

Is Virtualization at Present a Cloud Science?

¿Es la virtualización una ciencia de la nube en la actualidad?

Prantosh Kumar Paul¹, VijenderKumar Solanki²✉

¹ Raiganj University, Raiganj, India

² CMR Institute of Technology (Autonomous), Hyderabad, Telengana. India



✉ CMR Institute of Technology (Autonomous), Distt. Medchal, Kandalkoya (V), Pin 501401. Hyderabad, Telangana India.
Email: spesinfo@yahoo.com; vijendersolanki@cmritonline.ac.in

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Abstract

Introduction: The present research was conducted in 2017 at Raiganj University, India. Cloud Computing and *virtualization* are significant concepts in today's computing and information technology world. Cloud Computing is helpful for creating eco-friendly atmospheres, in other words, complete and healthy sustainability. Academic programs in the field of virtualization and Cloud Computing are still rare. This study seeks to learn more about such affairs.

Methods: Cloud Computing is actually a kind of virtualization which ultimately helps create virtual platforms, thus it is useful to learn about various educational programs in the field, the methods of general search engine have been used with proper keywords and titles.

Result: Cloud Computing and its wider uses resulted in academic programs, centers and departments in many countries around the world. Cloud Computing forms a tool and mechanism of virtualization for complete scientific domain nowadays. Virtualization has become a field and an available study program in international universities and also in Indian academics.

Conclusions: This paper highlights several aspects of Cloud Computing from the beginning to growing nature as a field of study with academic and techno-managerial points of view.

Originality: In major indexing agencies, studies on Cloud Computing are rarely available in Indian context.

Limitation: The study concerned a specific area in India and used search methods conducted from July to September 2017. After that period, work has not been included and analyzed in the study.

Keywords: Cloud Computing, computing systems, cloud sciences, eco information systems, universities, research and development, emerging science and technologies.

¿Es la virtualización una ciencia de la nube en la actualidad?

Resumen

Introducción: el presente trabajo de investigación se llevó a cabo en el 2017 en la Universidad de Raiganj, India. La computación en nube y la virtualización son conceptos importantes en el mundo de la informática y la tecnología de la información actual. La computación en la nube es útil para crear atmósferas ecológicas, en otras palabras, una sostenibilidad completa y saludable. Los programas académicos en el campo de la virtualización y la computación en la nube aún son escasos. Este estudio busca aprender más sobre tales asuntos.

Métodos: la computación en la nube (Cloud Computing) es un tipo de virtualización que ayuda a crear plataformas virtuales, por lo que ahora es útil en diferentes estancias, y para aprender sobre programas educativos en el campo, los métodos de búsqueda general se han hecho con títulos y palabras clave adecuadas.

Resultado: la computación en la nube y sus usos más amplios dieron como resultado programas académicos, centros y departamentos en muchos países alrededor del mundo. La computación en la nube genera una herramienta y un mecanismo de virtualización para un dominio científico completo en la actualidad. La virtualización se ha convertido en un campo y un programa de estudio disponible en universidades internacionales y también entre académicos de la India.

Conclusiones: este documento destaca varios aspectos de la computación en la nube desde sus inicios, incluyendo su naturaleza en crecimiento como campo de estudio con puntos de vista académicos y tecno-gerenciales.

Originalidad: en las principales agencias de indexación, los estudios sobre computación en la nube raramente están disponibles en el contexto de la India.

Limitación: el estudio se refiere a un sector específico de India y se utilizaron métodos de búsqueda realizados entre julio y septiembre de 2017, no se incluye y analizan trabajos posteriores en este estudio.

Palabras clave: computación en la nube, sistemas de computación, ciencias de la nube, sistemas de información ecológica, universidades, investigación y desarrollo, ciencias emergentes y tecnologías.

A virtualização é uma ciência da nuvem na atualidade?

