CS 218 Project 1: Research Project and Oral Presentation

Load Balancing Algorithms in Cloud Computing

Project Report Outline

Team Members:

Piyush Bajaj
piyush.bajaj@sjsu.edu

Saketh Saxena
saketh.saxena@sjsu.edu

Introduction

Cloud computing is a computing model which ensures delivery of computing services such as servers, storage, databases, networking and software over the internet and is commonly referred to as the cloud. Cloud Load Balancing is a technique to divide the load among different available resources and equalize it across virtual machines to achieve efficiency and increases throughput. [4] Cloud computing brings advantages such as "cost, flexibility and availability of service users."[5] These advantages make the demand for cloud services to rise which brings along a lot of technical issues such as availability of resources and scalability. Thus, load balancing becomes a major concern and requires to dynamically allocate workload evenly across all nodes. There have been many load balancing algorithms and policies, such as the Load balancing Min Min (LBMM), workload and client aware policy (WCAP), Random Biased Sampling, etc. and many new algorithms have been proposed with the aim to increase the efficiency of load balancing some of which we will be analysing such as LB-BC and LB-VC-FC algorithms to understand how they work and compare their performance.

Overview of Cloud load balancing algorithms:

1) Load Balancing based on Bayes and Clustering Algorithm (LB-BC):

A novel heuristic approach is implemented called Load Balancing based on Bayes and Clustering (LB-BC) [1] to improvise the selection problem of physical hosts for deploying requested tasks more efficiently. Most previous works, generally, utilize a series of algorithms through optimizing the candidate target hosts within an algorithm cycle and then picking out the optimal target hosts to achieve the immediate load balancing effect. However, the downside is that for the next task, the efficiency of high execution is not guaranteed although it has abilities in achieving high resource utilization. Based on this methodology, LB-BC introduces the concept of achieving overall load balancing in a long-term process in contrast to the immediate load balancing approaches in the current literature. LB-BC makes a limited

constraint about all physical hosts aiming to achieve a task deployment approach with global search capability in terms of the performance function of computing resource. The Bayes theorem is combined with the clustering process to obtain the optimal clustering set of physical hosts finally. This approach has improved the throughput, reduced the failure number of task deployment events and optimized the external services performance of cloud data centers.

2) Load Balancing Algorithm for Virtual Cluster Using Fuzzy Clustering (LB-VC-FC):

With the development of virtualization technologies, virtual clusters have been widely applied. [3] The dynamically changing node loads within the virtual cluster cause difficulties in reasonably partitioning the comprehensive loads consisting of multi-dimensional factors. [2] Thus, it is extremely important for the virtual clusters to dynamically balance the loads of different computing nodes and ensure high utilization efficiency of system resources. The basic idea of a fuzzy based clustering algorithm is to take into consideration all the loads of various system resources together. Most traditional fuzzy based algorithms only consider the CPU load, consider network resources as ideal data links and fail to fully consider the features of virtual cluster. To realize the quantization of comprehensive loads, each load of system resources is treated as one dimension of the comprehensive loads and feature weight is attached to each dimension. [2] The improved fuzzy clustering algorithm optimizes distance metric, adds weight constraints and penalty terms, to build the specific objective function for load data of virtual cluster. During load balancing, the suitable objective node for virtual machine migration is located based on clustering partition. Experiments demonstrate that the proposed algorithm can achieve fuzzification of multi-class load data and balance loads within virtual cluster.

Conclusion

The conclusive analysis and comparison of the cloud balancing algorithms from [1] and [2] will help us in understanding the nuances of cloud load balancing in physical as well as virtual clusters and help in deciding which algorithm is best to use to provide efficient load balancing during tremendous spikes in resource requests.

Future Work

Based on our learning from this research project we would like to propose a model to implement a dynamic selection strategy of the Cloud Load Balancing algorithms to manage the load efficiently across multiple nodes using approaches discussed in [4].

Report Organization

Our research report for “Analysing Cloud load balancing algorithms” will have the following headings and subheadings:

- Title

- Contents
- Abstract
- Introduction
- Overview of Cloud load balancing algorithms
- Analysis
    - Analysis of algorithm 1
    - Analysis of algorithm 2
    - Analysis of algorithm 3
- Comparison of above algorithms
- Results
- Conclusion
- Future Work
- References

References

[1] Zhao, Jia, et al. "A heuristic clustering-based task deployment approach for load balancing using bayes theorem in cloud environment." IEEE Transactions on Parallel and Distributed Systems27.2 (2016): 305-316

[2] Huang, Weihua, et al. "Load balancing algorithm for virtual cluster using fuzzy clustering." Computer and Communications (ICCC), 2016 2nd IEEE International Conference on. IEEE, 2016.

[3] S. Wu, H. B. Chen, S. Di, B. B. Zhou, Z. J. Xie, et al. "Synchronization-Aware Scheduling for Virtual Clusters in Cloud," IEEE Transactions on Parallel and Distributed Systems, vol. 26, no. 10, 2014, pp. 2890-2902.

[4] Khara, Satvik, and Umang Thakkar. "A novel approach for enhancing selection of Load Balancing algorithms dynamically in cloud computing." Computer, Communications and Electronics (Comptelix), 2017 International Conference on. IEEE, 2017.

[5] Randles, Martin, David Lamb, and A. Taleb-Bendiab. "A comparative study into distributed load balancing algorithms for cloud computing." Advanced Information Networking and Applications Workshops (WAINA), 2010 IEEE 24th International Conference on. IEEE, 2010.