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A Study of Load Balancing Algorithms in Software Defined Network

Dr. S. Narayanan,
Assistant Professor, Department of Computational Logistics, Alagappa University, Karaikudi, India

Abstract **-** -The Software Defined Networking (SDN) is an methodology for computer network management that improves the performance of the network by dynamic and efficient network configuration. The network control plane and forwarding plane are physically separated and where the control plane regulates the connecting devices. The rapid growth of mobile devices affects the network traffic management. Network Traffic Engineering plays a very vital role in managing the network traffic. The traffic is managed by several load balancing algorithms. The load balancing algorithms aimed to maximize the network utilization and minimize the response time. In order to achieve it, an absolute knowhow of up to date network traffic level is required. The control plane of the SDN maintains the link of the network nodes unlike the traditional network. So it is necessary to deliberate about the customary load balancing algorithms which are suitable for SDN.

Keywords-- *Software Defined Network, OpenFlow, Load BalancingAlgorithms, Throughput, Round Robin, Load Balancer Metrics.*

I. INTRODUCTION

Generally, routing devices route the data packets in a same route which are destined for the same destination.A routing specifies how to route thetraffic between each origin-destination pair across anetwork [1]. Some intelligent routing devices route the packets according to the level of priority. Some routers resolves congestion control and traffic engineering problems. Unpredictable traffic flow is the major cause of network congestion. The traditional IP network does not support any changes in the network infrastructure and hardware due to cost effectiveness. A network performance can be improved by outlining routing rules in a centralized software module so that network administrator can regulate the traffic. This method of traffic regulation is christened as Software Defined Network (SDN). The SDN system decoupled the Data Plane and Control Plane. In the Control Plane, the device called controller manipulates all the routing decisions and relays instructions to the data plane which has router and switch [2]. In SDN, control plane is the in-charge of routing the packets and data plane moves packets from one node to another node. When packet arrives to a router which has predefined algorithm given by the centralized router will decide to forward the packet to the direction. Occasionally, modus operandi of SDN is torequest a controller to issue a routefor a packet which does not have a specific route. This process is entirely different from the dynamic routing method.

II. LOAD BALANCING

The allocation of tasks around multiple resources through a proper network channels is called load balancing. This method allows to achieve better utilization of resources and maximize throughput. The major objective of load balancing is to distribute the load evenly to all the resources in cloud.

In classical network design models consider a graph with n nodes describing the network and a matrix providing the amount of traffic to be delivered for each pair of nodes [3].A management component allocates resources for the request. Monitoring and calculating functions ensure Quality-of-Service (QoS) [4].Here, load balancing is done by a hardware. This will not be helpful in case of changing traffic loads. Hence, in SDN the software load balancing is done. So any time it can be programmable to meet the requirement of vendor-specific devices. Here, various load balancing algorithms are discussed in SDN because it needs more refinement.

The load balancing algorithms can be classified into two methods namely static and dynamic.

A. Static Load Balancing

Static load balancing algorithms do not consider current status of the network. These algorithms work with prior knowledge of statistical information collected about the network [5].

1. Round Robin

The round Robin method mechanism is to divide the process amid all processors in a Round Robin method. This mechanism leads to another problem of processing time between processors. Even though, the process is allotted to each processor equally but processing time will be different for each processor. So at some point of time the processors finish the job earlier may be idle and other processors may still at work.

2. Min Min algorithm

This mechanism tries to find out the least execution time of available tasks from it chooses the task with minimum execution time and that task will be allocated to the resource. This process will be repeated until all the tasks are allocated to all the available resources.

3. Randomized algorithm

In this mechanism processes are allocated self-reliantly to the distant processors. This algorithm maintains the probabilistic approach.

B. Dynamic Load Balancing

Dynamic load balancing algorithms traffic load will be distributed to the processors by considering the current status of the network and load is distributed at runtime [6]. Always the neighboring information will be gathered for new routing decisions.

1. Central Manager

Central Manager maintains a queue if any new request comes in for any activity then it removes the primary activity from the

queue and sends back to the requester. The queue will be buffered if there is no activity is present.

2. Token Routing

This algorithm uses tokens to minimize the load in the cloud. These tokens collects the information about the state of the network and traffic will be distributed according to those information. The routing decision will be made quickly by using this algorithm.

3. Least connection

This is a dynamic algorithm which calculate the number of connections for each server dynamically for appropriation of the load. The connection number is recorded by the load balancer.

The other way of classification of load balancing algorithms are flow request division and flow request distribution among multiple controllers.

C. Load Balancing Among Controllers

A network can be controlled efficiently by dividing into different sub-domains. These sub-domains have an SDN enabled border router which aids in routing other domains.

D. Load Balancing Among Switches

The controller always maintains a table about current status of the network for the switches by sending commands periodically. This is called active method.

In passive method whenever request is sent to the controller then the controller will try to maintain the information about the current status of the network.

There are two types of load balancing done in SDN. The first one is known as nondeterministic load balancing. In this method, different output will be achieved when it is executed with same set of inputs. Deterministic methods yields persistent output same set of inputs [7].

CONCLUSION

The network load balancing is an efficient way to achieve network optimality and to improve efficiency. Here, various load balancing algorithms were discussed. The current load balancing techniques do not consider the whole factors that affects balancing of the load. These algorithms practices simple mechanism to adopt and route through communication path but lacks in performance. In future, few other efficient load balancing algorithms will be introduced to balance the load among controllers and switches.

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