# Networks and/in data centers

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(with contributions from Fahimeh Alizadeh and Hao Zhu)

Does the network matter?

- The energy footprint of data center networks is 10-20% of total energy

- The proportion could be up to 50% if power management techniques are used on the server-side

- Global cloud IP traffic will 3.9-fold from 2013 to 2018.

- Networks suffer from inefficient power usage because of over-provisioning.
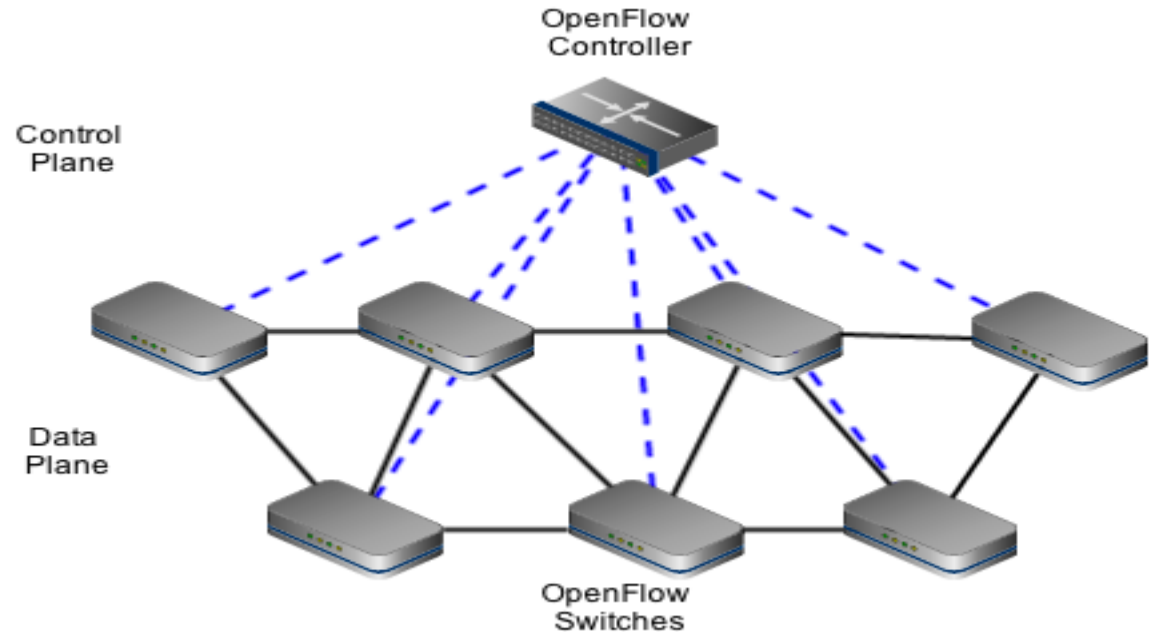
Learned at ICT4S!
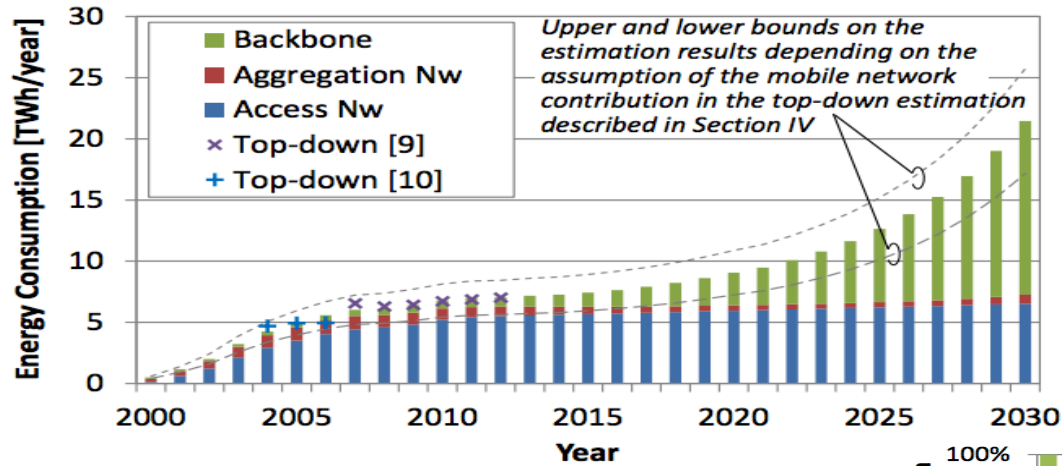
"Unifying Top-down and Bottom-up Approaches to Evaluate Network Energy Consumption"

