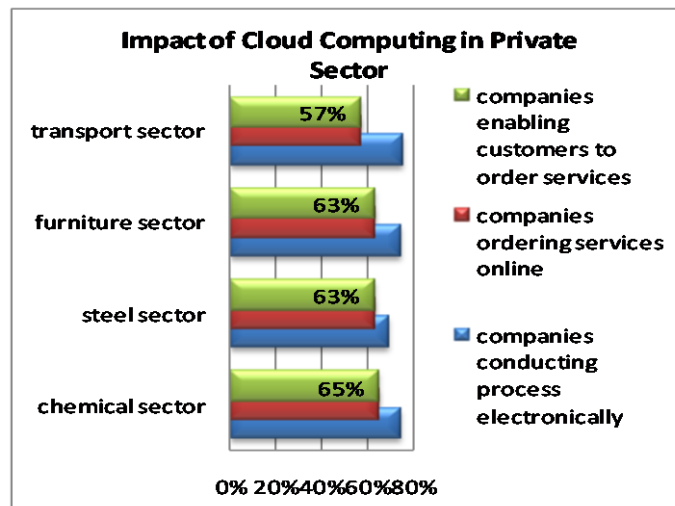


Fig. 1 Growth in Private Sector by Cloud Computing

Indian government is keen to implement the model of e-Governance on country level as well in all states of India. The main objective is to use ICT for planning new ways of interacting, improving user end services, optimizing processes and revitalizing democracy by the new form of ICT based governance. E-Governance aims to deliver more interactive services to citizens at their door steps with businesses oriented applications like e-commerce, m-commerce through ICT and e- Governance. The identified barriers are cost , un availability of infrastructure like hardware , software and network , untrained workforce and software applications on user end Cloud computing is a new form of computing can solve various problems identified earlier and it may lead to significant cost savings with a infrastructure less model for e-Governance. The function of cloud computing is based over the use of Internet with third party hardware and software infrastructure and applications. All that applications can run by a web browser easily. In this paper, we describe how this newly emerged paradigm of cloud computing can be helpful to design future e-Governance model in India.

## II. INTRODUCTION ABOUT E-GOVERNANCE

E-Governance is a process of reform in the way and deliver services to external and internal users or stock holders for the benefit of both government and the users that they serve. There is a great number of government services that can be offered online to end users in a e-Governance model. E-governance requirements may be driven by economic, political, technical and cultural reasons. E-governance requires applications to be secure and protect the privacy of end users. Some of services that can be offered by e-Governance are:

### A. Government to Government (G2G)

Various functions of the government interact to fulfill the work. Majority of these applications are both vertical and horizontal. Vertical applications target a specific application of the government and horizontal make it. These applications have a high degree of message passing across departments. G2G systems generally come in one of two types:

- 1) *Internal facing*: Joining up a single Governments departments, agencies, organisations and authorities

2) *External facing*: joining up multiple Governments IS systems - an example would include the integration aspect of the Schengen Information System (SIS), developed to meet the requirements of the Schengen Agreement.

**B. Government to Enterprise (G2E)**

Enterprises like Water Board, Electricity are controlled by the governments and should react quickly to government policies. Policy enforcements, security and auditing (for accountability) are the biggest challenges.

**C. Government to Business (G2B)**

Government interacts with various business in terms of policy enforcement, collection of taxes, contract management etc. The biggest area that falls under government is Contract management.

**D. Government to Consumer (G2C)**

Government provides numerous services to their citizens. Different departments offer various services that could scale from a simple request resolution to a starting workflow related scenarios. [4]

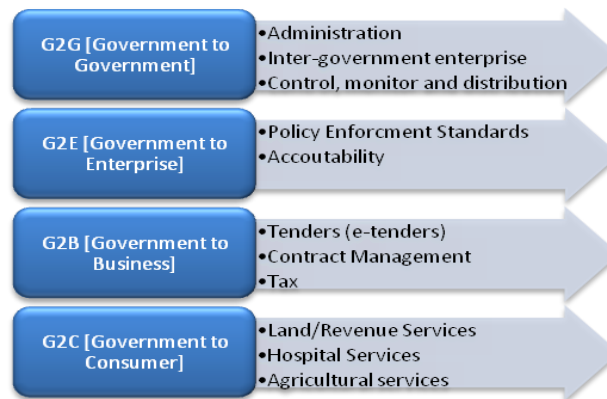


Fig.2 Types of E-Governance Applications

**III. CLOUD COMPUTING MODELS TO OFFER E-GOVERNANCE SERVICES**

According to National Institute of Standards and Technology, USA (NIST) Cloud Computing is defined as 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. [3]

