

A Study on Various Load Balancing Algorithms for Mobile Cloud Computing

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Abstract - Mobile Cloud Computing is the brain child of cloud computing and mobile computing. Mobile Cloud Computing is a cutting edge technology in the concept of computing. There are lot of paybacks of this emerging technology such as scalability, data sharing, resource sharing, computational offloading, and quick response time. In MCC, data are stored in the distributed environment. So accessing the stored data will increase lot of computations and network traffic. This will lead to the congestion and network imbalance. In the MCC, load balancing is one of the challenging issue to keep track of multiple resources with dynamic workload. So many load balancing algorithms have been introduced to balance the dynamic load among the multiple nodes in the distributed environment. Load balancing facilitates to achieve the optimum utilization of resources by balancing the network load. Hence, it augments the performance of overall network performance. There are few static and dynamic load balancing algorithms are proposed to achieve good balancing among the network nodes. It is vital to achieve good balancing with significant resource utilization. This paper is aimed to discuss some of the load balancing algorithms for MCC.

Keywords: Mobile Cloud Computing, Load Balancing,

I. INTRODUCTION

The endemic growth of mobile and portable devices generated a tremendous challenge to administer the network traffic in a distributed environment. MCC offers numerous resources for the mobile users. MCC architecture enables the users to access wide range of servers, storages, applications and network access facilities. Internet Service Providers can manage the mobile users with minimum exertions. There are lot many advantages of using mobile cloud computing such as processing capacity, enriched synchronization and mobility services. Lot many mobile users started accessing clouds to process their data in an economical way. So providing the guaranteed service to everyone is the major issues in MCC [1]. The mobile cloud computing characteristics are classified as on-demand service, wide network access capabilities, resource sharing, rapid elasticity and measured service. MCC is aimed to bring out the battery life, computation time, communication and other services for the users. MCC has significant issues such as security, bandwidth, cost, mobility, device energy, network connectivity, location awareness and context awareness. [2]

A. Need for Load Balancing

Common objectives of traffic engineering include balancing traffic distribution across the network and avoiding congestion hot spots [3]. Load balancing techniques are used to migrate the tasks between the overloaded datacenters and to the underutilized datacenters. So it assists to increase the data processing capacity for the datacenters. MCC load balancing guarantees the following benefits to the users such as availability of the resources, high bandwidth at lower cost,

saving energy, saving time, reduce waiting time and quality of service.

B. Measures for Load Balancing:

There are several measures in prevailing load balancing algorithms given below:

a) Scalability:

This is about the competence of a load balancing algorithm to manage the increasing load in the network. Mobile apps need to meet the uncertain user demands. Service provides can easily expand/add application with or without any constraint [4].

b) Network Resource Utilization:

The aim is to utilize the resources optimally according to the load.

c) System Performance:

All the load balancing algorithm must check the efficiency of the system by reducing the delays.

d) Minimized Response Time:

An amount of time taken to respond to a particular task must be minimized by the load balancing algorithm.

II. LOAD BALANCING IN MOBILE CLOUD COMPUTING

Load balancing is classified as two types of algorithms:

A. Static load balancing algorithms

This simple algorithms can be implemented easily without much computing overhead. Static load balancing algorithm do not take the current network state. These algorithms are suitable for network with constant communication speeds. The goal of static load balancing method is to reduce the execution time, minimizing the communication delays [5]. The advantage of this method is reduce the execution delays. The major disadvantage of these algorithm are not suitable for dynamic mobile cloud environment.

a) Round Robin Algorithm

Round Robin algorithm allocates task equally to all the processors in turn like a cyclic queue. The advantage is reduce the operating cost. The performance cannot be achieved due to prolonged execution time by using this algorithm. This algorithm is highly suitable for web server application.

b) Randomized Algorithm

Randomized algorithm selects the processors randomly to attain the best performance.

c) Centralized Algorithm

When the level of network traffic nears, reaches or exceeds the design maximum, the network is said to be congested [6]. This algorithm distributes the traffic load through the central node to all the other nodes. The central node collects the load information about its neighboring nodes to distribute the load evenly to all the processors. Bottleneck is the major disadvantage of this algorithm.

d) Threshold algorithm

This algorithm implements a limiting the workload of a node by giving a predefined threshold value depends upon its processing capacity.

B. Dynamic load balancing

Dynamic load balancing depends upon the changes in the current traffic in the network. When the loads are not uniformly distributed among the path redistribution of these loads [7]. So the network traffic will be distributed dynamically according to the incoming load. These algorithms are suitable for dynamic Mobile Cloud Computing environment. Dynamic load balancing algorithms are classified into distributed and non-distributed.

a) Task Scheduling Algorithm Based on Load Balancing

This dynamic load balancing is to meet dynamic user requirements to attain extreme resource utilization. Virtual machines were mapped first to host resources thus develops the response time, overall performance and resource utilization in this load balancing method.

b) Biased Random Sampling

In this approach, the balancing of the load through all across the network nodes will be done by random sampling. The logical connections of nodes will be created like a graph signifies the load on the server. This approach is suitable for very large networks. This method is fully decentralized method.

c) Min-Min Algorithm

First, minimum job completion time will be calculated for all tasks. Then minimum value of job completion time will be selected among all the tasks. Then the selected task is scheduled to the corresponding machine. Then the job completion time is updated on that machine by adding the execution time of the assigned tasks.