Resumen

Introdução: esta pesquisa foi levada a cabo em 2017, na Universidade de Raiganj, na Índia. A computação na nuvem e a virtualização são conceitos importantes no mundo atual da informática e da tecnologia da informação. A computação na nuvem é útil para criar atmosferas ecológicas, em outras palavras, uma sustentabilidade completa e saudável. Os programas acadêmicos no campo da virtualização e da computação na nuvem ainda são escassos. Este estudo busca aprender mais sobre esses assuntos.

Métodos: *cloud computing* é um tipo de virtualização que ajuda a criar plataformas virtuais, por isso, agora, é útil em diferentes áreas e para aprender sobre os programas educativos no campo, os métodos de busca geral têm sido utilizados com títulos e palavras-chave adequadas.

Resultados: a computação na nuvem e os seus usos mais amplos deram como resultado programas acadêmicos, centros e departamentos em muitos países ao redor do mundo. A computação na nuvem gera uma ferramenta e um mecanismo de virtualização para um domínio científico completo na atualidade. A virtualização tornou-se um campo e um programa de estudo disponível em universidades internacionais e, também, entre acadêmicos da Índia.

Conclusões: este documento destaca vários aspectos da computação na nuvem desde o princípio, inclusive a sua natureza em crescimento como campo de estudo com pontos de vista acadêmicos e tecnológicos gerenciais.

Originalidade: nas principais agências de indexação, os estudos sobre computação na nuvem raramente estão disponíveis no contexto da Índia.

Limitação: o estudo se refere a uma área específica na Índia e foram utilizados métodos de busca realizados entre julho e setembro de 2017, um trabalho posterior não foi incluído nem analisado no estudo.

Palabras clave: ciências da nuvem, ciências emergentes e tecnologias, computação na nuvem, pesquisa e desenvolvimento, sistemas de computação, sistemas de informação ecológica, universidades.

1. Introduction

Computing architecture depends on various types of virtualization principles as well as flexible computing platforms and services called *Cloud Computing*. Tools and devices such as monitors, printers, databases, applications and packages are the key matters of this system. Cloud Computing is similar to cloud platform, cloud architecture in many contexts, and it helps to save costs since there is no need of extra software, hardware, as well as IT packages. Cloud Computing also promotes the online availability of resources, positively. It is mainly provided by a third party (public-clouds) and service seekers need to connect with the provider through the Internet or similar communications [1], [5], though, majorly Internet is playing a valuable role to provide the required hardware, software, and systems including other IT applications. Corporate basically perform their task using computing and technological devices. Similarly, academic institutes and universities need IT and computing for several assignments such as official administration, teaching as well as learning, teleconferences and many other activities.

Today, apart from the developed countries, many institutes and corporate houses are adapting Cloud Computing services and also IT intelligent systems [2-3], [9]. This way Cloud Computing has emerged from an extended service of grid-distributed computing platforms. Its applications are also increasing rapidly and there are many new fields where use of Cloud Computing becomes important. Academic institutes and corporate research houses are actively engaged these days to promote Cloud Computing, as a field of study and research with many possibilities.

2. Objectives with Agendas

This is a type of theoretical and conceptual research assignment; it has been prepared and conducted with the following aim and agendas:

- To study about Cloud Computing and virtualization with its basic principles and features at a glance.
- To dig out the main advantages and facilities of Cloud Computing and similar systems in a simple manner.

- To learn about higher education systems and research systems in academia and corporate houses.
- To learn about the emerging, possible Cloud Computing and virtualization utilizations in corporate houses, industries and education (online education, virtual education, e-learning).
- To dig out the growing changes of Cloud Computing and a look of cloud science with emerging academic initiation by universities worldwide.
- To draw the core and main challenges, issues (including towards a full-fledged domains cloud science) related to Cloud Computing, especially in the developing countries.

3. Methods

As any other conceptual and theoretical work, this research work also aimed at the collection of Cloud Computing and similar subjects. Thus theoretical research-work and literature review have played a leading role. Various sources related to Cloud Computing, virtualization, green computing etc., have studies in journals and conference publications easy to find using the Google Scholar Indexing System. Similarly, for educational aspects and its emerging studies universities and their programs have accessed Google. BSc-Cloud Computing and MSc-Cloud Computing courses and Cloud Computing Degrees, these three search sentence/ keywords etc., and have been mainly used to get the latest results. We revised results of up to 10 pages considered for the research work. Similarly, Cloud Computing initiatives of several industrial units have also mapped the use of web research in the related company's URL to get the latest on the field and future potentials.

