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APPLICATION OF CLOUD COMPUTING FOR RURAL DEVELOPMENT

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ABSTRACT:

According to the United Nations, almost 50 percent of world population and more than 70 percent of that of developing countries are living in rural areas. Majority of this population live in poverty especially in North and sub Saharan Africa. Rural population face unique problems compared to their urban counterparts in terms of access to technologies, infrastructure, markets and social services. Experts have identified ICT as the tool for overcoming the inefficiencies in traditional methods for the empowerment of rural masses. In this paper, we study how cloud computing can be used to meet the ICT requirements for rural development in terms of opportunities and challenges of implementing and using the new technology.

1. INTRODUCTION

Cloud computing is internet-based computing, where shared servers provide computing power, storage,development platforms or software to computers and other devices on demand. This frequently takes the form ofcloud services, such as 'Infrastructure as a Service' (IaaS), 'Platform as a Service (PaaS)' or 'Software as aService' (SaaS). Users can access web-based tools or applications through a web browser or via a cloud-basedresource like storage or computer power as if they were installed locally, eliminating the need to install and runthe application on the customer's own computers and simplifying maintenance and support. There are severalpossible deployment models for clouds, the most important being public, private and hybrid.[1]

Cloudcomputing is the fastest growing field that provides many different services, which are provided on demand ofthe client over the web. Cloud computing is based on the model of pay-as-you-go.This gives the user cost reduction, fast and easy way to deploy the applications. Cloud computing usage in theInformation Support Systems will facilitate businesses to run smoothly and efficiently. A number of virtual machines and applications can be managed very easily using a cloud. With the use of cloud in businesses willnot only save the cost of staff required to maintain servers, but will also require lesser servers and with that lesspower consumption. [2]The most important sector which requires a lot of

information, data and computing power is healthcaresystem. Doctors require medical history of the patients in critical times and within no time. But we see thatdifferent departments of a healthcare system has have different information of the patients medical history, withrequire time to get assembled. Doctors have to start the treatment without the complete information of patient'smedical history, which sometimes, is life threatening for the patient. Technologies could be used in healthcaresector to provide better healthcare facilities and reduce the operations costs. In our country we see that there isscarcity of doctors, nurses and pharmacy. But still there is rapid growth in healthcare services, while diseasesare becoming more complex. More and more new and efficient diagnostic techniques and new way oftreatments are being developed and used in healthcare sector so as to provide the patients with best possibletreatment and in their budget. Many healthcare organizations are providing different kind of services to cater tohighly diversified economic population which in turn has resulted in competition in the market. So theorganizations which do not perform well are out of business. [3][4]

As healthcare providers need cost effective automating processes which gives more profits, cloud computingwill provide perfect platform in the healthcare information technology space. Many hospitals may shareinfrastructure with large number of systems linked together. By this pooling the hospitals automatically reducethe cost and increase utilization. The resources are delivered only when they are required. This also means real-timeavailability of patient information for doctors, nursing staff and other support services personnel from anyinternet enabled device [5].

The recent capture of a group of 50 defrauders using fake invoices to claim medical reimbursement in China's Guangxi Zhuang Autonomous Region revealed loopholes in the country's New Rural Cooperative Medical Scheme (NRCMS). According to Xinhua, China's state media, the scheme has enabled 98 percent of therural population to receive 60 to 100 percent of medical coverage after submitting an annual fee of 60 yuan (about 10 U.S. dollars). Despite of its benefits, the program has been criticized for lacking a national information sharing network to prevent misappropriation of rural residents' funds, guarantee the safety of sensitive medical data, as well as facilitate migrant workers to receive reimbursement in cities where they currently reside. Facing poverty and the many structural deficiencies, rural communities are facing immense challenges as they overcome their disadvantages to diffuse cloud technology in the medical insurance system.

