A
Project
by

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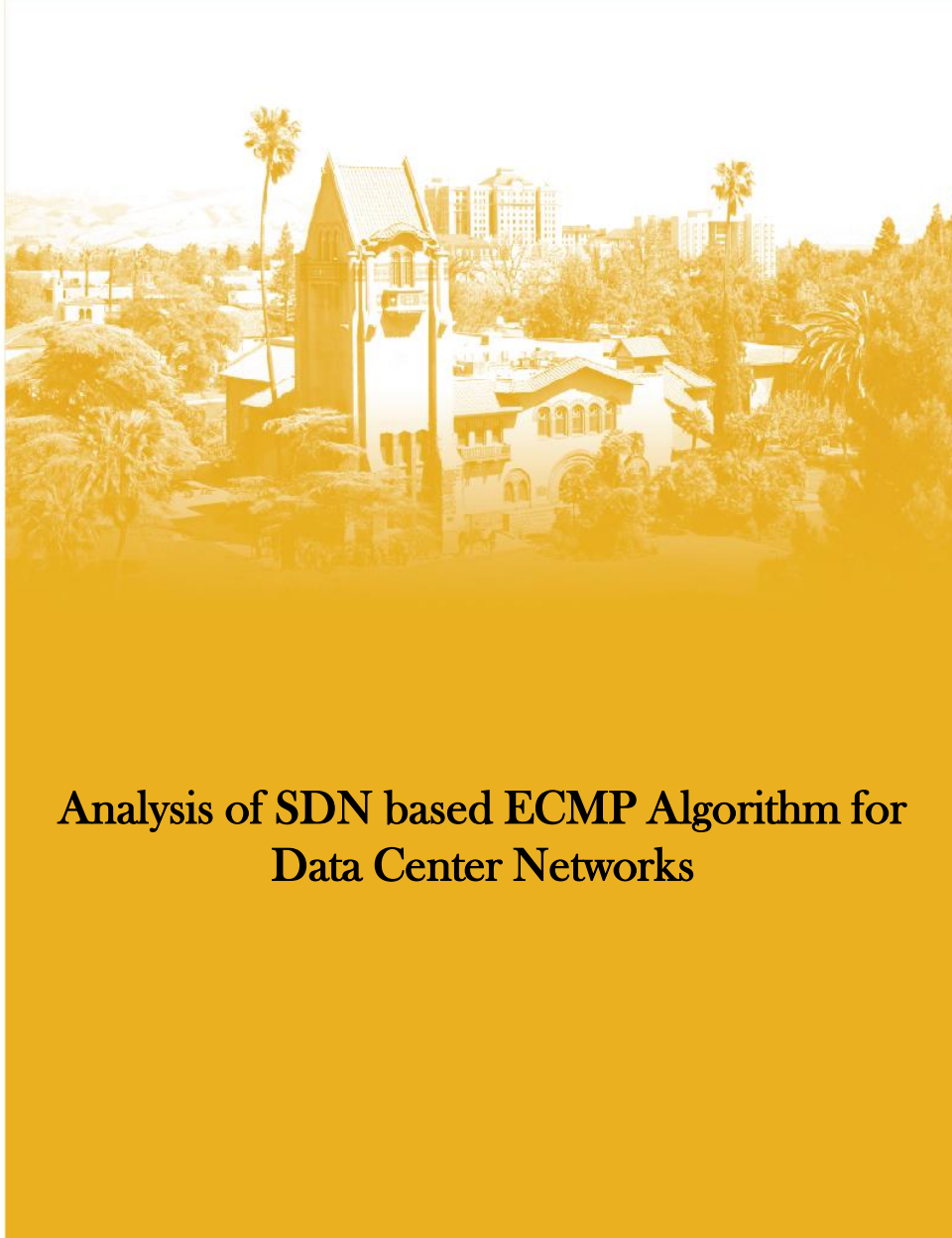
Analysis of SDN based ECMP Algorithm for Data Center Networks

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Need for Data Center Network

- Increased need for data availability and better performance
- To Enable large storage domain and faster network switching

What is a Data Center Network

- A collection of storage and network devices connected over a communication channel
- A Network which provides a virtualized environment

Need for a Scalable network

- Maximizing flexibility, increasing design life cycle
- Decreasing cost of the network and latency

Need for a Software defined Control

- For Dynamic Scheduling of Flows and selecting flows based on bandwidth utilization of core links.

