Network Analysis

-- Available Bandwidth Estimation Using SoNIC

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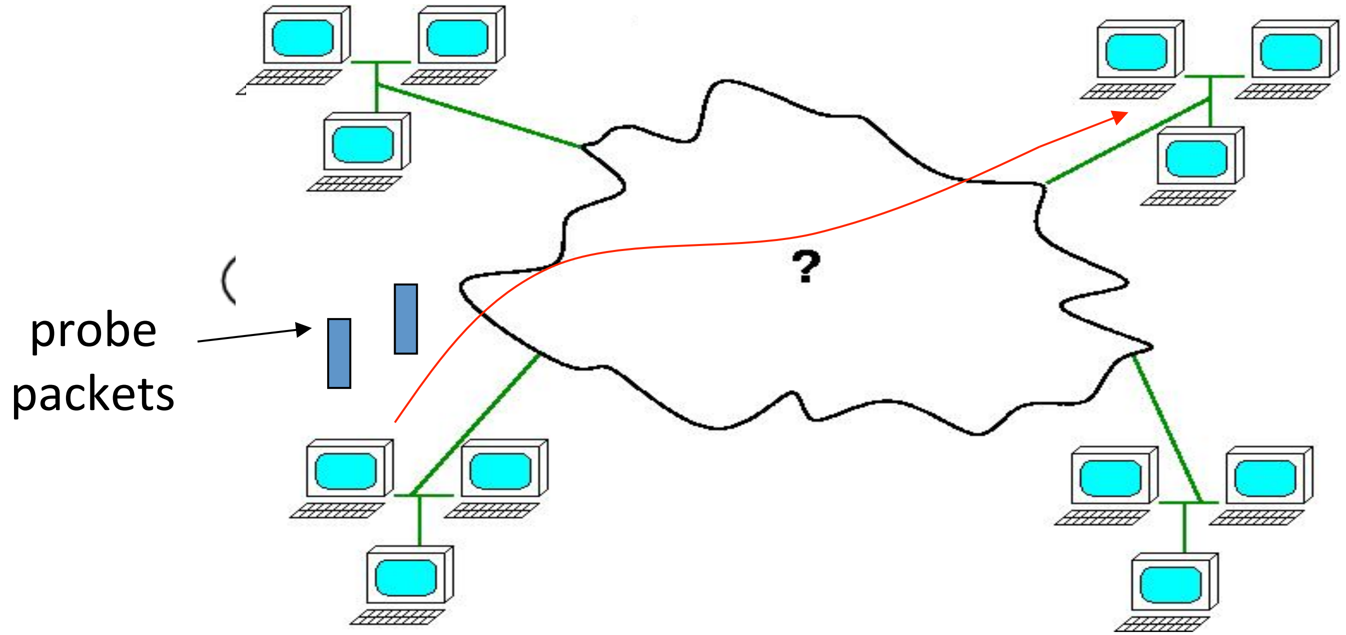
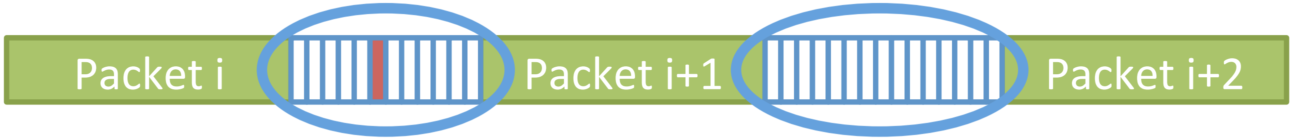
Available Bandwidth Estimation