Research Questions: 1. How will cloud computing empower rural medical insurance system and how should its negative externalities be minimized in a rural context? (Professor Michael R. Nelson) 2. What kind of development strategies might help the diffusion of cloud computing in rural areas in order to construct an effective and secure medical information sharing network? (Professor Linda Garcia)

Assumptions and Methods

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The emergence of cloud computing has brought an information revolution as users can access and store data and software on the Internet rather than in a personal computer. This new technology is especially beneficial to improving the rural medical insurance system. By linking the rural communities to a national medical information network, NRCMS managing centers in rural areas can prevent future fraud cases and supervise funds by effectively checking and sharing patient records and identifying fake invoices in a fast and inexpensive manner. A national information platform will also enable migrant workers and frequent travelers to access their insurance information and receive reimbursement in hospitals, clinics and pharmacies across the country. On the other hand, the rural communities will need to minimize the possible risks, such as security and liability issues, when applying cloud technology in their local context. The leak of millions of people's medical data will be a catastrophe to the national medical system. The local government will also come under greater pressure to regulate policy and provide subsidies to encourage cloud companies to invest in rural networks where the yields might be lower than those in cities. From the network perspective, the rural communities will need to play to their strengths in the diffusion of cloud technology and reinforce their local and horizontal ties with other rural regions to create economies of agglomeration. As Dr. Garcia proposed in her paper that rural areas must build their own set of assets (Garcia, 2005), cloud technology will need to be applied so as to enhance horizontal collaborations and sharing between different rural regions and encourage each community within the network to specialize in a certain aspect that matches its strength, whether by providing medical facilities, healthcare personnel or pharmaceutical resources.

1.1 Introduction to Cloud Computing

- Higher inter-node bandwidth in cloud computing
    - Critical for distribution/synchronization of large quantities of data
- Virtualization
    - Virtualization of hardware in CC
    - Virtualization of data in CC
        - User-facing representation of data is independent of data storage implementation
        - E.g. Amazon stores stuff over multiple nodes, you do not care how it stores it, just that it is available

Similarities between cloud computing and grid computing

- Increased reliability of infrastructure, hardware, and data
- Increased flexibility
- Reduces cost
- Historical point of time, makes a copy of installed services, programs
- Allows administrator to easily mass produce a resource of a specific configuration

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- Provides a backup of a "healthy" state/template to build other configurations from

- On-demand self-service[7]
  - Must automate the delegation of resources - this is critical to self-service since humans have a higher probability of committing an error
- Digital rights management is better than automation.
  - We have technology that force legality for digital rights.
  - Other areas (e.g law) has human that govern the rules (e.g judges)
- Ubiquitous network access (Application for multiple devices)
  - Why support heterogeneous platforms:
    - Greater market penetration (get more people can access it)
    - Separation of concerns -- must isolate interface (for various devices) from the business logic
  - Must be mindful of performance capabilities of different types of clients
    - E.g. phones has less bandwidth than laptops
- Resource pooling [8]
  - Resources are shared by the users
    - Mutli-tenancy
  - How do we partition data to isolate each organization's data from the others?
    - Table partitioning
  - Has implications for performance
  - Has implications for scalability:
    - Easy to add (set null to everyone)
    - Not easy to remove/reconfigure data
  - Security is accomplished by the service provider
    - Service provider has access to data

2. LITERATURE REVIEW

Stphanie W.Cawthon(2009): This paper are describe how we can implement accommodation. it include the changes to administration of the test, extended time, change test item impact of this accommodation is on student with disabilities. This paper also some kinds of term theoretically basis for validation and accommodated assessment factor that affect impact of accommodation. And extending time . this paper mostly describe significant challenges and opportunity to integrating multiple construct S.K.Nayak and Dr. Kalyankar.N.V(2010) : This paper focuses on the childhood education in rural india , 21 century is the century of hi tech. It compromised with IT , ICT , BT & Nano technology traditional learning faced many problems but in now days internet plays important role in E- learning cloud based e-learning no limitation or area and time due to there characteristics share any time any where . ICT development has changed learning process this paper describing issue and approaches of e-learning in India and how we can developed childhood education in issue India . in this paper describe limitation of e-learning and strategy to solve this problem. Harjit Singh Lamba and