Software Defined Networking

- Decoupled control logic from data plane which shifts the control on network to a centralized controller
- Decreases the physical management costs and improves operational flexibility

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Multi-Tier Architecture
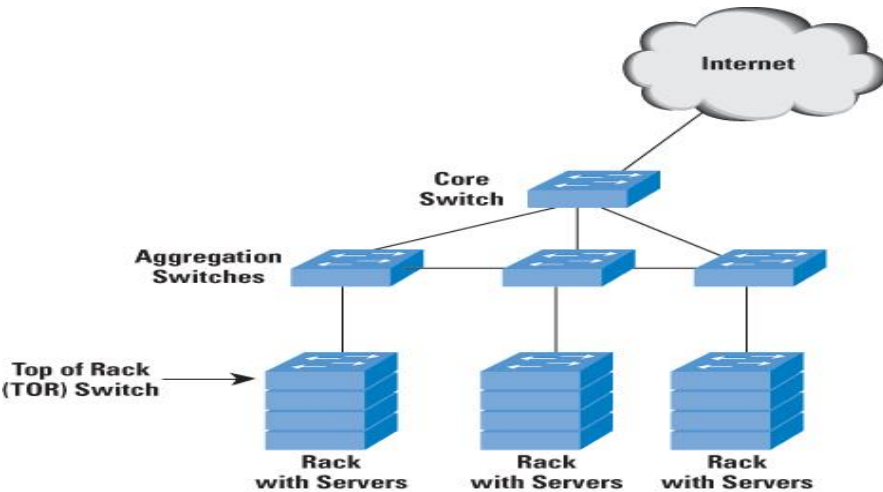
Algorithm
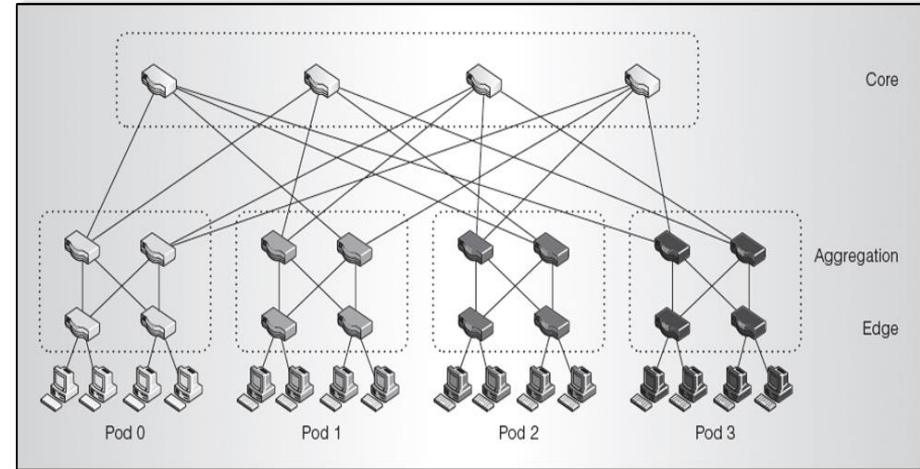
where k is the number of servers per rack

Number of Top of the Rack switches = k/2

Number of Aggregate switches = k/4

Number of Core switches = k/8

Fat tree Architecture

Algorithm

Where k is the number of pods;