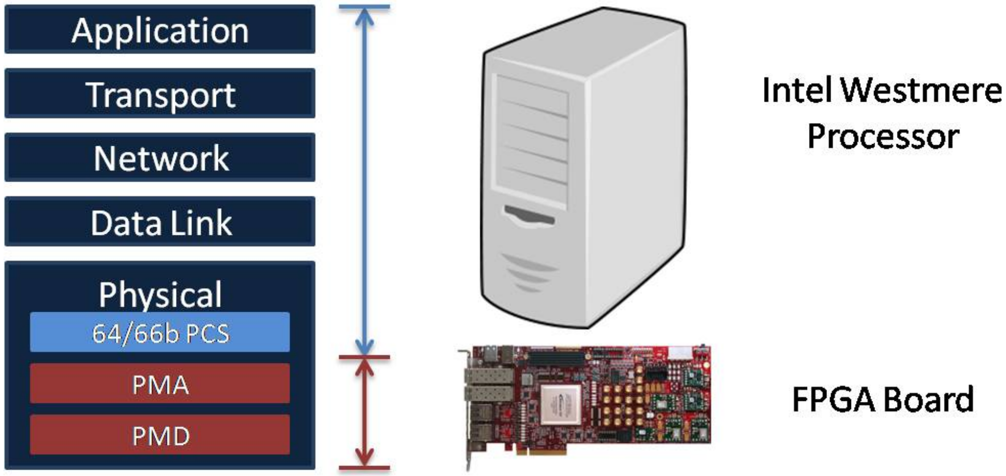


- Current end-to-end estimation
  - Intrusive, inaccurate, does not work with bursty cross traffic
- Motivation
  - Address the above issues

SoNIC



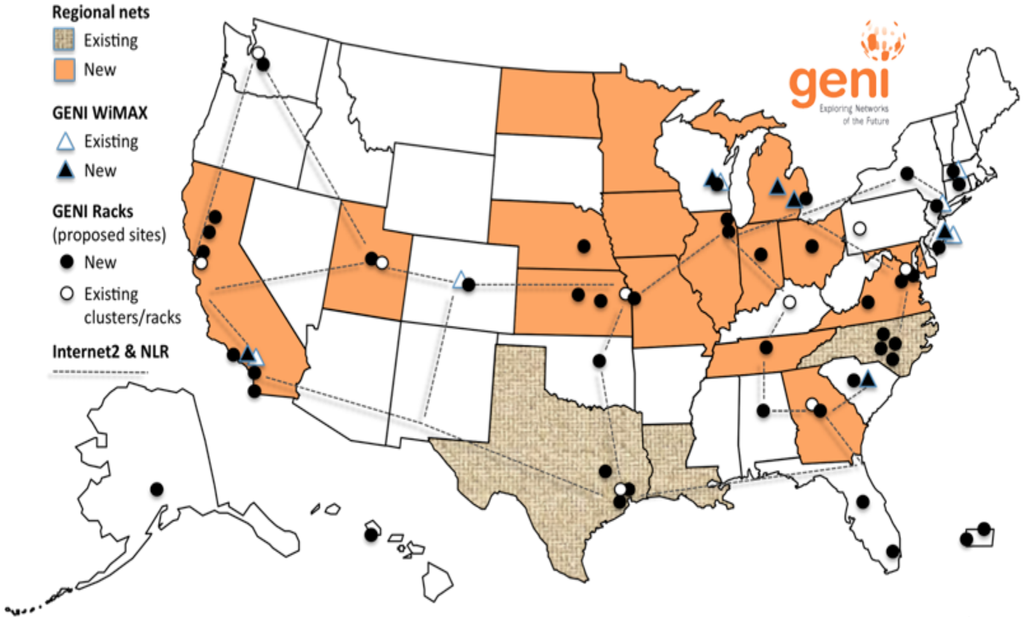
- Physical and data link layer
- Idle characters: accurately measure inter-packet delays
  - Hardware: hard to access
- SoNIC: Software-defined Network Interface Card
- Flexible realtime access to physical layer in software
- Accurate: control over idle characters



GENI

- Global Environment for Network Innovations
- Virtual laboratory for networking and distributed system research
- Easy to set up different topologies for research
- UC Davis &

  UNC Chapel Hill

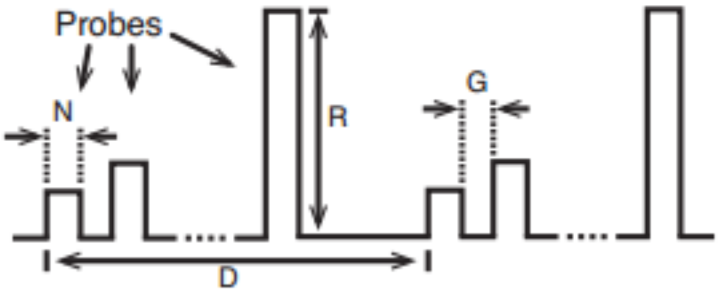


Goal

- Use SoNIC to estimate available bandwidth on GENI
- Tasks:
  - Local machine
    - Reproduce the measurements and analysis in paper
    - Complete and automate data analysis process
  - GENI
    - Load script and rerun the above experiments
    - Make the process available to others