Gurudev Singh(2011): This paper describing education cloud for the E-management of NGO's . cloud computing provide four services Iaas in this type of service Amazon offers S3 for storage EC2 for computing power and SQA for network communication Dinesha H A and DR.V.K Agrawal(2011): This paper focuses on implementing advance technology tools in rural education. In rural area few school are well facillate . but lack of school do not provide proper education due to insufficient resources , lack of expenses and insufficient knowledge . this paper describe virtualization technology to solving traditional learning problem . which provide virtual desktop, virtual storage . in virtualization is the integrating multiple core into a single die. this paper also describe "moodle" it stand for modular object oriented dynamic learning environment. Daas offering database as service .SaaS offer software packages to be purchased by individual customer and PaaS offer facility to support entire application development life cycle .NGO educational cloud introduce the functionality of cloud computing to improve educational methodology including school ERP, E-learning, virtual classroom, school portal, university portal, and university ERP. Educational cloud provide many beneficial aspect elasticity, reliability, quality of services are non functional aspect and technical aspect .this paper describe the kaligidhar trust is multifaceted, non-profitable charitable organisation working for rural education and cloud computing providing effective solution to achieve goal of quality education. Lincy Meera Mathews and Dr.bandaru rama Krishna Rao(2012): This paper describe components of rural education system . in current scenario education system in village facing many problems open space learning, less infrastructure, less amount of knowledge and equipment. This paper describe feasible rural education system. semantic web based education system explain use case scenario to understanding difficulties of a student from rural background. Swati vitkar(2012): This paper introduce a new paradigm of higher education and also explore the potential of cloud computing it improve the traditional model or learning using cloud base learning to design, implement, select, manage, support, & Extend learning . In cloud architecture define two things service consumer & service creator. Cloud service consumer need to protect anytime anywhere access cloud computing architecture define the capability of virtualized infrastructure. This paper also describe benefits & limitation of cloud computing and various security issues. Bhruthari G.Pund et.al.(2012): This paper describe new agenda of cloud based E-learning and also presenting case study of educational cloud. This paper concerning many beneficial aspect about cloud based E-learning. It reduces cost of hardware, licensing cost, .user can only paying individual software cost and also avoid time, cost patches and update. it also provide flexibility and accessibility of resources over internet. In this paper describing five layer of E-learning architecture infrastructure . resource layer it is base layer that IT infrastructure resources. And also share hardware resources secure and scalable way. second layer of architecture is software resources layer. This

layer composes operating system and middleware. Many developer can develop application base software and embedded in the cloud. third layer of architecture is resource. Management function of this layer to manage the software and hardware resources .fourth layer s service layer are categorise into three services SaaS, PaaS, IaaS and last layer of this architecture is application layer. it is application of integration and maintain all teaching resources .this paper also explain grid computing concept. D.kashi Vishwanath et.al.(2012): This paper describing feasible E-learning using cloud. this paper conclude many aspect about cloud computing . it is promising pathway of education system providing many services like SaaS,PaaS,IaaS. E-learning cloud computing business model facilate three things. cloud providing building ,maintain the cloud and cloud user can access this cloud on demand using E-learning cloud.some security, privacy, reliability, legal and compliance issues are discuss here and there possible solution are also finding using encryption of data Samarsinh Jadhav and Sarika Bodake(2012): This paper describe utilization of resources using cloud computing to enhance the Elearning system. This paper focuses on resource stability and utilization. Cloud computing application combine distributed computing and grid computing, web 2.0, virtualization, IaaS, PaaS, SaaS, MSP. This paper also describe system architecture of cloud computing divided into three layer. Access layer permit access permission, shared service interface layer shared resources on cloud network and based management system layer to maintain resource pool and physical resource. Odunik SA et.al.(2012): Internet is the best medium of learning system it is not only use for learning . it is also useful in business, research, institution,. Now day we are not need to go any where to gain information. We can collect glob information using internet. This paper introduce to transforming education and opportunities around the glob by allowing different kind of interaction this. Paper also describe the promise of cloud computing could be employ to enhance or mitigate the challenges poised to E-learning has recorded a slow growth the rural area. Its implementation is plugged by server sustainability. Nisha gautam and Dr. Manu Sood(2012): Now day government can doing much expense is very low due to requironment of much resources. Now day we want to pay high cost of any service for that purpose author can introduce new paradigm that is cloud computing . this paper frame a website on the basis of SRS and checked inter operatability among the different services through SOA. This paper conclude how we can implement cloud base Elearning in university to make learning powerful and reduces a cost of service. Devajit Mahanta, Majidul Ahmed (2012) According to this paper author suggest the working of e-learning objectives, methodologies and limitation of e-learning. The author utilizes their knowledge to find the solution on e-learning limitations and they also work on e-learning tools. They gives us the overall world are connected to internet ie- teaching are easy to electronically form. They fruitfully gather knowledge and education both by

