



LOAD BALANCING IN SDN

TEAM MEMBERS:

Mithesh.A - 2019503533

B.Niveditha - 2019503541

Rubak Preyan.G - 2019503553

Yogeeswar.S - 2019503573





DOMAIN INTRODUCTION

MAJOR DOMAIN

Software
Defined Networks

MINOR DOMAIN

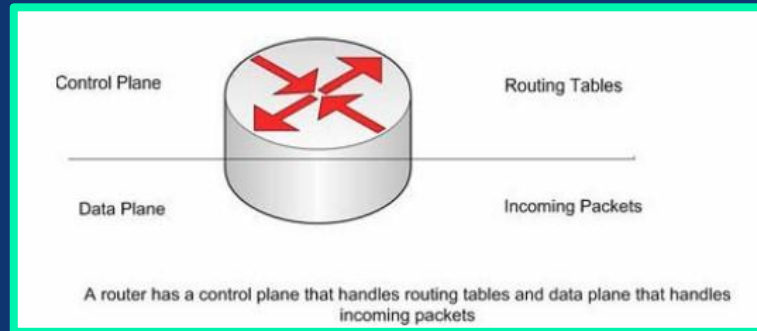
Intelligent Load
Balancing Techniques in
Software
Defined Networks



INTRODUCTION

In the current pandemic situation of COVID-19, where school, colleges, offices are closed, the demand of data is highly increasing. The normal day to day activity is conducted over online means. Classes are shifted to online classes; offices are running in work from home mode. The major problem of this situation is load management. Traditional networks work in a static architecture, so it is very difficult for them to work with dynamic network demands.

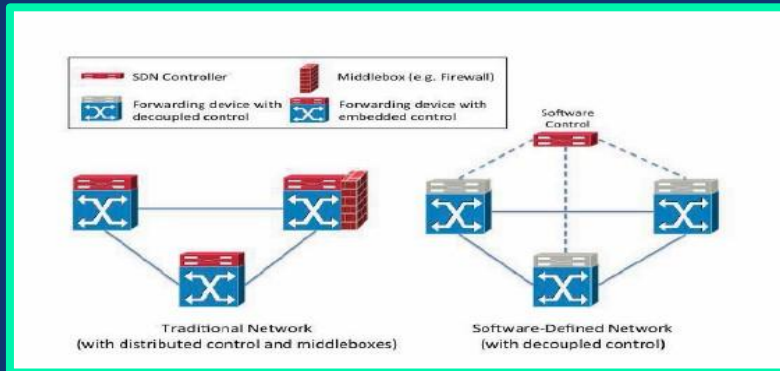
This issue is more challenging in high network traffic cases. The complexity increases at an exponential rate when size of the network increases. In traditional network the router is divided into two planes: the data plane (job of computation) and control plane (job of communication).



SOFTWARE DEFINED NETWORKING (SDN)

The number of routers increase with increase in the size of the network. In a big network, an ample amount of time is spent in route computation than data communication. Software Defined Networking (SDN) frees the routers from computation job, by decoupling data plane and control plane.

The control activity of all the routers are managed by the external controller which controls the entire network and takes the routing decision globally. It also has a piece of software which enables it to make decisions for network management.



TRADITIONAL VS. SOFTWARE DEFINED NETWORKS

These networks are static and are not flexible.	These networks are dynamically programmable (they can be programmed before deployment and while the network is running.)
These are made up of hardware devices	These are created using open softwares.
Traditional networks are made up of hardware devices.	Software defined networks are created using open softwares.
These networks consist of a control plane, data plane and a management plane.	These networks consist of a single layer of data plane with an openflow API interfaced with a controller which comprises of the control and management plane.
These work using protocols.	These use APIs to configure as per the needs.
It has a distributed control plane.	It has a centralised control plane.



LOAD BALANCING TECHNIQUE

With the increase in the number of packets, the controller is over burdened with taking routing decisions. An effective load balancer helps in evenly distributing the network load to improve network parameters such as latency, network throughput, fault tolerance and resource utilization effectively. It also takes care to minimize the power consumption issues of the overall network.

The main goals of load balancing are:

- Improving system performance
- Maintaining stability in the system
- Building a system which is tolerant to faults
- To be able to make modifications in the future



NEED OF THE PROJECT

SDN provides the network administrators to control, manage, and dynamically change how the network behaves.

The ever increasing number of client requests to the server leads to an overloaded system which may be the cause for poor performance which could further lead to reduce in quality of the service provided.