d) Max-Min Algorithm

Max-Min is almost similar as the min-min algorithm except the following: after finding out minimum job completion time, the maximum value is selected which is the maximum time among all the tasks on any resources. Then accordingly, the task is scheduled on the corresponding machine. Then the execution time for all other tasks is updated on that machine by adding the execution time of the assigned tasks.

e) Token Routing

The tokens were moved around the network to minimize the system cost. Mobile Cloud Computing has problem in the distributing the information due to bottleneck problem. This distribution does not have rigid pattern. This method of load balancing can be replaced with the heuristic approach. This routing gives constant and proficient routing outcomes. This algorithm does not consider the state of the

system and knowledge of the neighboring nodes. It always maintains its own knowledge base through the previously delivered tokens to forward the current tokens to the proper destination.

III. LOAD BALANCING CHALLENGES

There are several significant challenges in MCC load balancing methods. A few challenges are addressed here:

a) Energy

Saving energy is another key issue in the MCC environment. Creating common datacenters instead of each company creates its own datacenter.

b) Storage

Data storage and management is strenuous task in Mobile Clouds because disseminating data to the cloud for ideal storage and quick access are two different ideologies and very hard to achieve.

c) Elasticity

In MCC, resource allotment and release must be done automatically without affecting the performance of the system. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time. [8]

d) Resource Virtualization

One of the major challenge is moving tasks from heavily loaded machine to lightly loaded machines because it may create bottlenecks in the Mobile Cloud Computing environment.

CONCLUSION

Load balancing is required to distribute the workload evenly across all nodes to achieve high performance; with minimum overheads [9]. The supremacy of Mobile Cloud Computing is designed to provide all the unsurpassed services of cloud computing to the mobile users. In future, Mobile Cloud Computing can be done with less computations and it can be automated. MCC is extensively embraced by the industries to resolve their existing challenges such as load balancing, virtual machine migration tasks, consolidation of jobs, energy saving. This paper discussed the MCC metrics, challenges with a special emphasis on load balancing techniques. Future research is to unveil efficient multi-objective load balancing of tasks scheduling algorithm with quality of service improvements for homogeneous and federated heterogeneous mobile cloud environment [10].

References

- [1] P. Herbert Raj, P. Ravi Kumar and P. Jelciana, "Load Balancing in Mobile Cloud Computing using Bin Packing's First Fit Decreasing Method", Springer Nature Switzerland AG 2019, S. Omar et al. (Eds.): CIIS 2018, CIIS 2018, AISC Vol 888, pp. 97–106, ISBN: 978-3-030-03302-6_9, 2019.
- [2] M. George, X. M. Constandinos and P. Evangelos, "Resource Management of Mobile Cloud Computing Networks and Environments," IGI Publishing Hershey, PA, USA, March 2015.
- [3] P. Herbert Raj, S. Raja Gopalan, A. Padmapriya, S. Charles, "Achieving balanced traffic distribution in MPLS networks", 2010 3rd International Conference on Computer Science and Information Technology, Volume 8, Pages 351-355, Publisher, IEEE.

- [4] P. Herbert Raj, P. Ravi Kumar, P. Jelciana, "Mobile Cloud Computing: A survey on Challenges and Issues", International Journal of Computer Science and Information Security (IJCSIS), Vol. 14, No. 12, December 2016
- [5] Abhijit A. Rajguru, S.S. Apte : A Comparative Performance Analysis of Load Balancing Algorithms in Distributed System using Qualitative Parameters, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-1, Issue-3, August 2012 . 3. Rajani .SH, Garg .N: A Clustered Approach for Load Balancing in Distributed Systems, SSRG International.
- [6] S. Rajagopalan, E. R. Naganathan& P. Herbert Raj, "Ant Colony Optimization Based Congestion Control Algorithm for MPLS Network", International Conference on HighPerformance Architecture and Grid Computing, HPAGC 2011, Springer Berlin Heidelberg, Volume 169, pp 214-223, 2011, ISBN No.Online ISSN 978-3-642-22577-2.
- [7] S. V. Kasmir Raja, P. Herbert Raj, "Balanced Traffic Distribution for MPLS Using Bin Packing Method" International Conference on Intelligent Sensors, Sensor Networks and Information Processing, 3-6 December 2007, University of Melbourne, Melbourne, Proceedings are published in the IEEE, pp: 101-106, ISBN: 978-1-4244-1501-4, 2007.
- [8]Amandeep Kaur Sidhu, SupriyaKinger, "Analysis of Load Balancing Techniques in Cloud Computing", International Journal of Computers & Technology, Volume 4 No. 2, March-April, 2013, ISSN 2277-3061.
- [9] Zahra Mohammed Elngomi, Khalid Khanfar, "A Comparative Study of Load Balancing Algorithms: A Review Paper", IJCSMC, Vol. 5, Issue. 6, pg.448 – 458, ISSN 2320–088X, June 2016.
- [10] Danlami Gabi, Abdul Samad Ismail, Anazida Zainal, "Systematic Review on Existing Load Balancing Techniques in Cloud Computing", International Journal of Computer Applications (0975 – 8887) Volume 125 – No.9, September 2015.