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## REDUCING THE CONTROLLER PLACEMENT DISPUTES IN MASSIVE SCALE SDN NETWORKS

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### Abstract

Software Defined Networking is the method which is mainly used in telecommunication, due to the increase of nodes on the internet, the main purpose of the internet cannot be achieved. To overcome all this problem SDN is introduced which can reduce the issues that are faced by the traditional network. The nature of applications that we use and the technologies equipment in today's network is different and this will make the management process complex. In a normal network the multiple vendor devices cannot communicate with each other, but in software defined networking multiple vendor devices can able to communicate, so this makes the network so feasible. In this paper, I proposed a method called Location Independent Controller Placement Algorithm, which works along with the Searching Location Algorithm and it finds where the controller should be placed in the network and how many controller should be placed in the Large Scale SDN Networks. Using NS2 Simulator the performance metrics like time delay and the accuracy is simulated.

**Keywords:** Software Defined Networking, Open Flow, Searching Location Algorithm, Location Independent Controller Placement Algorithm.

### 1 Introduction

#### 1.1 Software Defined Networking

Software Defined Networking (SDN) is a logically centralized method which can separate both the control plane and the data plan and hence control plane will be taken separately and it is the programmable device. The user can able to change the process in the control plane depends on the situation in which the network is needed, so it was very easy to access the network compare to the traditional network. The important task of SDN architecture is of controller placement so that the requirements for the number of resources within a network can be solved. In large SDN Networks the controller can be misplaced, so due to this misplacement, these requirements range failure tolerance,

load balancing, scalability, adaptability, time delay and accuracy. At least some of the above-mentioned objectives are competing, so not even a single best placement is available and hence decision makers should find the best method for controller placement.

Because of the logically centralized network control plane in SDN, the devices can able to get access from the controller directly and all the users can able to get same responses at the same time. In SDN both the data plane and the control plane are separated, so it was easy to access with control plane and it was the programmable device .Due to this separation in SDN network, the control plane will act as a controller and the controller, So SDN is the best choice for them, which is more efficient, elastic to the network. And if any new service needs to use, it can easily do in SDN Network but it can be done in the traditional network. In SDN we have two planes called as control plane and data plane, in which control plane can take separately and it was the programmable device. Due to this method in the network the data transformation can be easily done without any time delay and the accuracy will be good.

In the control plane, the program has to be done and it will be act as the controller node, the devices which are connected to this controller are routers and switches in which the transport network protocol and distributed control are running inside it so it will pass the information in digital packets. In a traditional network, it was not possible and it was difficult to manage the large scale network.

In the SDN Network, the different vendor can communicate with each other so that this network is user-friendly. Control plane will be handling the traffic in the network and Data plane will be controlled by the control plane and hence it will be forwarding the traffic in which the decision will be taken by the control plane. During this process of data plane which is framed in the networking devices which will reduce flexibility and the infrastructure of the network. Even more protocol are there not all the problem is solved and in many process some of the technique is still unfinished still they are under development like IPv6, it was represented as protocol update, but it will take more than ten years to complete the process within that time more issues will happen in network, so to find the correct solutions the exact technology is to be found and should use in the network, so that lots of issues can be solved. SDN is the network technology which up comes all the problem which is mentioned above, and it gives a hope to solve some of the important problems in then etwork.

Open Flow is the communication protocol which can communicate both the control plane and data plane .Service providers are very much eager to adopt SDN, because they need a network with is more reliable and differentiated services to make revenue and to retain customers and also they are looking for the network which will reduce Capital

expenditure and Operational expenditure, so they are taking the advantage of the new technology in SDN, cloud computing. SDN also manages the traffic exploring in the network and it also increases the average revenue per user also it was elastic and more efficient. After a long research, they decided to go with SDN because of the low-cost options for Service providers. Hence they can provide good service to the client at the same time the service to the client will be in an efficient manner.

## **1.2 Control Plane and Data Plane**

Both the control plane and the data plane can be defined by the programming in the control plane which will have the interface between the SDN controller and the switches. The controller will have the direct control over data plane in which will have the interface between Application Programming Interface (API).

Open flow is one of the examples of API. It was the type of application which will have certain rules in which is used in the communicate between the devices, so this technique which makes the devices to communicate in an easy manner without any hard rules. Only the controller will have certain responsibilities to take all the decisions, so the devices have less work and it will directly obey the rules in the controller. Hence the data transfer will be easy and it will reduce the traffic in the network. Open flow will be act as the switch, router, load balancer, traffic shaper by depending on the rules in the controller the open flow will act.

Especially in the telecommunication, the SDN plays a big role, which is using the SDN and Open flow from the beginning and most of the vendors are using both technologies for the past few years and got a good success. By introducing that technology in networks both the client and the users will have advantages. Not only the advantages but also it solves lot of problems which cannot solve by any other methods. Each vendor will have different types of network and which will have different modules to work their network and also have a different platform. But nowadays most of the vendor are using SDN to make their network more efficient and agile.