4. Cloud Computing and its Basics: A Review

Cloud Computing is an approach and importantly, a model where it is possible to get the sources like hardware, software, applications, systems etc., for their use. In this information technology and computing services, grid computing and distributed computing have played a leading role [4], [8], [13]. Cloud Computing is helpful for minimizing

individual company's IT resources and server related affairs, and ultimately helpful for the limited workload, it would also be helpful to access in someone's personal data center. It renders several types of amenities to us such as:

- Cloud Computing platforms are virtual and thus they may easily provide software, hardware, database, systems and other applications to clients.
- Cloud Computing is very proficient and much smarter as here clients need to join with cloud data service providers to get the desired services [6], [7], [14].
- Flexibility and suppleness are emerging issues in Cloud Computing for its rapid popularity in most of the organizations, which include MNCs, IT organizations, governmental houses, universities and academic institutions, even knowledge organizations.
- Cost effectiveness and economic sustainability are major reasons for Cloud Computing development. In this computing platform, organizations and their establishments do not need to buy costly computing systems or peripherals. Thus by the centralize machines and equipment services may be availed.
- Cloud Computing offers velocity in addition to easy convenience as the client computer users only use some of the in-house machine and systems.

Cloud Computing is a mechanism and a platform for trouble-free, supple-flexible resource sharing. Among the main resources, it includes hardware, software, IT applications, systems, many other contents and facets. Cloud Computing is one of the most advanced and emerging technologies that appeared after the internet according to numerous agencies and scientists, and are useful in almost all the organizations, regardless of private or governmental, small or large, etc.

Between 1940-1970's computing was speed and velocity was very less (*including the non flexible features*) although at some stage in the progress of internet and similar services, Computer and its traditional thinking become changes [10], [11].

After integration and incorporation of various applications, many other platforms have evolved and emerged; these are parallel computing and grid computing.

After 1990's and especially in 2000's the traditional look of computing and information technology changed due to the virtualization technology. This resulted in the promotion of the hardware, software, as well as IT applications and resource sharing by several other online and virtual services, including its platform, dedicated, concerned with prefixed clients and users.

5. Towards Cloud Sciences: Diverse Computing and Information Technologies

Cloud Computing and flexible computing IT tools are an advance and support several sharing of the advance computing tools. Sharing of various small hardware devices like *printers, routers, switches* software and applications, packages and utilities, are positively possible thanks to Cloud Computing [12], [13], [15]. Today most of the organizations are using Cloud Computing and running their business effortlessly. In first generation computing systems and thereafter, speed was very slow and presented less softness. Though, from big computing such as mainframe computers (or personal computers) single user to client server architectures have changed rapidly. Client centric service has brought a revolution in the computing and IT segment; in this, several IT based applications and their sharing are easily possible among users with proper techniques. Similarly, distributed computing also changes traditional computing solutions. After this development, the fundamentals of Cloud Computing have evolved with a number of services to the users with anytime and anywhere offerings. This model and its development leads to many new models such as public cloud (with computing basically offered by third parties through internet to the users), private cloud (in which Cloud Computing offered and established in-house basis), hybrid cloud (this is a combination of public and private clouds and depends on users need), etc., that eventually charge an important issue for the introduction of Cloud Computing and virtualization in most of the organizations.