Cloud computing encompasses a whole range of services can be hosted in a variety of manners, depending on the nature of the service involved and the data/security needs of the contracting organization. Cloud computing enables providers to use distant data centers for cloud computing. Still, while some have predicted the end of the PC era with the rise of the cloud computing model, many believe that most organizations and even individuals will continue to make use of traditional PCs and laptops, even if more and more of their use will be to access the cloud [5],[2]

For individuals, cloud computing means accessing web-based email, photo sharing and productivity software, much of it for free [9]. 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 [7]. And for governments, the value proposition of the cloud is

especially appealing, given both changing demands for IT and challenging economic conditions [12]. See below the Fig 3, Architecture of Cloud Computing for E-governance.

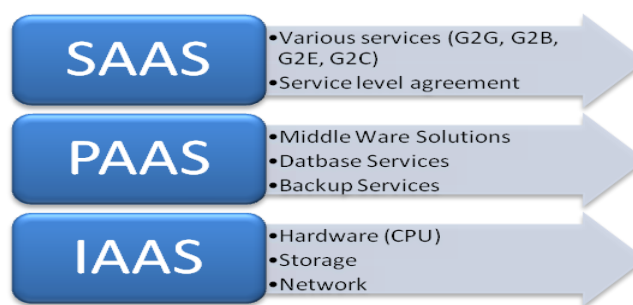


Fig. 3 Architecture of Cloud Computing

In cloud computing three delivery models are defined:

#### A. *Software as a Service (SaaS)*

The consumer uses an application, but does not control the operating system, hardware or network infrastructure on which it's running. Cloud offers applications as a service.

Imagine a case of new state like Uttarakhand deciding to move to E-Governance to offer some services on districts level. They need solution for some application for their citizens. The state need not to purchase applications, hardware and software. They can make a request for a particular service from the cloud provider. Applications instances can then be created for their use. Numerous applications can be provided as standard services, where departments can request and manage online without wait for development. Some of the applications can be:

- Birth, death, cast certificates management System
- Job portal to provide employment support to users
- E-Procurement management system
- E-police, E-court
- Municipal management system
- Water Boards, Electric, Telephone Billing and Payment Systems
- District Management Solutions
- Service and help Desk

In this model there is no need for each department to purchase hardware, software and applications, they can get all the applications from cloud serviced provider at district level and they may offer to all that services to down level. As with cloud the implementation phase of e-Governance services can be faster we may offer the service within short time. This model can also reduce the cost of e- Governance infrastructure in early phase. [2],[8],[14]

#### B. *Platform as a Service (PaaS)*

The consumer uses a hosting environment for their applications. The consumer controls the applications that run in the environment (and possibly has some control over the hosting environment), but does not control the operating system, hardware or network infrastructure on which they are running.

The platform is typically an application framework. In traditional model of e-Governance the departments have to wait till they purchase, deploy and start working with. Now in PaaS model if some Government departments requiring resources for new Operating system or for new Database software they can request and get resources instantly. Some online application

that requiring middle ware services to run the process can be provided instantly. Some of the working platforms that PaaS provide are:

- Dynamic Operating System
- Dynamic Query Service
- Dynamic Database Software services
- On demand Middleware Services
- On demand Workflow Services

#### C. *Infrastructure as a Service (IaaS)*

The consumer uses "fundamental computing resources" such as processing power, storage, networking components or middleware. The consumer can control the operating system, storage, deployed applications and possibly networking components such as firewalls and load balancers, but not the cloud infrastructure beneath them. E-Governance applications like Indian railway or Indian bank ATM services requires a model which can offer 24 hours and all 365 days online services to end users, for that a great infrastructure availability is required. There is a need of unlimited supply of power, CPU services, applications and server services. When operating from cloud using IaaS model e-Governance applications can use unlimited supply of CPU, storage and bandwidth when operating from cloud. Thus, applications perform better on cloud compared to traditional architecture. [7],[11]

### IV. FOUR DEPLOYMENT MODELS

#### A. *Public Cloud*

In simple terms, public cloud services are characterized as being available to clients from a third party service provider via the Internet. The term "public" does not always mean free, even though it can be free or fairly inexpensive to use. A public cloud does not mean that a user's data is publically visible; public cloud vendors typically provide an access control mechanism for their users. Public clouds provide an elastic, cost effective means to deploy solutions.