Number of servers per rack = $(k/2)^2$

Number of Access Layer/TOR switches per pod = k/2

Number of Aggregate Layer switches per pod = k/2

Total Number of Core Switches in the topology = $(k/2)^2$

KEY COMPONENTS

➤**IPERF- BANDWIDTH CALCULATION**

Mininet> iperf <Source Host Name> <Destination Host Name>

*** Iperf: testing TCP bandwidth between <Source Host Name> and <Destination Host Name>

➤**PINGALLFULL-DELAY CALCULATION**

Mininet> pingallfull
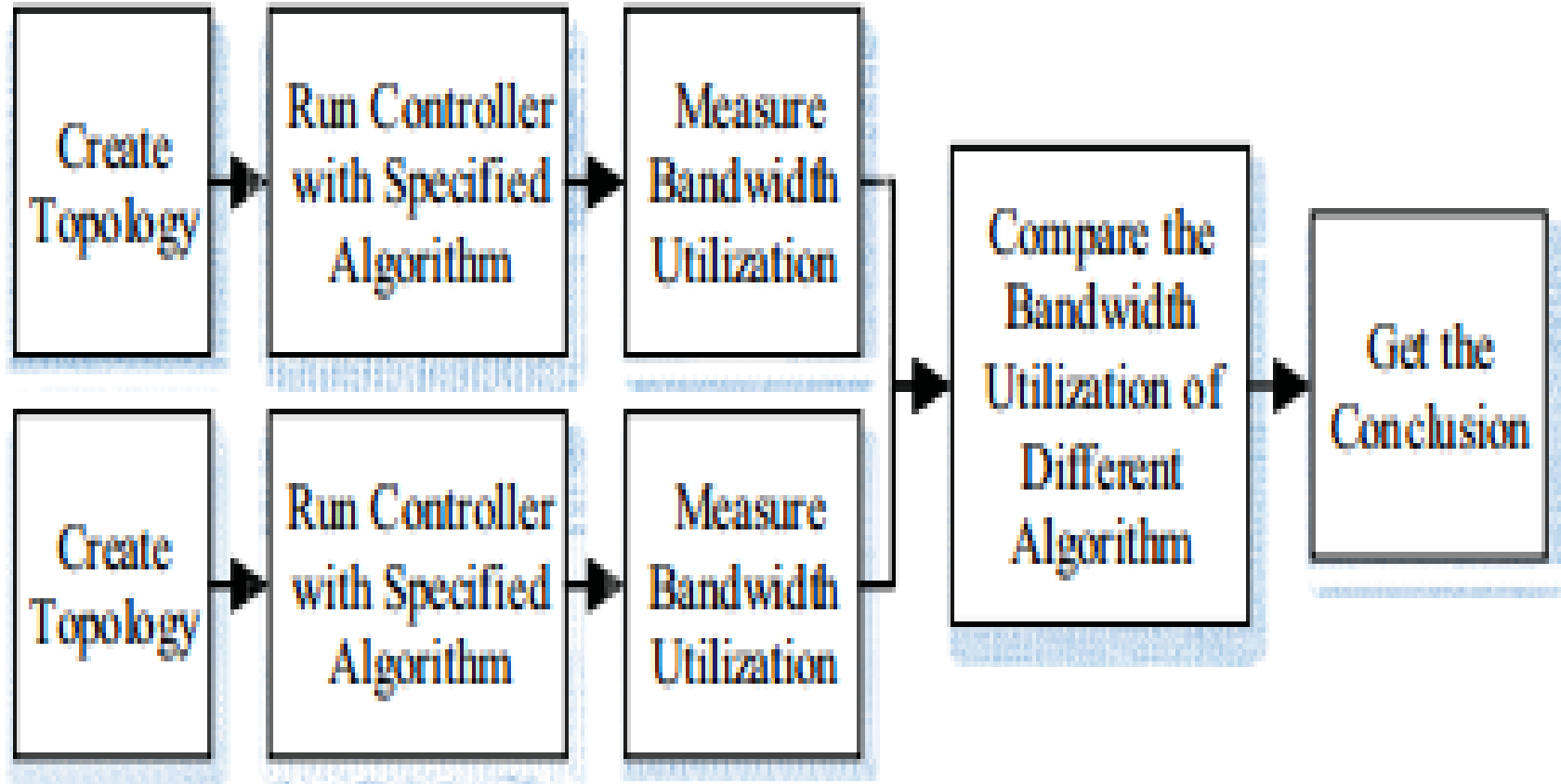
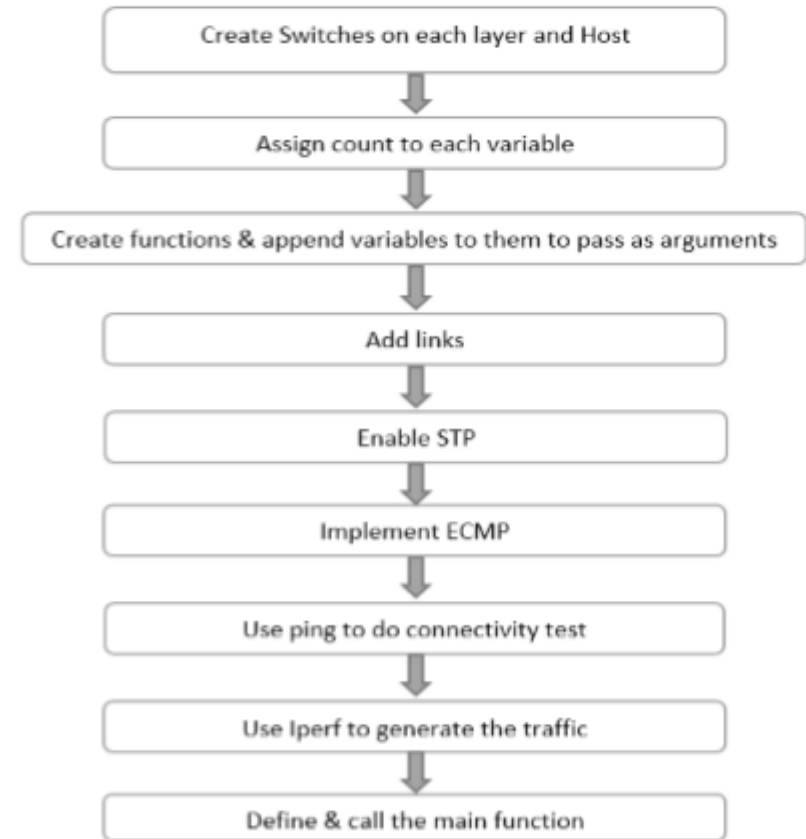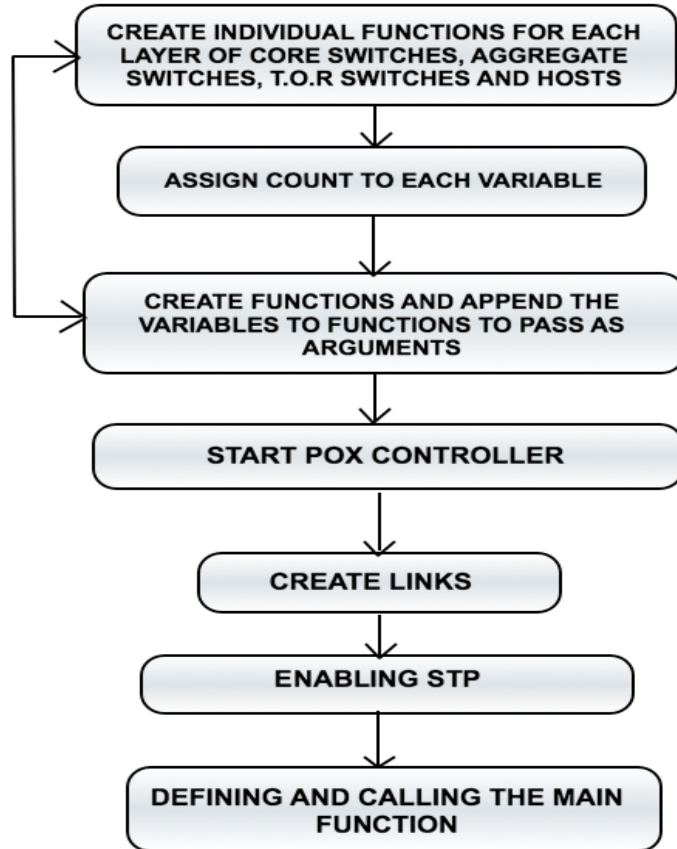➤**Mininet- SDN Simulator**