Therefore, Software Defined Networks needs an economical and effective load Balancing algorithm to provide continuous service without crashing and without compromising on the quality of service. It helps in improving the network performance as compared to traditional network. SDN is really helpful in automation of network management. It also efficiently manages allocation and utilization of jobs.





LITERATURE SURVEY

IMPROVING THE EFFICIENCY OF SOFTWARE DEFINED NETWORK THROUGH LOAD BALANCING ALGORITHMS (IEEE 2021)

- The main idea of this paper is to increase the efficiency of load balancing by using least connection algorithm rather than using round robin algorithm.
- The round robin algorithm does not consider the actual status of the server connected to the network and allocates the load in a circular manner.
- Three experiments have been conducted to prove that least connection is better than round robin using mininet and floodlight controller.
- The least connection algorithm assigns the new connection to that server with the least number of active connections, this is a dynamic algorithm because it counts the number of active connections for each server. To improve the efficiency even more, Dijkstra algorithm is used to find the shortest path from the client to the selected server this can be done as SDN has a global view of all the connections. This paper does not consider real time loads on the server, that is, it does not consider traffic volume.



AN EFFICIENT LOAD BALANCING MECHANISM IN SDN (IEEE 2020)

- This paper has implemented round robin load balancing strategy and random load balancing strategy using OpenFlow switch and Mininet.
- In random selection algorithm the load balancer arbitrarily chooses one server node for forwarding the request from the client nodes. In case the server capacities are disproportionate, this algorithm might still distribute request without considering it. This can result in over heading of a specific server which might affect the network.
- In round robin load balancing algorithm each server node receives the request from client nodes in a circular manner, here specifications of the servers such as CPU RAM etc come into context so that the workload can be properly assigned to each of the server.
- Both the algorithms are tested by varying number of host servers, number of clients and was found that round robin had higher throughput and reduced packet loss.



PERFORMANCE ANALYSIS OF ROUND ROBIN LOAD BALANCING IN SDN

[IEEE 2020]

- This paper presents a novel technique by implementing the load balancer in SDN, to improve throughput utilization.
- Mininet software is used to build the network environment. Moreover, the floodlight controller and Python programming language were used for implementation. The experiment in this paper was conducted under the Ubuntu environment
- The essence of SDN-based server load balancing is complex OpenFlow flow tables, based on a combination of "single flow table" and "group flow table," "single flow table" can reliably monitor and traffic to client, and "group flow table" can effectively categorize client hosts.
- The load balance mechanism is done on the open flow in the southbound in this method. The load balance mechanism is done on the northbound depending on the type of protocol demanded by the end-user.
- Two scenarios were tested and evaluated, before and after the load balancer using IPerf for TCP and UDP protocols. The results show a huge increment in network performance when using the load balancer with SDN.



SYSTEMATIC REVIEW OF LOAD BALANCING TECHNIQUES IN SDN (IEEE 2020)

- The traditional networks are facing difficulties in managing the services offered by cloud computing, big data, and the Internet of Things as the users have become more dependent on their services.
- Software-Defined Networking (SDN) has pulled enthusiasm in the integration process of technologies and function as per the user's requirements for both academia and industry. The emergence of SDN has given another idea to empower the focal programmability of the system.
- Due to the increasing demand and the scarcity of resources, the load balancing issue needs to be addressed efficiently to manage the incoming traffic and resources and to improve network performance.
- One of the most critical issues is the role of the controller in SDN to balance the load for having a better Quality of Service (QoS). The paper includes the study of metrics and parameters which have been used to measure the performance. It would allow gaining more information on load balancing approaches in SDN and enables the researchers to fill the current research gaps.



RELIABLE AND LOAD BALANCE-AWARE MULTI-CONTROLLER DEPLOYMENT IN SDN (IEEE 2018)

- SDN decoupling control plane and data plane introduces issues regarding the reliability of the control plane and controller load imbalance in the distributed SDN network, which will cause the low network stability and the poor controller performance. This paper proposes Reliable and Load balance-aware Multi-controller Deployment (RLMD) strategy to address the above problems.
- Firstly, a multiple-controller network model is established and the relevant parameters for RLMD is defined. Controller Placement Selection (CPS) algorithm is introduced to explore the reliable deployments of the controllers. Now, Multiple Domain Partition (MDP) algorithm is used to allocate switches for controllers according to node attractability and controller load balancing rate, which could realize the reasonable domain planning.
- The simulations show that, compared with the typical strategies, RLMD has the better performance in improving the reliability of the control plane and balancing the distribution of the controller loads.



