

Evolving E-Governance through Cloud Computing based environment

Vikram Jeet Singh¹, Ashwani Chandel²

Research Scholar, Department of Computer Science, Himachal Pradesh University, Shimla, India^{1,2}

Abstract: The introduction and continuous development of information and communication technologies has made governments across the globe realize their potential benefits. Although the computerization of departments has enhanced the efficiency with which information is handled and processed, it comes at a large cost in terms of infrastructure, skilled personnel and user reluctance. Whenever there is a change or update in technology, there arises a major need to update the infrastructure, skill set as well as the user perspective. Its not always possible to carry out such hugely expensive changes every time there is a technology update. Leaving aside the under-developed ones, even the developed countries would not afford to risk their resources for such tasks every now and then. In this paper, we take up the issue from a cloud based computing perspective and propose a cloud framework for the Indian National e-Governance Plan (NeGP) to ensure interoperability functionality among different states and to see the benefits such as - reduce the operating costs, provide greater reliability, transparency and sustainability while using latest technologies.

Keywords: cloud computing, e-gov, governance, NeGP

I. INTRODUCTION TO E-GOVERNANCE

“E-Government” refers to the use by government agencies, of information technologies (such as Wide Area Networks, the Internet, mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management [1]. The resulting benefits can be- increased transparency, greater convenience, revenue growth, cost reductions, better efficiency and performance.

Electronic governance is all about using the information and communication technologies (ICT) to transform the traditional government operations through the application of faster, more efficient mechanisms which help simplify the administrative processes in addition to facilitating the integration of services among different departments.

Governments have innumerable applications that can be automated to increase productivity and ease the decision-making and policy enforcement processes at a higher level. The various application areas of the government can be classified as follows:

- Government to Government (G2G): Various functions of the government agencies interact to fulfill a work, which requires a high degree of message passing across departments. For instance, Administration Control, Employment Exchange
- Government to Business (G2B): The different government departments need to interact with various business houses in the private sector. The conduct of online transactions simplifies the regulatory processes, therefore helping businesses to become more competitive. For instance, Tendering/e-tenders/e-procurement, Tax collection and related activities

- Government to Citizen (G2C): A number of services are being offered by the government agencies to the citizens that can range from a simple request resolution to anything useful to both the parties. For instance, Vehicle/Land Registration, License Issuing
- In order to implement these functions through the traditional mechanism, it is required by each of the government departments to separately maintain the required infrastructure as there is a more or less clear cut boundary between the operations of any two departments. The emphasis is more towards the computerization of the work processes at a departmental level as observed in the Fig. 1.

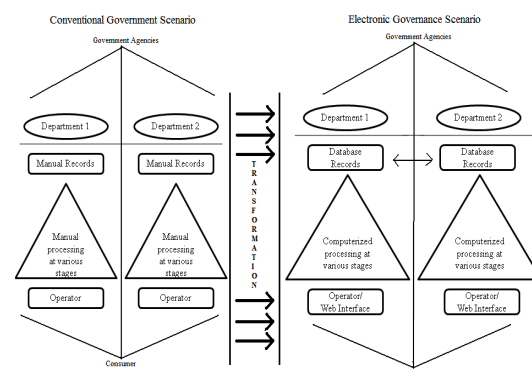


Fig 1. Shift from Conventional to E-Governance

II. INTRODUCTION TO CLOUD COMPUTING

Cloud computing is a relatively new business model in the computing world. According to the National Institute of Standards and Technology (NIST) official definition, "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." [2]

The definition lists five essential characteristics of cloud computing: on-demand self-service, broad network access, resource pooling, rapid elasticity or expansion, and measured service. It also lists three "service models" (software, platform and infrastructure), and four "deployment models" (private, community, public and hybrid) that together categorize ways to deliver cloud services. In this paper, we take up the cloud characteristics and services in greater detail.

