A Study on SDN for an Optimized Network and Power in Traffic Engineering

K. Gunasekar, P. Vanitha, K. Kavitha and C. Navamani

Abstract--- *A crucial technique to optimize a network and improve network strength is traffic engineering. As traffic demand will increase, traffic engineering will cut back service degradation and failure within the network. To allow a network to adapt to changes within the path, the research community proposed several traffic engineering techniques for the traditional networking architecture. However, the standard specification is troublesome to manage. Software Defined Networking (SDN) is a new networking model, which decouples the control plane and data plane of the networking devices. It guarantees to change network management, introduces network programmability, and provides a global view of network state. To exploit the potential of SDN, new traffic engineering ways are needed. This paper surveys traffic engineering for SDN. It focuses on some of the traffic engineering methods for SDN-based networks. This paper conjointly explores the reviews and future directions for SDN traffic engineering solutions.*

Keywords--- *Software Defined Networking, Traffic Engineering.*

I. INTRODUCTION

Computer networks is a digital telecommunication networks, which allows nodes to share resources. Traditional networks rely on physical infrastructure such as switches and routers to make connections and run properly. In this model the data planes represent the data where its go, and the control plane is located within a switch or router, this model require more physical infrastructure and need new hardware. Compared with the traditional networks architecture, the Software Defined Network (SDN) has more ability to communicate with devices throughout the network. The core difference between the two can be summed up as virtualization. SDN virtualizes your entire network. Virtualization creates a conceptual version of physical network which permits resources to be accommodated from a centralized location. Apart from that SDN has many merits to support Traffic engineering due to its distinguished characteristics.

A Software-Defined Network (SDN) design (or SDN architecture) defines however a networking and automatic data processing system is designed employing a combination of open, software-based technologies and artifact networking hardware that separate the SDN management plane and also the SDN information plane of the networking stack.

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Software-Defined Network (SDN) may be a paradigm wherever a central package program, known as a controller, dictates the network behavior. In SDN, network devices become easy packet forwarding devices (data plane), whereas the "brain" or management logic is enforced within the controller (control plane).

II. SDN Has Introduced New Characteristics Such As

- Separation of the control plane functionality, and the data plane functionality.
- Centralized architecture allows the controller to have a central view of the deployed network. The controller has the global view of the network devices, servers, and virtual machines.
- Network programmability, SDN provides an open standard, which allows external applications to program the network.
- Facilitates innovation, new protocols and control applications can be introduced because Open Flow provides the required abstractions, so we do not need to know the switch internals and configuration.
- Flow management, through the Open Flow

A controller can define flows in different granularity, and how the switches should treat the flows.

There are four critical areas in which SDN technology can make a difference for an organization.

- Network programmability
- Logically centralize intelligence and control
- Abstraction of the network
- Openness

III. Software Defined networking Architecture

Software-Defined Networking (SDN) is a paradigm wherever a central computer code program, referred to as a controller, dictates the network behavior. In SDN, network devices become straightforward packet forwarding devices (data plane), whereas the "brain" or management logic is enforced within the controller (control plane). This paradigm shift brings many edges compared to heritage ways. First, it's a lot of easier to introduce new concepts within the network through a computer code program, because it is simpler to vary and manipulate than employing a fastened set of commands in proprietary network devices.

Second, SDN introduces the advantages of a centralized approach to network configuration, hostile distributed management: operators don't need to set up all network devices severally to form changes in network behavior, however instead create network wide traffic forwarding choices in an exceedingly logically single location, the controller, with world data of the network state.

The sector of computer code outlined networking is sort of recent, nevertheless growing at a awfully quick pace. Still, there square measure necessary analysis challenges to be addressed. During this paper, we tend to survey the progressive in programmable networks by providing a historic perspective of the sector and conjointly describing well the SDN paradigm and design.

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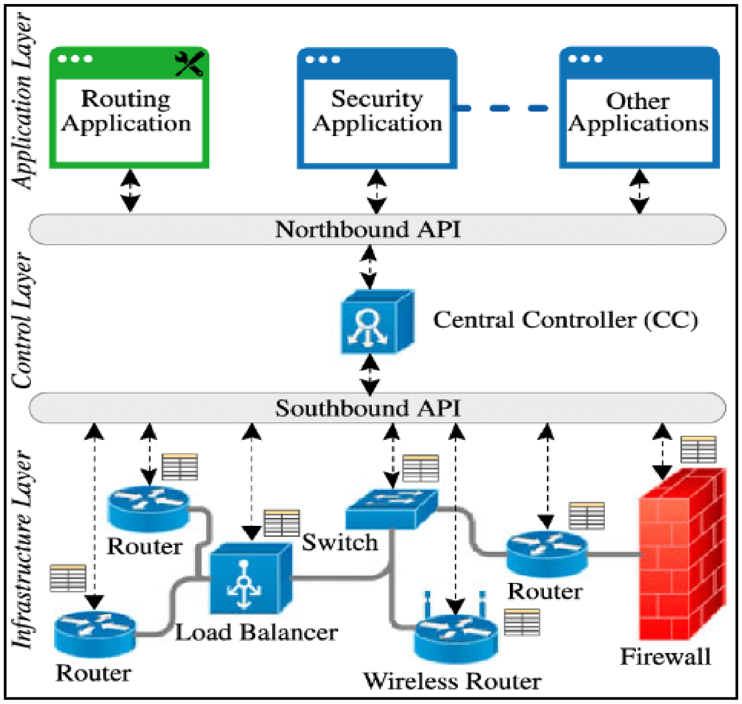

