Chapter 35
Virtual Machine Placement Strategy for Cloud Data Center

Sourav Kanti Addya
National Institute of Technology, India

Bibhudatta Sahoo
National Institute of Technology, India

Ashok Kumar Turuk
National Institute of Technology, India

ABSTRACT
The data center is the physical infrastructure layer in cloud architecture. To run a large data center requires a huge amount of power. A proper strategy can minimize the number of servers used. Minimization of active servers caused minimization of power consumption. But the maximum number of virtual machine placement will be a monetary benefit for cloud service providers. To earn maximum revenue, the CSP is to maximize resource utilization. VM placement is one of the major issues to achieve minimum power consumption as well as to earn maximum revenue by CSP. In this research chapter, we have formulated an optimization problem for initial VM placement in the data center. An iterative heuristic using simulated annealing has been used for VM placement problem. The proposed heuristic has been analysis to be scalable and the coding scheme shows that the proposed technique is outperforming traditional FFD on bin packing technique.

1. INTRODUCTION
Cloud computing is an emerging computing technology that uses the Internet and central remote servers to maintain data and applications. This technology is expected to be much more efficient computing than the presently available technology by centralizing the storage, memory, processing and bandwidth. It allows consumers and businesses to use applications without installation and access their personal files on any computer with the help of Internet. A list of a few organizations and their contribution in the field of cloud computing is shown in Table 1 (Marston et al., 2011). Some of the dominant cloud computing products are Amazon EC2, Microsoft Window

DOI: 10.4018/978-1-4666-9466-8.ch035
Azure platform, Google App engine, etc. Over the past few years IBM, Google, Amazon and Microsoft are able to provide powerful, efficient and reliable cloud computing infrastructures. The major benefits that are achieved from the cloud computing infrastructures are *No up-front investment, Lowering operating cost, Highly scalable, easy access, Improved automation and Sustainability* (Zhang et al., 2010).

Some renowned organization, such that The National Institute of Standards and Technology (NIST) (NIST, n.d), Cisco (Bakshi, 2009) made standard definition for cloud computing.

- **NIST Definition**: Cloud computing is a model for enabling convenient, 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 of service provider interaction.

- **Cisco Definition**: IT resources and services that are abstracted from the underlying infrastructure and provide “on-demand” and “at scale” in a multitenant environment.

Setting up and maintaining the IT infrastructure for any small or large scale organization to meet their IT need is a difficult task, especially for non IT organization. The up-front, operational and maintenance cost is higher which may not be actually need for the organization. Cloud computing offers the solutions for these types of problem as well as maintain the client data and information secure. Public cloud offers on-demand storage and virtual host (VM) to the client at a low rate. Beside these, the few other cloud environment offers the development environment without complete purchase of the application.

Two main important characteristic to implement a large scale cloud data centers are a great deal of flexibility and agility. In the real time scenario, the needs of *computer resources* to be available in a short time period for the dynamic scaling and shrinking requirement. At the time of overloaded condition of hardware resources, the dynamic transfer is required for some load to another system with a minimum downtime for the users’ service. *Virtualization technology* can provide this kind of flexibility.

**Characteristics**

The cloud computing, grid computing, high performance computing (HPC)/supercomputing, and data center computing all belongs to the family of parallel computing. HPC focuses on scientific

### Table 1. Contribution of Different organization in cloud computing

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Cloud Name</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>Blue Cloud</td>
<td>By using this cloud they access those tools that allow all to manage large scale of application and database. The organization spends $400 million and try to expand the number of researchers in the area of cloud computing</td>
</tr>
<tr>
<td>Google</td>
<td>App Engine</td>
<td>This cloud mainly offers client organizations access to company’s platform by which they can build and host web applications.</td>
</tr>
<tr>
<td>Microsoft</td>
<td>Windows Azure</td>
<td>It is a cloud operating system mainly build on the concept of PaaS to appear in early 2010. Addition with this the organization creating a windows azure operating system to provide different client access several Microsoft product like .NET, SQL, LIVE etc.</td>
</tr>
<tr>
<td>AT &amp; T</td>
<td>Synaptic Hosting</td>
<td>By this all clients will be able to store Windows server and Linux client server applications. Along with they also able to store various we applications. IT is enabling clients to store their data on AT&amp;T’s cloud.</td>
</tr>
<tr>
<td></td>
<td>Synaptic storage</td>
<td></td>
</tr>
</tbody>
</table>