The main tenets of Cloud computing are instant availability of services, pay-per-use model, increased reliability and massive scalability. Following are the main characteristics:

- **On Demand Self Service:** The consumer can make use of the computing resources such as processor time, storage or bandwidth as and when required, without the need of any human involvement with the service/resource provider. The government related processes, in a traditional manner, take some time for the processing of such requests and the delay caused may lead to loss of productivity. The cloud approach reduces this delay substantially.
- **Broad Network Access:** The consumer can access the cloud services through a variety of channels irrespective of the platform, architecture or the operating system. The same content can be accessed via a mobile phone, workstation or a laptop. The only requirement is of connecting to the cloud and once you are there, you have virtual access to the huge cloud resources at your convenience. The government agencies and personnel need not be always present at their workstations. Rather, they carry their entire work over the cloud wherever and whenever there is a requirement.
- **Resource Pooling:** The cloud service provider pools the computing resources to serve multiple consumers at multiple locations. There is dynamic allocation and de-allocation of resources according to consumer demand, independent of the consumer location. The government agencies can free themselves from botheration of having limited resources such as storage, network bandwidth, processing speed etc. They can rather focus more on the productivity and efficiency of their operations assuming they have unlimited resources at their disposal, when operating over the cloud.
- **Rapid Elasticity:** The cloud has the ability to manipulate its resources among the consumers based on the user demand. The scaling capacity is so efficient and rapid that the resources appear to be unlimited for provision of the user and can be appropriated in any quantity at any time. The government departments can scale up the scope for any of their projects without giving much thought to the resource constraints.
- **Measured Service:** Cloud systems automatically control the resource usage by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing,

bandwidth, and active user accounts) being accessed. Resource usage can be monitored, controlled and reported, providing greater transparency. The government agencies can control and keep check on the amount of services being used by each of its employees, thus providing greater transparency and preventing misuse of resources. This can easily be accomplished as whenever a person wishes to use the cloud services, he/she is first authenticated and then logged for every activity performed.

Fig. 2 shows how the cloud concept can be used to integrate the functioning among various government agencies and departments.

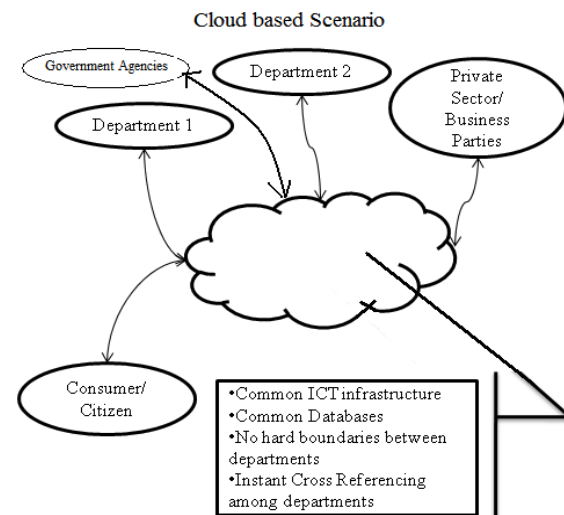


Fig 2. Cloud based E-Governance

Following are the different services provided through the cloud platform:

- **Infrastructure as a Service (IaaS):** The capability to provide fundamental computing resources like processing, storage, networking etc, where the consumer is able to deploy and run arbitrary software that can include operating systems and applications. The consumer does not have to bother about managing the underlying cloud infrastructure but has control over the deployed applications.
- **E-Governance** requires fulltime infrastructure availability with minimum downtime. Application designers can focus more on the features and usability instead of worrying about the scalability, platform and infrastructure requirements when they design for the cloud. Hardware maintenance is greatly reduced on part of the government, which can then divert more of its attention towards enhancing the quality of software and thereby providing better quality services to the consumers.
- **Platform as a Service (PaaS):** To provide consumer with the capability to deploy onto the cloud infrastructure, applications created using different programming languages, libraries, services and tools. The consumer does not have to worry about the underlying cloud infrastructure including network, servers, operating systems or storage, but has control over the deployed applications and possibly the

configuration settings for the application-hosting environment.