Fig. 1: Software Defined Networking Architecture

IV. Review Of Traffic Engineering Techniques In SDN

In this paper [10] Software Defined Networking (SDN) is considered as a promising approach in networking paradigm. It distinguishes the control plane of the network from the plane which is used for data forwarding. This technique not only helps in optimal resource utilization in the network, but it also simplifies the complexity in management of the network, reduces the operating cost of the network and also encourages the innovative and evolutionary ideas. An emerging way to achieve this requirement that optimizes a network and helps in the improvisation of the network robustness is traffic engineering. Traffic Engineering can reduce link failure and service degradation in the network. Research communities have worked a lot on methods for traditional networking structures, which allows the network to adapt to the changes in traffic patterns.

In this paper [8], creator proposes an exceptionally proficient traffic rerouting way to deal with process an ideal BPT for a connection on a given topology and a given traffic vector, called Universal Single-interface Traffic Rerouting. USTR can productively ideal BPT, which has an indistinguishable dimension of optimality from LPTR. As far as TE execution, USTR is same as LPTR and much superior to CSPF. As far as the running time, USTR is a couple of requests of greatness quicker than LPTR and practically identical with CSPF. The running time of USTR is completely worthy to ensure every one of the connections in a TE interim. Here the creator utilizes SDN to execute a USTR model and test its execution. The controller is ODL for the reason that it can work in Open Flow, MPLS and IP networks. In the information plane of the reinforcement directing, ODL utilizes VLAN ID to execute name sending.

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In this paper [2], IP quick reroute strategies are utilized to recuperate bundles in the information plane upon connection disappointments. Past work gave strategies that ensure disappointment recuperation from at most two-connect disappointments. We build up an IP quick reroute strategy that utilizes established curve disjoint spreading over trees to ensure recuperation from up to (k-1) interface disappointments in a k-edge-associated network. As bend disjoint traversing trees might be developed in sub-quadratic time to the extent of the network, our methodology offers superb versatility. Through exploratory outcomes, we demonstrate that utilizing circular segment disjoint crossing trees to recuperate from various disappointments diminishes way extend in the examination with recently known methods.

In this paper [11], As the next generation network architecture, Software-Defined Networking (SDN) has exciting application prospects. Its core idea is to separate the forwarding layer and control layer of network system, where network operators can program packet forwarding behavior to significantly improve the innovation capability of network applications. Traffic Engineering (TE) is an important network application, which studies measurement and management of network traffic, and designs reasonable routing mechanisms to guide network traffic to improve utilization of network resources, and better meet requirements of the network Quality of Service (QoS). Compared with the traditional networks, the SDN has many advantages to support TE due to it’s distinguish characteristics, such as isolation of control and forwarding, global centralized control, and programmability of network behavior. This paper focuses on the traffic engineering technology based on the SDN.

First, we propose a reference framework for TE in the SDN, which consists of two parts, traffic measurement and traffic management. Traffic measurement is responsible for monitoring and analyzing real-time network traffic, as a prerequisite for traffic management. In the proposed framework, technologies related to traffic measurement include network parameters measurement, a general measurement framework, and traffic analysis and prediction; technologies related to traffic management include traffic load balancing, QoS-guarantee scheduling, energy-saving scheduling, and traffic management for the hybrid IP/SDN.

In this paper [9], In applications such as video surveillance systems, cameras transmit video data streams through network in which quality of received video should be assured. An Intelligent Traffic Engineering Method over Software Defined Networks for Video Surveillance Systems Based on Artificial Bee Colony. Traditional IP based networks cannot guarantee the required Quality of Service (QoS) for such applications. Nowadays, Software Defined Network (SDN) is a popular technology, which assists network management using computer programs. In this paper, a new SDN-based video surveillance system infrastructure is proposed to apply desire traffic engineering for practical video surveillance applications. To keep the quality of received videos adaptively, usually Constraint Shortest Path (CSP) problem is used which is a NP-complete problem. Hence, heuristic algorithms are suitable candidate for solving such problem. This paper models streaming video data on a surveillance system as a CSP problem, and proposes an Artificial Bee Colony (ABC) algorithm to find optimal solution to manage the network adaptively and guarantee the required QoS. The simulation results show the effectiveness of the proposed method in terms of QoS metrics.