In this way, Cloud Computing may become more apparent to users and may offer to be built in several methods. The degree of information technology may be mobilized by Cloud Computing in which one cloud service provider basically provides

all category of services. The services are already depicted and these are data storage, hardware, software, to its users with strong Internet association. This way the elasticity of computing has resulted in elastic or flexible computing [5], [16]. Cloud Computing and its emergence has been efficient in many other areas, models and platforms such as:

- Software-as-a-service
- Infrastructure-as-a-service
- Platform-as-a-service
- Security-as-a-service

Combining all these models, platforms and existing grid computing, distributed computing etc., Cloud Computing has become a domain of advance for scientific computing. Moreover, Cloud Computing is also associated with environmental sciences. And the combination of both has resulted in green computing. Green computing is the computing practice for designing and developing eco-friendly and sustainable information infrastructure. Green computing is a procedure, which allows the development of IT products with power-consumed features and no-doubt, less based in carbon secretion. Development and promotion of information systems in organizations with minimum hardware, infrastructure and technology are also a component of green computing. Thus, today's Cloud Computing fulfills many strategies of the green computing practice, and in many contexts both are termed as a single thing, i.e. *cloud-green computing*. In many countries, both computing platforms are getting the highest priorities to introduce green computing and eco friendliness (cloud based too) in computing system building. Thus when combining all the models of clouds, its platforms, features and functions, Cloud Computing may become an important domain of applied science and may be called cloud sciences. The merging of green computing into it will with no doubt help its solid academic promotion.

6. Academic Initiatives towards Cloud Computing as Cloud Sciences

Internationally Cloud Computing has fallen under the domain of Information Technology and Computing, similar to what has happened with other computing disciplines (such as database technologies, networking technologies,

web technologies, multimedia technologies etc.) During the last few years, Cloud Computing has increased rapidly due to its unparalleled benefits of various nature. The market of cloud products and services are eye catching. Developed countries like United States, the United Kingdom, Australia, Japan, Germany, Switzerland, etc., have played a leading role for the solid implementation of Cloud Computing. Similarly, in developing countries like India, the cloud market has developed rapidly during the last few years. For example in Colander, year 2009, the Cloud Computing market in private cloud was of 250 to 260 us dollars, where as in 2011 it was about 700-720 us dollars (in millions). Details are depicted in Table 1.

Table 1. Cloud Computing Market in India with its growth in millions (USD)

Indian Domestic Cloud Computing & Virtualization Market (in SD)		
Private Cloud (2009)	250-260 millions	Mainly in Government, defense and industries
Private Cloud (2011)	700-720 millions	
Public Cloud (2009)	67-93 millions	In all segments (Health, Education, Finance & Banking, etc.)
Public Cloud (2011)	160-192 millions	

Reference: the authors

Hence this industrial requirement in Cloud Computing in the international market leads to the development of solid and sophisticated manpower in the field; initially such manpower was created by many corporate bodies, associations, IT Training firms which include Microsoft Technologies, Red Hat, Oracle Corporation, Cisco Systems, EC Council, Juniper Networks, International Information Systems and Security Consortium, with many training programs and manpower development projects etc., [13], [14]. In Microsoft Technologies, the most popular and important include the MCSE (Microsoft Certified Solution Expert)-Private Cloud. Though the Cisco Systems have offered wide range of programs such as:

- Cisco Certified Network Associate (Cloud).
- Cisco Certified Network Professional (Data Centre)
- Cisco Certified Network Professional (Cloud)

Apart from these, there are many other designing courses with several platforms and architectures. Similarly, programs of Oracle Corporation, EC Council and others are also important and these are depicted in Table 2.

Cloud computing is gradually becoming an important and valuable domain internationally during the last few years. In universities, especially in European and American universities, programs are offered at Bachelor and Master Degree with specialization in Cloud Computing and allied subjects. Apart from Cloud Computing and its technological and managerial aspects, these specialized programs are also offered:

- Database Systems
- Strategic Management of the ICT and Infrastructure development
- Network Computing and Informatics
- Converged Networks
- Web and Internet Sciences

Most of these programs are available as Masters Degree with full-fledged Major of Cloud Computing (e.g. MSc- Cloud Computing). Among the offering institutes, majorities are from United Kingdom and include the University of

Wales; Staffordshire University; University of Wolverhampton etc. Cloud computing programs are also available with Bachelor Degrees (with BSc Degree). The course structure and common subjects, with duration etc., are shown in Table 3.

