

SDN as a Change Agent

Sharanjit Singh , Amardeep Singh, Shruti Sharma*,Ramanpreet Kaur

Dept. of Computer Science and Electronic Engineering

Guru Nanak Dev University (G.N.D.U.) Amritsar, Punjab

sharan_sran@yahoo.co.in,amardeep1508@gmail.com,ershruti0131@gmail.com,ramangill091@gmail.com

Abstract

The explosive growth of connected components and devices lead to data traffic that further cause the latency or and many for future challenges for communication networks. To overcome these challenges need to introduce innovative networking technology, Software define networking(SDN) is one them that redefine the way we think about networking industry. It fundamentally change the IT operations just like server virtualization accepted in network by using software based infrastructure rather than hardware based structure. SDN take complicated network and separate control plane from data plane, we get simple and flexible network that are able to solve bunch of problems from network perspective.SDN give hope to built faster and efficient high capacity network at low cost and Openflow is standardized interface for communication between SDN controller and network devices . Here we discuss different version of OpenFlow for SDN implementation, their features, specifications, comparison

Keywords: SDN, OpenFlow, specification, Application, XTEF,ONF

1. INTRODUCTION

Software define networking(SDN) is an existing technology in the new era have potential to transform the network industry in interesting way or we say SDN is the key to transformation. According to the researchers and experts the future of network traffic will rises multiple times of the today traffic.SDN is the new buzz in telecom industry, is basically how software will be helpful to manage all hardware entities and make it dumb terminals and software will be the power. It change the way we design the network ,there is separation of control plane from the data plane ,control plane is responsible for computing, controlling all the algorithm are written in controller that are reinstall in data plane ,data plane redirect the path of data packet. The main motive behind the construction of flexible services is to reduce the hardware limitations.[1]OpenFlow is one of the most widely used SDN controller protocol that provide a mean to control a

switch without knowing vender's source code of devices .According to Google search engine after importing SDN, performance improved three times than earlier

Networks and the operational cost reduced to one third to achieve same quality of services.

Initially OpenFlow was used in business organization, academic institute and any more organization. According to the 2016survey report of northern American enterprise predict that near about 90% of large and medium enterprises of north America uses SDN in their live production and international market of SDN rises up to\$45 million. The notion of SDN that provide flexibility by dynamically adding features to the networks, also used in many mobile OS like Android, iOS where we can add "apps" dynamically. OpenFlow proposed a standardized communication between control and forwarding plane. OpenFlow provide a strategy to reduce the operational cost and hard limitation while increasing the functionality of the network. There are many capabilities and challenges face while using OpenFlow as standard in SDN.[2]

2. RELATED WORK

In this section we explain the related work of OpenFlow. ONF (open networking foundation) is technical community founded in 2011. Microsoft ,Google, Face book, Verizon, yahoo, Huawei, NEC, Intel, Cisco, Aricent, Deutsche Telekom etc. all are the member of ONF that dedicatedly work on the promotion and Adoption of SDN ,manages OpenFlow based networks. OpenFlow is the first standard of communication interface between control and data plan of SDN architecture defined by ONF[3]

Initially OpenFlow considered as tool to enable the network innovation in educational campus. The gain of using Openflow motivate the researchers to do new experiment in production field. OpenSecis first SDN based product to simplify the network management and also able to implement security policies in the network at campus like area[4]

While rising the demand of SDN based implementation ,new product introduced XTEF(extensible Traffic engineering Framework) inspired by the Google's

network demonstration. XTFE to enable application – driven traffic engineering and plan to transport network resources by using on demand WDM tunnels(wavelength division multiplexing). The Mobility First was started in 2010-14 as first phase by National Science Foundation under the Future Internet Architecture Product(FIA) and the second phase announced in may 2014.The basic concept of Mobility First was separation of naming and addressing for better mobility support. The major goal of proposed architecture are: traffic analysis, efficient routing and centralized control capabilities.

3. OPENFLOW

OpenFlow as propose standardized communication interface of SDN by ONF .OpenFlow is one of the most commonly considered protocol as southbound interface ,that decouple the brain of the network from forwarding plane. In this section we start with overview of OpenFlow future paper[5]their basic packet forwarding structure, features and specifications.

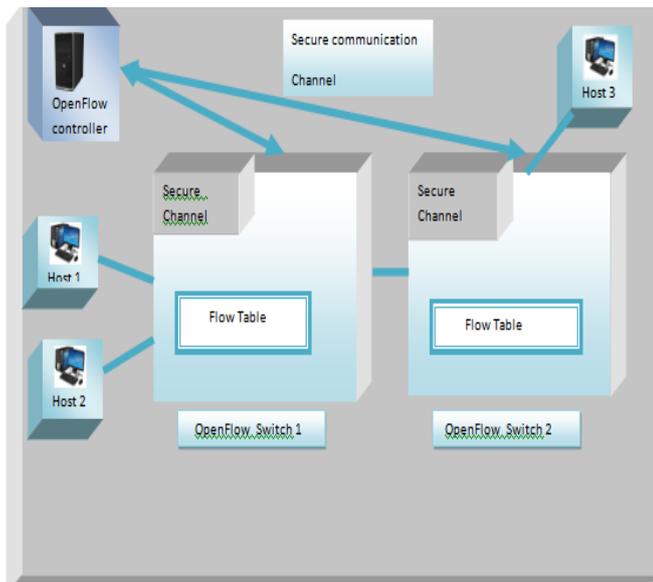


Fig1: OpenFlow basic Structure

3.1 OVERVIEW

OpenFlow now become the most frequently used SDN technology. The basic architecture of OpenFlow based on the three notions. First is the control panel built up by more than one OpenFlow controllers. Second is the data panel consist of OpenFlow switches and the last one is to connect the data panel's OpenFlow switches and control panel secure channel is maintained. OpenFlow switches are taking responsibility for packet forwarding according to flow table .Flow table

having three main entries column like header field counter and action.[innovation]The header field give the information for applicable packet entry.[5]TCAM(ternary content addressable memory) is the concept used for fast forwarding packet transfer.TCAM enabled OpenFlow switches perform comparison of incoming packet and look up to identify the highest priority match for each incoming packet.