In this paper [6], Network management is difficult. To operate, maintain, and secure a communication network, network operators should grapple with low-level vendor-specific configuration to implement advanced high-level network policies. Despite several previous proposals to form networks easier to manage, several solutions to network management issues quantity to stop-gap solutions thanks to the problem of fixing the underlying infrastructure. The rigidity of the underlying infrastructure presents few potentialities for innovation or improvement, since network devices have usually been closed, proprietary, and vertically integrated. a replacement paradigm in networking, code outlined networking (SDN), advocates separating the info plane and also the management plane, creating network switches within the information plane easy packet forwarding devices and departure a logically centralized code program to manage the behavior of the whole network. SDN introduces new potentialities for network management and configuration ways.

During this article, we have a tendency to determine issues with this progressive network configuration and management mechanisms and introduce mechanisms to enhance varied aspects of network management[12]. we have a tendency to concentrate on 3 issues in network management: sanctionative frequent changes to network conditions and state, providing support for network configuration in an exceedingly high level language, and providing higher visibility and management over tasks for performing arts network identification and troubleshooting. The technologies we have a tendency to describe alter network operators to implement a good vary of network policies in an exceedingly high-level policy language and simply confirm sources of performance issues. Additionally to the systems themselves, we have a tendency to describe varied paradigm deployments in field and residential networks that demonstrate however SDN will improve common network management tasks. Overview of traffic engineering techniques in SDN.

Table 1: Overview of traffic engineering techniques in SDN

Technique	Description	Routing	Comments
B4 [7]	• It uses a centralized TE, layered on top of the routing protocols, to achieve fairness it allocates re-sources using Min-Max fairness technique.	• It uses hashed-based ECMP to balance the load among multiple links.	• If TE service can be stopped so that the packets are forwarded using short path forwarding mechanism.
Hedera [1]	• Detects the elephant-flows at the edge switches, if threshold is met, i.e. 10% of NIC bandwidth, the flow is marked as elephant flow, uses periodic pulling, every 5 s.	• Uses the global view of network and calculate the better paths, which are non-conflicting, for the elephant flows.	• It achieves 15.4 b/s throughput, achieves better optimal bisection of bandwidth of network, in com-parison to ECMP, Periodic actuation will cause high resource utilization in switches.
DevoFlow [5]	• Detects the elephant-flows at the edge switches, • If threshold is met, i.e. 1–10 MB, it marks the flow as elephant- flow.	• It uses aggressive use of wild carded OpenFlow rules, and a static multi-path routing algorithm to forward the traffc.	• It can improve throughput up to 32% in CLOS network.
Mahout [4]	• Detects the elephant-flows at end host using a shim layer, the default threshold is 100 k, and then the flow is marked as elephant-flow, • It uses in-band signaling to inform the controller about the elephant-flows.	• It computes the best path for elephant-flow; otherwise it for-wards other flows using ECMP, • It calculates the path that is least congested by pulling the elephant-flow statistics and link utilization from switches.	• It can detect elephant flow, if threshold is 100 k, in 1.53 ms, it has 16% better bisection than ECMP.
MicroTE [3]	• Detect the elephant flows at end-host. • It calculates the mean of traffic matrix between ToR-ToR, if the mean and traffic is between of each other, default is 20%, then it is predictable.	• Uses short term predictability to route the traffic on multiple paths, the remaining flows are routed by the EMCP scheme with heuristic threshold.	• If traffic is predictable it perform close to optimal performance other- wise it performs like ECMP.

V. CONCLUSION

In this paper we have reviewed literature in the field of traffic engineering techniques for Software defined network architecture. SDN is a new networking paradigm which simplifies the network management and enables innovation. It tries to address many problems in the traditional network architecture by simplifying network management through centralized management of a network, introducing network programmability, and providing a global view of a network and its state. New traffic engineering techniques are used to develop these features for direct and management of traffic. Different TE mechanism should be included in SDN to control congestion and manage traffic for different applications in various QoS-sensitive scenarios such as video or business data, and to provide required QoS while balancing the load among the available resources in a network. To improve the network load handling, a traffic engineering mechanism should enable a network to react in real-time and classify a variety of traffic types from different applications. Routing optimization is one of the main techniques in TE. It should take advantage of multiple paths in the network and coordinate traffic scheduling by using global view of traffic across the available network paths. Beside load-balancing and improvement of resources, different elements of traffic engineering area unit QoS and suppleness type failure. Such networks can be optimized for each application to provide a good QoS and improve user experience.

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