Optimization of Network

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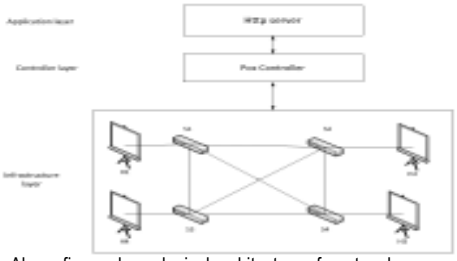
Introduction

Effective bandwidth allocation has always been an issue for which various techniques have evolved both in traditional networking and upcoming SDN architecture. Bandwidth management requires a certain understanding of the user's requirements and available resources . While SDN has many different applications for bandwidth management, we have tried to implement a different theme of network optimization where a user himself selects the path out of available options provided by the SDN controller according to his needs. Earlier, this choice was not always offered to a user to access the application of his choice. This project deals with enhancing link utilization in a small size network from a Software Defined Networking environment. We have implemented a data forwarding scheme which not only takes the shortest path into consideration but also bases its decision according to the bandwidth availability in any given link.

Our implementation runs in such a way that it gives customer privileges to select it's on choices based on type of service it wants. Considering options of paths based on bandwidth allocation (and delay) or the shortest path. We have used Mininet and its python API for generating SDN environment. We have used Http server on the top of controller to guide the controller what types of flows it should add.

Block Diagram



Above figure shows logical architecture of our topology.

We have used 4 switches named S1 S2 S3 S4 and for hosts H1 H2 H3 H4 connected to respective switches.

All the links are preassigned by the different bandwidths and weights.

Http server asked pox controller to introduce flows according to the client's need. If client selects shortest path as an option then Http server introduce that particular script in pox and pox will add flows as per that script notifying client that it has been connected.

SDN technology VS Bandwidth Management

The basic idea of SDN is taking the intelligence away from the hardware devices rendering them dumb. It does this by separating control plane from data plane. It changes the way we design basic networks simply to add flexibility.

SDN Has following planes

Control Plane:-its job is to calculate the routing table and simply forwarding it to the forwarding plane which consists of the hardware devices.

Forwarding Plane :- this plane "actually moves the packets" based on the decisions made by control plane.

Service plane:- The task that the forwarding plane is not able to perform is done by this plane. But this plane is rare. It is not used on very basic devices.

Management Plane :- This plane dictates as to how a network device should interact with other devices in the network. But it doesn't perform this function unless it is told to do so unlike the control plane

Bandwidth Management:- Major advantage of SDN is that it helped today's networks to be application aware and cost-friendly.

Bandwidth management is one such issue where traditional networks have always struggled to keep up with the ever-changing requirements of clients.

Bandwidth on Demand: A key area of SDN bandwidth management consists of availability of bandwidth as and when required. This process runs under the theory that a connection is opened only when there is enough data to be forwarded and the connection is closed as soon as data is sent. Various companies like MyKRIS, XO Communications, and Verizon Partner offer bandwidth on demand service

Bandwidth Aggregation: Another area of bandwidth management deals with combining bandwidths of more than one link in case the number of packets in queue exceed than a link can handle.

This project deals with the bandwidth management by providing voice of customer (VoC) service.

Client requests particular service (In this case Shortest path or Widest Path) to http server.

Http server is at management layer it asks controller to run requested script and according to that controller will behave, providing customer what it wants.

Results

Scenario 1:- First, a user (any host) wants a shortest path to a destination (any host or any application in real world) and is not really concerned about the bandwidth allocated on that link. He will select shortest path offered to him. First, we start the server along with POX controller as shown below and the result of iperf is also shown.

Following image shows the output when httpserver starts

Http server gives user two preferences

1. Shortest Path
2. Widest Path

Suppose user selects Shortest path as its option

As soon as user enters shortest path option. Server guides pox controller to add flows to open flow switches

Now pox is connected to the topology and if we run Iperf command we will see the bandwidth used by the client to reach to the destination

Scenario 2:- Similarly If User selects widest path as its preferable path then we will get following output.

Summary

To summarize, the client first connected to destination via shortest path and Iperf value has been calculated.

Then client was connected to destination via widest path and iperf value has been calculated

If we compare both the outputs then we can say that in widest path H1 uses more bandwidth than in shortest path. However the delay caused by widest path is more as compared to shortest path

Key References

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