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SYSTEM-WIDE ROUTING BASED MECHANISMS FOR ALLOCATING SERVICE QUALITY

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ARTICLE INFO	ABSTRACT

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In especially because of the growing use of mobile computing devices, the exchange of data has evolved into an essential element of our daily lives and was crucial to the operation of many computer programmers. To enable the communication features built into these apps, the underlying computer networks must meet a wide range of requirements. The latency or completion time of data transfer can be used to measure these needs, which are also referred to as Quality of Service (QoS) requirements. To maintain the appearance of a real-time connection, teleconferencing systems, for example, require that audio and visual data be provided with as minimal packet delay as feasible. Videos must be streamed over a large quantity of bandwidth in order for there to be little to no buffering while they are being viewed. In the absence of this, the playback of the video will be interrupted at the receiving end.

Keywords: Routing, Mechanisms, Allocating, Quality of Service,

They might also have extra quality of service requirements, such low packet loss and jitter ratios. We do not have a firm deadline for the transmission of packets for applications that involve substantial data transfers, unlike video streaming. It's probable that we'll have to keep an eye on the equipment's condition and send control signals in cyber-physical systems like the smart grid and home networking systems in order to start an operation. The feedback loop must be completed even if there isn't much information being provided because all sensor data and control signals must reach their destinations promptly. These all cause issues for the networks below the surface. For data transmission, the typical network design does not support quality of service (QoS).

Numerous studies have been done on the different methods that traditional networks employ to offer QoS. Most of these are just theoretical inquiries that haven't been significantly scaled-up for the Internet. One of the contributing elements may be that the proprietary protocols that the providers put in the network equipment are, for the most part, unchangeable and cannot be modified by end users. Because networking device makers want to keep their technological implementations concealed behind closed doors rather than share them with the public, programming networks is often challenging. This reduces the network's flexibility and makes controlling it more challenging. The actions of the network administrators cannot be changed in any way to fulfil the requirements of the end applications.

Unlike the case with video streaming, we do not enforce a strict deadline for the delivery of packets when it comes to applications that entail the transmission of significant amounts of data. On the other hand, we do rely on the networks to provide adequate bandwidth in order for the transfer to be finished in a time period that is satisfactory to us. This is true even if there isn't a lot of information being conveyed. All of these factors present challenges for the networks that lie beneath the surface. The conventional architecture of networks does not provide any support for quality of service (QoS) for the transmission of digital data.

A. SEGMENT ROUTING BENEFITS

- The most significant benefit of SR is that it can reduce the amount of resources that are used while at the same time simplifying the network. Because of this, the management and operation of your network are going to become much easier. Additional advantages contribute to the desirability of SR in a network.

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- SR minimizes the number of nodes that must be interacted with in order to make path provisioning and modification modifications. Because of this activity, SR is able to be more sensitive to changes in the network, which makes it more agile and adaptable than alternative methods for traffic engineering.
- SR traffic engineering is responsible for providing application quality of service and mapping network services to end users and applications as they travel through the network.
- SR offers resiliency by way of headend restoration and topology-independent loop-free alternative (TI-LFA) technology, both of which contribute to improved route dependability during times when a network is down.

Within the scope of this study, we analyses novel software-defined networking (SDN) solutions with the intention of delivering quality of service (QoS) to certain network flows. As a consequence of our investigation, we have arrived at the conclusion that there are two criteria that absolutely must be met by time-sensitive applications, and these requirements are known as bandwidth and latency. In order to make the most of the available bandwidth, rather than depending on the destination-based routing algorithm that is traditionally used, we are looking at alternative routing approaches for particular flows.

This is one of the things that creates the problem. This is something that we believe to be one of the problems that needs to be addressed. We devise a whole new system that pre-assigns higher priority queues in the routers and switches, and then we set these queues aside for the traffic that comes from the sensors and control devices. This approach may be discovered over here.

This kind of reservation is known as an elastic reservation, and its name comes from the fact that it gives other users permission to utilize the bandwidth in the case that it is not used by the traffic that has been scheduled. 3 Despite this, the traffic for reserved vehicles is given priority over the traffic for ordinary vehicles. This is done in conjunction with the fact that the network can be outfitted with mechanisms to install new routing pathways. In addition to this, the network is capable of being furnished with means to set up new routing paths. This is an additional benefit. One of the application areas that we spend a lot of emphasis on is researching new and novel transmission mechanisms that can be used for the transfer of massive volumes of data in a cloud computing environment. As an alternative to relying on just a single TCP channel for the transportation of data, we are looking into methods that will make it possible for the programme to establish a number of TCP paths for the same application.