LOAD BALANCING USING SDN METHODOLOGY (IJERT 2018)

- In this paper we are implementing and comparing our algorithm using Floodlight controller, Mininet and testing our results via Wireshark Network Analysis Tool.
- The most common protocol used in SDN networks which helps to communicate the controller with all the network elements(NE) is Open flow.
- In this paper, they have used python in mininet to convert the algorithm into code for balancing the load. It is a powerful high level language which can be used in any of the projects. This language is supported in linux, windows.
- In this paper, the information about the host connected is found using Shortest Path First concept. So according to the code, to balance the load it should choose that link which has the least cost. The total link cost for all possible routes is found. After getting the current transmission rate, the best path is chosen.



GAPS IN PAPERS

- Most of the algorithms are implemented using centralized controller but in Wide Area Networks(WAN), as the size of the network rises, centralized architecture cannot meet the need for concerning scalability, unlike distributed architecture where multiple controllers can be placed to overcome this issue.
- Algorithms which are proposed do not consider real time traffic.
- In least connection algorithm, only number of connections are taken into account. It does not consider the time each client takes to be served as server with less connections but serving large files can take more time than the server which has to serve comparatively high number of connections but with very small data. These are the kind of situations that can arise in case of data center networks.
- SDN architecture can effectively solve the issues of a traditional load balancer. However when load imbalance occurs among multiple controllers, it would also reduce network performance and increase the delay.
- Server load balancing is based on Open-Flow. It reduces network latency and increases network performance. But, when the number of servers is increased, it increases the load of the controller and hence, affects the user's experience and quality of service.

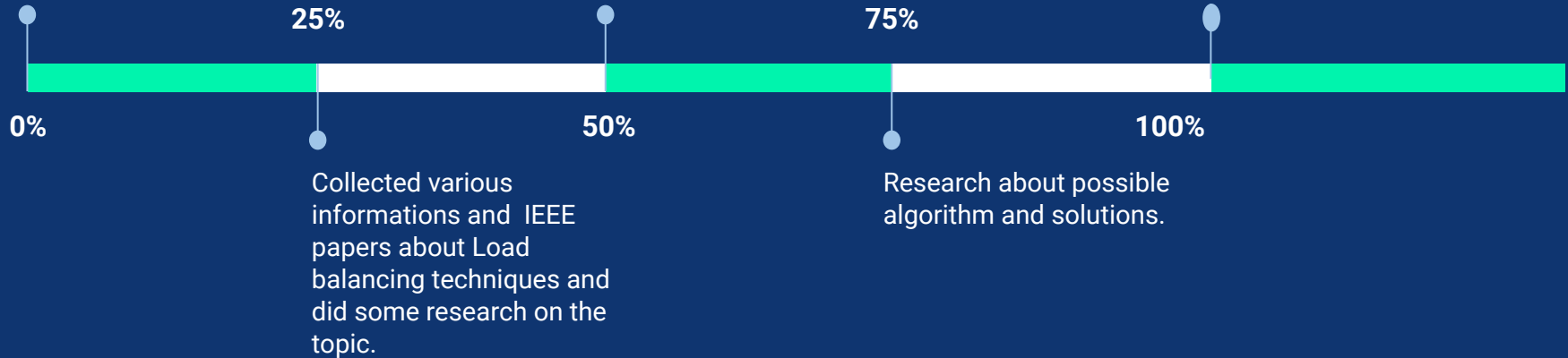


TIMELINE CHART

Chose "Intelligent Load Balancing Techniques in Software Defined Networks" as topic for project.

Analysis of existing solutions available in the previous IEEE papers

Implementing the solution which can be published later.



TOOLS USED

- Mininet : Mininet is a network emulator which creates a virtualized network and that network resembles the real hardware system. Its runs the collections of virtualized host, switches and controllers in single system. Running and debugging is real quick. Network topologies can be created by Mininet and this is a replica of hardware system in real life which is programmed by OpenFlow protocol.
- Floodlight Controller : Floodlight Controller is a Java based SDN Controller that uses the OpenFlow. protocol to set up traffic flows.It provides the protocol in an SDN environment that allows the communication between control plane and data plane. Floodlight controller has a REST API which provides information on controller, switches, topology etc.



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THANK YOU

