

CLLOUD BASED HIMS

An Indian Perspective

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Abstract: The advent of Cloud Computing has opened up newer avenues for business. Traditional industry verticals like the healthcare are yet to reap the benefits of such cutting-edge technology in India. In an age of collaboration over virtual medium, the lack of coordination and an effective communication mechanism is creating information “silos” that are not propagated at other levels. In this paper we briefly discuss the state of Health Information Management Systems (HIMS) in India, the challenges faced en-route deployment of the solution. We then introduce some interesting aspects of cloud computing to show that how a cloud-based system can help reduce the technical barriers to HIMS acceptance and endorsement. Our contribution lies in addressing issues for HIMS deployment in an Indian scenario and arguing for a cutting-edge technology like Cloud Computing as an agent of change.

1 INTRODUCTION

Many business organizations have successfully transformed and moved up the value chain with the successful adoption of Information and Communication Technology (ICT). Government adoption of ICT in developed countries have resulted in transparency and reinforced faith on the public systems. With effective control flow and instant response facilitating effective communication and feedback, the distance between the citizens and the government has narrowed in instances of successful ICT deployment. In a country like India where the healthcare service requirements are more than the available resources, it's necessary to have the resources utilized properly in order to gain maximum utility. Unfortunately, the government's public service system in this area has failed to reap the benefits of technological advancements owing to very low adoption rate. The reasons for such low-penetration are manifold, policy, people, politics and system to name a few. The issues one faces with the system are the lack of awareness, lack of support, obsolescence of technology and inappropriate deployments. This has resulted in loss of faith on e-health system putting in more barriers towards maturing of a proper ICT-enabled healthcare system. In this paper, we discuss the state of Health Information and Management System (henceforward

termed as HIMS) in India. We have shown that how the existing technology deployment plan has put barriers towards adoption and making the system obsolete with policy changes. We have then shown how a technology like Cloud Computing can wade off some of the barriers.

The rest of the paper is organized as follows. Section 2 contains a brief description of related works. Preliminaries like the definition of Cloud Computing and its advantages over the traditional computing models are discussed in Section 3. Section 4 introduces the early works of Health Information Management System (HIMS) in India. Section 5 does a SWOT analysis of HIMS implementation and future implementation barriers. Arguments that support the implementation of Cloud Computing in HIMS are presented in Section 6. Section 7 discusses some future scopes of work and the paper is concluded Section 8.

2 RELATED WORKS

Research in the area of e-Health is not new in India. Ramani (2004) has discussed the pitfalls in ICT implementation in the health segments in the mid 90s. Bedi et al. (2010) has done an in-depth study with the HIMS solution in Government Hospital in India. Cellary and Strykowski (2009) has provided

arguments for cloud computing in the public segment and has shown the role of effective governance and strong leadership for successful rollout. Their work fosters openness and includes local innovators and entrepreneurs. Buyya et al. (2008) propose Cloud Computing as the 5th utility after water, electricity, gas and telephony and has put forth an architecture for dynamic provisioning of cloud services. Most of the work focuses on the applicability of cloud computing as a whole with its novel features and how the government can benefit from it. Lately, the government in developing countries like India are waking up to the digital revolution. Competitive technology with adequate support from the government has made inroads for e-Governance. Sadly, the health department is yet to catch up with the pace of such newer trends and there hasn't been much works in this area that can reap such benefits. Our work tried to identify the roadblocks and makes a strong case for Cloud Computing adoption for HIMIS.

3 CLOUD COMPUTING

Cloud Computing is an extension of the idea of utility-computing where the necessary resources like computing, memory and data-storage are all handled in the "Cloud". In simpler words, all the vital resources are being managed by some third-party vendors who are specialized in handling the data and computing centres. Typically such data centres comprise a collection of machines that are pre-configured and provisioned dynamically. The machine allocation may take place by explicit user request or implicitly when the provisioned capacity is insufficient to meet the computing requirements. The user accesses the resources through some dedicated network or over the public network like the internet and is generally billed to the extent of his usage by the vendor. For enterprises, moving to the cloud means doing away with the capital expenditure of hardware, software and support staff for the desired service. Instead, the services are available on demand and generally backed by some SLA (service level agreements) that acts as a binding contract for the provider to deploy necessary services as agreed. Some prominent players in this arena are Amazon, Salesforce.com, Google and Microsoft.