Ishii et al. In: Lightwave Technology, Journal of , vol.PP, no.99, pp.1-1

Fig. 7. Fraction of the energy consumption for each network
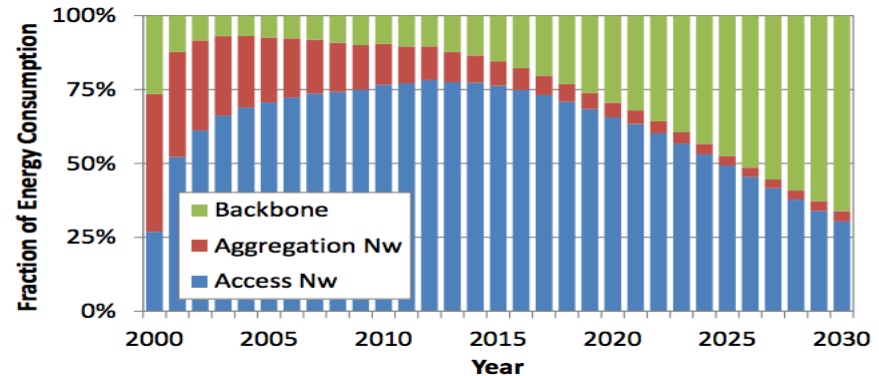
Whats new? Programmability

- 87% growth in SDN deployment in North American-based enterprises by 2016 [2]

- White-box networking

- Diverting the control to the software

[*] Clifford Grossner, http://www.infonetics.com/pr/2014/SDN-Strategies-Survey-Highlights.asp (July 2014)]

System and Network Engineering

Emerging interest in SDN for energy efficiency

- Emerging studies improve on the energy consumption of servers by the VM migration.
- Some change the OpenFlow protocol to be energy-aware.
- All of them are implemented in intra-data center scale.
- All have a fixed initial traffic matrix.
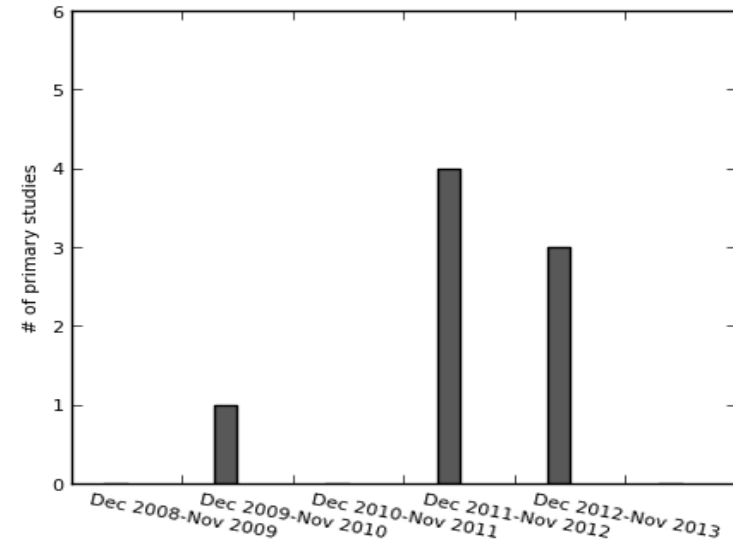
Moghaddam, F. A., Lago, P., & Grosso, P. (2015). Energy-Efficient Networking Solutions in Cloud-Based Environments: A Systematic Literature Review. ACM Computing Surveys (CSUR), 47(4), 64.