➤**POX Controller**

➤**STP**

➤**ECMP**

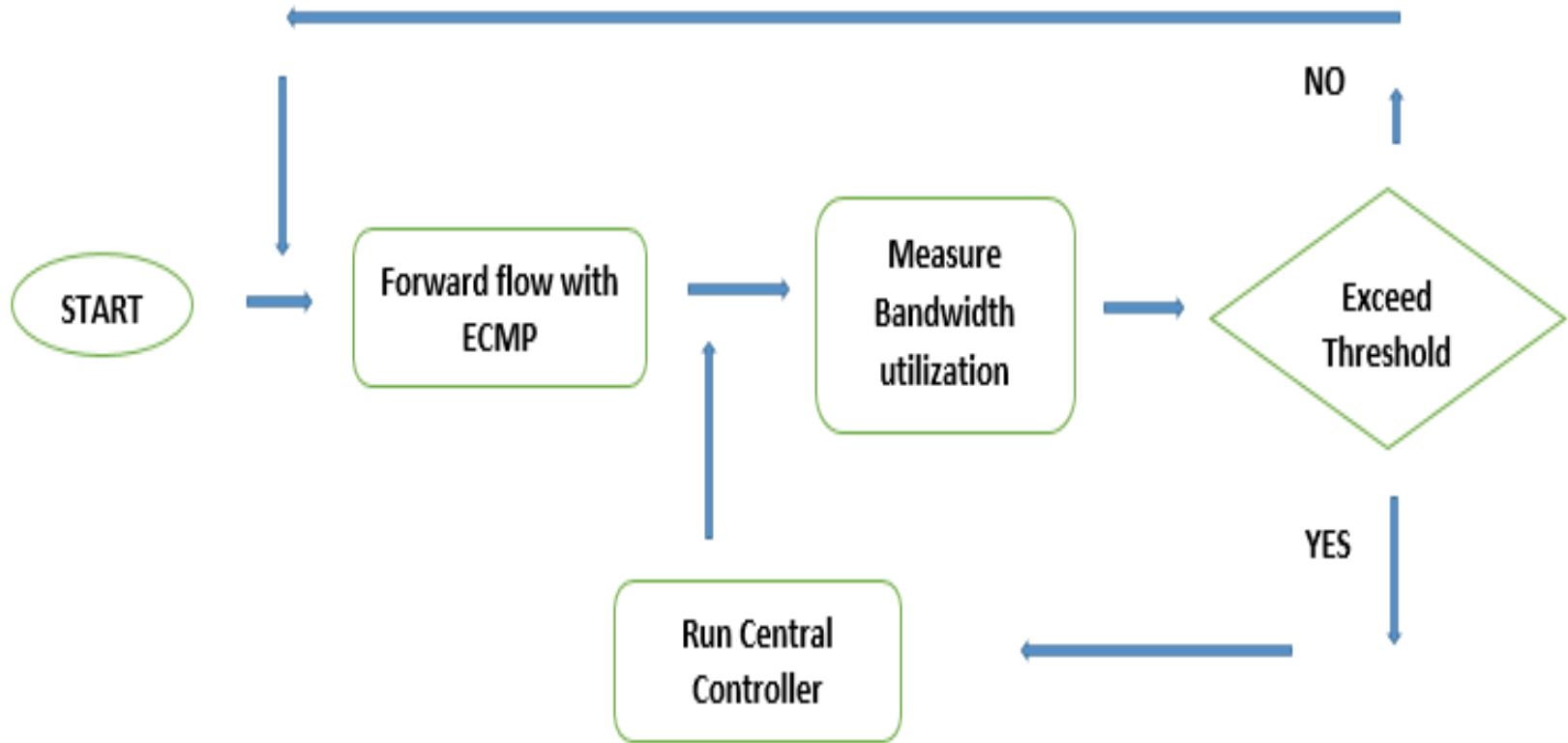➤**Ovs-vsctl – Open VSwitch Command Line**