At this time, we only make use of a single TCP route to transmit data. We make a distinction between short flows and lengthy flows, and we employ an adaptive method to determine whether or not to construct sub flows for a TCP connection, as well as the number of auxiliary sub flows that should be generated.

Within the confines of this study, we propose three distinct approaches as potential means of improving the quality of service (QoS) offered to certain network flows. We provide methods and systems that are geared toward meeting the performance objectives of certain categories of network traffic, for which we describe the requirements. Additionally, we outline the demands of the various types of network traffic. The SDN is what these approaches are built upon, hence it is essential to have it. The recommended mechanisms have been developed and tested using the testbed settings, which have been utilized for this purpose. The most important addition that this dissertation brings to the field is an improvement to the quality of service that is provided to traffic flows that have requests for bandwidth. We provide a system that is based on SDN for continually monitoring the health of the network and dynamically setting up forwarding channels for traffic flows that demand a lot of bandwidth. Both of these functions are accomplished via the use of SDN.

- Making certain that latency-sensitive traffic is provided with a superior level of service We suggest a system for managing and rerouting traffic flows that, in order to meet deadlines, need to be supplied with a higher priority. This system would also allow for more efficient use of resources. This architecture is sufficiently adaptable to enable a diverse range of traffic flows, each of which has its own specific requirements to meet.
- Using Multipath TCP and SDN to maximize the throughput of extremely large flows to the extent that it is possible to do so. We propose a novel architecture that, by utilizing a number of different paths, is capable of accommodating vast amounts of traffic while also preserving a high throughput. Applications are able to dynamically generate new sub flows using our technique, and these sub flows are subsequently routed by the SDN controller along the channels that have the least degree of congestion.

B. QUALITY OF SERVICE

One of the key reasons that was not one of the Internet's core purposes when it was initially envisioned was to ensure a particular degree of service quality. However, as time went on, Internet applications such as streaming multimedia content, online gaming, teleconferencing, and other similar services emerged, and it became obvious that these services required a Quality

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of Service (QoS) guarantee. Over-provisioning network resources in order to fulfil quality of service criteria is an option that could be debated as being economically more realistic than changing the existing network infrastructure. This is because over-provisioning network resources allows for the fulfilment of quality of service criteria. In spite of this, there have been many various attempts made throughout the years to provide great service. These endeavours have been met with varying degrees of success.

C. SOFTWARE-DEFINED NETWORKING (SDN)

1) Initial Attempts Made Before the SDN

The ideas and concepts range from decoupling control plane and forwarding plane to achieving some level of programmability in networks.

Platform for Controlling Routing

Within autonomous systems, the Routing Control Platform, abbreviated as RCP, was conceived as a solution to certain problems associated with the present routing mechanism (AS). The design doing so might lead to complications in the form of protocol oscillations, persistent loops, and complicated configurations.

The BGP decision process is executed on a physically decentralized platform, but it is logically centralized in RCP design. The IP forwarding plane and the routing control platform are two entirely different things. This platform's primary objective is to centralize the decision-making process for route selection so that routers will no longer be responsible for performing this function. The RCP is able to circumvent the issues described above because it makes routing decisions based on an exhaustive picture of the whole network topology as well as the paths that are currently open. This data is gathered through the utilization of the already established protocols, BGP and Interior Gateway Protocol (IGP).

The BGP Engine is in charge of acquiring the necessary BGP routing information from each router. In order to determine which path is most advantageous for each router, the Route Control Server compiles the data that it obtains from the other two modules. Following the completion of the route selection procedure at a centralized location, the Route Control Server engages in two-way communication with the routers using the BGP engine in order to instal new forwarding entries that correspond to the routes that were chosen. The Routing Control Platform and the routers only use the already established standard protocols (BGP and IGP) to communicate with one another. There has been no attempt to modify these protocols or to implement any new protocols.

2) METHOD

During the process of evaluating the QoS routing method, the tools that were utilized included Mininet and Open v Switch. Mininet is a piece of emulation software that provides a virtualized environment. This environment may be utilized for the purpose of testing and creating software development network (SDN) applications. At the level of the operating system, some lightweight virtualization methods may be used to simulate hosts, connections, switches, and controllers. This can be done by applying certain lightweight virtualization methods. Python scripts were built to make advantage of Minnie's Python application programming interfaces (APIs) so that the network topology could be generated. If the user so desires, Mininet can be con Figure d to run by using software switches instead of physical ones. We selected Open v Switch as our switch software of choice because of its versatility as well as its robust support for the Open Flow switch protocol.