## **2. SDN Applications**

### **2.1 ONOS (Open Network Operating System)**

ONOS is an SDN system working framework for administration suppliers. The elements of ONOS are its high accessibility, execution, scale-out, rich deliberations. ONOS remains for Open Network Operating System and it's the main open source SDN system working framework. The essential point of ONOS is to manage administration supplier and mission basic systems. Notwithstanding the system requests like high accessibility, scale-out and

execution, ONOS highlights northbound deliberations and APIs which help in application advancement, and southbound reflections and interfaces, which helps in controlling open stream and legacy gadgets.

The ONOS Characteristics are

- Scalability
- Availability
- Performance
- Agility

## **2.2 ONOS Architecture**

ONOS was intended for administration supplier with the central elements scale-out, high accessibility, and execution alongside effective Northbound and Southbound reflections. The structural elements of ONOS are

- Distributed core
- Northbound Abstraction
- Southbound Abstraction
- Software Modularity

## **3. Related Works**

In [1] the Software Defined Networking the main method is the controller placement in which the location should be properly identified and the controller should be placed. Due to the large traffic in the network, the controller should be placed in many parts at the same time the only limited number of the controller should be placed else the controller overhead will be happening. To up come from that the controller should be placed in the exact position. Even though the controller are been placed in the right position the routing problem will be happening so to overcome the problem the reverse logistics been used with entropy weight During MOPSO which is based on the GRA combined with Entropy Weight

1. GRA did with entropy weight.
2. MOPSO which is done by LRP

At first, the PSO parameters can be done then the values should be entered and first algorithm[1] is been done and at the Second algorithm will be calculated. The output will be having the method which is better than the previous method and it will be more effective compared the old one for the placing of location routing.

In[2]An especially vital errand in the SDN setting is the position of such outside assets in the system. The controller arrangement issue with an emphasis on SDN-based center systems, including diverse sorts of versatility and disappointment resilience[2]. At the point when a few execution and versatility measurements are considered, there is typically no single best controller situation arrangement, yet an exchange off between these measurements. The Pareto-optimal method is the method in which the controller can be placed in the exact position by the help of an annealing algorithm. In[3]Software Defined Networking (SDN) has risen as another worldview that offers the programmability required to progressively arrange and control a system. A conventional SDN usage depends on an intelligently brought together controller that runs the control plane. In an extensive scale WAN sending, this simple brought together approach has a few impediments identified with execution and adaptability. To address these issues[3], late recommendations have pushed conveying different controllers that work helpfully to control a system. Regardless, this methodology drags in an intriguing issue, which we call the Dynamic Controller Provisioning Problem (DCPP). DCPP progressively adjusts the quantity of controllers and their areas with changing system conditions, so as to minimize stream setup time and correspondence overhead[3].The system progressively changes the quantity of dynamic controllers and delegates every controller with a subset of Open stream changes as per system elements while guaranteeing negligible stream setup time and correspondence overhead. The ideal controller provisioning issue as an Integer Linear Program (ILP). The minimizes stream setup time while bringing about low correspondence overhead. In [4]The Global Environment for Networking Innovation, is the method which has been used in smaller network sections which are highly used on the college network. a conveyed virtual lab for exploration in organizing and conveyed frameworks, with applications in space science[4]. The assets incorporate both switches and GENI Racks (SDN skilled process bunches with Open Flow switches for inward and outer correspondences). GENI Racks are as of now introduced on many college grounds and inside R&E system spines. Additionally accessible is a different gathering of programmable registering and remote systems administration assets. In[5] The set of algorithms in which the previous controller they mentioned that the controller will have certain problems due to the separation of control plane and the data plane it is also called as the forwarding plane in which the packets from the data plane will be sent to the controller[5], but they says that because of this separation there will be the packet loss and the performance will be reduce. so they designed the algorithm in which time does the controller will need the algorithm to forward the packets it's in normal time or in traffic it should be done. In[6] The open flow is the method in which is developed in the earlier days, it was the protocol which is used for the

communication between the controller and the devices. They have mentioned that the open flow method is the way to make the network in an efficient way[6]. The content-centric networks have become the best method in the network. This technique will treat the network in regular and in a simple way. In software-defined networking the existing method is good and in this paper they have considered an upcoming which is good in efficiency rate and to manage the network in a good manner. The technique is done by handling different load balancing which is in the current network in each and every interval it should be noted[6]. The process which is done inside the network will be hidden to the end user, they won't have any idea how the network is working. The existing topology is been used in the network for the communication purpose. The method in the open flow is to manage the resources in a particular manner and to bring towards the content centric network. In[7]Software defined networking is the method which is playing the important role in the networking. In this paper, the POCO is the method in which the controller should be placed and how many controller should be placed[9]. The tool will be able to take down the performance of the network in the previous network and it will do its design into it . this is to make the network in an efficient manner while will be good for the user. By the help of the Pareto controller placement, the controller will be placed in the correct position.