➤**Python API**

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FLOW CHART OF TWO EXPERIMENT

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PROGRAM FLOW OF FIRST AND SECOND EXPERIMENT

CREATE INDIVIDUAL FUNCTIONS FOR EACH LAYER OF CORE SWITCHES, AGGREGATE SWITCHES, T.O.R SWITCHES AND HOSTS

ASSIGN COUNT TO EACH VARIABLE

CREATE FUNCTIONS AND APPEND THE VARIABLES TO FUNCTIONS TO PASS AS ARGUMENTS

START POX CONTROLLER

CREATE LINKS

ENABLING STP

DEFINING AND CALLING THE MAIN FUNCTION

Create Switches on each layer and Host

Assign count to each variable

Create functions & append variables to them to pass as arguments

Add links

Enable STP

Implement ECMP

Use ping to do connectivity test
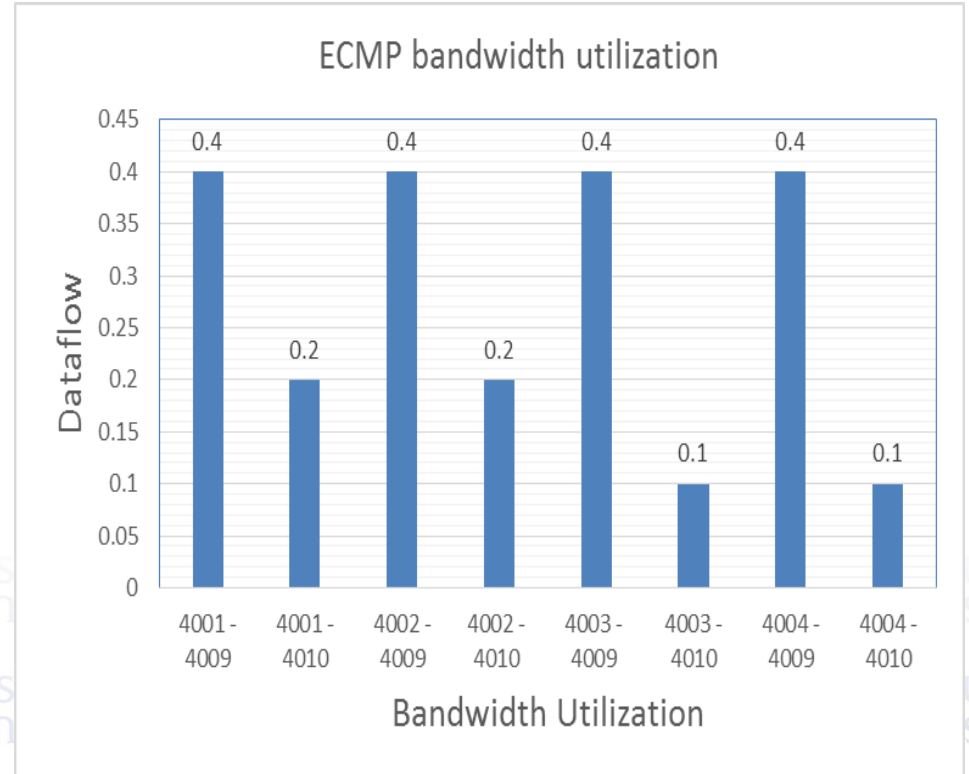
Use Iperf to generate the traffic

