



CLOUD COMPUTING: CHALLENGES AND CONCERNS FOR ITS ADOPTION IN INDIAN SMEs

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Abstract: Cloud computing an emerging technology, ready to replace the traditional mode of computing and to make the organizations more agile and independent in terms of choosing the technology. Apart from many other benefits cost and flexibility in adoption of this technology have provided SMEs a viable option for technology adoption. Cloud computing provides different services i.e. IaaS, SaaS, PaaS in different cloud environments i.e. Public, Private, Community and Hybrid clouds

Keywords: Cloud computing, SMEs, SaaS, IaaS, PaaS.

I. Introduction

Since the advancement of information technology, business establishments are concerned with exploiting it most in various ways as it helps them in reducing the effort and maximizing the output. Different types of organizations came into existence and at present thousands of Small and Medium Enterprises (SMEs) are serving in the country. The Government in India is making its own effort to improve the conditions of small business establishments by providing them financial, technical and appropriate training in different fields. SMEs in India are facing stiff competition from within and outside the country as per reports SMEs are contributing around 45%-50% of the exports and successfully contributing around 22% in GDP.

Information technology and business have very close proximity with each other SMEs need to be aware of recent technologies and their usefulness. Technology is changing rapidly and to be in business SMEs need to be in pace with the technological advancement. For the last few years, cloud computing came into existence and it was the centre of attraction for the researcher and for the industries. Cloud computing has changed the perception of computing in today's era by revolutionizing the way computing used to be.

In general SMEs do not have much to spend on IT/IS, preventing them to have advanced IT infrastructure needed to run the business successfully and keeping pace with other large organizations. Cloud computing seems to be the solution for the SMEs to access the hardware and software which they require for their commercial activities in comparatively less cost. Cloud computing is willing to deliver various consumer models which provide high availability and easy access [1],[2],[3]. Its adoption is a major task for SMEs. They need to understand the services they are providing, and the consumer needs to be well aware before adopting it. Those organisations who understand the benefits of cloud computing are realizing the tangible benefits of cloud computing and are seriously considering adoption of this technology[4],[5]. Cloud computing is an online service model which provides hardware and software services on demand of consumer and pay as an operating expense without incurring high cost [6].

II. Cloud and its Services

Although there is no concrete definition of cloud computing it is a general concept [7], [8]. Different people have different perception about cloud computing and have different definitions, therefore it is necessary to refer the official definitions by international standardization bodies like NIST (National Institute of Standards and Technology) and ETSI (European Telecommunication Standardization Institute).

According to NIST "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." [9], and according to ETSI "Cloud Computing is a rapidly provisioning infrastructure (e.g. compute, storage, network resources) that supports dynamic scaling with uniform interfaces to these resources." [10].

Cloud computing is a new paradigm [11],[12],[13],[14],[15] which provides ubiquitous services like storage, infrastructure, processing and Business Processes which are not physically available at the users place albeit

service provider owns it and manages all the resources and user can access the services through internet, internet works as interface between user and service provider to access all the resources provided by the cloud. There are different cloud service models, According to IBM cloud computing reference there are four cloud service models –Infrastructure –as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS) and Business-Process-as-a-Service (BPaaS) whereas NIST has defined three service models i.e. IaaS, PaaS and SaaS shown in fig 1.

Infrastructure-as-a-Service (IaaS): IaaS provides virtual machines, virtual storage, virtual infrastructure, and other hardware assets as resources that clients can provision. The service provider has to manage all the deployment aspects and the user has no worry about all the complexity regarding the resources. IaaS service make user feel like all resources are available on the machine he is working on, virtualization enables high, reliable and agile deployment mechanism and management of services. There are many vendors providing IaaS services for example Amazon Elastic Compute Cloud (Amazon EC2)[16] is on top, Rackspace[17], Microsoft Windows Azure[18], Google Compute Engine[19].

