ECODANE - Reducing **E**nergy **CO**nsumption in **DA**ta Center **NE**tworks based on Traffic Engineering

Truong Thu Huong[#1], Daniel Schlosser[*2], Pham Ngoc Nam[#3], Michael Jarschel[*4], Nguyen Huu Thanh[#5], Rastin Pries[*6]

[#] *Hanoi University of Science and Technology, Vietnam*

{[1]huong.truong,[3]pnnam-fet, [5]thanhnh}@mail.hut.edu.vn

[*] *University of Wuerzburg, Germany*

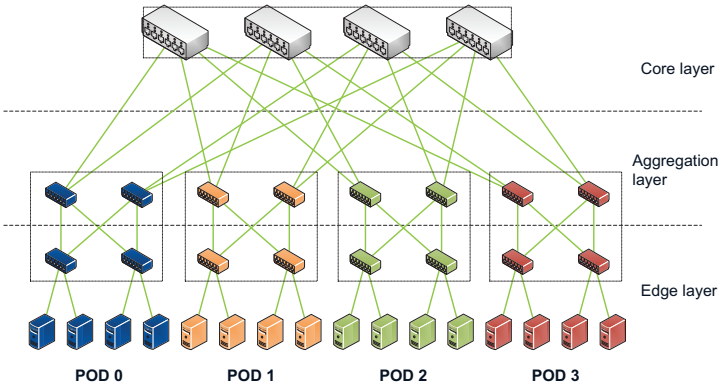
{[2]schlosser, [3]michael.jarschel, [6]pries}@informatik.uni-wuerzburg.de

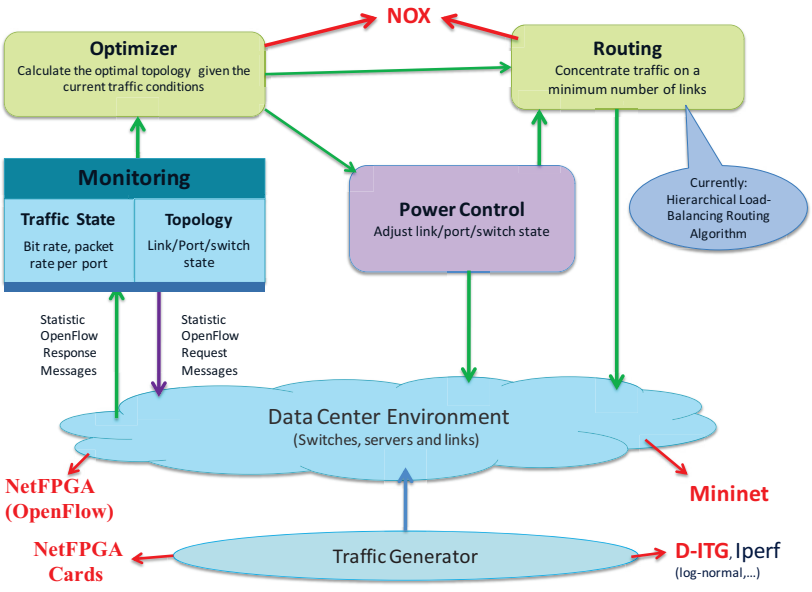
Objectives of the Work

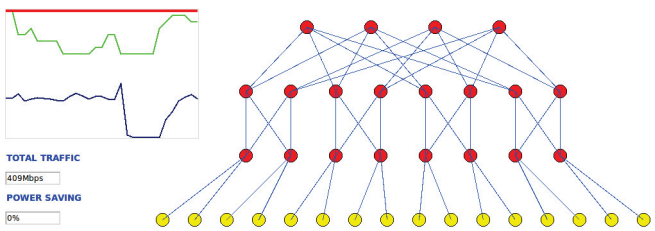
- Analyze the impact of traffic volume on the resource and energy consumption in data centers
- Optimize the resource and energy consumption based on data center traffic measurements
- Build an energy-aware network testbed as the basis for green-network research

Problems and Assumptions

- **Problems**:
  - High redundancy vs. energy consumption in data center network topologies
  - Energy consumption is not inter-related with traffic volume in current data center networks
- **Assumption**:
  - Make use of Elastic-Tree approach based on Fat-Tree topology







Network Architecture

- **Focus**: optimizing power consumption by designing intelligent mechanisms to adapt the set of network components to the total traffic volume

Deployment

- **Tools**:
  - Emulation: Mininet
  - Testbed: 4-ary elastic tree based on NetFPGA OpenFlow switches
- **Network components**:
  - *Optimizer*: NOX controller gathering network traffic statistics based on topology-aware heuristics to find minimum power network subset.
  - *Power Control*: COntrol of power states of network devices (switches, line cards etc.) through OpenFlow messages and Mininet APIs. Power management module integrated on NetFPGA platform.
  - *Forwarding*: A NOX module to optimize routes based on the reduced topology.
  - *Traffic Generator*: Able to generate different traffic patterns, gathered from data center traffic measurements. Based on D-ITG

Initial Results

- Experiment scenarios:
  - Near traffic (within rack), mid-traffic (within POD), far-traffic (global)
  - Traffic pattern: lognormal
- Results:
  - Energy saving between 10% - 35% depending on traffic
  - On NetFPGA, by reducing working clock frequency, energy consumption reduces significantly