synchronous and asynchronous methods. They conclude in this research , it is helpful for ICTS, Vida Conformity, Students and educators etc. Aashita jain and Sonal chawla (2013): This paper describe terms of cloud computing and E-learning using cloud network. cloud computing technology is use for designing E-learning technique . this paper can describe cloud base E-learning model . like abstract model and cloud computing architecture. As compare to traditional learning cloud computing will essentially allow for delivery of learning resources anytime anywhere. Utpal Jyoti Bora and Majidul Ahmed(2013): This paper describe cloud computing benefits for organisation cloud computing is adoptable technology for educational organisation providing usage of virtualized resources as a service through the internet . There are many educational institution in rural area cant offered investment but cloud computing provide a solution for that institution cloud computing provide resources any where any time. This paper describe benefits of cloud computing for both teacher & student and also describing services of cloud like Saas, Paas, Iass and deployment strategy of cloud like- private, public and community cloud. Dinoop M.S and Durga.S (2013): This paper describe uploading and downloading high resolution video using dynamic chunk size method to effectively stored data without interrupt and without wastage of memory. This paper also describe security issues, less consumption of bandwidth using dynamic chunk size method divide the file size into different size of chunk to load of the server it is helpful to stored data effectively .the first step of E-learning is downloading video this video user can access easily at the time of video streaming they check the HSF value of block . this upload time analyses and download time analysis. Pranay Kumar et.al.(2013): This paper describe various application of cloud computing which will help to student, staff, trainer and also institution to improve rural education system. This paper also describe some approaches of E-learning service. Like E-learning program based on computer, computer based training and effective approach is computer supported collaborative learning approach CSCL focuses on behaviour of student in classroom, sharing of information R.kamala, E.ramganesh, (2013) In this paper describe effective to contribute of cloud computing in education in various method. Cloud computing offer more beneficial and reliable services to user like high returns on investment, reduces maintenance cost, flexible infrastructure etc. this paper also describe many application that regard to improve educational environment. Amazon cloud service are the most extensive cloud service to provide resizable compute capacity. Microsoft educational cloud computing are of about power of choice . A hybrid model of resources it also provide ability to use same Microsoft technology in the educational institution. Microsoft@edu it is popular browser to support tools for student as well as researcher. Another popular application of cloud is GAE (Google Application for Education)it is more popular for sharing educational idea for staff, teacher, student it available on free of cost. This paper also describe IBM cloud services it offers design to help education

system and also provide services to faculty, student, researcher at school, collages and university. Salesforce is another pioneer application of cloud . it is trusted leader in cloud and CRM it provide big discount on educational product R.kamala and E.Raganesh(2013) This paper describe knowledge about specific learning disabilities among teacher, educator in puduchery. In classroom teaching there are all student intelligence quality are not same and also many learning disability problem are faced by student. This paper indicate proper method to reducing and knowing learning disability . investigators developed a closed ended questionnaire which consist of 35 item four dimension were taken namely dyslexia, dysgraphia, dyscalcula and behavaral problem of specific learning disabled student. Vaishnavi.J.Deshmukh et.al.(2013): In this paper describe. the architecture or cloud computing .this paper describe method to improve current education system or traditional education system an adaptive e-learning system designed. in this paper adopt B/A/S Model namely Browser/Agent/Server Model. Adaptive E-learning System structure are build to solving the problem of integration , interexchange and demonstration of multimedia this paper also discuss business and dataflow of adoptability test in adoptability Elearning system to compare the traditional computing and cloud computing. this paper bind the traditional learning to modern cloud based learning. Cloud based E-learning can not completely replace the teacher. it is only updating for technology. modified system architecture can combine cloud environment and institution.