Estimate Available Bandwidth

- Generate probe trains pattern
- Packet pacing to generate probe packets
  - Add idle characters to manipulate rate

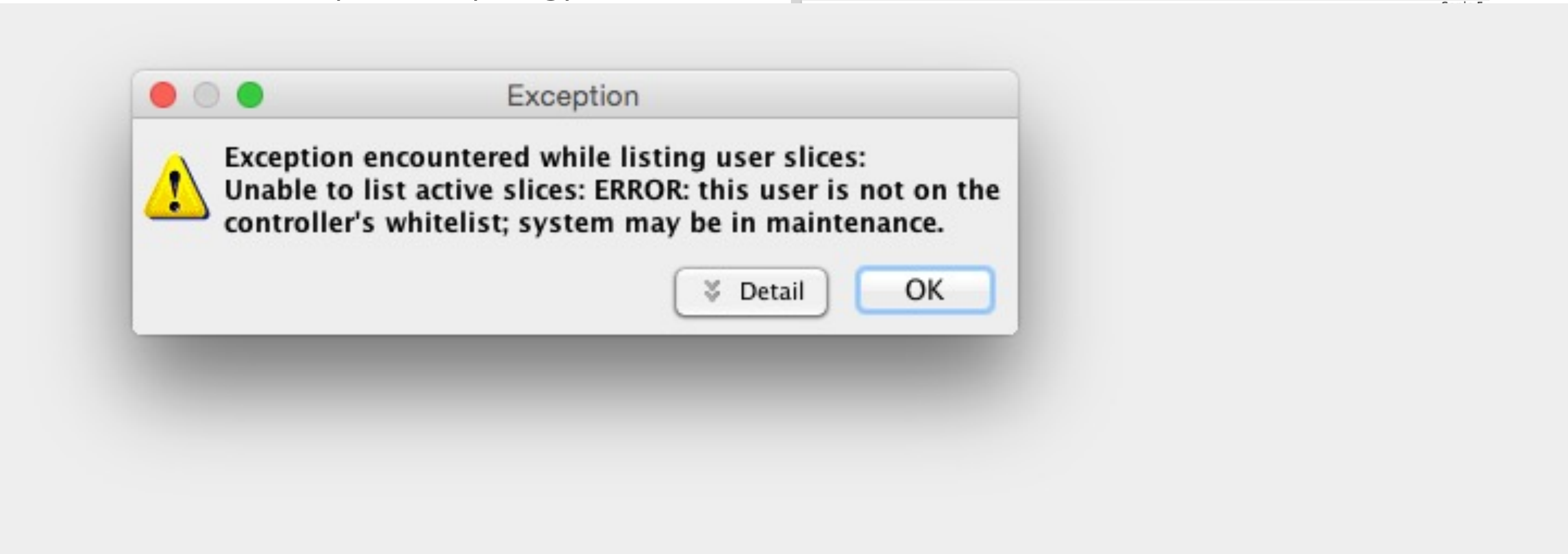


- Accurate inter-packet delay
- Use increasing one-way delay to estimate available bandwidth