In order to test the capabilities of our QoS routing module, we constructed a network topology in Mininet that included twenty-two hosts and eight Open Switch switches. Figure 3. 3 presents a comprehensive representation of the topology. The bandwidth of the connections that connect the switches is capped at 25 megabits per second. Mininet takes use of the traffic control command included in Linux known as tc in order to select the bandwidth. Following that, we utilized iperf3 to generate a total of 14 flows, which may be seen in [30]. Each of these five fluxes has a critical flow that needed to be maintained. Table 3. 1 has a rundown of all the different flows that were observed throughout this experiment. We started the Mininet topology by executing a script that was developed in Python, and after that, we created the flows in the table in the same sequence that they are presented in the table.

3) RESULTS

The first thing that we did was run this experiment without the Floodlight QoS routing module active, and see how well it worked. After that, we carried out the test once more, this time ensuring that the QoS routing module was on. Because of the fact that the connection between switches and hosts is able to transport data at a rate of 10 Mbps, the maximum speed that an essential flow is capable of sending data at is likewise 10 Mbps. The throughput that was determined to be appropriate for each flow under both of these conditions is shown here.

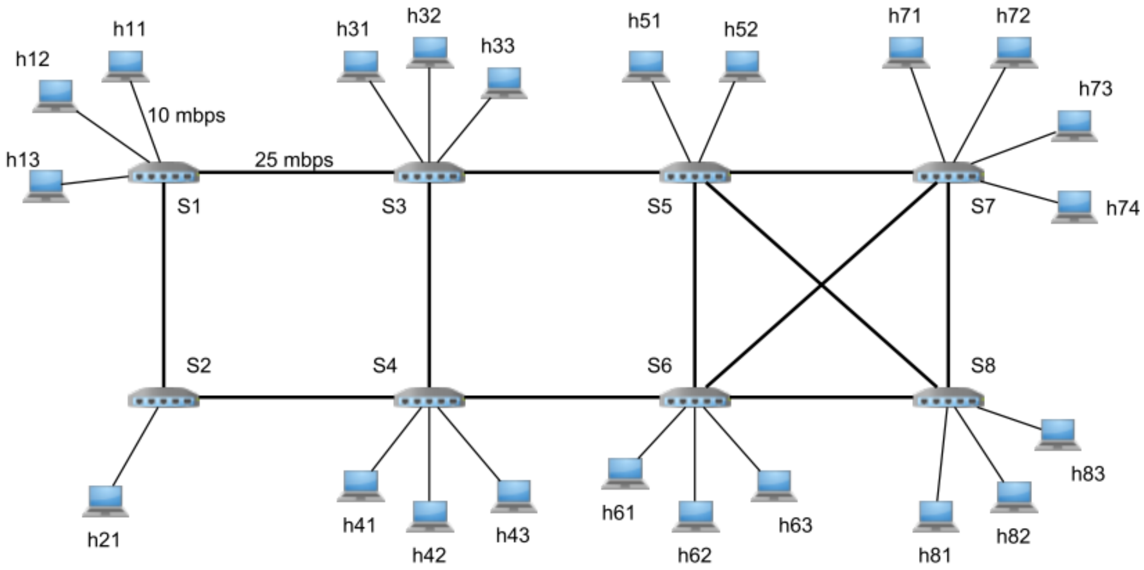

Figure 1: First experiment topology in Mininet

Table 1: Traffic flows

Flow	Source	Destination	Starttime	IsCritical	Size
1	h31	h42	2	No	150MB
2	h41	h32	3	No	140MB
3	h32	h41	4	No	145MB
4	h42	h31	7	No	135MB
5	h11	h71	22	Yes	135MB
6	h71	h61	23	No	140MB
7	h43	h33	25	No	120MB
8	h33	h81	41	Yes	130MB
9	h74	h63	42	No	115MB
10	h12	h51	57	Yes	125MB
11	h72	h62	59	No	125MB
12	h51	h83	76	No	100MB
13	h13	h82	91	Yes	120MB
14	h73	h21	106	Yes	110MB

in Figure 2 The findings of the experiment demonstrate that Flow No. 5 had an average rate of 8046 kbps, whereas flow No. 2 had an average rate of 7248 kbps.

