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QOS Evaluation in SDN and Ethernet Networks

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Abstract: Traditional network architectures such as ethernet are not very satisfactory to its clients and users and do not meet their requirements. SDN (Software Defined Network) has completely changed the network architecture in terms of quality of service. In this respect, this study is a comparative study between the two architectures: SDN and ethernet. How efficient is SDN compared to ethernet?

Key words: SDN, controllers, QoS, SIP, Mininet, ethernet, architecture, comparative

INTRODUCTION

With the coming of SDN (Software Defined Network) (Seddiki, 2015), network architecture has witnessed a very positive change when dealing with QoS (Quality of Service) (Aurrecoechea *et al*., 1998). SDN is a recent architecture that has come to solve the complexity of those approaches by detaching control and data planes.

It is in fact a combination of network and software systems in order to separate the signaling part (control planes) of the transfer of data (data planes) (Vemuri, 2014) and making the control planes programmable. Therefore, we have more flexibility to manage the network behavior in general and the mobility in particular.

State of the art: Quality of service and VoIP in telecommunication network has always been the core requirements that meet user's expectations.

User's of these technologies have an extremely low tolerance for any form of voice or video delay service quality. QoS is the ability to transmit a type of traffic in the right conditions in terms of latency, jitter, packet lost rate, time of issue and so on. QoS is very important for the proper use of voice over networks and indirectly, for the priority processing of voice in the flow of data transmission.

This is to avoid the congestion of problems of the switch at the level of the data links as the resolution of the collisions. Ethernet increases the rate lost of the packets which poses the possibilities of saturation to the memory of the switch also the frames lost implies a recovery of losses by the transport layer which collapses the efficiency of the end-to-end with a transmission delay increase.

For all these reasons, SDN networks have been developed to improve the QoS (Gigue, latency, packet lost rate and call intake time) at the level of the latter compared to ethernet. The goal of this resarch is to show "What is the contribution of QoS under SDN report to ethernet"?

MATERIALS AND METHODS

Software defined network: Open Networking Foundation (ONF) and International Telecommunication Union (ITU) have been recently working on the Standardization of SDN Networks. A high level view of the SDN architecture together with the key principles of SDN networks have been presented by ONF (Cabaj *et al*., 2014) (Fig. 1).

SDN contains three layers (Ungureanu, 2014)

The infrastructure layer: Network switches and routers and the data itself as well as the process of forwarding data to the appropriate destination (Matteson, 2014).

The control layer: This layer is the Controller (CR) that is logical entities that receives instructions or requirements of SDN application layer and relay them to the network components.

The application layer: Applications are programs that explicitly, directly and programmatically communicate their network requirements and desired network behavior to the SDN controller via. NBIs. In addition, they may consume an abstracted view of the network for their internal decision making purposes (ONF., 2013).

The SDN controller acts as a network "brain", directly communicates with network applications via. North-bound interface (control-application plane

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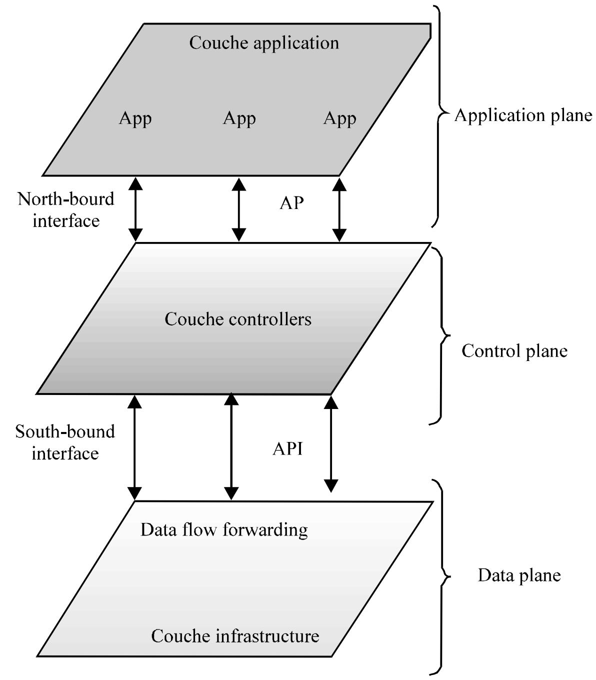

Fig. 1: SDN architecture

interface) to provide network state information from data plane and to translate requirements and high-level policiesfrom applications to low-level commands via. South-bound interface (control-data plane interface). The most popular protocol used today for communication between the SDN controller and network data plane is openflow (McKeown *et al*., 2008).