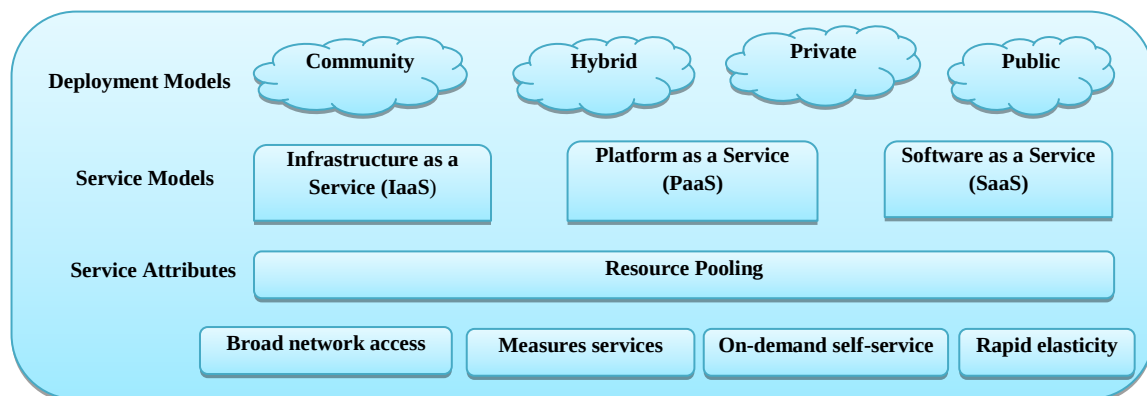


Fig-1 NIST cloud Models and their relationship to essential characteristics of cloud computing

Platform -as –a- Service (PaaS): PaaS provides virtual machines, operating systems, applications, services, development frameworks, transactions, and control structures, it has changed the way business establishment used to be, and simplified the business functionality .Service providers provide platform for the user and user is responsible for installing and using the application. User need not worry about its deployment PaaS is simple, scalable and reliable. In addition PaaS offering may include the following:

- Deployment of complete applications, including pre developed platforms.
- Management of underlying software and hardware and hosting capabilities.
- Provisions for application development, testing, deployment and hosting.

Today’s organizations are looking for buying time and cost saving in developing and deploying their own applications. Google app engine, Amazon Simple Storage Service (S3) and Windows Azure etc. are some examples of PaaS products and providers.

Software- as- a- Service (SaaS): SaaS is a complete operating environment with applications, management, and the user interface. It is a software that has been provided by the different vendors and is offered on pay-per- use basis[20], SaaS can also be defined as “Software deployed as a hosted service and accessed over internet”[21]. SaaS offerings have various advantages over the traditional application or an On-premises software application.

Traditional Software	SaaS
• Licenses • Customization • Implementation • IT support personnel • Training for custom application • Network, servers, data storage and backup • Application support and maintenance	• Subscription fees • Configuration fees • Internet access • End-user support usage fees • Training on standard application

Cloud deployment models:

On the basis of requirement of SMEs different deployment models [22] have been defined

(i) Private Cloud: This deployment model can be accessed by a particular group of organizations or just by a single organization, access has been constrained to subscribed organizations only.

(ii) Public Cloud: This deployment model can be accessed by any organization subscribed to the service provider having an internet connection.

(iii) Community Cloud: when two or more business organizations have similar requirements community cloud can be adopted by them.

(iv) Hybrid Cloud: Hybrid cloud can be combination of any of the above three clouds.

A. Applications of cloud computing for SMEs

Cloud computing provides various business software modules for use which most of SMEs cannot afford to purchase like ERP, CRM and various other business application software, SaaS has gained popularity among the SMEs in recent years and it is increasing[23]. In India there are various cloud service providers some of the common applications that are of use for the SMEs are categorized as:

Table 1: Services available for cloud Consumer

Consumer Type	Cloud Services
SaaS Consumer	HRM, ERP, Financials, Content Management, Document Management, CRM, Sales, Billing, Email& Office Productivity, Social Networks
PaaS Consumer	Database, Application Deployment, Integration, Development and testing, business intelligence.
IaaS Consumer	Backup and Recovery, CDN, Storage, Compute, Platform Hosting, Service Management

III. Issues and Challenges

Indian SMEs are reluctant to adopt this new technology. Cloud computing is a dynamic field of information and communication technology with its growth worldwide. It justifies its effectiveness among organizations, still there is need to educate the market and show business organization the potential offered by this technology. So far most of the organizations do not know why they should prefer this technology prior to other available technologies, as cloud computing have various advantages over other existing technologies there are some issues that cannot be ignored such as challenges for organization's embracing this new paradigm. Zhen [24] lists a number of major challenges with respect to the following:

- Data management and governance
- Service management and governance
- Product and process control and monitoring
- Infrastructure and system reliability and availability
- Information and visualization security

SMEs in India as well as in other countries have some serious issues in adoption of cloud computing because of its dependence on broadband internet, some of the issues are as follows:

(i) Security: Cloud services involve many services and there is involvement of third party in providing some of the services. Security is one of the major issues of cloud computing. Various studies have been conducted regarding this issue for example CIO research centre report fig 2. [25], of SMEs cite security as the biggest challenge for cloud users.

