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CLOUD COMPUTING AND VIRTUALIZATION IN AGRICULTURAL SPACE: A KNOWLEDGE SURVEY

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Cloud computing is based on virtualization principles and practices that normally encourage online computing services and platform. Information Technology and Computing tools and products like monitor, printers, database including other applications as well as packages. Cloud computing is also known as cloud platform and cloud architecture. Cloud computing is helpful in cost saving due to its fewer requirements of additional software, hardware etc. Initial costing is also an important matter of cloud computing as it is offered by third party service provider and here there is no requirement to attach the service provider. Internet is always an important player here to provide definite level of hardware, software including other IT applications. In many developed countries cloud computing applications are widely using in different segments and sectors. India is a agriculture based country but there are huge problems in adopting cloud computing and intelligent IT into agricultural space. Though with the initiation of some plans and programs cloud computing utilizations are positively possible. In this paper the overview of Cloud including its features and function with need and possibilities in Agriculture are provided.

KEYWORD: Cloud computing, computing, IT application, Information Transformation, Information Management, Agriculture, Horticulture, India, Development, ICT in Agriculture.

INTRODUCTION

Cloud computing is a kind of computing platform in addition to mechanism for software and hardware practices. Cloud computing lies on architecture that uses as well as inspire for the less and minimum uses of computer, hardware as well as IT Delivery. Cloud computing is also helps in limited software along with application. Virtual as well as online hardware, software services, are the core in this computing model (Burrell, J., Brooke, T., and Beckwith, R. 2004 and Satpute, P, O. Tembhurne, 2014). Here one service supplier is prepared with several types of service and thus organizations may also get their mandatory facilities by wired medium only. Here medium of communication despite of physical hardware, software playing a vital role. Cloud computing is also based on green computing principles and strategy due to its less involvement in devices. Moreover use of carbon discharge is possible with cloud computing strategy as well as models. Cloud computing is the latest emerging tool after internet and world is moving towards cloud applications in different sectors and uses in agriculture no doubt also play a vital and important role.

OBJECTIVE

Aims and objectives of doing this conceptual research work is includes but not limited to as follows:

- To learn about Cloud Computing with its basic features as well as characteristics in brief.
- To study about the significant benefit as well as gain of Cloud Computing and Virtualization.
- To dig out matter of Green Computing and Technology for designing and building advance and intelligent information infrastructure.
- To know the strategies of Cloud Computing based Agriculture systems creation and building.

- To dig out the procedure and practice to begin Green along with sustainable information infrastructure for the agriculture and horticulture segments.
- To gain knowledge of possible approaches to bring Eco IT Systems in Agriculture systems for solid and inclusive development.

What is Cloud Computing?

Cloud Computing is a virtualization model which is used many tools like hardware, software, application for their solid utilization in remote environment. This is the integrated and centralized Information and Communication Technology services automated by internet and similar technology. The Cloud Computing is helpful for creating environment of Grid Computing throughout its service as well as structure and nature (*Refer Fig: 1*.).

Cloud Computing Applications

Cloud Computing brings several benefits as well as benefits than the conventional computing as well as networking services. Some of the important and valuable applications are include:

- Very much quick as well as advance technological services are possible with cloud for offering remote hardware, software, application and utilization of utilities.
- Cloud Computing provides easy and smartest adjustment of presented services with proper and healthy bandwidth, processing, speed including data storage.
- A smart as well as standardized and scalable, secure physical infrastructures etc are possible with cloud applications (Hori, M. E. Kawashima, T. Yamazaki, 2010, Mahesh D. S et.al. 2014 and Paul, P.K., 2013).
- Cloud Computing permit wider and modern database services with multiple value added services.
- Cloud Computing also promote the online as well as virtualized information infrastructure and systems in very few time.
- Cloud Computing and virtualization is allowing centralize service and ultimately it reduces the tools and techniques and therefore it helps in best power management and helps in Green and Eco Computing practices.
- In Cloud Computing one customer or client may get only one public cloud-private cloud or combining both the services that is called Hybrid Cloud Computing.
- It allows Mobile Commerce, E-Commerce including E-Business services with very lowest amount time.