The communication between the controller and the two physical layers is guaranteed by OpenFlow protocol (OF) (Tury, 2015).

Controller SDN: This is the brain of the SDN Model, it collects information on all network. It offer a centralized view of the global network and sends commands to all network devices, it centralizes the intelligence of the network.

It contains the tools, technologies and protocols needed to program the network infrastructure. The SDN controller defines the flows of data that occur in the SDN data plane, each stream across the network must first obtain permission from the controller which verifies that communication is allowed by the network policy if the controller allows flow, it calculates a route to take it and adds an input for flow in each of the switches with all the complex functions encompassed by the controller, the switch simply manages the flow tables whose inputs can be populated only by the controller.

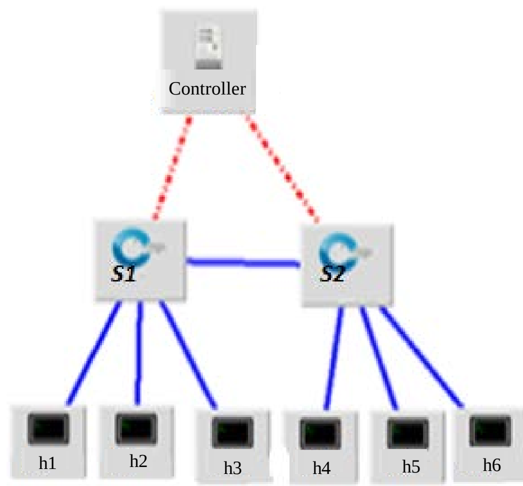

Fig. 2: SDN architecture

Switch open flow: An openflow switch consists of one or more flow tables and a group table. It performs packet look-ups and forwarding. The controller manages the openflow-enabled switch using the openflow protocol over a secure channel. Each flow table in the switch is made up of a set of flow entries in which each flow entry consists of match header fields, counters and a set of instructions to apply to matching packets (ONF., 2012).

Software-defined networking and open flow architecture: Most current network devices have control and data-flow functionalities operating on the same device. The only control available to a network administrator is from the network management plane which is used to configure each network node separately. The static nature of current network devices does not permit detailed control-plane configuration. This is exactly where software-defined networking comes into thepicture. The ultimate goal of SDN as defined by Duan *et al.* (2012) is to “provide open user-controlled management of the forwarding hardware of a network element.” SDN operates on the idea of centralizing control-plane intelligence but keeping the data plane separate. Thus, the network hardware devices keep their switching fabric (data plane) but hand over their intelligence (switching and routing functionalities) to the controller. This enables the administrator to configure the network hardware directly from the controller. This centralized control of the entire network makes the network highly flexible (BSN., 2012; Shin *et al*., 2012).

Implementation with “Mininet” and “gns3" (Fig. 2 and 3): In this research, the Session Initialization

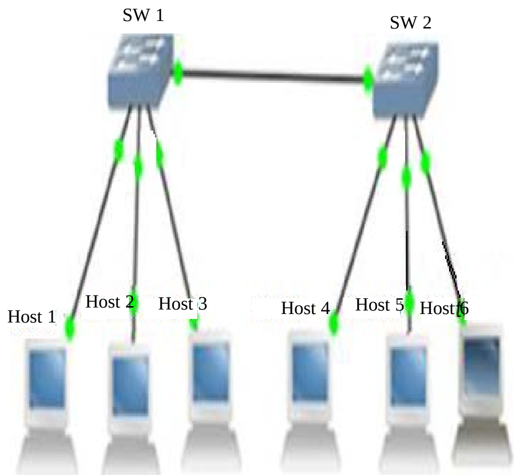

Fig. 3: Ethernet architecture

Protocol (SIP) (Donovan, 2000) is used, it is used for end-to-end signaling control to establish a communication session between two networks for the exchange of data (or streams) over the internet, this standard is presented with an exchange process between UAC (10.0.1) and UAS (10.0.0.4) as follows:

Here, the two topology are used one represents an SDN network under Mininet and the second figure for the ethernet network under GNS3.

RESULTS AND DISCUSSION

Settling time of call: On the basis of the results found, it is observed that the time of call establishment under SDN (0, 009888 μsec) is faster than ethernet (0, 860855 μsec) as illustrated in Fig.4.

In this case, the machine "10.0.0.4" wants to communicate with other one "10.0.0.1". It starts with a request for communication via. the sending of an INVITE request. We note the message of the processing start with "180 RINGING" and OK which show us that the machine "10.0.0.4" accepts the establishment of a communication session. Finally, the machine "10.0.0.4" returns to its recipient an ACK message to confirm this establishment of the connection.