#### B. *Private Cloud*

A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based. The difference between a private cloud and a public cloud is that in a private cloud-based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might entail. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security and resiliency because user access and the networks used are restricted and designated.

#### C. *Community Cloud*

A community cloud is controlled and used by a group of organizations that have shared interests, such as specific security requirements or a common mission. The members of the community share access to the data and applications in the cloud.

#### D. *Hybrid Cloud*

A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non business- critical information and processing to the public cloud, while keeping business-critical services and data in their control. (See Table 1 ) [16]

## V. FIVE ESSENTIAL CHARACTERISTICS

### A. Rapid Elasticity

Elasticity is defined as the ability to scale resources. To the consumer, the cloud appears to be infinite, and the consumer can purchase computing power as they need. This is the essential characteristics of cloud computing.

### B. Measured Service

In a measured service, aspects of the cloud service are controlled and monitored by the cloud provider. This is crucial for billing, access control, resource optimization, capacity planning and other tasks.

TABLE I  
PUBLIC VERSUS PRIVATE AND HYBRID CLOUD COMPUTING SERVICES

	Public Clouds	Private Clouds	Hybrid Clouds
Characteristic	<ul style="list-style-type: none"> <li>Often depicted as available to users from a third-party provider, “public” clouds are typically made available via the Internet and may be free or inexpensive to use.</li> <li>There are many examples, such as Amazon Web Services, providing services across open, public networks today</li> </ul>	<ul style="list-style-type: none"> <li>Private clouds offer many of the same benefits as “public” clouds, but are managed within the organization.</li> <li>Private clouds are unburdened by network bandwidth and availability issues, or by potential security exposures that may be associated with public clouds.</li> </ul>	<ul style="list-style-type: none"> <li>Some ICT functions (for example, email, calendaring, document production) may be handled in lower cost public clouds.</li> <li>Other functions such as data storage or mission-critical business apps may be retained in-house.</li> </ul>
Benefit	<ul style="list-style-type: none"> <li>Commercial clouds in operation today provide best practices and examples for those considering cloud computing.</li> <li>Key Benefit: Tremendous elasticity and lowest cost.</li> </ul>	<ul style="list-style-type: none"> <li>Private clouds can offer the provider and user greater control, security, and resilience.</li> <li>Key Benefit: Gives users greater control than public clouds.</li> </ul>	<ul style="list-style-type: none"> <li>Hybrid clouds offer greater architectural flexibility.</li> <li>Key Benefit: Offers greater business choice and avoids all-or-nothing approach.</li> </ul>
Risk	<ul style="list-style-type: none"> <li>Potentially greater risks in terms of security, resiliency, transparency, and performance predictability (at least in the near term).</li> </ul>	<ul style="list-style-type: none"> <li>Potentially less risk—security, resiliency, infrastructure, and support processes will not differ significantly from current environment.</li> </ul>	<ul style="list-style-type: none"> <li>Risks and costs fall between public and private models</li> </ul>

### C. On-Demand Self-Service

The on-demand and self-service aspects of cloud computing mean that a consumer can use cloud services as needed without any human interaction with the cloud provider.

### D. Ubiquitous Network Access

Ubiquitous network access means that the cloud provider’s capabilities are available over the network and can be accessed through standard mechanisms by both thick and thin clients.