Define & call the main function

Flow chart of SDN based ECMP with central controller

Results for ECMP in Fat Tree Topology

DATA	FLOW	Bandwidth Utilization
4001 − 4009	4002 − 4009	0.4
4001- 4010	4002 - 4010	0.2
4003 - 4009	4004 - 4009	0.4
4003 - 4010	4004 - 4010	0.1

RESULTS

Results for SDN based ECMP in Fat Tree topology

DATA	FLOW	Bandwidth Utilization
4001 – 2001	4002 – 2002	0.4
2001 – 1001	2002 - 1001	0.4
1001 – 2005	1001 – 2005	0.4 + 0.4 = 0.8
2005 – 4009	2005 - 4010	0.4

SDN based ECMP — Bandwidth Utilization vs Data Flows (4001-4009, 4002-4010)

COMPARATIVE ANALYSIS FOR FAT-TREE AND FAT TREE BASED SDN
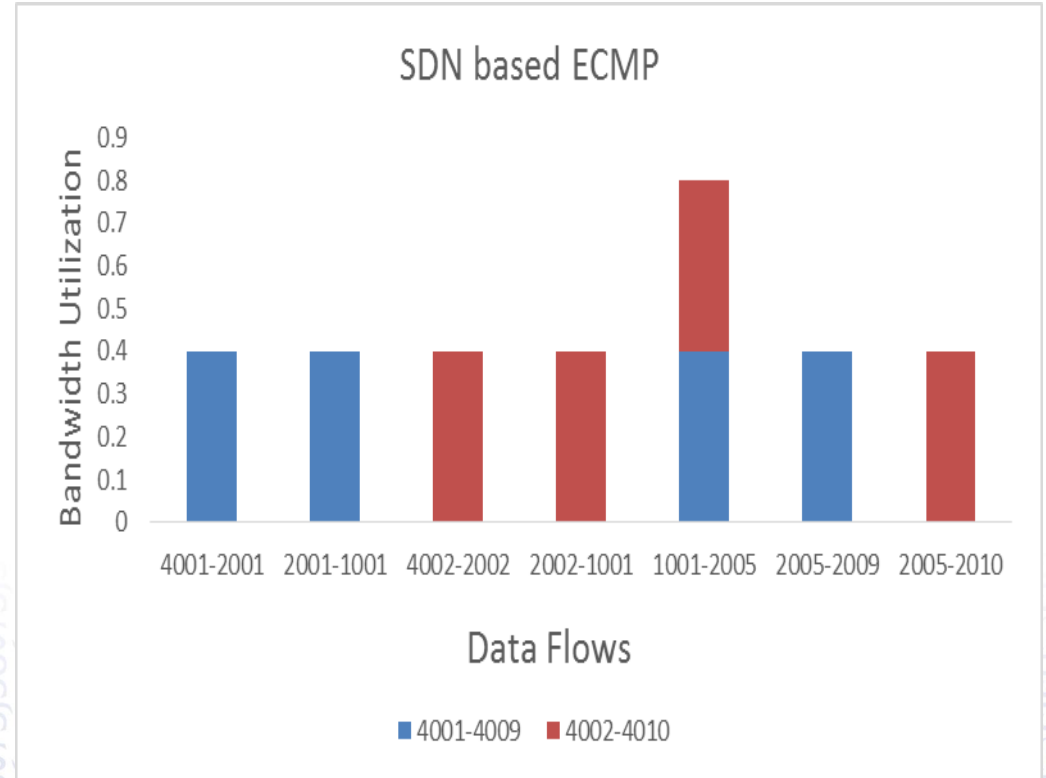
Comparison of ECMP in Fat Tree Architecture and in SDN based Environment
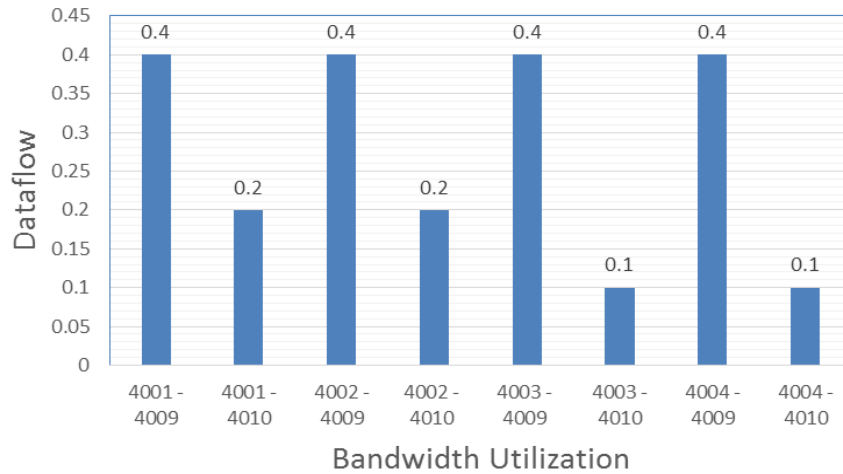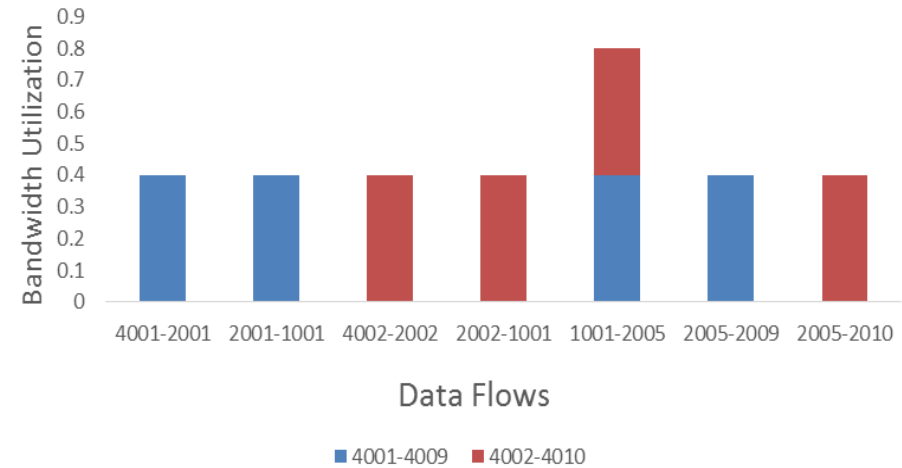
CONCLUSION

ECMP in Fat Tree Networks

SDN based ECMP in Fat Tree Networks

Offers better Throughput

Lack Of flexibility

Select flows according to links bandwidth utilization .

Lack of Dynamic Scheduling Mechanism

Central Controller Dynamically adjust flows

SDN based environment is suitable for data center networks.

- Software Defined Networks (EWSDN), 2013 Second European Workshop on, Issue Date: 10-11 Oct. 2013, Written by: Teixeira, J.; Antichi, G.; Adami, D.; Del Chiaro, A.; Giordano, S.; Santos, A.

- M. Al-Fares, A. Loukissas, and A. Vahdat, ``A scalable, commodity data center network architecture,'' in Proc. ACM SIGCOMM, 2008, pp. 63_74.

- Hailong Zhang School of Information Engineering, Communication University of China, Beijing, China Xiao Guo ; Jinyao Yan ; Bo Liu ; Qianjun Shuai - SDN Based ECMP Algorithm for data center networks.

- Yi-Chi Lei ,Kuochen Wang and Yi- Huai - Hsu ,Department of Computer Science, National Chiao Tung University, "Multipath Routing in SDN based Datacenter ", 2015

Thank You

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