QoS parameters: In this part, we will see all the parameters of QoS (MOS, jitter, latency, lost packets) are done to show that the new SDN technology is better than ethernet in terms of QoS offered by voice application. We will test the different parameters of QoS.

Jitter: Jitter is the variation of the end-to-end delay between two successive packets, a jitter of <50 msec is acceptable for high-quality VoIP calls (Rattal *et al*., 2013) (Fig. 5 and 6).

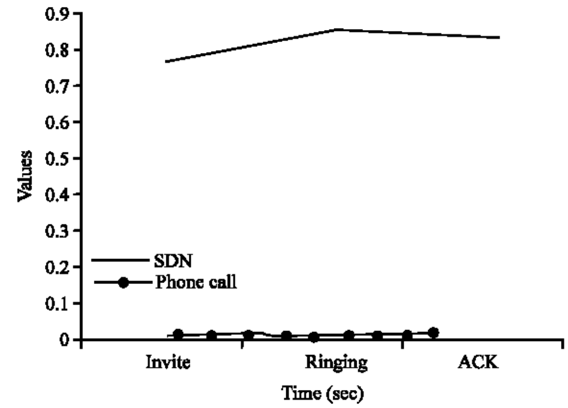

Fig. 4: Settling time of call in SDN and ethernet networks

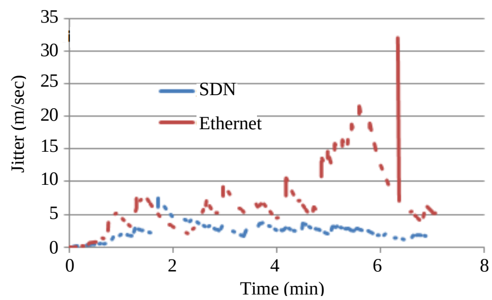

Fig. 5: Jitter in SDN and ethernet networks

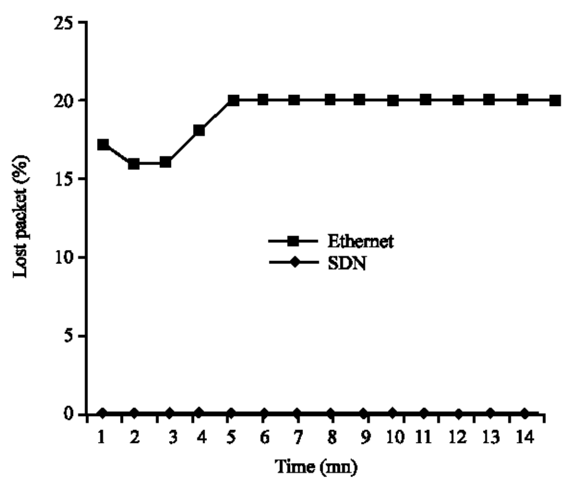

Fig. 6: Lost packets in SDN and ethernet networks

In a 7 min communication, we notice that the curve of the jitter (blue color) varies between 0 and 6 msec for SDN and the ethernet curve (red color) between 0 and 21 msec this shows that SDN is better than ethernet.

Lost packets: The end-system delay occurs due to the encoding and decoding delay and the jitter buffering

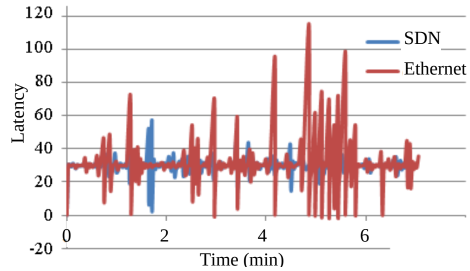

Fig. 7: Latency in SDN and ethernet networks

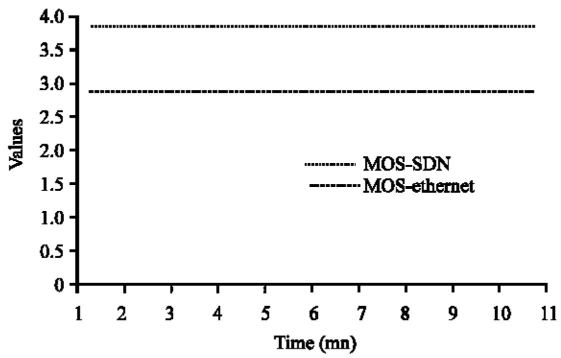

Fig. 8: MOS in SDN and ethernet networks

Table 1: Relationship of MOS values to the quality of voice rating

MOS	Perceived quality
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad

delay (BSN., 2012). From the selected curves, it can be seen that the number of packets lost under ethernet is higher than SDN because the latter is almost zero.