Government departments requiring such resources can request and get them instantly as compared to the traditional methods where they have to wait until the resources are first purchased and then deployed. The programmers do not have to constrain their imagination or adjust their skills according to the available resources. They can also code for various platforms simultaneously.

- Software as a Service (SaaS): Consumer has the capability of running applications over the cloud infrastructure, which are accessible through either a thin client interface (such as a web browser) or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Since the cloud offers applications as services, numerous applications can be provided as standard packages, which the similar departments all over the world can request and manage. These services can be generalized to cater to a wider audience base distributed across international boundaries, so that time is not wasted in creating similarly functioning redundant applications. Instead, one can contribute towards enhancing the capability and quality of the general one so that all the consumers of the same service are benefitted altogether. According to studies in the field of Software Engineering, Software Maintenance consumes maximum of the total cost involved in a software product during the Software Development Life Cycle (SDLC) process [3]. Hence, it is always economical to maintain a general copy of software and deliver it to the consumers with minor customizations as desired by the latter's requirements, instead of going in for an entirely new piece of software application right from the scratch. In case of any bug detection after the deployment too, a single patch file shall be able to take care of multiple installations but this is not the case in standalone systems. A cloud based approach can better handle such situations through its service oriented architecture and thus reduce the government expenses. Fig. 3 represents how the cloud solutions scale up near to the rate of business as compared to the traditional ones based on a survey conducted for the Confederation of Indian Industry by PricewaterhouseCoopers (PWC).

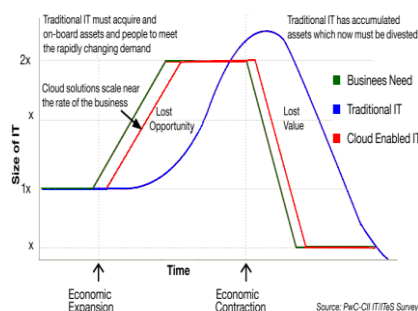


Fig 3. Traditional IT versus cloud computing based IT

Going through the basics, we can have the following advantages using the cloud platform:

- Availability: The cloud is responsible to provide 24x7 access of its service uptime to the consumers. The government agencies can get benefitted in a way that they do not have to maintain the infrastructure and hence no delays in the delivery of services to the users.
- Disaster Recovery: The cloud service providers generally maintain their data centers at multiple locations that are geographically distributed. In case of any natural calamity, the data can be well recovered as multiple copies are being maintained. The important documents need not be taken care of from a physical storage point of view by the government agencies.
- Transparency: As the cloud provides measurable services, activities of the users can be well audited against any type of misuse. This also helps provide a mechanism against corruption. There can be no unnecessary delays in the processing of documents.
- Updation of Technology: Change is an inevitable process. The government has to handle many costs (software, network bandwidth, personnel training etc.) whenever there is a change or update in technology. Such costs can be greatly reduced on part of the government if these considerations are handled by the cloud provider.
- Cost Reduction: The government has to handle costs for multiple departments in the traditional e-governance scenario. With cloud based e-governance, these costs can reduce substantially. According to P Sridhar Reddy, CEO and CMD, CtrlS Data centers, government estimates say that, if two or more states consume IT-as-a-service using the private Cloud model, it could save the exchequer almost 50% of the Rs. 1,378 crore allocated for the state data center projects [4].
- Software Licensing: With multiple installations of the same software at multiple workstations in the various departments, a huge amount of recurring cost is involved in the name of Software Licensing fee which is renewed after some period of time. In the cloud concept, one does not have to purchase the license for every software that is to be used. Just a usage fee is charged for the time the software is being accessed by the consumer.
- Reliability: As the resources are being pooled from various unknown locations and appropriated according to the consumer demand, there is increase in the reliability of resources as the cloud service provider is bound to provide non-stop services to its clients. The client, on the contrary, does not have to worry about the availability or non-availability of the required resources.
- Reporting for Policy Planning and Enforcement: The upper level management can get instant access to the reports from various departments simultaneously. The desired information is available as and when required.