3. PROPOSED APPROCH

3.1 E – Governance and Cloud Computing

E–Governance is used to strengthen the communication between government and other sectors of life. E–Governance applications are divided into four broad categories**.**

- Government to government (G2G). E–Governance support the use of information, shared services, revenue and law enforcement, decision making, and fund transfer between the inter-organizational government departments.

- Government to Business (G2B). E–Governance provides service like registration, tax filling, transaction and payments. Businesses could be appraised and also use, the services provided by government through a secure mechanism.

- Government to Citizen (G2C). E–Governance support services like registration, land, resume, services and others for the benefit of the citizen.

- Government to Enterprise (G2T). E–Governance supports some enterprises like water board, electricity board that are controlled by government where some policies and standard are to be

enforced. Notwithstanding the challenges, cloud–based e–governance can take advantage of services rendered by the cloud for better effectiveness and efficiency.

3.2 Benefits and Challenges of Cloud Computing to E–Governance

Cloud computing can significantly improve the way a government functions, and the service it provides to its citizens and government institutions. The major advantage of cloud computing is the multi-tenancy shared environment that enhances the delivery services over the Internet. The cloud provides an attractive alternative for the citizen to transact and do business online. The key benefits for using cloud for the hosting of e – government applications is as follows.

- **Accessibility**. The greatest advantage of a cloud environment is its accessibility to users, because the Internet is always available. A user with the required equipment can access a cloud application anytime.

- **Availability**. Applications hosted on the Internet are available anytime, anywhere and can be accessed even by people with mobile platforms. The cloud is assembled on an infrastructure that assures the availability of resources. All vital elements are clustered and single points of failure eliminated.

- **Scalability**. E–Governance is distinguished by uncertainty in demand and workload. There could be an increase in demand during certain periods of the year and relatively low loads and constant demands in other periods of the year. At peak periods of government activities, the platform should provide extra resources dynamically to meet excess request. Cloud offers this capability because of elastic and dynamic services available on the cloud. Technologies like high availability, clustering, virtualization and load balancing ensure scalability. There are current technologies that can be used to increase computing resources without disrupting software or hardware operations.

- **Services Orientation**. Cloud is engineered on the idea of service orientated framework. The provisioning of services in the entire cloud process, tends to keep the ultimate consumer in mind. The model often guarantees ease of operation for a service receiving citizen and a service providing enterprise. This includes some of the value added services provided by external partners in adding to government services. This promotes customer centricity and also value added services that enhance e–governance.

- **Inter-operability**. E–Government is about diversified departments and agencies providing services to the consumers. With various set of autonomous applications in different department, cloud computing will enable e–governance make these application available to citizens. This also implies that the IT infrastructure should sustain several

sets and versions of applications and technologies to bring about inclusive governance. Cloud computing supports inter-operability because of its core characteristics of virtualization and platform independent services.

- **Cost Saving**. In cloud based e–governance, public organizations do not need to acquire and install IT equipment and software on their premises, as it is in traditional e–governance. The public sector will use applications provided for them by the CSP through government interventions, which reduces cost on infrastructure. The cost of ICT services for government agencies and individuals also reduce in a cloud based e-government systems because they loan IT resources and service according to demand instead of investing in these resources. The cloud advantage of pay–as–you–go also decreases the operating cost for public sector organizations.

- **Efficiency.** Providing public services efficiently and effectively to citizens and businesses is one of the major characteristics of e–governance. Cloud based e–government system makes this easy. It's also possible to create new services in a cost effective manner using the readily available resources on the cloud infrastructure.

- **Cloud Option**. The cloud service types and deployment models provide the flexibility needed for e–governance. The government can take advantage of any cloud deployment type or service to render efficient service to the citizens and business alike.