Latency: Figure 7 shows that, the end-to-end delay values captured for 7 min, it reaches up to 58 msec in SDN networks and 118 msec. The case of ethernet.

MOS (Mean Opinion Score): MOS (Mean Opinion Score) is a measure of voice quality. It is a quality measure that has been used in telephony for decades as a way to assess the human user's opinion of call quality (MN., 2015) (Fig. 8). This is the equation, we used for MOS:

$$MOS = 4\text{-}\ln(loss)\text{-}0.7*\ln(size)$$

From the results received, it is found that MOS under SDN which has the value of 4 is better than under ethernet which has the value 3 (Table 1).

CONCLUSION

This study examines the performance of QOS via. the SIP protocol under Ethernet and SDN through SIP protocol in term of the QoS parameters (Jitter, Latency, Packet lost and MOS).

As a result, it was absolutely noticed that the performance of QOS under SDN is more efficient when compared to ethernet.

REFERENCES

Aurrecoechea, C., A.T. Campbell and L. Hauw, 1998. A survey of QoS architectures. Multimedia Syst., 6: 138-151.

BSN., 2012. The open SDN architecture. Big Switch Networks,Santa Clara, California, USA. http://www.bigswitch.com/sites/default/files/sdn_overview.pdf

Cabaj, K., J. Wytrebowicz, S. Kuklinski, P. Radziszewski and K.T. Dinh, 2014. SDN architecture impact on network security. Proceedings of the International Conference on Computer Science and Information Systems FedCSIS Position Papers Vol. 3, September 4-7, 2014, ACSIS, New Jersey, USA., pp: 143-148.

Donovan, S., 2000. The sip info method. Network Working Group, 1: 1-9.

Duan, Q., Y. Yan and A.V. Vasilakos, 2012. A survey on service-oriented network virtualization toward convergence of networking and cloud computing. IEEE. Trans. Network Serv. Manage., 9: 373-392.

MN., 2015. What is MOS (Mean Opinion Score) for VOIP?. Mushroom Networks, San Diego, California, USA. www.mushroomnetworks. com/blog/2015 /12/10/what-is-mos-mean- opinion-score-for-voip/

Matteson, S., 2014. Software defined networking: The cisco approach. TechRepublic, San Francisco, California.http://www.techrepublic.com/article/ software-defined-networking-the-cisco-approach/.

McKeown, N., T. Anderson, H. Balakrishnan, G. Parulkar and L. Peterson *et al.*, 2008. OpenFlow: Enabling innovation in campus networks. ACM SIGCOMM Comput. Commun. Rev., 38: 69-74.

ONF., 2012. Open flow switch consortium. Open Networink Foundation, USA.https://www. opennetworking.org/images/stories/downloads/ sdnresources/onf-specifications/openflow/ openflow-spec-v1.3.0.pdf.

ONF., 2013. SDN architecture overview. Open Networink Foundation, USA.https://www.opennetworking.org/images/stories/downloads/sdn-resources/technical-reports/SDN-architecture-overview-1.0.pdf.

Rattal, S., A. Badri and M. Moughit, 2013. Performance analysis of hybrid codecs G. 711 and G. 729 over signaling protocols H. 323 and SIP. Intl. J. Comput. Appl., 72: 30-33.

Rattal, S., A. Badri and M. Moughit, 2016. Performance analysis of hybrid codecs, G.711 and G.729 over signaling protocols H.323 and SIP. Intl. J. Comput. Appl., 72: 29-31.

Seddiki, M.S., 2015. Allocation dynamique des ressources et gestion de la qualite de service dans la virtualisation des reseaux. Ph.D Thesis, Universite de Lorraine, Nancy, France.

Shin, M.K., K.H. Nam and H.J. Kim, 2012. Software-defined networking (SDN): A reference architecture and open APIs. Proceedings of the 2012 International Conference on ICT Convergence (ICTC), October 15-17, 2012, IEEE, Jeju Island, South Korea, ISBN:978-1-4673-4828-7, pp: 360-361.

Tury, M., 2015. Les risques d'OpenFlow et du SDN. ANSSI, France. https://www.ssi. gouv.fr/uploads/2015/06/SSTIC2015-Slides-risques_openflow_et_sdn-tury.pdf.

Ungureanu, O.M., 2014. Flexible and programmable evolved packet core: A new SDN-based model. Ph.D Thesis, TU Delft Library, Delft, Netherlands.

Vemuri, K.K., 2014. Policy carry-over for mobility in software defined networks. Ph.D Thesis, University of Houston, Houston, Texas.