Experiments – Environment set up

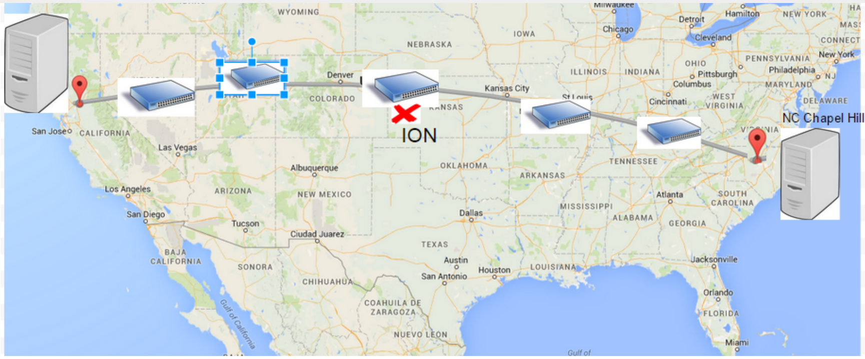
Factus loopback topology

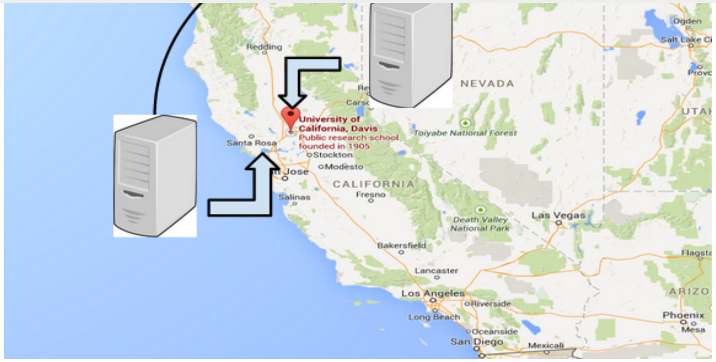
Syslab Topology



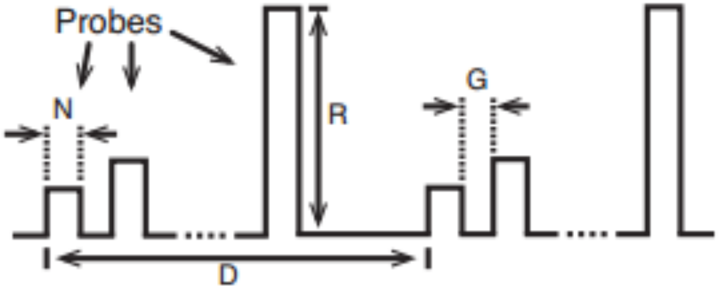
Exception

Exception encountered while listing user slices:
Unable to list active slices: ERROR: this user is not on the controller's whitelist; system may be in maintenance.



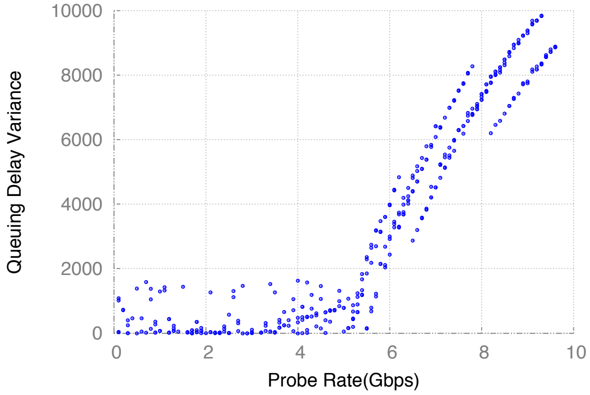


Experiments

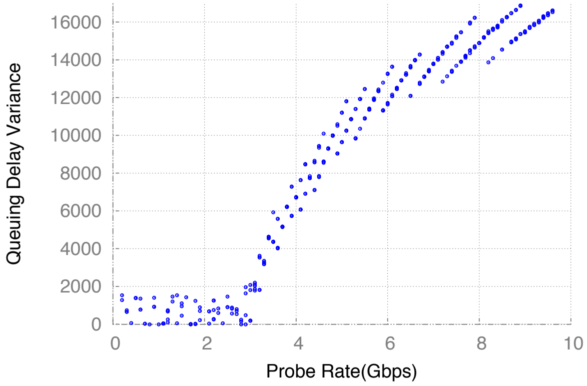


- Algorithm
  - Pathload: (N, R, G, D) = (20, [0.1:0.1:9.6]Gbps, 120000B, variable)
  - Increasing one-way delay (OWD)
  - Difference in the OWD between the first and last packets
  - Available bandwidth: lowest probe train rate where queuing delay increases
  - Add cross traffic to limit the available bandwidth
- Automation
  - Automate the process for analyzing the available bandwidth
  - Generate cross traffic

