

# Discovering the Scope of Mobile Agent Technology in Cloud Computing Environment: A Study

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**Abstract-** The Cloud Computing has come into spectacle as a new computing archetype. It proposed to provide consistent personalized dynamic computing environments which helps to focused towards better quality of service, storage and infrastructure (network) availability with minimum cost. This paper explores the cloud computing personification from various aspects like service models, deployment model, also it focus on the issues like intrinsic challenges and explores the potential scope for research. It also study the potential of amalgamating mobile agents as a software technology in cloud computing, since both these technologies are capable and commercially useful thus the idea is to doggedness challenges concerning in cloud computing by controlling mobile agent technology.

**Key Words -** Cloud Computing, IaaS, Mobile Agents, PaaS, SaaS, cloud deployment model.

## I. INTRODUCTION

This paper aims to study the review of the research already been done and highlights the research challenges which still require attention. In this paper we are discuss different issues of cloud computing like basic terminology of cloud computing, review the service model architecture with different types of deployment model(types of clouds) and the role of mobile agent in cloud computing. We were also talk about how mobile agents technology is beneficial for cloud computing and role of that technology. We were also discuss the future of this technology integrating with cloud computing and challenges of it.

Now days the role of Computing is being changed and it converts to a model consisting of services that are uses and delivered in a manner similar to traditional utilities[1]. In such a model, users access services based on their requirements without regard to where the services are hosted or how they are delivered. There is lots of computing who transport this utility through various computing technologies like cluster computing, Grid computing, and more advance Cloud computing. In the concept of cloud computing the businesses and academican (users) are able to access applications from anywhere in the world on demand (including infrastructure, storage and network). Thus the computing world is hastily motivated towards developing software to use as a service, rather than to run software on their individual computers[1,2].

In Cloud computing all computational operations is made to be performed over the cloud as it is based on internet. We know that if we want to use the resources for which we required more cost to pay. So it is better to use the resources on rent basis rather than to buy our personal resources. Cloud computing provides pool of resources which include the storage and computing server to the different users. The environment of cloud computing is in distributed fashion which may dynamic in nature.

## II. BASIC TERMINOLOGY OF CLOUD COMPUTING

The Cloud computing offers variety of services to the users such as flexible dynamic IT infrastructures, good QoS (Quality of Service), computing environments and configurable software services. As Cloud computing is an Internet-based computing it can be shared resources, software, and information and provided to computers and other devices on demand as per the requirement. The term "cloud" is used as a metaphor for the Internet[2]. Many formal definitions have been proposed in both academia and industry, the one provided by U.S. NIST (National Institute of Standards and Technology) appears to include key common elements widely used in the Cloud Computing community: Cloud computing is a model for facilitating convenient, as per 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[3].

### 2.1 Characteristics of Cloud Computing

- On-demand self-service: where a consumer can unilaterally provision computing capabilities as needed automatically without requiring human interaction.
- Broad network access: where the capabilities are available over the network and accessed through standard mechanisms, promoting the use of heterogeneous thick or thin client platforms such as mobile phones, laptops, and PDAs.
- Resource pooling: where the provider's computing resources are pooled to serve multiple consumers

using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumers demands.

- Rapid elasticity: where the capabilities can be rapidly and elastically provisioned.
- Measured service: where the cloud service providers automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service.

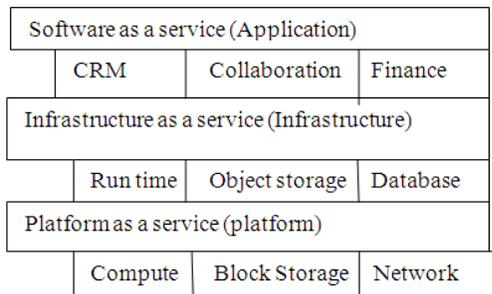
## 2.2 Advantages of Cloud Computing

- Ubiquitous network access
- Location independent resource pooling
- Rapid elasticity
- Pay per use
- Virtualization
- Flexibility
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## III. CLOUD COMPUTING ARCHITECTURE

Architecture of cloud computing mainly comprises of four layers: Hardware, Infrastructure, Platform and Application. Figure 1 given below provides the architecture of cloud computing. These four layers facilitate three different types of cloud services i.e. Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). These layers are described in detail as follows:

**Fig 1: Architectural layered approach of cloud computing**



**3.1 Software as a Service (SaaS):** Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet. SaaS is on demand computing delivery model. Generally SaaS model is available into two forms first the hosted application management and second is software on demand model.

**3.2 Platform as a Service (PaaS):** PaaS provides resources such as Operating System and software development frameworks. In Platform as a service (PaaS) the customer has the freedom to develop, run and manage multi tenant applications. These applications are user friendly as they can be easily modeled and launched with minimum tolerance. There are two ways of delivering PaaS.