Yearly distribution of the OpenFlow technique adoption by decision frameworks from December 2008 to November 2013 [3
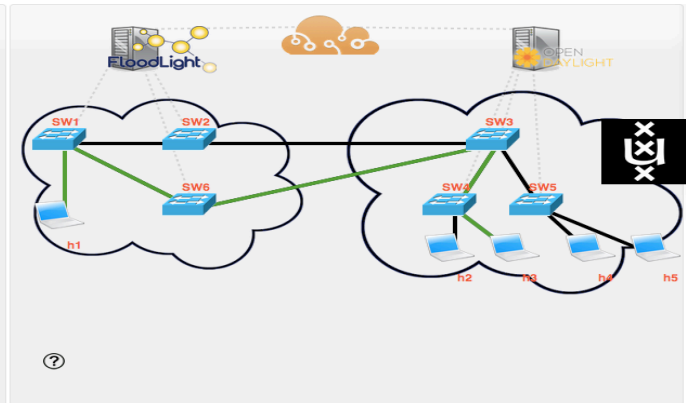
Green routing with SDN

Make a routing decision to aggregate traffic over a subset of links and devices in over-provision networks and switch off unused network components
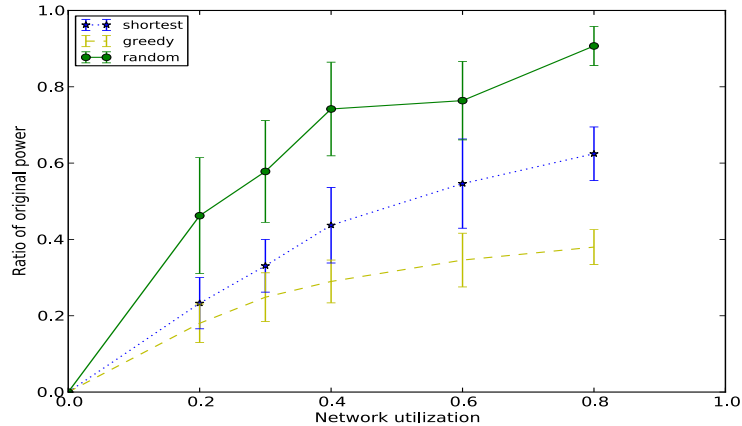
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Simulation

Topology: BCube(2,3) , 8 8-port switches in total.
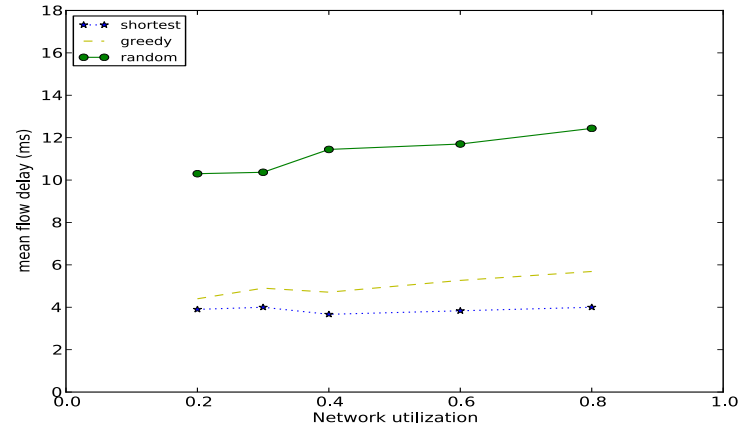Capacity of each link: 1Gbps;
Delay of each link: 1 millisecond.
Mean power of switch: 120 watts.
Dynamic power/Overall power = 10%.

Network power saving against the network utilization in the BCube network

Mean flow delay time against the network utilization in the BCube network

What next? Food for thoughts.

3 thoughts:

Moving from simulation to experimentation in real data center networks. *Will we see main stream use?*

Couple the programmability of the network with the application desired service. *How to manage the decentralization?*

The datacenter of the future is embedded in the fabric of the Cloud and driven by Big Data operations/analytics/computation.
How do we coordinate inter-data-center?