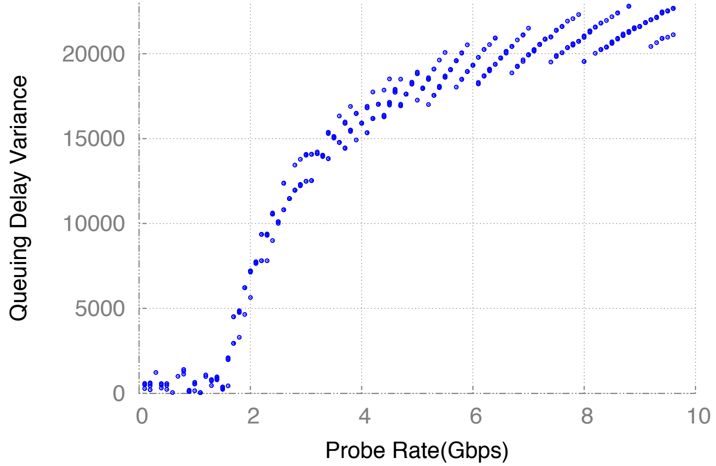
Experiment Result on syslab machines



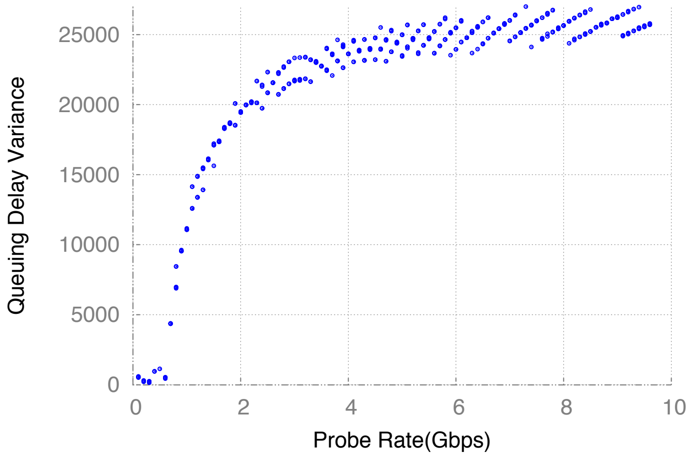
2 Gbps cross traffic
(est: 5.3)