**3.3 Infrastructure as a Service (IaaS):** This type of cloud computing offers computing resources which are virtualized over the Internet. IaaS is also considering used as a cloud computing service, alongside Software as a Service (SaaS) and Platform as a Service (PaaS). In an IaaS model, a third-party provider hosts hardware, software, servers, storage and other infrastructure components on behalf of its users. The IaaS providers hold the capacity to host the users' applications and handle tasks including system maintenance, backup and resiliency planning. Another outstanding feature of IaaS platforms is it offers extremely accommodating resources that can be adjusted on-demand. IaaS customers pay on a per-use basis as per they use the services, typically by the hour, week or month [3].

| Service model | Advantages  | Disadvantages   |
|---------------|---|---|
| <u>SaaS</u>   | <ul style="list-style-type: none"> <li>• Ease in administration.</li> <li>• Automatic updates and patch management.</li> <li>• Compatibility.</li> <li>• Global accessibility.</li> </ul>   | /   |
| <u>PaaS</u>   | <ul style="list-style-type: none"> <li>• It allows for higher-level programming.</li> <li>• It will help to reduced complexity.</li> <li>• Easy to maintain applications.</li> <li>• It can also be useful in situations where multiple developers are working on a single project involving parties who are not located nearby.</li> </ul> | <ul style="list-style-type: none"> <li>• Locking a platform.</li> <li>• Lack of support</li> <li>• To hack the system.</li> </ul>       |
| <u>IaaS</u>   | <ul style="list-style-type: none"> <li>• Automation of administrative tasks.</li> <li>• <u>Dynamic scaling</u>.</li> <li>• Desktop virtualization and</li> <li>• Policy-based services.</li> </ul>  | <ul style="list-style-type: none"> <li>• <u>IaaS</u> only provides basic security (perimeter firewall, load balancing, etc.)</li> </ul> |

## IV. COMPARATIVE ANALYSIS OF DEPLOYMENT MODEL

| Deployment model | Advantages   | Disadvantages   | The situation in which we use type of cloud  |
|------------------|--|---|--|
| Public cloud     | <ul style="list-style-type: none"> <li>➤ Ability to scale seamlessly on demand scalability.</li> <li>➤ Elasticity</li> <li>➤ Accountability</li> <li>➤ Low-cost, pay-as-you-go model</li> <li>➤ Greatest efficiency in case of shared resources</li> </ul> | <ul style="list-style-type: none"> <li>➤ Lack of control</li> <li>➤ Slow speed</li> <li>➤ Lack of investment</li> <li>➤ Perceived weaker security</li> </ul>  | <ul style="list-style-type: none"> <li>➤ Standardized workload for applications is used by lots of people, such as e-mail.</li> <li>➤ Need to test and develop application code.</li> <li>➤ Need incremental capacity (the ability to add compute resources for peak times).</li> <li>➤ Collaboration is used in project.</li> </ul>   |
| Private cloud    | <ul style="list-style-type: none"> <li>➤ Greater control</li> <li>➤ More security</li> <li>➤ High performance</li> <li>➤ Customizable</li> <li>➤ Deeper compliance</li> </ul>  | <ul style="list-style-type: none"> <li>➤ Higher cost</li> <li>➤ Onsite maintenance</li> <li>➤ Capacity ceiling</li> </ul>   | <ul style="list-style-type: none"> <li>➤ We need data independency with cloud efficiencies.</li> <li>➤ We want consistency of data and control across services.</li> <li>➤ We have more server capacity than your organization can use</li> <li>➤ Data center must become more efficient.</li> </ul>   |
| Hybrid cloud     | <ul style="list-style-type: none"> <li>➤ Cost effective</li> <li>➤ Increased flexibility</li> <li>➤ Better security and control</li> <li>➤ More scalability of resources</li> </ul>  | <ul style="list-style-type: none"> <li>➤ performance</li> <li>➤ security</li> <li>➤ management</li> <li>➤ infrastructure dependency</li> <li>➤ security compliance</li> <li>➤ networking</li> </ul> | <ul style="list-style-type: none"> <li>➤ If company wants to use a SaaS application regarding the security.</li> <li>➤ If company offers services that are tailored for different vertical markets.</li> <li>➤ You can use a public cloud to interact with the clients but keep their data secured within a private cloud.</li> <li>➤ If we can provide public cloud to your customers while using a private cloud for internal IT.</li> </ul> |
| Community cloud  | <ul style="list-style-type: none"> <li>➤ Cost is cheaper.</li> <li>➤ Easy to manage</li> <li>➤ Quick result with time.</li> </ul>  | <ul style="list-style-type: none"> <li>➤ Costs higher than public cloud.</li> <li>➤ Fixed amount of bandwidth and data storage</li> </ul>   | <ul style="list-style-type: none"> <li>➤ If there is need to share resources.</li> </ul>   |

## V. SCOPE OF MOBILE AGENTS IN CLOUD COMPUTING PARADIGM

Mobile Agent :A Mobile Agent, namely, is a type of software agent, with the feature of independency, collective facility ,knowledge and most significantly, mobility[4]. Mobile agents technology is basically use to address the services such as load balancing, fault masking and service discovery . A Mobile Agent (MA) is a software module that autonomously migrates from machine to machine in a varied network. It can be networked with every machine that offers different services to perform some desired task on behalf of the user[5,6]. MA can be used as intermediary between users and ubiquitous devices that we are using while performing operations. When Mobile agents are shift from one to another process, it saves its own state, transports this saved state to the new host, and recommence execution from the previous state that can be saved[7,8].