It helps the government agencies to plan and control the policies more efficiently.

- Scalability: The ability of the cloud architecture to provide rapid scaling helps the government agencies in a great deal to magnify the scope of their projects without thinking much about resource pooling.
- Environment Friendly: All the data gets stored in a centralized fashion over the cloud. The operations of multiple data centers are not desired. There is no need for additional air conditioning in the server rooms hence no more chloro-fluoro carbon emission. Cloud computing also results in lesser use of paper in the offices.

Fig. 4 indicates the results of a survey conducted by the PricewaterhouseCoopers (PWC) in which the opinion of IT users was recorded to register their reasons for turning attention towards the cloud based computing environment [5].

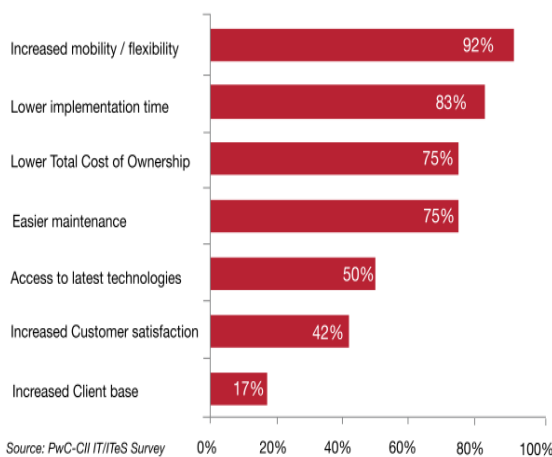


Fig 4. Reasons for adopting Cloud computing among IT users

III. CURRENT INITIATIVES

According to a statement by Praveen Bhadada, Manager-Global Consulting, Zinnov Management Consulting Pvt. Ltd., Governments in Brazil, Russia, India, China, South Africa and South Korea (BRICSS) nations are extremely active participants in the Cloud ecosystem [6].

The Korean government has plans to spend around 610 billion won (about \$521 million) through 2014 to provide the foundation for a Web-based computing industry. According to the initiative announced by the Korea Communications Commission (KCC), the country's media and telecommunications regulator, much of the planned spending is to be devoted to establishing cloud computing infrastructures and developing core technologies [7]. With this, the government intends to increase the Korean Cloud market share to 10% in the global marketplace and reduce the cost of public ICT infrastructure by 50%.

In the US, the federal government's Chief Information Officer (CIO) has given a mandate that every department in every state should have at least two state applications on the Cloud. To fast track adoption, the U.S. General Services Administration has established a portal dedicated to cloud computing applications for the public sector. The

portal - www.apps.gov - provides the public sector agencies with a common platform for the procurement of cloud services from recommended service providers [8].

In 2010, the Taiwanese Government announced its Cloud Computing Industry Development Program with the aim of maintaining its ICT industry's competitiveness in the global market. The Government plans to spend \$744 million over the next five years to establish cloud computing technology and services in the country. Microsoft inked a separate agreement with Taiwan's largest phone company, Chunghwa Telecom, allowing the carrier to deploy the Windows Azure operating system for its cloud-technology applications. Microsoft also signed a deal with the Taiwanese government to jointly establish a cloud-computing research center [9].