Cloud computing provides the following advantages over traditional computing models of the enterprise:

- i. Significant reduction in initial setup costs:

This is achieved by converting the in-house IT capital expense to operating expenses

- ii. Increased Flexibility: On demand solutions and lesser implementation times with support from a large ecosystem of providers.
- iii. Ubiquitous Access: Services can be accessed over the internet
- iv. Elastic Scalability: Capacity alteration as per changing needs.
- v. Pay-per-use: Payment only for the capacity utilized. EOS (economies of scale) reduces the cost of usage.
- vi. Easy to Deploy: The user doesn't need to purchase hardware or software. All a user needs is a compatible web-browser.
- vii. Auto-upgrade: Since the system is managed centrally, all updates and policy requirements can be enforced at all locations simultaneously
- viii. Reliable Service Quality: Large storage and computing achieved through distributed fault-tolerant systems
- ix. Focus on Core Competence: Traditional organizations need to have a dedicated IT team and sometimes there is a conflict of interest during system upgrades. With cloud computing, the organization can focus on its core-competence while leaving the chores of the system to the service provider.
- x. Collaboration: Since application and data are accessible from anywhere, it encourages collaboration
- xi. Disaster Recover Capabilities: Since the data and the application are replicated at multiple locations, in the event of any disaster or natural calamity, business resume can be fast
- xii. Business Migration and Continuity: As business expands, the cloud computing model can enable rapid capacity additions. New business units can start functioning immediately without needing to wait for system deployment and configurations.

4 HEALTH INFORMATION MANAGEMENT SYSTEM IN INDIA – EARLIER STUDIES

A survey conducted by C-DAC (Bedi et al. 2010) revealed that on average, there is 1 bed for every 2315 people in India. Some states like Assam in the country has only 1 bed per 9293 people. Such high patient/bed ratio invariably puts a pressure on the infrastructure resulting in crippling of the entire

system. This calls for an efficient HIMS (Hospital Information Management System) that will make best use of the available resources. The C-DAC already had built an ERP package, namely e-Shusrut for Hospital in India. This is a major step from the government towards adopting technology for healthcare. The capabilities of e-Shusrut exceeds the capabilities of any traditional Hospital Management System to encompass ancillary activities like accounts, payroll and procure management. It is has been implemented in several government hospitals. During each of the rollouts, C-DAC had to take the entire onus of infrastructure building, application development, deployment and go-live of the various modules. In spite of the government support for an electronic healthcare, the movements in the direction are considerably low owing to very low participation, resistance and lack of enthusiasm.

Similar to a traditional e-government system (Jayaradha and Shanthakumar, 2003 & Rastogi, 2010), a typical Hospital Information Management System also suffers from the common symptoms of ICT barriers, namely:

- i. Inadequate ICT infrastructures
- ii. Inadequate human resources
- iii. Inadequacy of funds
- iv. Adapting to frequent technology changes
- v. Inability to make informed decision
- vi. Application life-cycle management
- vii. Software Support
- viii. Accountability
- ix. Modifiability
- x. Physical Security

In this paper, we are not going to address all the issues mentioned above. Poor literacy, inadequate infrastructures, lack of enthusiasm, absence of incentives and low participation can bring down any established process or system. There are many fundamental challenges in implementation of an e-health system in India. Issues like inadequacy of funds or inadequate human resources are not in the purview of our scope. Instead, what we are going to argue is that how evolutionary information management systems like cloud computing can minimize barriers to ICT adoption in health, analyzing from a SWOT perspective for the cloud.

5 TRADITIONAL HIMS IN INDIA – A SWOT ANALYSIS

Taking the case of e-Sushrut, we would undertake a SWOT analysis of traditional HIMS based implementation in India

Table 1: SWOT Analysis.

Strength	<ul style="list-style-type: none"> ▪ C-DAC has established a working ERP that has been rolled out successfully ▪ Being a govt. enterprise, it can provide low-cost solution custom made for the people ▪ Regionalization possible with a HIMS solution like e-Sushrut ▪ Ability to interface with the government for policy changes and its impact on system
Weakness	<ul style="list-style-type: none"> ▪ High initial setup costs of infrastructure during first rollout ▪ Decreased interests due to non-sustained awareness and poor support post implementation ▪ Shortage of specialized manpower to support individual rollouts ▪ Hardware system faults stalls the software functionalities ▪ In times of disaster or any natural calamity at the health-center, the data might get lost forever ▪ System is expensive to maintain and upgrade
Opportunities	<ul style="list-style-type: none"> ▪ Focus on a centralized system ▪ Smart resource utilization ▪ Replicable model for enterprises resulting lower lead-time and lower initial costs for rollouts ▪ Shared centralized server for efficient use of resources and EOS ▪ Lower costs of change requests due to centralized system ▪ Policy updates can be synchronized at multiple locations instantaneously
Threats	<ul style="list-style-type: none"> ▪ High cost of change requests due to multiple rollout versions ▪ Software is generally maintained in-house after a small training post implementation. If the employee leaves, the knowledge is lost ▪ Policy changes at both government and regional levels calls for software modifications. A long lead-time for change requests makes the product infeasible

6 ARGUMENTS TO SUPPORT CLOUD COMPUTING FOR HIMS

In terms of architecture, Cloud Computing comes in various flavours as show below.

