Chapter 67
Fuzzy Dynamic Load Balancing in Virtualized Data Centers of SaaS Cloud Provider

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ABSTRACT

Cloud computing provides a robust infrastructure that can facilitate computing power as a utility service. All the virtualized services are made available to end users in a pay-as-you-go basis. Serving user requests using distributed network of Virtualized Data Centers is a challenging task as response time increases significantly without a proper load balancing strategy. As the parameters involved in generating load in the Virtualized Data Center has imprecise effect on the overall load of Virtual Machine, a fuzzy load balancing strategy is required. This paper proposes two efficient fuzzy load balancing methods - Fuzzy Active Monitoring Load Balancer (FAM-LB) and Fuzzy Throttled Load Balancer (FT-LB) for the distributed SaaS cloud provider. The authors implemented a cloud model in simulation environment and compared the results of otheir novel approach with the existing techniques. Among them FT-LB has provided better performance compared to other scheduling algorithms.

1. INTRODUCTION

Cloud computing is a fast growing field both in computing industry and research. Cloud has been flourished under the idea that computing can be provided to the end users as a utility service like electricity. It comes with many types and layers of computing services like –Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Many industries have flourished in this business such as Amazon EC2 (Amazon, 2015), Salesforce (2015), Microsoft Azure (2015). End users now get relief of the trouble of dealing with the complex underlying structure of computing and they can have any service they want in a pay-as-you-go basis (Buyya et al., 2009). Therefore, cloud provid-

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ers have to deal with users who are not permanent rather temporary ones. These users request service for a short time and then pay according to that. So cloud providers, particularly SaaS, are now facing a huge amount of user requests in a short time. Thus, a good load balancing strategy is a vital factor in providing a good response time.

Load Balancing in cloud environment is a fascinating challenge as it is essential for the growth of cloud industries. SaaS Cloud providers with intense user traffic require a good load balancing strategy. We focus on load balancing strategies in this paper. Our primary interest is to investigate the existing load balancing strategies and provide more robust techniques to improve performance. Many algorithms like Round Robin Scheduler, Active Monitoring Load Balancer, Throttled Load Balancer (Wickremasinghe et al., 2010), and Min-min Scheduler (Kon et al., 2011) have been discussed in literature. Each of them has its own pros and cons. Round robin and Min-min scheduler have very simple idea of load balancing but they often fail to address the problems of unpredicted internet traffic. Active Load Balancer schedules traffic based only on the current task allocation count and ignores all other important parameters. Throttled Load Balancer basically implements a queuing strategy to address the load balancing. The inherent structure of load balancing is rather imprecise than direct. It mostly depends on the parameters of resource requirements of the user requests. So their fuzzy implication on the overall load status is required to improve the performance of the Virtual Machines. To solve these problems, we proposed Fuzzy Active Monitoring Load Balancer (FAM-LB) and Fuzzy Throttled Load Balancer (FT-LB) which provides superior performance compared to existing ones. The novel characteristics of the proposed methodology include:

1. To make the load balancing decision more accurate we have introduced the memory, bandwidth and disk-space requirements of the user requests to predict the load status of the VMs.
2. To capture the imprecise relation between the various parameters (memory, bandwidth, and disk-space) and load status a Fuzzy Inference system (FIS) is introduced.

This paper is organized as follows: the literature review related to existing Load Balancing techniques are described in Section 2 while Section 3 describes our cloud architecture used in simulation. Our proposed algorithms are detailed in Section 4. The simulation and experimental results are provided in Section 5 followed by concluding remarks in Section 6.

2. LITERATURE REVIEW

2.1. Load Balancing in Virtual Data Centers

A Virtualized Data Center with unpredictable user traffic needs a good load balancing strategy. If all the load of a Data Center is routed to a few servers while the rest sitting idle, it automatically increases the response time needed to serve a request. Uniform distribution of load among all the virtual servers can provide a better response time. Existing literature provides numerous number of load balancing techniques. These techniques are described briefly below.