The Japanese Ministry of Internal Affairs and Communications (MIC) has compiled and announced the outline of Digital Japan Creation Project (ICT Hatoyama Plan). The Project Outline sets priority policies that will be implemented intensively over the next three years based on the emergency proposals of the Panel on ICT Vision. Government information systems are using innovative technologies, such as cloud computing, to develop the Kasumigaseki Cloud (tentative name) in stages by 2015. The Kasumigaseki Cloud will enable various ministries to collaborate to integrate and consolidate hardware and create platforms for shared functions. Efforts will be made to efficiently develop and operate information systems with the aim to greatly reducing electronic government-related development and operating costs while increasing the pace of processing by integrating shared functions, increasing collaboration among systems, and providing secure and advanced governmental services [10].

The government of India is actively promoting Cloud computing through the construction of various test beds and the launch of multiple Cloud service initiatives such as e-governance, Cloud grids etc. The adoption of cloud computing services, which is expected to cross one billion US dollar by 2014 in India, will be driven by government initiatives like e-governance and the Unique Identification Authority of India (UIDAI) project.

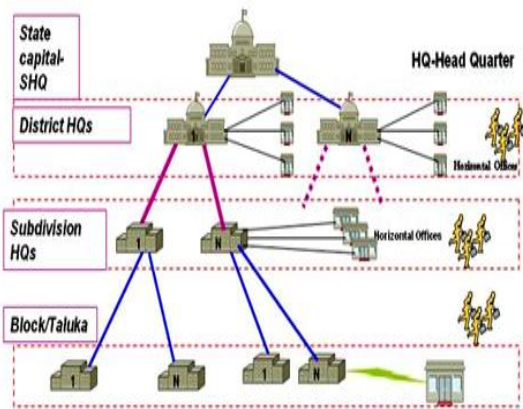
National Association of Software and Services Companies (NASSCOM) envisioned and launched eGovReach Portal -<http://egovreach.in> - a solutions exchange portal to foster closer interaction and connect between the Government and industry. Mr. R. Chandrasekhar, the then Secretary-Information Technology, Government of India launched the portal, in August 2010. It has been developed by a start-up member company of NASSCOM, and is hosted on the Cloud platform. The portal has built a rich directory of service providers in the eGovernance ecosystem. The portal now hosts daily updates on tenders and opportunities from the Central and State Governments, local bodies, municipalities, few public sector undertaking and banks. The portal also provides latest news stories on eGovernance, both at the Central and State levels [11].

The Vision Statement of the National e-Governance Plan of the Government of India (NeGP) aims at making all the

public services accessible to the common man in his/her locality through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man [12].

In the present scenario, the different Indian states are responsible for maintaining their respective statewide data centers through State Wide Area Networks (SWAN) right from the grassroot Panchayat level in the villages to the Block and District levels as shown in Fig. 5. Under NeGP SWAN policy, it is proposed to connect state Head Quarter (SHQ) with all the District Head Quarter (DHQ) and subsequently all the DHQ to be connected with Blocks Head Quarters (BHQ). It will then be extended to Village & Gram Panchayat level. The present layout of the SWAN does not provide for the interoperability functionality among the various states which tends to pose problems. For instance,

- The police departments of the different states are not yet inter-connected over the cloud because of which the criminal information records are not instantly available to the authorities outside their states.



Source: Orissa State Wide Area Network (OSWAN)

Fig 5. Current Structure of a State Wide Area Network (SWAN)

- The vehicle registration records of different states are also not yet available under one centralized portal. In case of a vehicle making some traffic rule violation out of its state of registration, it is a cumbersome process of tracking and penalizing the culprit.
- Due to the present unavailability of land/property registration records over the cloud, the concerned people have to travel to the respective locations and follow up with the concerned officers (like the Patwaris, Tehsildars etc.) for every small task. This leads to a lot of frustration on part of the information seekers and sometimes even misconduct on part of the officers in charge. This has been a very serious issue in parts of the Punjab state where a large number of Non Resident Indians (NRI's) have to bear with such conditions.
- A large number of heavy motor vehicles plying on the national highways have to make halt at the entry and exit check posts while crossing the different state

boundaries, for the payment of taxes. Currently, the queues get so long that the goods that are being transported by them, some of which may be perishable items, get stale by the time they reach their destinations.