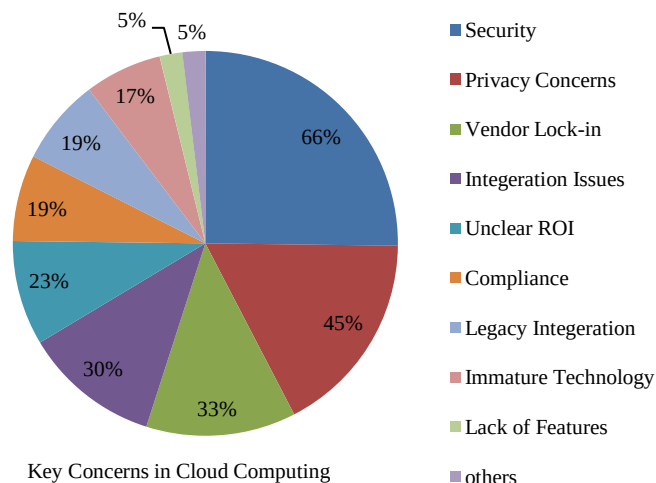


Fig.2: Key concerns in Cloud Computing

Gartner has identified seven cloud computing security risks that customer should raise with service provider before selecting a vendor[26]

- *Preveleged user access*: All the organisation sensitive data processed outside the owner's site that raises serious concern about the privacy and security of sensitive data, because outsourced services bypass the "Physical, logical and personal controls" Organizations availing the services must know about the people who are managing their data .
- *Regulatory compliance*: ultimately clients are responsible for security and integrity of their own data even when it is stored by the vendor . initially service providers are responsible for external audits and security.
- *Data location*: Clients must try to know the location where their data is stored, probably user might not know the actual location of their data or in which part of the world their data is stored. it is advised to make a contractual commitment to obey local privacy requirements on behalf of their customers.
- *Data segregation*: Cloud vendors have data from different organizations and it is typically in shared environment. Different encryption schemes have been applied on data stored on the same hard disk. There might be possibility of corruption of encryption code. Customers must make sure that encryption schemes were designed and tested by experienced specialists.
- *Recovery*: Although cloud providers have different schemes for the recovery from disasters, user needs to know the backup mechanism of service providers and their ability to restore the data in case of disaster and the time period they are going to take in such situation.
- *Investigative support*: In case any organization comes to know any illegal use of data by any other organization, client must know the support provided by the vendor in such situation and upto which extent vendor will go with the investigation.
- *Long –term viability*: There might be a possibility of acquisition of vendor by some other large vendor or vice versa. Client must know in such situation what will happen to their data? Will they get their data in the same form and so forth.

(ii) Privacy: All the data stored in the clouds are managed by the service provider. User does not have any information on whereabouts of the data, controls are shared by the user to the provider as, cloud is scalable in nature that creates some security concerns for the consumer, as well as legal concerns as to who has access to the information [27].

(iii) Vendor Lock-in: Cloud computing is a relatively new technology for which; standards are still being developed [28]. Most of the cloud services and its platform are built on some specific standards. Tools and protocols developed by a particular vendor for its particular cloud offering, this would make migration difficult and expensive. Three types of vendors lock-in can occur [29] in cloud computing namely are Platform lock-in, Data lock-in and Tools lock-in.

(iv) Integration issues: Depending upon the needs of organizations they may need to adopt services from different cloud vendors, they need to integrate applications and data on multiple public clouds. Furthermore organizations may need to adopt services of hybrid cloud, they need to integrate applications and data between the private clouds and the public clouds [30][31].

Prior to adoption of services of cloud computing SMEs need to understand the IT maturity level and assessing their cloud readiness by identifying right fitting combination and have plans for long term stability. It is not easy task to adopt cloud services, with cloud enterprise IT will become a mix of cloud solutions from multiple vendors.

IV. Reasons for Cloud adoption by SMEs

Indian SMEs in current scenario need to be more aggressive to remain competitive among worldwide SMEs specially the neighbouring countries like China, Japan etc. and to remain competitive SMEs need to adopt fast communication media and channels to grow their business across the globe. The use of internet has increased in recent year, a study shows that 57% of the Indian SMEs use the internet as a sales channel and to get direct business leads [32] there are various reasons that have been cited by various authors for adoption of cloud computing.