In most of the programs, cloud computing is also offered with networking technology focus. It has been mentioned that industries are also offered cloud computing and allied programs as depicted in Table 2. Such courses are very professional in nature and vendor specific in many cases. During this study we noticed that a few among the universities and institutes have listed the industrial matters in the curriculum and few are mapped with CCNA curriculum also with cloud computing focuses. The programs in cloud computing in the developing countries are more or less. The adopted search strategies (as mentioned in the methodology section) shows that BSc/MSc or similar in Cloud Computing do not exist in countries like Bangladesh, Nepal, Bhutan, Sri Lanka, Pakistan, Indonesia, etc. [13], [14]. As far as India is concerned, it is important to note that it is the largest player in the world and has over 40 000 Higher Educational Institutes, but still Cloud Computing programs are absent in Government Universities (State/Central). In the INI (Institute of National

Table 2. Few popular cloud computing certification programs offered by corporate companies

Most Popular programs related with Cloud Computing	
Microsoft	Microsoft Azure MCSE (Private Cloud)
Linux (Red hat)	Initial Level: Red Hat Certified Associate (Cloud)/RHCSA(Open stack)/Red Hat Certified Engineers (Hybrid Cloud)/ Red Hat Certified Engineers (Platform-as-a-Service) Higher Level: Red Hat Certified Engineers (Hybrid Cloud Storage)/ Red Hat Certified Engineers (Deployment and System Management)
Oracle Corporation	Oracle Network Virtualization/ Oracle Server Virtualization
Cisco Systems	Initial Level: Cisco Certified Network Associate (Cloud)/ Cisco Certified Network Associate (Data Center) Higher Level: Cisco Certified Network Professional (Cloud)/ Cisco Certified Network Professional (Data Center)/ Cisco Certified Internet-working Expert (Data Center)
EC Council	EC Council Cloud Essential
Juniper Networks	Juniper Network Certified Design Specialist (Data Center)/ Juniper Network Certified Design Professional (Data Center)
isc2	Certified Information Systems Security Professional (Cloud Security)/ ccsp (Cloud Security)

Table 3. Few popular cloud computing, bsc programs focusing in European Universities

Programs	University	Duration
bsc Cloud Computing	University of Wales, London	3 Years
<i>Core structures:</i> Computational thinking, computer architecture, information engineering, internet protocols, IP inter-networking, network principles, software development, Cloud Computing technologies, DBMS, LAN, network OS, web development, data center technologies, data center virtualizations, WAN, big data.		
bsc Cloud Computing	Staffordshire University	4 Years
<i>Core structures:</i> Computer networks, hardware and computer systems, data storage & software systems, virtualization, network security, routing & switching, virtual computing, professional skills for networking, converged technologies, communication technologies, project (program map with CCNA, CCNP & CCNP security modules of CISCOsystems)		
bsc Cloud Computing	CORK Institute of Technology, Ireland	1 Year Full Time 1.5 Year PT
<i>Core structures:</i> Cloud architecture, business intelligence, Cloud Computing with python, IT service management, converged networks, data center virtualization, cloud application development, enterprise storage systems, network security, internet & network services project, etc.		
bsc Cloud Computing	University of Wolverhampton	3-6 years
<i>Core Structures:</i> NA in Website		
bsc Software Design (Cloud Computing)	Athlone Institute of Technology, Ireland	4 years
<i>Core Structures:</i> Mathematics for software design, software development, agile methodologies, software development for cloud, databases, web development, networks, group project, web development, mobile application development, operating systems and concurrency, software development, software engineering, software development for cloud, server-side web development, web development, placement, computer graphics, networks, management and organizational behavior, databases, data mining and machine learning, engineer in society, security, distributed systems, service oriented architecture.		
bsc CIS (Cloud Computing)	ECPI University, Virginia	4 years
<i>Core structures:</i> Introduction to virtualization, virtual computing, data center infrastructure, system & network administration, mobile & wireless technology, web applications, integrated business processes with SAP ERP systems, computer systems security, information storage & management, internet of things: concepts & applications, enterprise programming for distributed applications, advanced database systems, designing & developing applications on cloud computer systems management, investigations in Cloud Computing, Cloud Computing project.		

