

High-level Framework for Software Defined Network: A Study

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Abstract: The SDN can be configured by writing codes, which means the low-level details should be known. A framework called OSDF can configure the network without using low-level details. It generates some rules and according to this rule the network behaves. Mainly forwarding and dropping of packets are takes place. Web-based framework means, it uses web page for creating the rules and the rules are automatically generated on the switch. Protocol OpenFlow is used. The paper presents the study to implement we-based framework for SDN.

Index Terms - Software Defined Network, OSDF, Openflow Switch, Networking, Framework

I. INTRODUCTION

Networking is the most important factor in the Internet. As the internet develops, new networking ideas are evolved in these days. As the requirements and size of the network increases, the network must be evolved. Switches are used for the communication of nodes in a network. It is not possible to increase the size of the hardware switch as the network size increase. Solution for this is programmable switch. Software Defined Network (SDN) is one among them. "SDN" is a bit like "cloud computing": it is often sold as a "miracle" solution to all network infrastructure problems. But besides marketing, it also corresponds to a new type of network architecture [7]. In SDN data plane and control plane are separated. Whenever a network is created, if any changes can be made to them is by changing them at low level. It is difficult and also a programmer needed for changing the requirements. SDN helps that the network requirements can be change by without using the low level details. SDN can be programmed at high level.

Mininet [5] is a tool which is used to emulate the SDN network. They can only perform at wired links. It cannot emulate for wireless links. Open Software Defined Frame Work (OSDF) [1] is the framework for Software Defined Networking. In this framework it uses Open Network Operating System (ONOS) [6] as SDN Controller. Mininet tool is only used for the emulation of network but in real network the programs may change, it is one of its main disadvantages. So a web-based framework is introduced.

In web based framework, in on system we can program the controller and switches. Also it uses a web page for rule generation. That means is rule is generated automatically. When the submit button press the rule is automatically generated and according to this rule further works takes place in the network. The low level details cannot be needed; also an admin or user can control the network. Whenever the low level details should be changed, a programmer is needed. But in case of web-based frame work, we use high-level language. So no programmer is needed. Also it uses a flow table. According to this flow table entries are generated. Rest of the paper organized as follows: following section presents related works during the study. Section III gives the new method and section IV gives the conclusion of the study.

II. RELATED WORKS

In the paper Software-Defined networking: A comprehensive survey [2] is a wide and clear survey about SDN. SDN is an emerging technology and which help to user to program the network. First it describes the disadvantages of traditional IP networks and introduces the new network type SDN. Traditional IP network is very complex and very difficult to manage. When a network interface is configured with an IP address, a route to the network of the address member is generally recorded automatically on the interface. In case of single hop network, it is possible to use traditional IP method. But in case of wireless multi-hop network it acts differently. In traditional IP, configuration of network with predefined policies needs much effort. This difficulty is because of the planes (data plane and control plane) are vertically integrated. The main difference with traditional IP to the SDN is, control plane and data plane are separated in SDN. This separation will help to program the network.

Infrastructure of SDN mainly consists of two approaches: bottom-up approach and layered approach. Cross layer problems such as debugging and troubleshooting are also checked in the SDN. Software defined network is used for forwarding the packets and these forward operations can be programmable. It is concluded that the SDN is the next generation networking. The paper Survey on SDN Programming languages: Toward a Taxonomy [3] compares different programming languages using in the Software Defined Network. Frenetic is one of them. Frenetic: A Network Programing Language [4] defines how to program software defined network through this particular language. Frenetic is a high level language used to programing the network switches. Frenetic faces some serious issues with OpenFlow and NOX programming model. And these both use high-level collection of operators for the network traffic management.

According to the paper [3] different programming languages have different functionalities. Also they react to the same problem differently. The comparison is mainly based on the OpenFlow protocol. The languages surveyed disclose a wide range of features, but at the same time, there are considerable intersections between them. Also note that the lack of consensus on the vocabulary used in the abstract provided by these languages, which often makes it very difficult to compare and classify them. So the main feature of each language is considered for the taxonomy. According to the paper [3] researchers can use any language, which is fit to their requirements.

Open Network Operating System (ONOS) [6] is a platform for distributed SDN Control. Two ONOS prototype are evaluated. The prototype one is based on distributed feature and the second one is focused on the performance and latency improvement. LINUX foundation hosted the ONOS. For large production of network, scalability, performance and availability requirements should be meet by the network operating system. For better improvement ONOS has introduced and it adopts distributed architecture. ONOS [6] uses simple connectivity abstraction, which doesn't depend upon the specific paths in the network. But the main disadvantage of ONOS is that at the end to end processing it is having a low latency.