Traditional e – governance has different challenges as discussed below that can take advantage of the benefits of cloud computing [2]

- Resources cannot be scaled up or down with the demands that change over time. This may result in insufficient or redundant service to both enterprises and citizens alike.
- Software and hardware have to be frequently upgraded and maintained which costs time and money, including other auxiliary IT infrastructure.
- New software licenses are required and systems may not be available always.
- Lack of accountability and limited storage.
- Need to provide a secure environment with secure acces

3.3 Adopting Software–as–a–Service Cloud Service for E–Government on a Hybrid Cloud Type

Cloud computing employs three basics service types, the SaaS, PaaS and IaaS [7]. In SaaS, cloud consumers use software application provided by the CSP, but have no control over the infrastructure being utilized. In PaaS, consumers use platforms provided by the CSP to develop and deploy an application. In IaaS, cloud users utilize basic computing resources such as networking, processing power, storage and VMs provided by the CSP. The private cloud is utilized by an organization with the infrastructure on-premise or off-premise and controlled by the organization. Public cloud is operated by a CSP, with control of the

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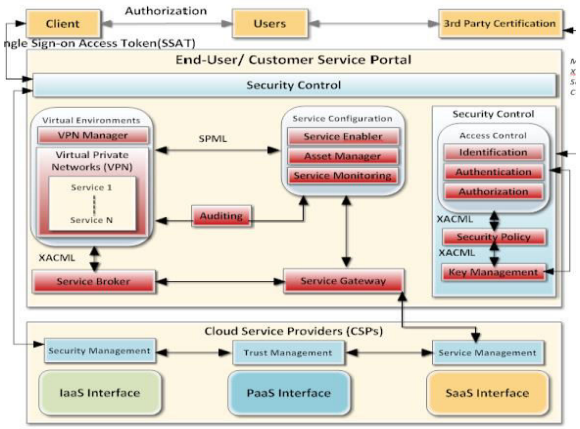
entire infrastructure while community cloud is operated by the organization with a common interest sharing the same infrastructure managed by them or a third party. Hybrid cloud is a combination of any of these three cloud types. Clearly, e – government can operate on all the cloud service and deployment types in varying degrees. However, as shown in Table 1, SaaS tends to suit the provisions of e–governance most.

SaaS provides a platform through which users can access software online. The software installation and operation is the responsibility of the CSP and already available by using IaaS and PaaS abstractions. This is typically end user applications delivered on demand over a network on pay–per–use basis. Typical examples of SaaS application include Google apps, Microsoft office 365, Onlive, GTNexus, Marketo, Trade Card, CRM etc.

4. FRAMEWORK FOR SECURE CLOUD COMPUTING

Framework for secure cloud computing is based on the security model shown above which describes the details of each component and apply the needed security technologies for implementation between components in cloud computing. Access control process on each component is as follows:

- **Client:** users could access the client side with multi factors authentication provided by End-User Service Portal. Multi factors authentication based on certification issued by 3rd party certification authority.
- **End-User Service Portal:** when clearance is granted, a single Sign-on access token (SSAT) could be issued using certification of user. Then the access control component share the user information related with security policy and verification with each other components in end-user service portal and cloud service providers by using XACML and KIMP.



- **Single Sign-on:** Users may have multiple accounts on different cloud services with same user name and password which poses inherent security risks. To overcome this problem, it is suggested that, to streamline security management and implement strong authentication with in the cloud.
- **Service Configuration:** The service enabler makes provision for personalized cloud service using user's profile for the integration and interoperation. The SPML can be used to share user's profile. The asset manager requests user's personalized resources with SPML to cloud service provider and configuration service via VPN connection.