Reference: the authors

Importance), considered as apex institutes in India (ITTs, IIMS, IIITS, IIESTetc.) surprisingly Cloud Computing programs are also not present as BSc, MSc, BTech/BE, MTech/MEetc. However some private institutes offered the program and these are depicted in Table 4 with engineering focus.

Cloud Computing programs in other developing countries, i.e. in Malaysia, is also available and a sample course structure of this BSc-IT (Cloud Computing) is as follows:

Asia Pacific University of Technology and Innovations, Malaysia, BScIT (Cloud Computing): Introduction to Virtualization, Virtual Computing, Data Centre Infrastructure, System & Network Administration, Mobile & Wireless Technology, Web Applications, Integrated Business Processes with SAP ERP Systems, Computer Systems Security, Information Storage & Management, Internet of Things: Concepts & Applications, Enterprise

Programming for Distributed Applications, Advanced Database Systems, Designing & Developing Applications on Cloud Computer Systems Management, Investigations in Cloud Computing, Cloud Computing Project.

This way Cloud Computing becomes an important and valuable applied science and engineering domain in many countries. It is a fact that developed nations have done important contributions to Cloud Computing promotion, including practices, academic programs, research and innovation, etc. Thus Cloud Computing today may be named as a cloud science. Actually it is not only a tool and principle; today it is a healthy, sophisticated applied interdisciplinary technological domain (before, Internet was treated as a tool but now it is treated as a domain with title/subject Internet Science/ Technology). For more development of a subject, continuous effort from

industries, government, and academics is important and valuable. Some proposed programs are depicted in Tables 5 and 6 keeping in mind the developing (and obviously for the developed countries) countries context.

This way it is possible to introduce cloud computing as a more interdisciplinary subject and field. Cloud computing and its current status with

availability of full-fledged Bachelor and Masters (BSc, MSc, BTech, MTech etc) with various research degrees etc., confirm that Cloud Computing is a science of computing. Thus it may be called a cloud science. However if the developing countries and developed countries try more of the above mentioned (tables 5 and 6) degrees in their academia, it will be advantageous.

Table 4. Depic BTech with Cloud Computing Specialization offerings in Universities

Universities	Programs	Specialization	Remarks
Hindsthan University, Tamilnadu	BTech IT	(Cloud Computing)	
Hindsthan University, Tamilnadu	BTech CSE	(Cloud Computing)	
Graphic Era University, Dehradun	BTech- CSE	(Cloud Computing)	In most cases the program is jointly offered by IBM.
University of Petroleum and Energy Studies, Uttarakhand	BTech- CSE	(Cloud Computing)	IBM also running programs with Business Analytics & Cloud in these institutes.
Sharda University, UP	BTech-CSE	(Cloud Computing)	
University of Technology and Management, Meghalaya	BTech-CSE	(Cloud Computing)	

Reference: the authors

Table 5. Proposed programs of Cloud Computing in favor of Engineering, Science and Management Science

Engineering	Science	Management
BE/BTech- Cloud Computing	BSc/MSc-Cloud & Eco Computing	BBA(Cloud & Big Data Management)
BE/BTech-IT/CSE (Cloud Computing)	BSc/MSc-Information Technology (CC)	MBA(Cloud Computing & Business)
BE/MTech- Cloud Computing	BSc/MSc-CS(Cloud Computing & Analytics)	PGBDA(Cloud & Big Data Systems)
BE/MTech -IT/CSE(Cloud Computing)	BSc/MSc-Information Science & Systems (CC)	PGDM(Digital Marketing with Cloud)
BE/MTech -Information Systems (Cloud Computing)	BSc/MSc-SE(Cloud Computing)	
	BSc/MSc-Networking (Cloud Computing)	

Reference: the authors

Table 6. Proposed programs of Cloud Computing in favor of Commerce, Social Science and Architecture