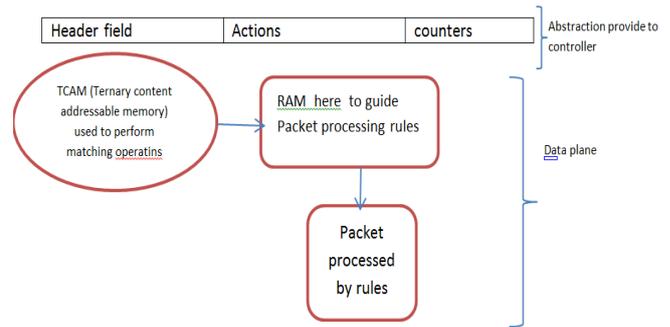


Fig2: Openflow header Field

4 .SPECIFICATIONS

Here we give review over the different OpenFlow protocol specifications ,highlight their features and comparison. OpenFlow protocol that allow us to program the flow table of different switches in data plane. OpenFlow was initially proposed by NickMcKe own from Stanford university in2008.After that in march,2011 OpenFlow is standardized by ONF(open networking foundation. From the past few year ,with the increasing popularity of SDN in the recent year there are several version of OpenFlow are introduced in the market with new features and improvements like virtual ports, synchronized table, multiple tables ,meter tables. The first version of OpenFlow was version 0.2.0 released in march 2008. In may,2008 versions 0.8.0 and 0.8.1 released. In oct, 2008 version 0.8.2 having feature Eco request and Eco reply messages. The Openflow Version 0.8.9 was released in dec ,2008 having additional static information, IP netmasks and some other updates.OpenFlow 0.9 released in july, 2009.At last most deployed version OpenFlow1.0 released in 31dec,2009 . Fig2describe the growing history of Openflow versions from version 1.0 released in dec,2009 to version 1.4.0 was released in oct,2013.[6][7][8]

OpenFlow versions	Release date
Version0.2.0	March,2008
Version0.8.0	May,2008
Version0.8.1	May,2008
Version0.8.2	Oct,2008
Version0.8.9	Dec,2008
Version0.9	July,2009
Version1.0	Dec,2009
Version1.1.0	Feb,2011
Version1.2	dec,2011
Version1.3.0	june,2011
Version1.3.1	Sep,2012
Version1.3.2	April,2013
Version1.4	Oct,2013
Version1.5.0	Dec,2014

Fig3: OpenFlow Specifications with releasing date

Protocols	Version Support			
	OF 1.0	OF 1.1	OF 1.2	O.F 1.3 and 1.4
Metadata		Y	Y	Y
IPv4	Y	Y	Y	Y
OpenFlow			Y	Y
Ethernet	Y	Y	Y	Y
IPv6			Y	Y
Ingress Port	Y	Y	Y	Y
TCP/UDP	Y	Y	Y	Y

Fig4. OpenFlow Specifications with their services and feature.

5.INNOVATIVE SDN APPLCATIONS

To run the application on the SDN controller for manipulating flow table of SDN switch ,Operating System needed. Operating system act as interface between user application and SDN Switch. To communicate with OpenFlow Switch ,OpenFlow protocol used by network operating System. Beacon, NOX, Maestro and floodlight are the network operating system .Frenetic and Trema are the network programming language that play key role to simplify the development of network operating System.[9] [10]

Controller	Language	Created by	Documents	Open source	multithreaded	Comment
Beacon	Java	Stanford	Good	Yes	yes	Used for research experiment
NOX	Python/C++	Nicira Networks	Good	Yes	Yes	Widely used
Trema	Ruby/C	NEC	Poor	Yes	yes	Support only Linux applications
Maestro	Java	Rice university	Fair	Yes	Yes	Licensed under LGPL,not commonly used
Floodlight	Java	Big Switch networks	Good	Yes	yes	Used for enterprise

Fig4: OpenFlow Controllers comparison chart

SDN is more flexible and extensible upcoming networking technology used in recent year.The contribution of SDN in various network application that are already implemented.SDN application fall in various category are:

- traffic engineering
- Network virtualization
- Security
- Routing Optimization
- Load balancing
- Denial of service prevention
- Disaster recovery
- Firewalls
- Web optimization

In addition to these, there are many other challenges improved by SDN like reduce cost as already discussed it is financially good. Others benefits are it reduces complexity, Increases scalability, improves traffic handling, implementation and management of network policies, other enterprise-specific applications. SDN is now becoming a huge buzz in the telecom industry Huawei like IT Company are one of the best example of SDN based mobile access network.

6. CONCLUSION

In this paper we review the notions of SDN (Software define Networking) using OpenFlow and also briefly discuss different versions of widely used Communication protocol for SDN ,their features and services since 2008 to 2014.In this paper we give growing history of OpenFlow. We also illustrate the contribution of SDN application in today society .It is comprehensive survey of SDN OpenFlow and their scope in future network industry.

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