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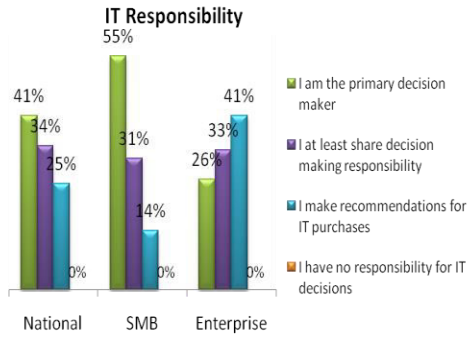
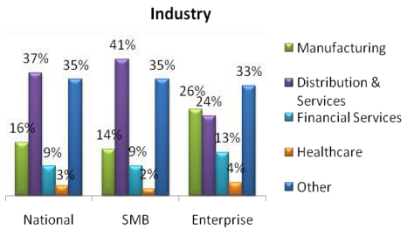
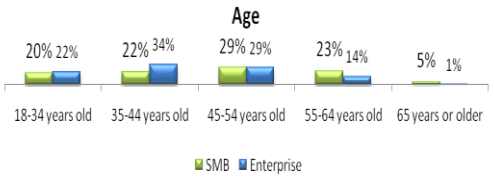
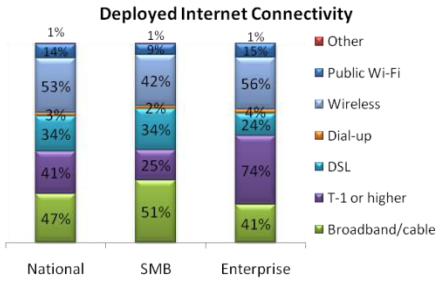
- **Service Gateway, Service Broker:** Service gateway manages network resources and VPN on the information life cycle of service broker.
- **Service Control:** The security control component provides significant protection against security threats. Based on the providers access control needs various access control models can be used. Role Based Access Control (RBAC) has been widely accepted as the most promising access control model.
- **Security Management:** Provides the security and privacy specification and enforcement functionality. The authentication and identity management module is responsible for authenticating users and services based on credentials and characteristics.
- **Trust Management:** Due to the cloud's nature i.e service oriented, the trust level should also be integrated with the service. One possible approach is integrated with service, and bidirectional.
- **Service Monitoring:** An automated service monitoring systems to guarantee a high level of service performance and availability.

5. Results and Analysis:









Investing in IT Promotes Profitability

More than one-third of SMBs and more than half of Enterprise companiessurvedagree that investing in IT increased profitability.

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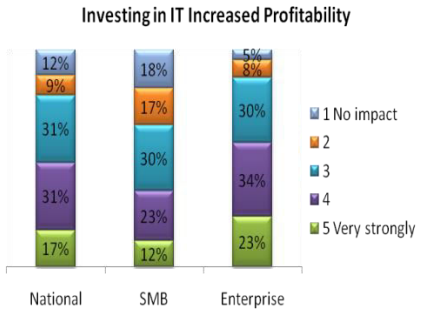

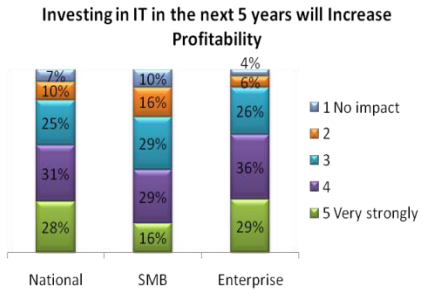

SMBS agree that the IT department must present an opportunity for the company to grow in revenue
(68%) and address the requirement to work anywhere at any time (66%), while Enterprise companies are
more concerned with addressing internal clients' needs (82%) and business process issues (82%).

CONCLUSION

Cloud computing, is a new style of computing technology depend on PAY AS YOU GO principle , users can use cloud resources and entering to system with less disk device and deal with cloud resources to using system benefits , provides users multiple benefits and characteristics , cloud computing has many disadvantages and challenges become future researches and studies , In this paper we discussed the cloud computing models , benefits , obstacles, and focused on challenges and characteristics of cloud computing .

Future research should be directed towards the management of risks associated with cloud computing. Developing risk assessment helps organizations make an informed decision to whether cloud computing is currently suitable to meet their business goals with an acceptable level of risks. Research should be persued finding methods for qualitative and quantitative risk analysis in cloud computing. These methods should enable organizations to balance the identified security risks against the expected benefits from cloud utilization.

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