- The information of foreign visitors to our country (such as personal data and the visa details) is not currently centralized, unlike many of the European Union countries. This poses a potential hazard to the security arrangements in our country as there is no efficient way to keep track of the foreigners with invalid permission and their activities.

With recent advancements in the computing field, the once looking dream to have centralized access to various services under one portal can now soon be fulfilled by the usage of cloud computing methodology.

IV. PROPOSED FRAMEWORK

The Government of India is discussing the concept of a national Cloud computing platform connecting the central and state government as well as the municipalities on a common platform where decision making is faster, procurement cycles are shorter and visibility on government functions is much higher.

Now that we are well aware about the benefits of having a cloud based working environment over a traditional one, based on our research, we figure out a cloud framework for its application to the Indian National e-Governance Plan as shown in Fig. 6.

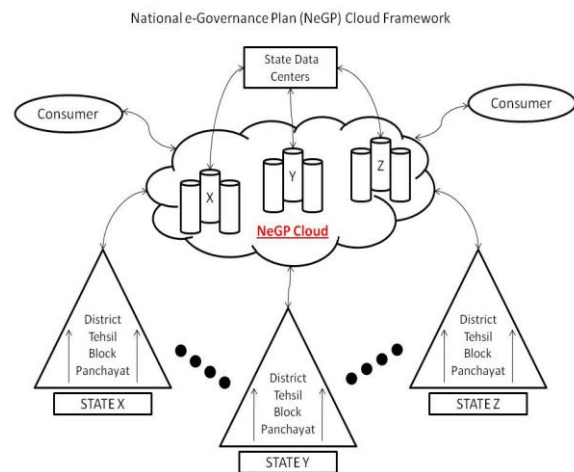


Fig 6. Proposed National e-Governance Plan Cloud Framework

In our proposed cloud framework, the State Data Centers corresponding to the various states can be integrated together logically over the cloud so that the concerned authorities may be provided instant access to the desired information without any delays and barriers to communication across the states. This will provide fast and efficient resolution to the governance related matters without causing inconvenience to the consumer.

With the use of Cloud based technology, the SWAN for all the states can be integrated together at a national level so that the consumers can get uninterrupted access to the

information they seek instantly. Listed below are some of the potential applications where cloud computing can prove beneficial:

- Having the criminal information records maintained over the cloud can help the police departments of the various states as well as other investigation agencies to track the criminal activities more efficiently.
- Controlling the movement of traffic on the roads can become easier. Any vehicle breaking some rule can easily be tracked and penalized, even out of the state of its registration once the registration information is available over the cloud and made accessible to the authorities outside the vehicle registering state.
- With the availability of land registration records over the cloud, the Non Resident Indians (NRI's) will not have to rush back to their villages and struggle hard to get some piece of paper ready. The cloud computing will also help curb the issue of corruption through increasing transparency of government agencies.
- We can also imagine having the barrier records for all the states centralized so that the vehicles do not have to make halt at every state barrier check post. Rather, they can make a collective tax payment for all the states being travelled at their starting location when they begin their long route journey in order to avoid unnecessary delays enroute.
- The information of all the foreign visitors can be maintained over the cloud so that there is an efficient mechanism to keep track of their background checks and activities in our country across all the states.

The Jammu & Kashmir (J&K) state government is the first to adopt Cloud computing for its e-governance services. The government, using the State Data Centers based out of Madhya Pradesh, is provisioning e-governance services such as issuing death or birth certificates and trade licenses through the Cloud. It is using Microsoft's solution to implement Cloud computing. The use of the cloud computing model enabled the J&K government to roll out these services within 60 days at zero initial cost. The governments of Himachal Pradesh and Uttaranchal are also in discussions with Microsoft to roll out e-Government services based on the Cloud platform [13].