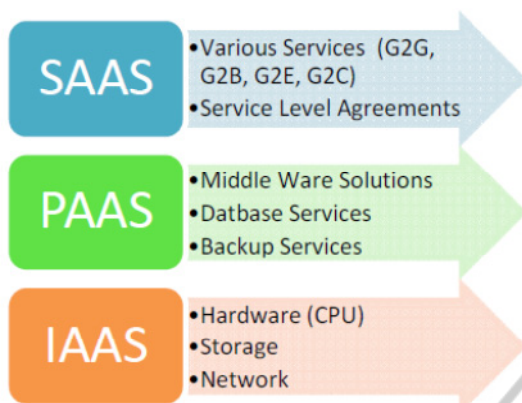


Figure 1: Cloud Computing Architecture

In case of the SAAS (Software as a Service model), the service provider itself hosts the system and the necessary software that runs on the system.

In case of PAAS, the Cloud Service provides the platform to host the in-house applications. Services like Network Management, Database management and system availability are still the onus of the cloud service provider.

In IAAS, the Cloud Service provider only provides the infrastructure required for the functioning of the enterprise. The service provider gives the necessary instances to the requester and is only responsible for the server uptime.

In the given case of e-Shusrut, C-DAC has already built a strong working ERP for health. The issues that arose were mainly operational rather than technical. A robust application development and deployment environment to host the necessary services would successfully reduce the barriers in adoption of the designated services. This forms an excellent case for the government to adopt the PAAS Cloud architecture from a qualified vendor. The software developed can be hosted on the cloud – so effectively C-DAC would have full control over the software and its functioning. The elements of uncertainty in case of centralized system, like service queuing, resource allocation, automatic backup, sudden increase in HIMS usage in case of any disaster – all would be handled by the platform provider.

From our SWOT analysis, we understood that managing a decentralized system was one of the main reasons that led to the failure of a mature ERP like e-Sushrut. The issues that decentralization brings with it can be handled by building a centralized system as discussed in the opportunities section. However a centralized system cannot fully account for the high initial rollout cost and subsequent maintenances costs. Further, in instances

like loss of vital data or a DOS (denial of service) attacks, a centralized system might cripple altogether.

Cloud Computing, as discussed earlier turns Capital Expenses to operating expenses. This means that the initial expenses in setting up infrastructure and hardware are heavily reduced. The usage of system is now an operating expense in business, like those of gas and electricity. The business needs to pay as per the metered usage. This effectively manages the initial hurdle of implementation.

The deployment of e-Shusrut met with criticism for lack of support. One of the main reasons for lack of support was the decentralized system and non-availability of staffs. Cloud computing with a supporting PAAS architecture eliminates the need for staff at every location. The issues that ask for critical support can be monitored and solved centrally resulting in greater post-implementation user satisfaction. Policy changes can be managed and deployed centrally hence the system faces lesser chances of obsolesce. Since the service is being used over some dedicated network or internet, a functioning system at the user's end is sufficient to access all the hosted services. Sometimes during disaster, the demand on HIMS increases manifold. Traditional systems sometimes fail to meet the changing demands. Owing to the elastic and fault-tolerant nature of the cloud, provisions are automatically enhanced during a crisis to ensure that the HIMS doesn't face any downtime due to over-usage. A cloud computing system automatically replicates data across several networked locations with version control. This ensures that critical-data is always safe and can be recovered in case any compromises may happen.

7 FUTURE SCOPE OF WORK

There are some risks with every deployment of cloud computing in the light of data and access security. Such risks cannot be totally shielded but proper preventive measures, SLA's and supporting architecture can help mitigate such risks to a great extent. A risk-management perspective of the cloud in the Indian Scenario would be an interesting area to explore. Developing countries are sensitive to huge budget for e-governance. Compared to developed countries, health expenses don't feature very high in the list of government agendas. Some innovative pricing mechanism can bring about an accelerated cloud acceptance for more e-government agendas. Finally cloud is just another piece of

technology. A framework that can simplify the cloud adoption process in critical areas like health would be beneficial for both the academia as well as govt.

8 CONCLUSIONS

In this paper we have tried to build a case for Cloud Computing implementation in Health Information Management System. Our paper has considered the technology aspects only finding a great fit of Cloud Computing in making the implementations viable and making inroads for more services on the cloud. We would like to extend the work in a scenario where there is interplay between all the affected agents like govt, business, citizen and technology.

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