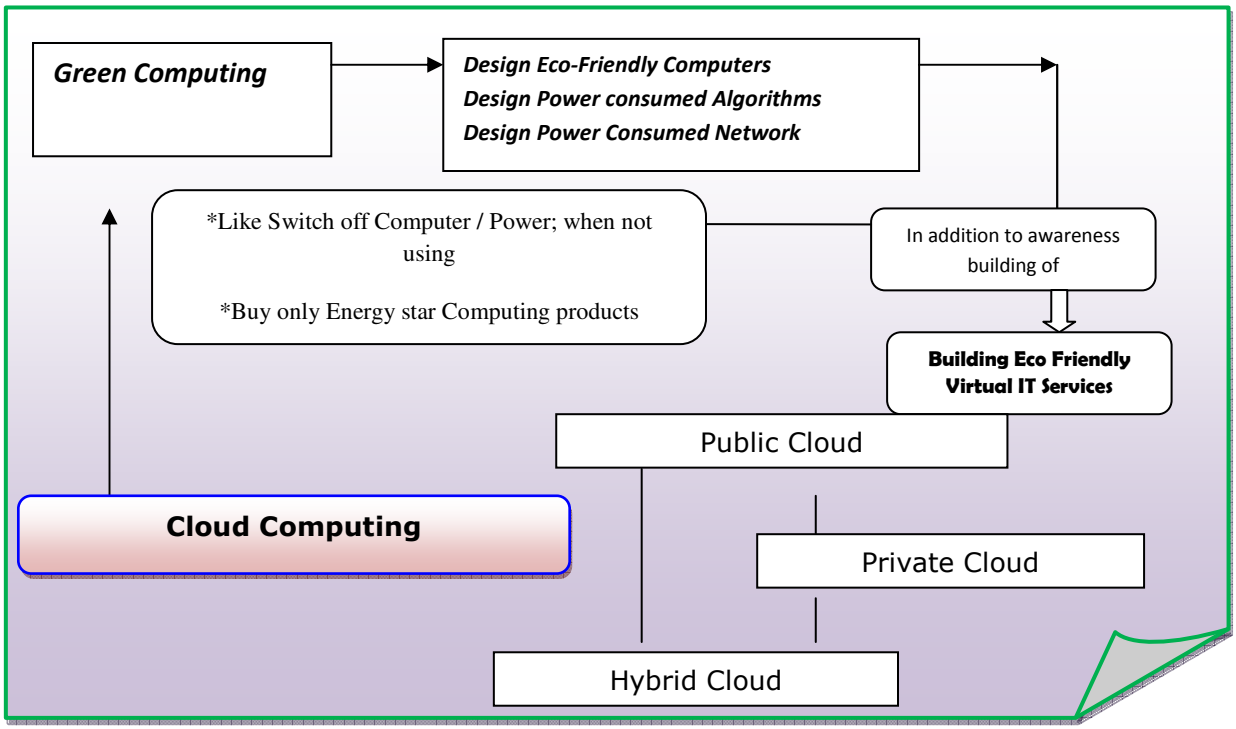

Fig: 1-Showing aspects of Green IT and vice versa promoting cloud computing

Agriculture and Cloud Computing:

Cloud computing and virtualization has utilization in almost all sectors regardless of scientific, engineering, business, commercial, social etc. It is become an important Service Science in many contexts. Agriculture is most common and important field for everyone (Prasad, G. J. Kumar, V.V.S. Naidu, G.J. Nagaraju, 2013 and Paul, P.K., et.al. 2014). It is a domain that being enormously benefitted with cloud computing as well as virtualizations. Farmers as well as cultivators internationally today using the IT and Information Analytics resources for trouble-free distribution as well as administration of their crop/yield related data. Hardware/software are useful in monitoring of temperature, humidity, soil moisture etc and these are being utilized by the farming and agriculture community. Standardization as well as development of agriculture basically minimize the temperature and climate dependency and also help in better uses of general resources. Cloud Computing also provides advance agriculture and similar equipment, machinery including for the agriculture planting as well as breeding technology. Cloud Computing is also helpful in weather observation as well as forecasting. Moreover current information scientist claims that the production as well as organization/ management methods of agriculture many ways become more positive with Cloud Computing practice. Increasing and modern capability for agriculture-horticulture powered with agricultural technologies. Many Cloud Computing based apps directly associated the farmers and cultivators for its operation and here cloud share their experience by the communication along with information and resource sharing (Paul, P.K., et.al 2014 and Rao, B.B.P,, 2014).

Cloud computing (including Big Data and IoT) is tends to connect various types of objects and devices in the world to the Internet. Use of several wireless and other wired communications also played a great role with other sensors. Several cloud based applications are designed based on several IOT devices to monitor along with control of a variety of domains based on applications.

Cloud computing and similar technology may utilize efficiently for the use of crop and other agricultural production. It helps in gathering of the rising requirements of growing population in India. Internet of Things is also helpful to for tracking the land. Cloud computing with IOT is helpful for paying usage and thus it reducing agriculture cost. New Cloud computing applications may be urbanized agricultural for its increasing quality, quantity, as well as cost effectiveness of agricultural and similar production.

Farmers worldwide are using several modern and advanced agriculture techniques and tools with machines, even in developing countries too. Farmers in regard of IOT technology uses are in fundamental level as far as agriculture is concerned. Though developed countries have reached a mark off level in farming with cloud and IoT.