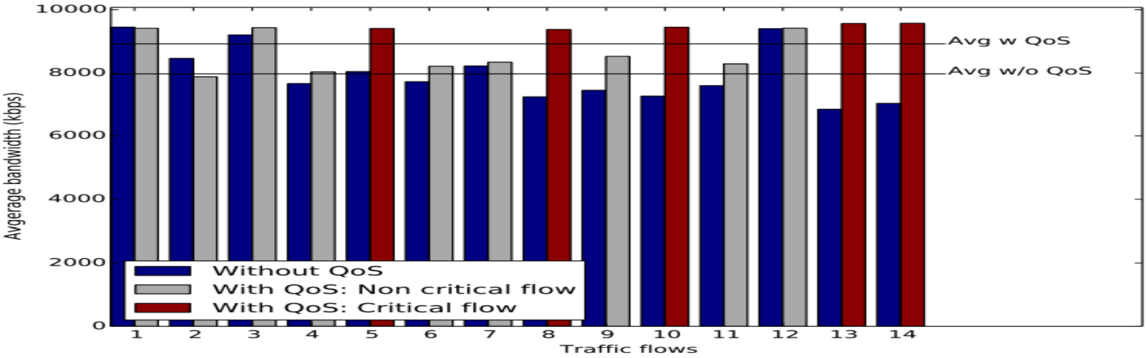

Figure 2: Through puts with five critical flows

(flow No. 8), 7272 kbps (flow No. 10), 6838 kbps (flow No. 13), and 7024 kbps in that order correspondingly (flow No. 14). In the case study in which the quality of service routing module was made operational, the measurements revealed an improvement. Flow number 5 had a throughput of 9408 kbps, flow number 8 had a throughput of 9374 kbps, flow number 10 had a throughput of 9446 kbps, flow number 13 had a throughput of 9565 kbps, and flow number 14 had a throughput of 9572 kbps. The throughput that was measured for each critical flow and that was reported by iperf3 is displayed in Figure s 3. 5 and 3. 6 with a ten second delay between each Figure. It is very crucial to take note of the fact that the x-axis does not reflect the time that the experiment was conducted; rather, it represents the amount of time that each flow was active. During the first experiment, the traffic for Flow No. 10, which travelled from House 12 to House 51, was routed through Rooms S1, S3, and S5. Due to the fact that the connection (S3, S5) was already handling two flows (No. 5 and No. 8), its capacity was somewhere around 5 Mbps. Because they chose to travel in this direction, the link quickly became congested with vehicles. Once the QoS routing module was active, it is evident from the data presented in Figure 3 that the throughputs of each of these essential flows saw a considerable improvement.

The findings of the measurements showed that there was an improvement in the case study in which the quality of service routing module was made active. The throughput of flow number 5 was 9408 kbps, the throughput of flow number 8 was 9374 kbps, the throughput of flow number 10 was 9446 kbps, the throughput of flow number 13 was 9565 kbps, and the throughput of flow number 14 was 9572 kbps.

There is a 10 second delay between each Figure in the presentation. It is extremely important to keep in mind that the x-axis does not represent the amount of time that the experiment was carried out; rather, it indicates the length of time that each flow was operational. This is a very important distinction to make. During the initial phase of the test, the flow of traffic for Flow No. 10Its bandwidth was probably in the neighborhood of 5 Mbps because the link (S3, S5) was already managing two flows (No. 5 and No. 8). They decided to proceed in this route, which resulted in the connection becoming clogged up with automobiles very fast. It is clear from the data shown in Figure 3. 6 that the throughputs of each of these critical flows witnessed a major improvement after the QoS routing module was activated. This is evidenced by the fact that the throughputs of the individual necessary flows increased. Flow No. 10 was redirected to move along a new path as a result of the QoS routing module, which prompted the rerouting to take place (S1, S2, S4, S6, etc.)