Mobile agents are codes that are active in that they can choose to migrate between computers at any time during their execution. Because of the feature of transportation of process from one state of one environment from other is mostly helpful in cloud computing as cloud used distributed application and hence we proposed to use mobile agent in the given architecture useful for educational environment as well as for businesses[9]. Benefits of mobile agent are as follows:

- Overcomes Network Delay
- Can work asynchronously and autonomously
- Dynamic in Nature
- Cooperative in nature
- Robustness
- Fault Tolerance
- Protocol Encapsulation
- Social
- Reactive/Proactive

Mobile agents proved them as beneficial as they have widely been used in semantic web services, e-commerce based applications, feeler and wireless networks. Now this technology may provide solution to challenges still existing in Cloud computing[10]. While working with the environment of cloud computing the major issue is related to the quality of service and fault tolerance. Usually when user wants to perform different operations like either they deploy their applications on cloud or to access the information from cloud data center the cloud service provider will help to manage all these things. While accessing information from cloud data center habitually user requests are sent directly from cloud to World Wide Web which leads to increase in network traffic and improved retort/response time. Instead if mobile agents are employed for providing various services, then network traffic may be reduced while at the same time reducing response time since MA can replicate themselves as and when desired and can transmit over the network from one machine to the other and perform the operations locally on the distant machines rather than sending requests and waiting for the response[11].

Many of applications based on mobile agents are recently used for web services discovery.As we know cloud computing support distributed systems, Mobile agent technology has been endorse as an emerging technology that makes it much simple to design, execute and maintain distributed systems.

As mobile agent is agent based software technology with several capabilities [12]. A mobile agent technology always

does not offer intelligent capabilities like reactive, proactive, and social behaviors. These capabilities help to resolve the problem of scalability and processing. And hence it is not always used in distributed approaches rather than it is just to use for the implementation approach of distributed systems not for intelligent systems.

## VI. ADVANTAGES OF MOBILE AGENT USED IN CLOUD COMPUTING

- Ease in searching: Mobile Agents are able to search for information in a smarter way, for example searching by concepts.
- Reduced communication costs: Mobile agent technology enables remote communications to operate as local communications.
- Flexible execution: After transferring the data from source to the destination side, a mobile agent does not have to interact with its source-side computer. This allows running procedure on server site and allowing transaction on client site.
- Ease in management: A mobile agent is locally executed on the computer it is visiting. It can directly access and control the equipment for the computer as long as the computer allows it to do .
- Improve accessibility: mobile agent will help to search the information easily with the help of model that it is used.
- Dynamic-deployment of software: mobile agents are useful in smart environments, because they consist of computers whose computational resources are limited.
- Quality improvement: The use of multiple mobile agents to execute services improves the quality of the proposed solution and to reduce the waiting time of the user.

## VII. USES OF MOBILE AGENT IN CLOUD COMPUTING

- *Mobile agent technology will be used* in traffic management systems of cloud computing.
- In the specification of discovery the cloud leads to use the mobile agent technology for web service discovery [13].

Mobile agent will help in mobile application development which involves collaboration between mobile and cloud to improve the performance for computability.

## CONCLUSION

Cloud computing is an emerging technology which serves the different services, storage and network over the network. It is a field of research with lot of potential for research and applicability in different area. This paper reviewed the recent advances of cloud computing. Cloud provides different services (storage, resources and network capabilities) to the customer through service providers.

This paper reviews the detail of these service models with its advantages and the scope to use it. We can also see the deployment model of cloud computing with its advantages and features. The cloud computing has lots of research challenges that have been elaborated to provide directions for future research. This field although requires more awareness about new technology and requires rigorous research efforts to overcome existing challenges. Mobile agent technology has been explored and its applicability in CC is analyzed. It is observed that there is wide scope for mobile agents in this computing paradigm if cloud computing is integrating with mobile agent technology .Due to special features of mobile agent technology it will give best result if we integrate it with cloud and hence it will help for future research challenges. In this paper, we are interested in the technology of mobile agents and their use for cloud computing environments.

From the study we analyze that if we use mobile agent technology in cloud computing we have lots of advantages regard of that few of them are as follows

- Reduced traffic control.
- Condensed amount of information exchanged.
- It will help to improve QOS with waiting time of the user.

Further research can be undertaken to improve the work presented. We proposed to work on integration techniques that will help to make system. We also take into account the acceptance of mobile agent technology not only in cloud computing but it also used in various area of research.

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