### E. Resource Pooling

Resource pooling allows a cloud provider to serve its consumers via a multi source model. Physical and virtual resources are assigned and reassigned according to consumer demand. In this the customer generally has no control or knowledge over the exact location of the provided resources but able to specify location at a higher level of abstraction. [7]

## VI. CLOUD COMPUTING BENEFITS IN E-GOVERNANCE[8]

In a traditional architecture, the services offered are bound to a physical machine. One has to maintain the redundancy in terms of the physical services. This increases the cost of deployment and becomes expensive to maintain a number of services. In a traditional infrastructure there will be one instance of application per physical server and has an average utilization of 10%. Cloud not only automates the maintenance and manual operations, but also raises the utilization rate by 50% and offers full virtualization.

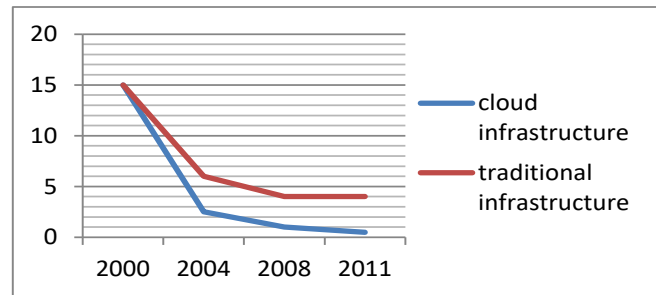


Fig.3 Reduction in cost compared to traditional IT

### A. Significant Cost Reduction

Organizations can reduce or eliminate ICT capital expenditures and decrease ongoing operating expenditures by paying only for the services they use and, potentially, by reducing or redeploying their ICT staffs.

### B. Increased Flexibility

Cloud computing offers more flexibility (often called “elasticity”) in matching ICT resources to business functions than past computing methods. It can also increase staff mobility by enabling access to business information and applications from a wider range of locations and/or devices.

### C. Access to Top-End IT Capabilities

Unlike to offer government services from a single computer or network, we may use different computers in shared network environment or we can use portable devices like laptops, notepads, mobile phones, to run applications and documents everywhere.

### D. Easy to implment

Without the need to purchase hardware, software licenses, or implementation services, an organization can deploy cloud computing rapidly

### E. Scalability

Organizations using cloud computing need not scramble to secure additional, higher-caliber hardware and software when user loads increase, but can instead add and subtract capacity as the network load dictates.

#### *F. Sharing documents and group collaboration*

Applications and documents accessible from anywhere in the world, will help in facilitating group collaboration on documents and projects. [15]

#### *G. Redeployment of IT Staff*

By reducing or eliminating constant server updates and other computing issues, and by cutting expenditures of time and money on application development, organizations can focus ICT staff on higher-value tasks.

#### *H. Focusing on Core Competencies*

Arguably, the ability to run data centers and to develop and manage software applications is not necessarily a core competency of most organizations. Cloud computing can make it much easier to reduce or shed these functions, allowing organizations to concentrate on critical issues such as (in government) the development of policy and the design and delivery of public services.

#### *I. Sustainability*

The poor energy efficiency of most data centers, due to substandard design or inefficient asset utilization, is now understood to be environmentally and economically unsustainable. Cloud service providers, by using economies of scale and their capacity to manage computing assets more efficiently, can consume far less energy and other resources than traditional data center operators.

#### *J. Data 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. Multiple installations in geographically separated locations with complete backup and recovery solutions is required as without this we may fall in huge problems. Applications and data must be redundant and should be available on a short notice to switch from one data center to center. Cloud virtualization technologies allow backups and restoring. It offers application migration seamlessly compared to traditional data center.

#### *K. Distributed Data Centers*

ICT based e-Governance model have many risks, like attack of viruses, hackers, fire and terrorist some time. Some disasters possess mass destructibility and even intentioned activities after disasters. Distributed data centers provide fault tolerance against such disasters. These centers facilitate robust communication support, self-supervision capability and real visible platform, which will help in e-Governance applications to use and manage. [17]

## **VII. PROPOSED MODEL**

This section discusses the new approach to migrate from traditional computing to cloud computing. This approach is basically based on the prototyping model of the software engineering. From traditional computing to cloud computing is the continuous improvement process till we attain our goals. (see fig 4)

#### *A. Step One: Learning*

The Cloud Migration Strategy begins with learning about the basics of cloud computing. Cloud computing is the thrust area in computing technology, it will be important for technology transfer to occur—the —techies in and outside of government will need to go the



extra mile to educate and inform the — nontechnical i.e, policymakers (agency executives, staffers, and lawmakers) as to the merits and value of cloud computing. It will be especially important to devote sufficient funding for research to establish how cloud computing is working - or not – in various areas and at all levels of government, so as to ground policy and practices in regard to governmental use of cloud computing.