The simulators ns-2[8] or Opnet [9] are the simulators and can run in any system. But the main drawback is that the code in the simulator is different in from real network. So an Emulator called Mininet [5] is introduced. It uses light weight mechanism. For creating custom topologies and experiments Mininet uses python API. It is mainly useful in case of system level testing. Mininet can customize and share a SDN prototype to simulate the network which uses the Openflow switch. At high loads the performance is decreased, this is one of the main disadvantages. And also they can emulate only wired links. It uses a partial virtualization approach. So it also limits actually a Mininet can do.

III. MODEL FOR WEB-BASED FRAMEWORK ARCHITECTURE

It is the basic work of a framework. The framework is web based. For web based framework mainly three components is considered. And they are:

- 1) Controller
- 2) Openflow Switch
- 3) Web page
- 4) Flowtable

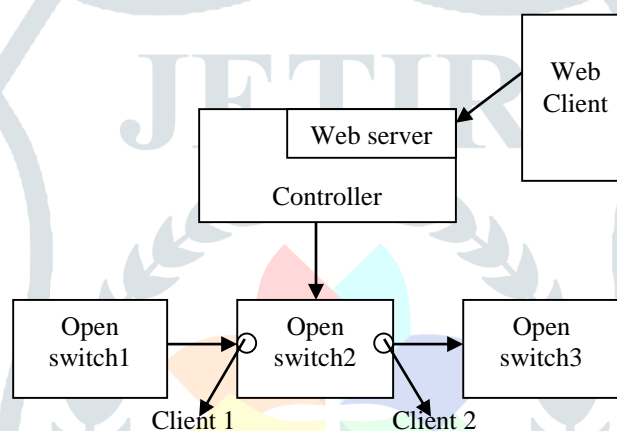


Fig1. Over all idea of web-based architecture

The figure 1 shows the architecture of the web-based framework for software defined network. Web server is inside the controller. Controller is connected with open switch. The number of ports can be increased. A switch contains number of ports. The open switch is started first, and then the server should be on. Then using web page rule is submitted. Then the rule is automatically generated and according to this rule, operations take place.

3.1 Controller

Controller is the main component in the framework. Mainly it is an application the SDN and runs on server. Also it can host many control applications. It controls the data from the webpage and creates the rule. Then it will be dynamically written in the Openflow switch. According to the rule packets are transferred in the network. Parsing of data can be takes place here and which is done by Jason (JavaScript Object Notation). When a data is passed from a server to webpage or vice versa Jason helps for storing it and transporting it. And the main feature of JSON is that it can be written in any programming language. The controller gets the data from the web page using request response mechanism.

3.2 Openflow Switch

Openflow is a protocol, which helps the communication between Openflow Switch and controller. As the name shows Openflow Switch is a Openflow enabled switch and which communicates with the server for what operation to be performed. It is mainly based upon flow table. Controller and open flow switch are connected to each other. According to the data from the controller it sets a rule by using setRule(). Also the rule is parsed format. For the functioning we create some ports. And these ports are listening to the server. Validity was also checked.

3.3 Webpage

Webpage is used for creating the rule. That means a user can control the network. It can be coded in Embedded Java Script (ejs). Simple html code with embedded java is used.

3.4 Flowtable

Flowtable mainly consist of three attributes and they are:

1. Classifier
2. Action
3. Statistics

- **Classifier:** Classifier consists of Ingress port, TCP/UDP connection, IP. Ingress port is the port where the data are coming from, that means the source port. And out port is where the data reaches, that means the destination port.
- **Action:** only two actions should be performed. Forward action and drop action.
- **Statistics:** It defines some priority or timeout to the rule.

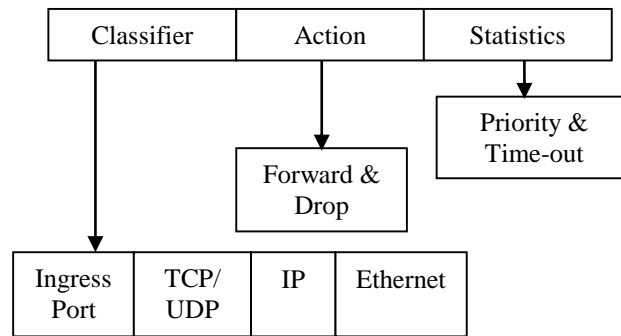


Fig2. Flow Table

IV. CONCLUSION

Software Defined Networks has its own importance in networking area. A framework for SDN is done in high-level language, because in case of low-level language there is programmer needed for making changes in the network. In case of high-level framework no need of programmer. Admin can make changes in the network. That means admin or user can create a network. Open Network Operating System is used as SDN controller in OSDF. In case of web-based framework all are in a single system.

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