4 Gbps cross traffic
(est: 3.1)

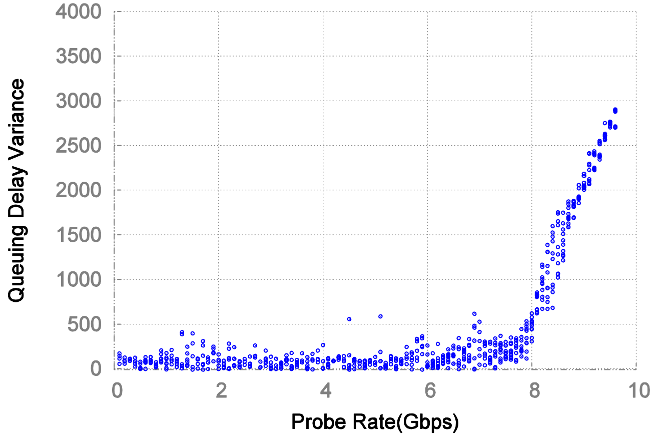


6 Gbps cross traffic (est: 1.5)

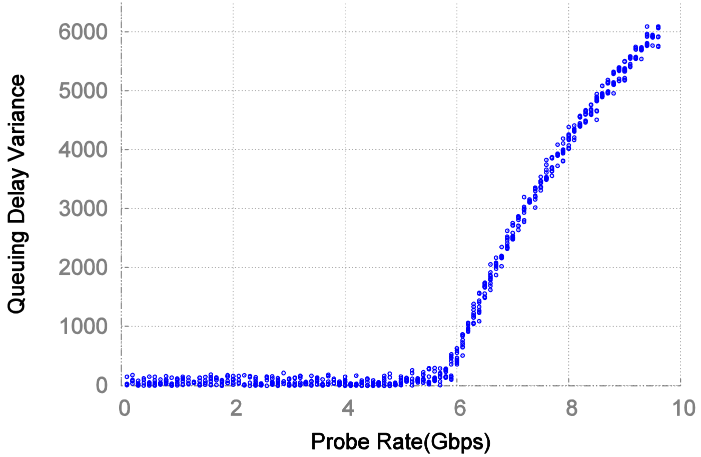


8 Gbps cross traffic (est: 0)

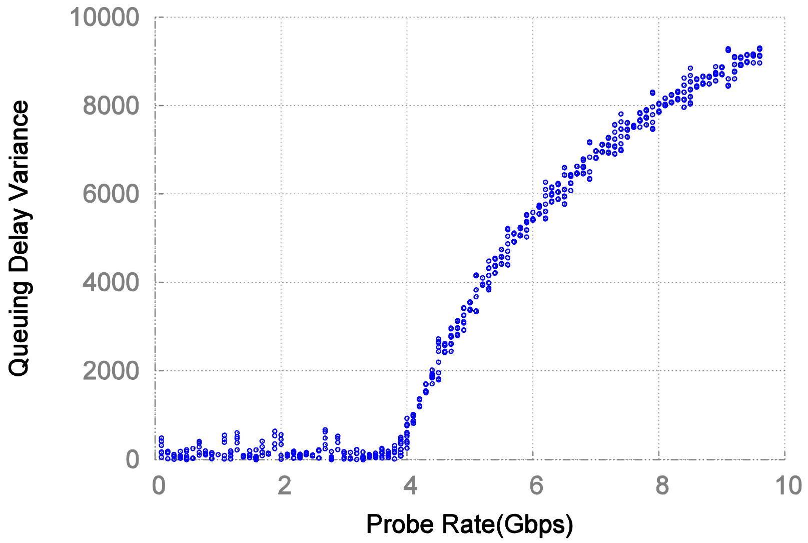
Results – with Han's data



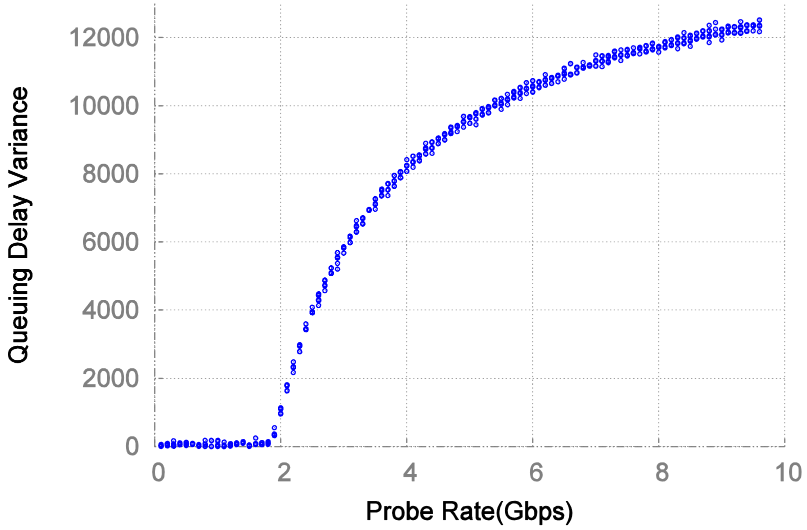
2 Gbps cross traffic



4 Gbps cross traffic



6 Gbps cross traffic



8 Gbps cross traffic

Discussion

- SoNIC difficult to deploy
  - Kernel version
  - Switch configuration
- SoNIC unstable
- SoNIC script issue
  - rpt command
- Estimation Measurement Application hard to build without the lower layers working properly