Cloud Computing will definitely prove to be a big step forward in the direction of providing SMART (simple, moral, accountable, responsible, and transparent) governance to the citizens.

V. CONCLUSION

We studied the basic concept of e-governance, the cloud computing characteristics and services. We studied how cloud computing is beneficial as compared to the traditional computing scenario in terms of attributes such as reliability, scalability and efficiency. We discussed about recent cloud implementations across the globe and finally proposed a cloud framework for the integration of the functioning of various departments among the different states under the Indian National e-Governance Plan. Now, we are in the process of analyzing the challenges and technicalities to be addressed for the practical

implementation of the proposed NeGP cloud framework such as considerations like deployment strategy [14], network limitations [15], latency and database irregularities, security and query optimization etc.

REFERENCES

- [1] Definition of 'e-governance', Official World Bank Website, URL: <http://go.worldbank.org/M1JHE0Z280>
- [2] Definition of 'Cloud Computing', National Institute of Standards and Technology (NIST) Website, URL: <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>
- [3] Pressman Roger, "Software Engineering-A Practitioner's Approach", McGraw-Hill
- [4] Jhingan Heena, "The Indian government's Cloud roadmap", Express Computer Online Edition, URL: <http://www.expresscomputeronline.com/20110731/cloudcomputing06.shtml>
- [5] A Report on "Changing landscape and emerging trends - Indian IT/ITeS Industry", Confederation of Indian Industry, PricewaterhouseCoopers (PWC), URL: http://www.pwc.com/en_IN/in/assets/pdfs/publications-2011/Indian_IT-ITeS_Industry_-_Changing_Landscape_and_emerging_trends.pdf
- [6] PTI News Agency, "Public cloud spending in BRICSS to reach \$3.48 billion by 2015", URL: <http://news.in.msn.com/business/article.aspx?cp-documentid=5093992>
- [7] Tong-hyung Kim, "Korea Leaps on Cloud Computing Bandwagon", Korea Times, URL: http://www.koreatimes.co.kr/www/news/biz/2010/11/123_58238.html
- [8] Federal Cloud Computing Initiative, URL: <http://www.cio.gov/documents/Federal-Cloud-Computing-Strategy.pdf>
- [9] Yu-Tzu Chiu, "Taiwan Sees Clouds in Its Forecast", IEEE Spectrum, URL: <http://spectrum.ieee.org/computing/software/taiwan-sees-clouds-in-its-forecast>
- [10] Communication News, International Policy Division, Global ICT Strategy Bureau Ministry of Internal Affairs and Communications (MIC), Japan, Vol.20 No.1, Apr 24, 2009 URL:http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/Releases/NewsLetter/Vol20/Vol20_01/Vol20_01.html
- [11] NASSCOM Annual Report 2010-2011, URL: http://www.nasscom.in/sites/default/files/NASSCOM_Annual_Report_2010-11.pdf
- [12] Official National e-Governance Plan (NeGP) website, URL: <http://www.negp.gov.in>
- [13] Bajwa Karan, "A Private Affair", Microsoft India Insights & Perspectives, URL: http://www.microsoft.com/india/msindia/msindia_pr_ca_a_private_affair.aspx
- [14] Vikram Jeet Singh, DP Singh, KL Bansal, "Proposed Architecture: Cloud Based Medical Information Retrieval Network", International Journal of Computer Science & Engineering Technology (IJCSSET), Vol 4 No 5 (May 2013), PP.485-496
- [15] Vikram Jeet Singh, V Kumar, KL Bansal, "Research on Application of Perceived QoS Guarantee through Infrastructure Specific Traffic Parameter Optimization", International Journal of Computer Network and Information Security (IJCNIS) – MECS Publisher (Hong Kong), Vol 6 No 3 (Feb 2014), PP.59-65, DOI: 10.5815/ijcnis.2014.03.08