

Fast, Accurate Simulation for SDN Prototyping

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Motivation

- ❑ Prototyping, evaluating and debugging SDN is hard because:
 - ❑ Increasing scale, diversity, and complexity of apps
 - ❑ Will my SDN app behave as expected when deployed in the wild?
 - ❑ Does it operate correctly and efficiently at scale?

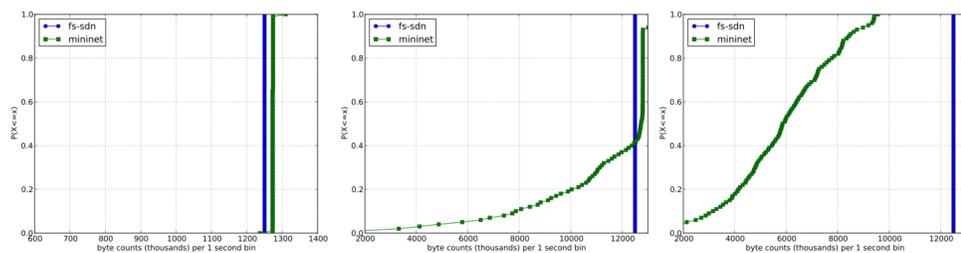
Objectives

- ❑ Develop an SDN simulation capability that complements existing development and debugging tools
 - ❑ A controller API environment to facilitate transition to live environments
 - ❑ Ability to generate realistic application traffic flows
 - ❑ Capability to scale up to large networks
 - ❑ Facilities for detailed debugging and tracing

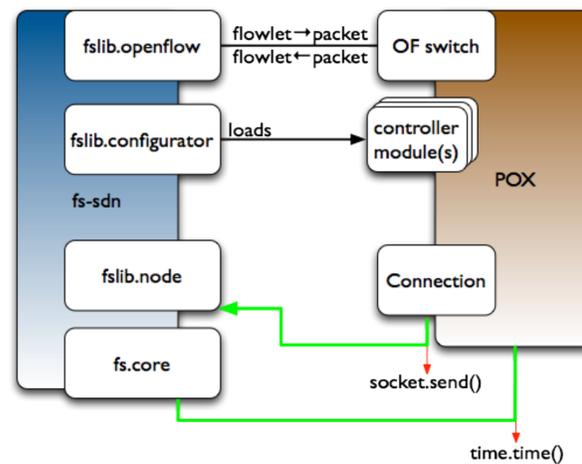
Design

- ❑ Integrate POX controller and library code via monkeypatching
 - ❑ Key aspects: calls that get or set external state (time, network) and packet/flowlet translation
- ❑ Upshot: POX controller modules can be used without modification in *fs*
 - ❑ Discovery, spanning tree, 12 learning, hub, 12 pairs, etc., all work out of the box

Results: Accuracy



fs-sdn Design



Results: Speedup

UDP CBR traffic				
Load	Tiny	Small	Medium	Large
Low	6	8	33	72
High	4	8	31	76

Harpoon traffic (Pareto distr. flow sizes)				
Load	Tiny	Small	Medium	Large
Low	16	33	104	193
High	30	62	194	337

Evaluation

- ❑ Evaluate accuracy and scalability of *fs-sdn*
- ❑ Set up congruent experiments in *fs-sdn* and *Mininet*
 - ❑ Background traffic: CBR stream or Harpoon flows at two different loads each
 - ❑ Linear topologies in 4 configurations of increasing size (up to 100 switches)
 - ❑ Simple layer-3 shortest paths controller module

Results

- ❑ Plots above show byte counts per second collected in *fs-sdn* and an equivalent setup in *Mininet*
- ❑ As topology and/or traffic increase, measurements collected in *Mininet* degrade
- ❑ Tables above show *fs-sdn* execution times for scenarios with 900 simulated seconds
 - ❑ *Mininet* takes 900 seconds for each experiment
 - ❑ pypy interpreter with JIT compiler was used for experiments

Timeline

- ❑ “Fast, Accurate Simulation for SDN Prototyping”, In HotSDN workshop of SIGCOMM '13
- ❑ Complete packet/flowlet translations to truly make the environment seamless
- ❑ Better tracing and debugging capabilities
- ❑ Improve scalability through parallelizing *fs*
- ❑ Is it possible to bridge other (including non-Python) controller platforms?