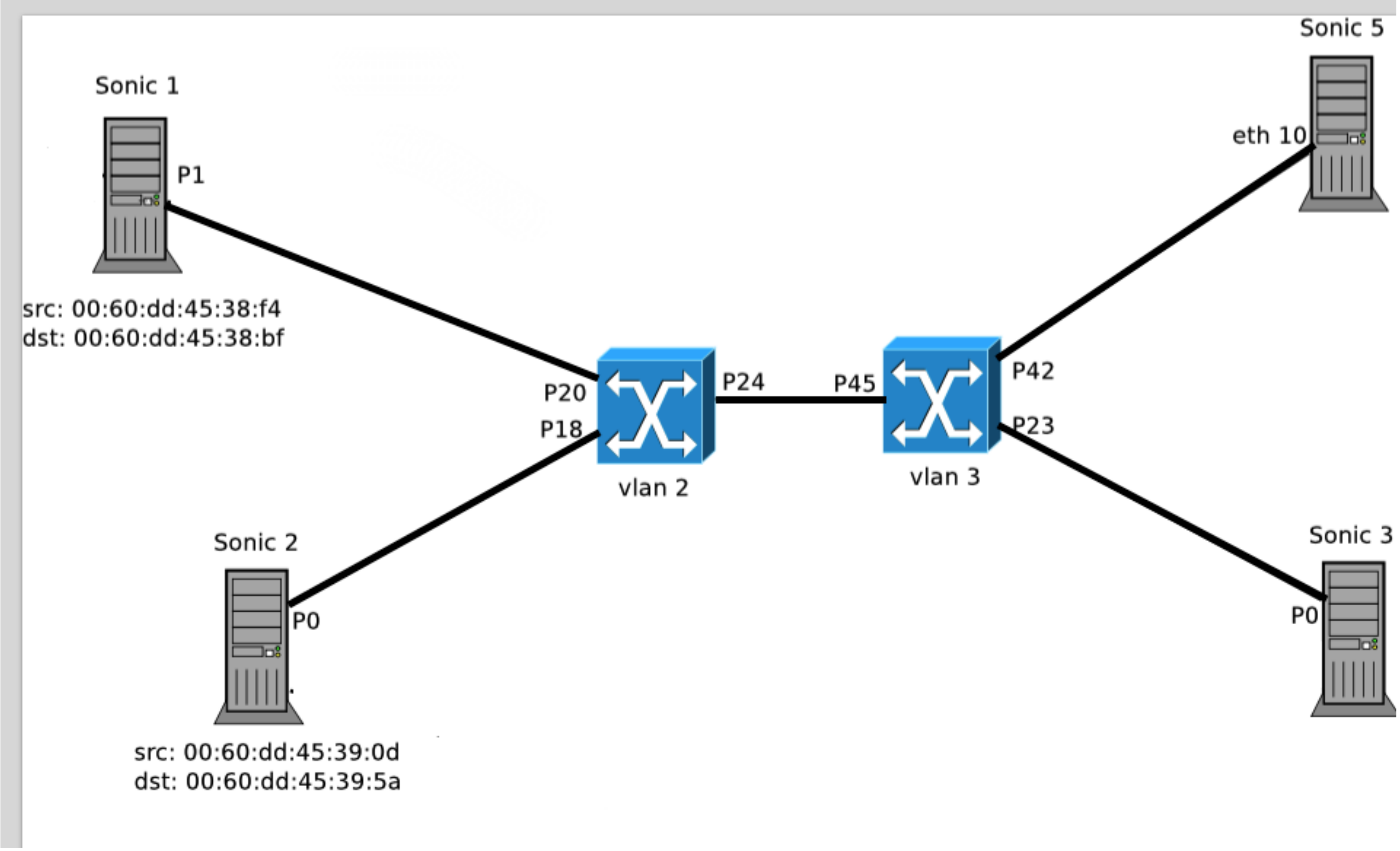
M.Eng portion

- Additional Algorithm
  - Pathchirp: (N, R, G, D) = (1, [0.1:0.1:9.6]Gbps, exponential decrease, variable)
  - IGI: (N, R, G, D) = (60, [0.1:0.1:9.6]Gbps, 30s, 30s)
  - Better estimation algorithm

Future Work

- More experiments on GENI
- Using application packets to address the intrusive issue
- User space measurement application

Demo


Sonic 5
Sonic 1
eth 10
P1
src: 00:60:dd:45:38:f4
dst: 00:60:dd:45:38:bf
P20
P18
P24
P45
P42
P23
vlan 2
vlan 3
Sonic 2
Sonic 3
P0
P0
src: 00:60:dd:45:39:0d
dst: 00:60:dd:45:39:5a