Chapter 97
Multi-Disciplinary Research Issues in Cloud Computing

Jitendra Singh
University of Delhi, India

Vikas Kumar
Asia-Pacific Institute of Management, India

ABSTRACT

Cloud computing, characterized by on demand availability of resources is gaining a lot of popularity in the present day business scenario. This new computing paradigm is predicted to revolutionize the Information Technology industry with its dynamic and scalable capabilities. Cloud computing is catering to the needs of a wide variety of users, across the different parts of the world with its huge number of offerings. Information technology resources are offered as services over the Internet, which leads to a number of technical and management concerns. Data is stored away from the users’ premises, leading to various challenges in maintaining security, privacy and regulatory compliances. Therefore, cloud computing does not involve single discipline rather multi-discipline. Considering this multi-disciplinary involvement, current work focuses on identification of research issues in the cloud computing environment, and categorizing these issues in the technical, legal and management domains. Work further discusses the multi-disciplinary research areas where cloud computing is currently focused and suggests the potential areas for further research.

1. INTRODUCTION

Cloud computing is a new style of computing where scalable and flexible information technology (IT) related capabilities are provided as a service (Lin, Fu, Zhu, & Dasmalchi, 2009; Yeo et al., 2010). Users can access the IT resources anytime and from anywhere using multiple devices such as computer workstations, laptops and smart phones etc. (Park & Ryoo, 2012). Cost saving, dynamic scalability and high availability are some of the most significant advantages of cloud computing. Even though, cloud is a new concept, it evolved from some of the existing technologies. It has come through a long journey of computing phases and changed drastically in last few decades (Voas & Zhang, 2009). The developments in computing can be categorized as described below:

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Phase 1: General purpose programmable computer;
Phase 2: Analog computers, non-flexible in nature. They were slow and had to be wired manually;
Phase 3: Digital computers to solve complex problems. These computers were fast in comparison to analog;
Phase 4: Users had dumb terminal and were sharing the powerful mainframes;
Phase 5: Users had autonomous computers with computing functionalities like a processor, memory and storage. Because of their own components, they did not depend on the mainframes;
Phase 6: PCs were connected to other computers and servers to form a network, so that the data sharing could take place. This also led to an improvement in performance;
Phase 7: Local networks were connected to global networks to form internet for global sharing;
Phase 8: Grid computing allowed the sharing of computing power and storage through distributed computing system;
Phase 9: Computing to become commodity and shared resources are provided on the Internet. Resources are scalable to cater the increased need.

At a first instance, comparing these paradigms, it appears that we have reached back to the mainframe computing. However, this is not true as cloud paradigm is significantly different from the mainframe and their differences are depicted in Table 1.

Depending upon the ownership, cloud computing paradigm has been categorized into four deployment models as: a) Private cloud b) Public cloud c) Hybrid cloud d) Community cloud (Mell & Grance, 2011). Among all the above deployment models, public cloud is having the highest scalability and minimum upfront cost. As a result, it is widely preferred and adopted by small and medium enterprises (SME’s). Public cloud adoption is further amplified due to the economic downturn that compelling the cost cutting to majority of the organizations (Pucciarelli, 2011). Public cloud focuses on five major areas of services, i.e. application development, application deployment, infrastructure, storage and servers. A recent International Data Corporation (IDC) survey has predicted that the worldwide market for the public IT cloud services to grow continuously at a blistering pace (Pucciarelli, 2011). IDC forecasts that public IT cloud services spending to reach $72.9 billion worldwide by 2015, a compound annual growth rate (CAGR) of 27.6% (Pucciarelli, 2011).

In the private cloud, organizations are maintaining the infrastructure and looking after the security themselves. This is also one of the most popular forms of cloud that is widely used by the cloud users. The main reasons for private cloud usage are the user’s control on the data while at data transfer as well as during storage. In private cloud, privacy of the data and legal compliances can be well taken care of by the owning organization.

All the above discussed cloud deployment model are not equally adopted by the cloud users instead it varies widely. Adoption of any cloud

<table>
<thead>
<tr>
<th>Table 1. Mainframe versus cloud computing</th>
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<tbody>
<tr>
<td><strong>Mainframe</strong></td>
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<tr>
<td>Computing Power</td>
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<tr>
<td>User Interface</td>
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<tr>
<td>Uses dumb terminals</td>
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<td>On demand scalability is not supported</td>
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