

# Implementation of Qoe/QoS mapping inSDN

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**Abstract** – Software Defined Networking (SDN) consists of two planes : control and data. The control logic or brains is separated from traditional switches/routers and migrated to a centralized controller, which is responsible for configuring devices in the network and editing and modifying flow tables that are to be used by data flows. The controller collects the information from switches in the network and manipulates the forwarding of packets. QoE (Quality of Experience) is a measure of customer's experience with a service. We propose a QoS/QoE model and adjusting application to translate the network QoS parameters in Software- defined networks. The application is implemented on the OpenDaylight controller platform. If user's QoE score is less than a derived lower bound then we adjust the QoS parameters in response. QoS parameters which are being adjusted include delay, jitter, bandwidth and availability.

**Key Words:** SDN, Opendaylight , QOE, QOS.

## 1.INTRODUCTION

Software Defined Networking (SDN) is a programmable network architecture. It separates the function of forwarding element of the switch from the function of the control element of the switch. Thus the architecture consists of two planes called the Data Plane and the Control Plane. The hardware switch is responsible for forwarding whereas the function of control element is done by external server called as controller. We can develop applications which interacts with the controller which in turn changes the flow tables of the switches. Each OF-switch has its own flow table for users to define the paths of the packets. Each rule in the flow table contains three main fields: Match, Instruction, and Action. When the OF-switch receives a packet, it will compare the values in the header fields of the packet with the Match field of each rule in the flow table. If the values in the header fields match the Match fields of any rule, the OF-switch will execute the command according to the Instruction field corresponding to the Match field. The switch can have multiple flow tables .The controller interacts with the switches using OpenFlow protocol. Thus the switches used in the infrastructure should support OpenFlow protocol. There are various open source controllers available, some of them are OpenDaylight, Ryu, NOX, Floodlight which are free. Quality of service is the overall performance of a computer network. QoS is measured in terms of

bandwidth, delay, jitter and availability. The current approach to providing QoS is based on the diffserv (Differentiated services) framework. However QoS lacks an important element in characterizing video streams which is user perception. User perception means how the user rates the service which he experienced. This parameter is called as user's Quality of Experience (QoE). QoE focuses on the entire service experience and expresses user satisfaction both objectively and subjectively .QoE, while not always numerically quantifiable, is the most significant single factor in a real world evaluation of the user experience. In this paper we propose a mapping between QoS and QoE in SDN architectures. If the user gets bad service then its QoE score will be low. The score can be adjusted by scaling the QoS appropriately so user gets proper service. Service providers can use the QoE and the proposed QoE function to monitor and adjust the user's QoE perception in the multimedia infrastructure. This enables service providers to respond quickly when the video stream has a negative impact on user's experience

## 2. RELATED WORK

In Work[1] we see the QoS-QoE mapping and adjusting architecture on the RYU controller. From the experimental results we see that QoS can be adjusted according to QoE. In [2] we see the calculation of QoE in cloud based infrastructure. This map-ping of QoE and QoS can be implemented in Software Defined Networks. An approach to modeling and control of QoE in next generation networks is described in [3]. In [4] we see that the SDN approach to provide Bandwidth on Demand services enables the automation of service provisioning, reducing the manual configuration and the operational costs. In [5] a path computation framework for SDN is described. Using this framework, bandwidth can be allocated dynamically. Packet inspection and forwarding schema [6] is developed in software defined networks. It is carried out with the help of OpenFlow switch. Path Querying system for SDN is described in [7] and [8]. Based on statistical analysis, path for packet can be determined.

## 3.THE ARCHITECTURE OF THE QOS/QOE MAPPING AND ADJUSTING APPLICATION

This paper presents implementation of QoS/QoE mapping and adjusting application on OpenDaylight controller. The process of implementing the QoS/QoE mapping is divided into two steps. The first step includes

the installation of user agent application on each host in the network. Architecture is divided into two modules:-

**A. User Agent Application:-** This application first captures all the packet that have been received while user is browsing the data. The role of this agent is to calculate QoE on the basis of various network parameters like bandwidth, jitter and delay. All the QoE scores calculated by the hosts is sent to the QoE adjustment application. Currently we have implemented adjustment model for video streaming in LAN and working only with TCP traffic. The application uniquely identifies each flow on user side. When the video streaming is complete the flow is removed from the database. All the adjustment takes place in real time when the flow is active and the video is streaming. If the user is experiencing a bad quality with the video, (i.e. video quality may be degrading or there may be intolerable amount of buffering time with the video) it is reflected in the degrading parameters in the network. Our proposed model tries to minimize this degradation in the network and improves user's experience with the network i.e. user's QoE score.

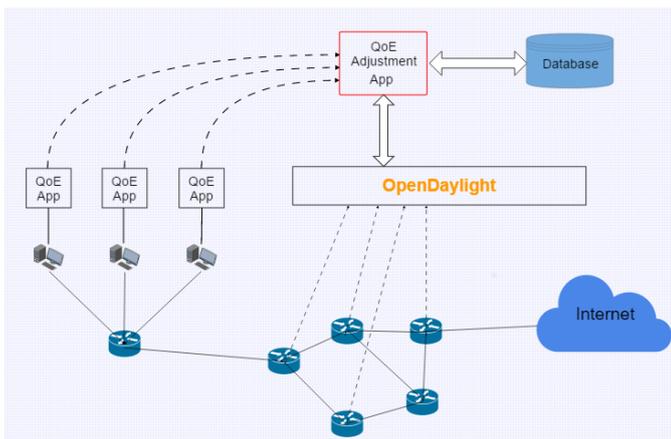


Fig -1: The QoS/QoE adjustment model architecture

**B. QoE Adjustment Application:-**

Application first reads network topology and flows present. All possible paths for each flow are calculated using K-Shortest Path algorithm[9]. Paths are sorted in ascending value of path cost. Paths for each flow are stored in database along with current path information. QoE and Flow information is retrieved from The Application then compares relative QoE of the hosts. It analyzes whether each host is getting valid QoE or not. If a particular host is getting less QoE then adjustment algorithm is used to improve QoE. Adjustment Algorithm: STEP 1: begin STEP 2: Check for current path of the flow. STEP 3: Increase cost of current path.. STEP 4: Check for new shortest path. STEP 5: Reroute the traffic through new path. STEP 6: Check for QoE score. If less than average, go to STEP 2 STEP 7: exit. Path changing can be achieved with the help of VLAN[ref].

First, VLAN is created . vbridge is created in VLAN and its ports are mapped to end interfaces of the flow

**4. CONCLUSIONS**

We implement a QoS/QoE mapping and adjusting application on the OpenDaylight controller. In this system ,we are going to implement a solution which will improve user experience. Service provider can use the proposed QoE application to monitor user's QoE perception and to respond quickly to rectify problems that degrade QoE in SDN. It will simplify network administration and management. Thus, we have successfully designed a system that improves user's experience in the network by taking into consideration their feedback.

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