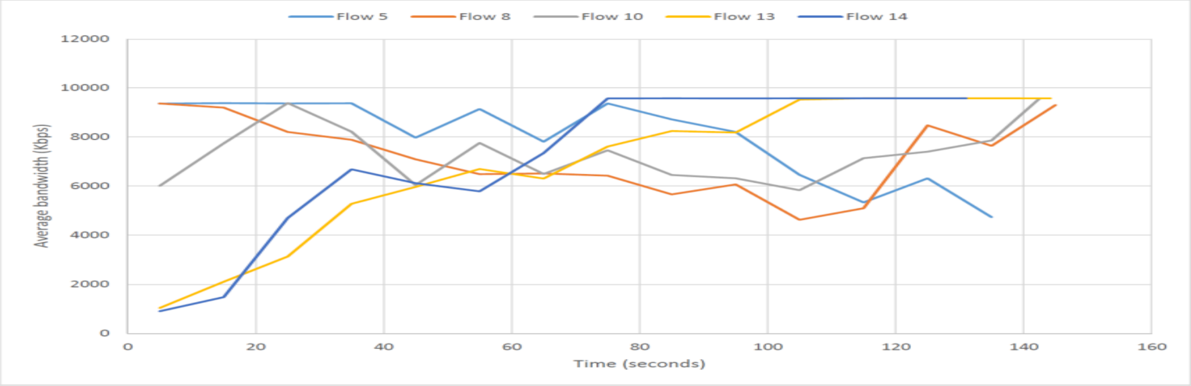

Figure 3: Throughputs for critical flows with out Quos routing module

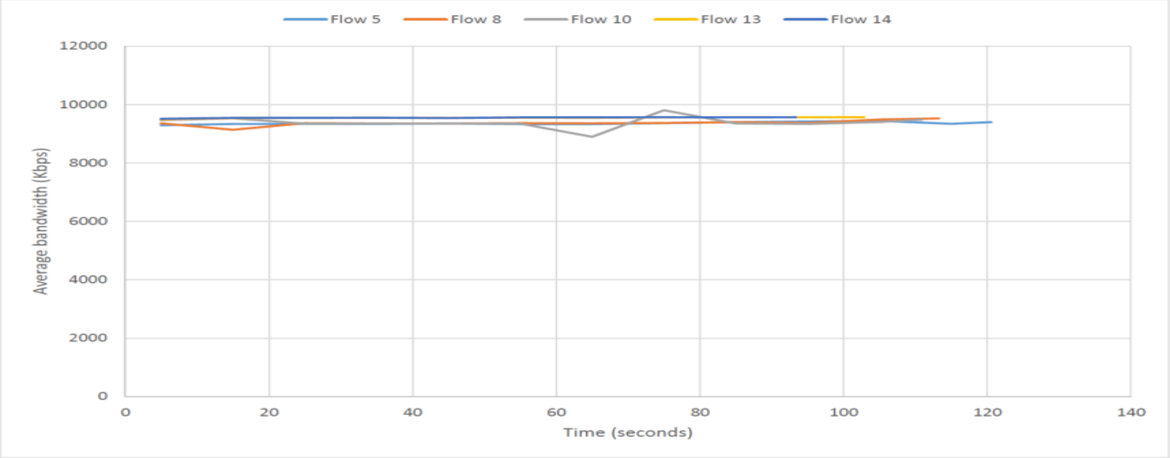

Figure 4: Throughputs for critical flows with QoS routing module

In order to demonstrate how differently one ought to handle a flow depending on the type of flow it is, we repeated the experiment after changing flow No. 11 from h72 to h62 and making it a critical flow. This allowed us to demonstrate how differently one ought to handle a flow depending on the type of flow it is. When it was evaluated in the two trials that came before it, when it was placed on path, this flow had a throughput of around 7600 kbps (S7, S6). After these modifications were implemented, the flow of traffic on the track did not change (S7, S8, S6). After being measured, it was found that the throughput for this flow was 9571 kbps. As can be seen in Figure 3. 7, this alteration also led to an increase in the throughput of other flows, which may be considered as a positive effect.

CONCLUSION

To better provide quality of service to bandwidth-demanding traffic flows, an SDN-based QoS routing strategy is proposed. The QoS routing programme routes data along lines with spare capacity by using a centralized controller to continuously monitor network metrics. The evaluation findings demonstrate that the proposed method outperforms the currently-used shortest path routing technique in boosting the throughput of bandwidth-intensive traffic. A pliable architecture for satisfying latency-sensitive traffic with priority service. One key indicator of network quality of service is latency, which is measured in many different ways depending on the type of application being used. A software-defined-networking (SDN) architecture that employs Multipath TCP to increase the throughput of massive traffic. The multi-path topologies available in today's data centers should be used in the traffic engineering of such networks.

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