(i) Cost: One of the primary advantages of cloud computing is cost. It does not incur extra burden on organization and SMEs need not invest its valuable capital in Hardware, Software and their licencing costs. Organizations do not have to worry about backup, maintenance and up gradation of software, it reduces the maintenance cost [33], they only have to pay for whatever they have used as there is no initial investment and cloud provides low cost subscription model which will get implemented within a week contrary to long implementation time required by traditional software and services.

(ii) Accessibility: Cloud service is accessible anytime, anywhere and user needs not to depend on a single repository. It only requires internet connection.

(iii) Rapid elasticity: Cloud computing has a provision to increase or decrease the services as per the requirement this properly of cloud saves the resources and cost of the vendor.

(iv) Resource pooling: Most of the resources of the vendors are pooled to provide services to multiple clients depending upon the need; resources are virtual and dynamically assigned on demand.

V. Cloud Service Providers in India

India has huge potential of cloud market. Vendors from around the globe are attracted towards capturing the market. Some of the cloud service providers are listed in table2.

Vendor	Location	Services
IBM	Bengaluru	IaaS ,PaaS and SaaS
Cisco Systems	Bengaluru	IaaS, VXi, Security as a service etc
VMware	Mumbai	Business Critical Application Services, Data centre Virtualization Services etc.
Sify	Chennai	IaaS ,PaaS and SaaS
CtrlS	Hyderabad	public and private cloud
ESDS Software Solution	Nashik	IaaS, ERP Hosting, Disaster recovery etc
SaaSIndia	Delhi	SaaS, IT Management Support etc.
salesforce	Bengaluru, Mumbai	CRM, SaaS etc
Reliance Data Centre	Mumbai	IT Infrastructure Services, Managed Hosting Services etc
TCS	Mumbai	CRM

Table2: list of cloud service providers in India.

Besides the above mentioned vendors there are various other companies providing the services in India like Amazon, Google, Microsoft etc. according to CIO research centre report Microsoft (19%) is currently perceived to be the most preferred Cloud Computing technology provider, followed by Amazon (14%) in the second place, and IBM and Google in the third place (11%). Salesforce comes in at the fifth position (at 10%).

VI. Conclusion

Cloud computing is emerging technology which provides various services to reduce the cost incurred in IT expenditure and making the organization agile, organizations need to think seriously about the adoption of cloud computing although there are some concerns in its adoption. Managers need to understand the need of the hour and take the necessary steps towards its adoption, SMEs needs number of customizations and changes the y required formal IT processes, service catalogues and self service capabilities. Although cloud vendors are expected to ensure service level adherence, SMEs need to be aware of the vendor's business viability and disaster recovery plans.

References

- [1]. L., Zheng, Y., Zheng, F., Zhong, S., & Ieee. (2009). *Cloud Computing Support for Personal Knowledge Management*. Paper presented at the International Conference on Information Management and Industrial Engineering, 26-27 Dec.
- [2]. Marta, F. C., Correia, A. M. R., & Neves, F. T. (2011.). *Supporting KMS through Cloud Computing: a scoping review*. Paper presented at the 6th Iberian Conference on Information Systems and Technologies (CISTI), Chaves, 15-18 June.
- [3]. Sheng-Yuan, Y., Chun-Liang, H., & Dong-Liang, L. (2010). *An ontology-supported ubiquitous interface agent for cloud computing: Example on Bluetooth wireless technique with Java programming*. Paper presented at the International Conference on Machine Learning and Cybernetics (ICMLC), 11-14 July.
- [4]. Chen, C. S., & Chien, J. (2010). *Insight to Cloud Computing and Growing Impacts Information Computing and Applications* (Vol. 105), Springer, pp. 250-257.
- [5]. Sultan, N. (2011). Reaching for the "cloud": How SMEs can manage. *International Journal of Information Management*, 31(3), 272-278.
- [6]. S. Bandyopadhyay, S. R. Marston, Z. Li, A.Ghalsasi, "Cloud Computing: The Business Perspective", November 2009
- [7]. Wang L, Tao J, Kunze M et al (2008). Scientific cloud computing: Early definition and experience. Paper presented at the *High Performance Computing and Communications, 2008. HPCC '08. 10th IEEE International Conference on*, 825-830. Los Alamitos: IEEE Computer Soc. doi: 10.1109/HPCC.2008.38
- [8]. Zhang Q, Cheng L & Boutaba R (2010b). Cloud computing: State-of-the-art and research challenges. *Journal of Internet Services and Applications*, 1(1):7-18. doi:10.1007/s13174-010-0007-6
- [9]. Mell, P., & Grance, T. (2009, 7 10). The NIST Definition of Cloud Computing, from NIST Information Technology Laboratory, [http:// www.nist.gov/itl/cloud/upload/cloud-def-v15.pdf](http://www.nist.gov/itl/cloud/upload/cloud-def-v15.pdf), retrieved on April 2013.
- [10]. ETSI TR 102 659-1. Study of ICT grid interoperability gaps.
- [11]. Youseff, L., Butrico, M., & Da Silva, D. (2008). Toward a unified ontology of cloud computing, In *Proceedings of Grid Computing Environments Workshop*, Austin.
- [12]. Armbrust, M., Fox, A., Griffith, R., Joseph, A., Katz, R., & Konwinski, A. et al. (2009). Above the clouds: A Berkeley view of cloud computing. Retrieved 1 April, 2013, from [http:// www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf](http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf) .
- [13]. Böhm, M., Leimeister, S., Riedl, C., & Krcmar, H. (2010). Cloud computing and computing evolution. [http://www.joint-research.org/wp-content/uploads/ 2011/07/BoehmEtAl2009c.pdf](http://www.joint-research.org/wp-content/uploads/2011/07/BoehmEtAl2009c.pdf)