#### *B. Step Two: Organizational Assessment*

In the second step the IT officers or Government officials should conduct an assessment of their present IT needs, structure, and capacity utilization. In a cloud computing environment, and study the requirement of addition or reduction of the resources can be added—or subtracted— based on needs and demand.

#### *C. Step Three: Cloud Prototype*

In the Third step the IT professionals will develop the prototype for cloud computing based on the requirement for the particular project. Figure4. The Six-Step Cloud Migration Strategy

#### *D. Step Four: Cloud Assessment*

After the internal assessment and external assessment of the prototype outreach stemming from the pilot effort, IT Professions should then conduct an overall IT cloud assessment to determine if their organization has data and applications that could readily move to a cloud environment, and which type of cloud public/private/hybrid cloud would be suitable or usable for these projects. As this assessment progresses, IT decision makers must focus on establishing decision rules as to which data and applications can – and cannot - be housed in any form of cloud environment. In doing so, they will discover a definite field of —cloud-ineligible data and applications.[12]

#### *E. Step Five: Cloud Rollout Strategy*

At this stage, it is time to begin rolling-out your cloud computing strategy - gaining buy-in from both organizational leadership and IT staffers, and communicating with both internal and external stakeholders as to the goals, progress, and costs/benefits of each cloud project. This is where the cloud goes from being a test effort to become more main stream in the way the agency manages its data, its operations, and its people. It becomes part of —normal organizational operations, just as other prior tech innovations (from telephony to fax to the Internet to e-mail and to social media) have become IT tools, used in support of the agency’s IT strategy, and more importantly, its overall strategy. [13]

#### *F. Step Six: Continuous Improvement*

This is the last step and we call it —continuous improvement tills we get the fully functional cloud computing based system with live data.

Many believe cloud computing represents a new era in computing. The cloud model is quickly changing how all of us interact with computing resources and how computing power will be procured and managed. This report addresses the use, challenges, risks, and prospects for cloud computing in government. [13]

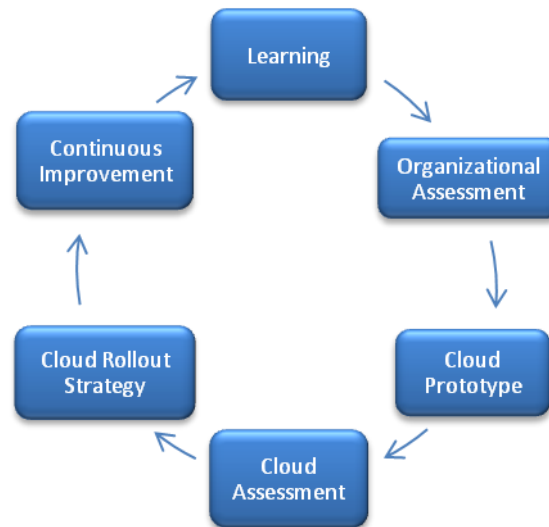


Fig.4 The Six-Step Cloud Migration Strategy

## CONCLUSIONS

As follows from this paper, due to the advances of Internet development and deployment, e-government solutions should be based on cloud computing. This approach has significant Technical, organizational, social and economical advantages. In Indian most of the states are willing to adopt the e-Governance model to offer government services online upto last level , some major barriers are unavailability of required infrastructure , unavailability of e-Governance application , unavailability of trained workforce in IT and unavailability of required funds . They can use the power of cloud computing to offer some urgently required e-Governance service within short time as described in this paper. In future they can use all the models of cloud computing to offer more complex service like e-commerce, e-procurement etc. The future of cloud computing has to be visible more in coming years and we will learn lessons about the drawbacks of cloud computing like security of data after some time. Cloud computing has also sociological impact. It enables advanced IT solutions to be rapidly available to all public offices, departments and agencies regardless of their locations or level of technical competencies.

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