Irtiza Sohail Butt 17100280  
Faizan Safdar Ali 17100152

**Topics in Internet Research - Project Proposal**

**P4 on Open vSwitch**

**Introduction:**

Programming Protocol-Independent Packet Processors (P4) is a programming language that is protocol and architecture independent. It allows packet processing based on a match and action forwarding model that has the potential to allow various specifications to be implemented. Open Virtual Switch (OVS) is an implementation of a virtual multilayer switch. The aim of this project is to implement Equal Cost Multipath Routing (ECMP) in P4 over a software switch (OVS).

**What is ECMP?**

Equal-cost multi-path routing (ECMP) is a routing strategy where next-hop packet forwarding to a single destination can occur over multiple "best paths" which tie for top place in routing metric calculations. Multipath routing can be used in conjunction with most routing protocols, since it is a per-hop decision that is limited to a single router. It potentially offers substantial increases in bandwidth by load-balancing traffic over multiple paths. [1]

**Uses of ECMP:**

* Incoming data traffic is evenly distributed over multiple equal-cost connections.
* Incoming data traffic is evenly distributed over multiple equal-cost connections member links within a bundle interface.
* ECMP can substantially increase bandwidth by load balancing traffic over multiple paths. Deploying it in a utilization aware manner through an algorithm will reduce the likelihood of congestion and hence improve overall performance. Using this scheme in P4 over OVS allows us to implement ECMP in Software Defined Networking and deploy it in datacenters or enterprise networks.

**Related Work:**

* “P4: Programming Protocol-Independent Packet Processors” in ACM SIGCOMM CCR 2014: This paper introduces P4 and sets out its implementation and possible applications.
* “PISCES: A Programmable, Protocol-Independent Software Switch” in ACM SIGCOMM 2016: This paper presents PISCES, a software switch that is not dependent on specific protocols which facilitates the addition of new features. It explores the possibility of forwarding and processing packets using P4 then compiling the specifications on the software switch.
* “HULA: Scalable Load Balancing Using Programmable Data Planes” in ACM SOSR 2016: HULA is a data plane load balancing algorithm that overcomes the limitations of CONGA, namely the shortage of switch memory and lack of flexibility. HULA is designed for emerging programmable switches and programmed in P4 which makes it relevant to our project.
* "A Simple Congestion-Aware Algorithm for Load Balancing in Datacenter Networks" in IEEE INFOCOM 2016: This paper seeks to address the shortcomings of ECMP by looking at alternative mechanisms. It presents a load balancing algorithm that performs well for various datacenter architectures.

**Proposed Approach:**

There are many algorithms and work available which let us work on the virtual switches and provide us with the programmable routers on which we can deploy any new feature in the datacenters without adding the new hardware or changing the old one. This feature can help us work and innovate on the control plane. In our project, we will use this feature and implement an ECMP protocol. We will use CONGA and other protocols as the state of the art ECMP protocol and try to come up with the better optimizations to the problems indicated in them by HULA i.e. they are implemented in custom hardware and have congestion control limitations. Also we will try to find out more issues in the state of the art protocols. We will also see how the different business policies and gateway protocols can affect the ECMP implementations. We will try to find how can SDNs help us in this matter and what changes in SDN can make it more helpful for us.

**Timeline and Division of Work:**

Week 1: Literature Review

Week 2: Learn the basics of P4 (Faizan), Open vSwitch (Irtiza)

Week 3: Integrate P4 and Open vSwitch into a single system

Week 4-5: Try to find a new and novel ECMP protocol or optimize present ones

Week 5-6: Implement ECMP

Week 7-8: Implement utilization aware load balancing algorithm

**Reference:**

[1]. http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mp\_l3\_vpns/configuration/xe-3s/asr903/mp-l3-vpns-xe-3s-asr903-book/mp-l3-vpns-xe-3s-asr903-book\_chapter\_0100.pdf