Commerce	Social Science	Architecture
B.Com. (Cloud Systems Management)	BA(Digital Sociology & Cloud Systems)	B.Arch. (Cloud Computing & Designing)
B.Com (Cloud Based E-Commerce)	BA(Social Informatics)	M. Arch. (Cloud Computing & Architecture)
B.Com (Cloud in Business)	BA-Economics (Cloud & Digital Economy)	B.Plan/M.Plan (Cloud Systems)
B.Com (Green Accounting)		

Reference: the authors

7. Issues & Findings

Cloud computing and similar systems have various issues, some of which are the following:

- We need strong dedicated networks available anytime for a healthy cloud computing implementation.
- Uninterrupted Internet connections positively powered by heavy bandwidth would help cloud computing services. For large storage (including audio, video, text, etc.), other content management cloud computing will be supportive.
- Cloud Computing demands for parallel power along with connectivity. Some models (under cloud) are not energy efficient and therefore green computing systems need to be implemented.
- Cloud Computing also may be slower in some cases, as every cloud client first needs to request or send data to its provider and again based on program service, the provider needs to send data or services.
- Security is one of the main problems in cloud computing platforms as cloud computing service is mainly provided by a third party, thus all the details of an organization need to be checked by the concerned service provider.
- In some cases, stored data may be replicated across multiple machines.
- It is still a big problem that developing countries are not able to do heavy IT infrastructure for all round activities.
- Awareness regarding cloud computing in government and public sector is partial. Hence we need to create the awareness among organization's management and common man about the benefits of cloud computing.
- The centralized systems of computing and information technology are performed with cloud computing; thus it is more challenging in that context.
- In case of centralized management, total services may be delayed or stopped if central systems shutdown.

It is worthy to note that cloud computing provides several facilities such as velocity, elasticity, money saving, resource management and so on. Governmental firms, defense institutions, financial corporations etc., need cloud computing systems.

In such cases service providers may be chosen from the government. Finally, real life benefits are possible for organizations of various kinds; with solid and healthy cloud computing or virtualization methods and a correct implementation.

These issues may be solved positively with healthy cloud computing strategies and their implementation in real basis with proper creation of manpower in the field of cloud computing. The development of cloud computing as a cloud science is properly possible by the initiation of computing systems in more academic fields, etc.

8. Recommendation

Cloud computing is a valuable cost-effective, eco-friendly and reliable way to get resources and it is then necessary to have a good implementation of its sophisticated practices.

- Healthy cloud computing requires to be sophisticated and have a speedy uninterrupted broadband service.
- Government inventiveness for the cloud computing policy along with essential supports are also imperative.
- Proper and sound financial support from the Government is very much essential and needed for the installation of cloud computing.
- Energy consuming systems are also very much important and here choosing 'Energy Star' enables IT services and products that are essential.
- Cooperation between the service providers along with the Government, and common users is important.

Cloud Computing and its solid practices are possible with proper management strategies and their implementation. As far as education is concerned, it is urgent to offer cloud computing programs in universities, colleges and research centers. There are many possibilities of cloud computing; which include the introduction of the program as a full-fledged Bachelor and Masters program with science, management, and engineering as focus. The same may also be offered with humanities and architecture as focus. The proposed programs with Cloud Computing specializations in related curriculum such as in IT, Computing, Management

Science, Architectural Science etc., may be offered. Collaboration between industries, academia and research centers needs proper preparation to offer cloud computing specializations, universities may adopt the technical and academic assistance of other departments if possible.

Conclusion

Disinclination to set up Cloud Computing is an important matter for a proper and healthy virtualization. Cloud Computing and virtualization are gaining popularity in health, agriculture, government, commerce, politics, education etc. Cloud Computing services in the educational domain have also huge potentiality in the management, teaching and learning research-related affairs. Cloud Computing is a kind of utility computing which can scale out and matter the workload demand. Consumption in time, money, technology, hardware etc., are positive with Cloud Computing implementation. It renders elasticity, flexibility, along with efficiency in to an information infrastructure. Thus academic and corporate worlds need to join efforts to create healthy information solutions and academic practices. Colleges, universities, educational institutes in the developing countries need proper and healthy steps for solid cloud computing and virtualization solutions. Academic collaboration among the departments of the universities is important and urgent in most cases.

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