#### **4. System Analysis**

In large scale, SDN networks the problem is the controller placement in which the controller plays the main role in the large-scale networks. The centralized control plane is the method is to reduce such type of problems in future, even nowadays most of the firm and the service providers are using this technology to make their network user-friendly. In the paper, the controller placement has the problem in which how many controllers should be placed and where should the controller could be placed. What type of topology can be used for these types of networks. During this problems, the load balancing has to be taken care and the fault tolerance should be reduced. The time delay and the accuracy is the major problems in the networks so to reduce that problem the controllers should be placed in a good manner. POCO is the method which is used to overcome all those problems. Pareto-based optimal controller placement is to overcome the issues in the network and many of the issues have been solved using [this](#) POCO. It is much useful in small and medium networks, and many of the issues have been solved. The troubleshooting is also easy, but when comes to the large scale network it was bit different. All the problems are not solving using this method at least any one of the above-mentioned issues happened again The analysis shows that the controller has been placed in a different manner in the network. At first, the controller fails and the latencies have occurred that is

because of the traffic in the controller or if the controller has failed the latencies will occur. The time is taken to travel from the source to the destination and again from destination to source. At second, the controller are been placed and some number of nodes are separated in which is not controlled by the controller, so it has its own path and it will not be controlled until some of the controllersis taking care of it. The controller in which the method of separating the nodes are said to be isolated nodes. At third, after the placement of the controller, all the controller will unable to load the balance in the network in which the network has the to be done correctly. The nodes will be imbalanced due to the problem and in which the whole method will be under traffic. The figure shows in which the even though the controller is placed it was in imbalance position. At fourth, different networks have different types of nodes so to manage them the perfect method to be implemented. In the network the functions will be due to therequest of the user in which the process will be done correctly. The nodes will not be connected to each other and all the controller will be not connected to each other

## **5. Proposed Method**

Due to the irregular placement of the controller in the network, the problems has been increasing day by day. For example, if any of the firms is having the data center of its own and the controlling devices and switches are in distance means, the problem arises from it. If the controller is placed near to it and if it was distributed in the correct manner then the time to communicate between the devices will be reduced and the throughput will be high and also the accuracy will be more efficient. By this way we can reduce the problem in the network.

The main aim is to reduce the

1. Time delay in the network and it should be less
2. Accuracy should be maximum.

In this paper, I have considered that due to misplacing the controller, issues has raised and to overcome that I have come up with the idea of Location Independent Controller Placement Algorithm in which will be taken care of location where the controller should be placed in the SDN module. The traffic and latency is also be noted using the algorithm.

## **6. Implementation**

### **6.1 Location Independent Controller Placement Algorithm**

This placement is the method which will help to place the controller in the exact position along with the Search Location Algorithm it will help to place the controllers. The Search Location Algorithm is the method in which the

part of the Location independent controller placement algorithm, it will gather all the information about the location through switches which are in sub-region. The main aim is to get the location and it will check for the minimum latency which will be greater before. The latency is the location and the switches which is in the controller.

At first, it will form the triangle in shape and it will search the location for the switch, it will consider the switch as the vertex of the triangle. Search Location Algorithm will be working likewise. At second step it will consider the center of the triangle and then by considering the center the minimize of maximum latency is taken.

$D_K$  can be considered as the latency which is present in the controller location. Switch will be considered as K and P. Search Location Algorithm will search the location until  $D_K$  should not exceeds over latency, if it was maintaining the method then the triangle formation will be formed else it won't. To stop the Search Location Algorithm the step is mentioned below

## **6.2 Dynamic method of controller placement**

The two important method of Location Independent Controller placement Algorithm is

1. The whole SDN modules will be partitions by Location independent controller placement algorithm into sub-locales, which is mainly based on maximum latency.
2. For every sub-locales, it discovers the area of the controller so that a most extreme number of switches can be worked, and the most extreme inertness can be diminished.

## **Conclusion and Future Work**

In SDN (Software Defined Networking) the analysis done is to place the controller in the correct position using the Location Independent Controller placement Algorithm, So by using this the Time delay will be less and the Accuracy will be high. By using the Searching location Algorithm it will help to find the location in which place the traffic will be high and to place the controller in that position. So by doing this the scalability in the network will be high and the minimization of maximum latency. Also how many controllers should be placed.

The future work of the project is to implement the algorithm, which has good performance on high availability, scalability and also it should be cost efficient.

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