- [14]. Etro, F. (2010) The economic consequences of the diffusion of cloud computing, in Dutta, S., & Mia, I. (2010). The Global Information Technology Report 2009–2010 ICT for Sustainability. Londres, Foro Económico Mundial-INSEAD.
- [15]. Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing: the business perspective. *Decision Support Systems*, 51(1), 176–189
- [16]. Amazon Elastic Compute Cloud (Amazon EC2): <http://aws.amazon.com/ec2/>, April 22, 2013.
- [17]. Rackspace cloud: <http://www.rackspace.com/cloud/>, April 22, 2013.
- [18]. Microsoft Windows Azure: <http://www.windowsazure.com/en-us/manage/linux/>, April 22, 2013.
- [19]. Google Compute Engine: <https://cloud.google.com/products/compute-engine>, April 24, 2013
- [20]. Mertz SA, Eschinger C, Eid T, Pring B (2007) Dataquest Insight: SaaS Demand Set to Outpace Enterprise Application Software Market
- [21]. Growth. Gartner RAS Core Research Note, 3 August 2007 Moxie Marlinspike, "New Tricks for Defeating SSL In Practice," 2009
- [22]. Alexa Huth and James Cebula, "The Basics of Cloud Computing"
- [23]. Vo'r'isek, J., Feuerlicht, G.: Trends in the Delivery and Utilization of Enterprise ICT. In:
- [24]. Zhen, J.: Five key challenges of enterprise cloud computing. *Cloud Comput. J.* (2008)
- [25]. URL Referred: <http://cioresearchcenter.com/2010/12/cloud-computing-in-india-cio-survey-report/>
- [26]. Jon Brodtkin, Gartner: Seven cloud-computing security risks, JULY 02,2008, http://www.idi.ntnu.no/emner/tdt60/papers/Cloud_Computing_Security_Risk.pdf retrieved on April 2013
- [27]. Siani Pearson, "Taking Account of Privacy when Designing Cloud Computing Services" , HP Laboratories, Hewlett Packard Development Company, L.P,HPL-2009-54,2009.
- [28]. McKendrick, Joe. (2011-11-20) "Cloud Computing's Vendor Lock-In Problem: Why the Industry is Taking a Step Backward," *Forbes.com*
- [29]. URL Referred: <http://community.zenoss.org/blogs/zenossblog/2010/06/09/three-cloud-lock-in-considerations>
- [30]. Mathew Schwartz. "Integrating Your Cloud And On-Premises Applications," <http://www.bmighty.com/shared/article/printableArticle.Src.jhtml?articleID=211100217>
- [31]. "Critical Link," *InformationWeek Research & Reports*, October 20, 2008.
- [32]. The Financial Express (2011). Indian SMEs get net savvy, 17 February 2011. <http://www.financialexpress.com/news/indian-smes-get-net-savvy/751337/>
- [33]. Michael Massoth and Dominik Paulus , " Mobile acquisition of sales operations based on a BlackBerry infrastructure with connection to an inventory and ERP management system", The Second International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies,2008 IEEE, pp 413-418.