IOT and cloud computing is a technology which tends to connect various objects in the world to the Internet. It involves the use of RFID as well as several kind of wireless and other sensors having Internet stack inbuilt into the device. IoT enabled devices have been also launched in the recent past for monitoring and controlling various kinds of domains based on applications.

Cloud Application and Agriculture

1. Wide-ranging information and content storage: Cloud computing promoting data storage for storing data of several level and kinds include large scale data as well as information. Here information of several kinds may be stored in the cloud systems such as crop related information, information on weather, market, agricultural processes, pesticides and so on easily possible to store on the cloud. Here thus a specific farmer may upload content and information as well as recover content easily from cloud database. Researchers from agro and horticulture related institutions can provide information and content about the recently created and developed agricultural techniques, tools etc to the agricultural community through cloud. Cloud is also a best and sophisticated infrastructure system for sharing mutual and similar information. It also helps in experiences regarding the farmers all over. Market condition and economics status, demand different crops related data may also possible to get for the decision making for several occasions including for choosing the crops (Paul, P.K. et.al., 2015).

2. Low cost IT resources and its availability: Cloud computing including the virtualization technology basically provides low cost IT resources and infrastructure access. Cloud computing is also implements per use model. Here the root level farmers are also need to use limited IT though they are able to get resources from the cloud space.

3. Cloud based Agricultural System: The cloud based computerized system is required for monitoring and managing overall information and content related to agriculture. Agricultural society and people is sprinkled international language as well as traditional and local languages and thus it removing the barriers. Online language translation mechanisms are the new gift of NLP Technologies and here cloud has many things to do. Information and content stored in the cloud database may be provided to the native language of farmer cloud agro system Cloud computing is helping the agricultural community for decision making of the crops production based on demand/ supply of the product in market.

Researchers and scientist may also collect farmers' situation and matters with the use of several IT tools and ultimately these may helps in experiments in designing of a new system which may promote agriculture more better way.

4. Agricultural Information Delivery: Cloud computing brings new systems as well as solutions based on problems of the farmers and cultivator that basically different stages of their farming processes starting from tilling to marketing and selling of their products. Cloud computing based system is an easy alternative to provide information and similar content. Expert advice regarding agriculture domain may be collected from the stored databases on cloud. It is become an important and valuable root to decipher the farmers problems right away very faster and accurately process (Mahesh D. S, 2014 and Paul, P.K., et.al 2014).

5. Record and data automation on land: Cloud computing provides large scale storage and thus land related records may be stored in this systems instead of manual one. Storing, managing land related record with full details like land purchasing details, soil analysis result and production history etc may avail from the system.

Agriculture and Cloud: The Challenges:

Though Cloud computing provide us several benefits but it also deals with several challenges and issues which include:

1. Computer and Systems availability

In the developing and undeveloped countries and their rural area are suffering with the financial problem. Thus purchasing computer and similar system is a burden in many cases. Electricity and its availability is a big problem in a developing nation and without that Cloud become impossible. Rain, cyclone as well as other natural condition is also a big factor on continuous power supply, internet etc.

2. Connectivity of Internet and Networks

In most of the developing countries poor network and internet access is a big factor. Hence the cultivator needs healthy and better internet connections. In the remote areas connectivity is not provided or very poor and thus it may disrupts the cloud based agricultural system. To provide and delivery internet connection by the mobile services it is an important to find out the possible easy delivery.

3. Computer Knowledge and Literacy

Computer Literacy is an important matter for developing Cloud computing based agricultural products. Most of the people in the world living in rural areas and they are not aware about the computer operation. Hence steps towards computer literacy and information literacy are the important and valuable issue.

4. Internet consciousness

Similar to the computer awareness, another important issue is internet awareness. Internet literacy needs to build among the common people. For internet awareness several steps may be taken. The governmental issue, technology issue also played a valuable role (Paul, P.K. et.al, 2015).

SUGGESTION

- From the point of sight of cost of setting up as well as low startup Cloud computing is an important issue and factor.
- Information management is also an important factor that based on information collection it is better to collect the information.
- Promoting as well as the circulation of agricultural products by the Cloud computing is also an emerging issue.
- Link and connection between farmers as well as customers makes it complex problem for farmers as well as cultivator to derive reimbursement.

- Unemployment and similar problem is determined as services and here Cloud computing based tools may be a good alternative.
- Data and information accessibility any time and any place is also a big factor and matter.

CONCLUSION

Cloud Computing comes with several kind of benefits. These types of systems are possible with better and healthy ICT implementation. Government steps are very much important and urgent for Cloud computing implantation in agriculture space. Here the ministries of technology and agriculture, both or others need to do the task in collaborative manners. Government need to provide special schemes and proposal to access these things easily similar to access of electricity, telephone etc to keep in mind for rural areas and community.

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