



Writing Fine-grained Measurements App with P4 Programmable Switches

Discussions, applications with
P4 switches, Tofino pods

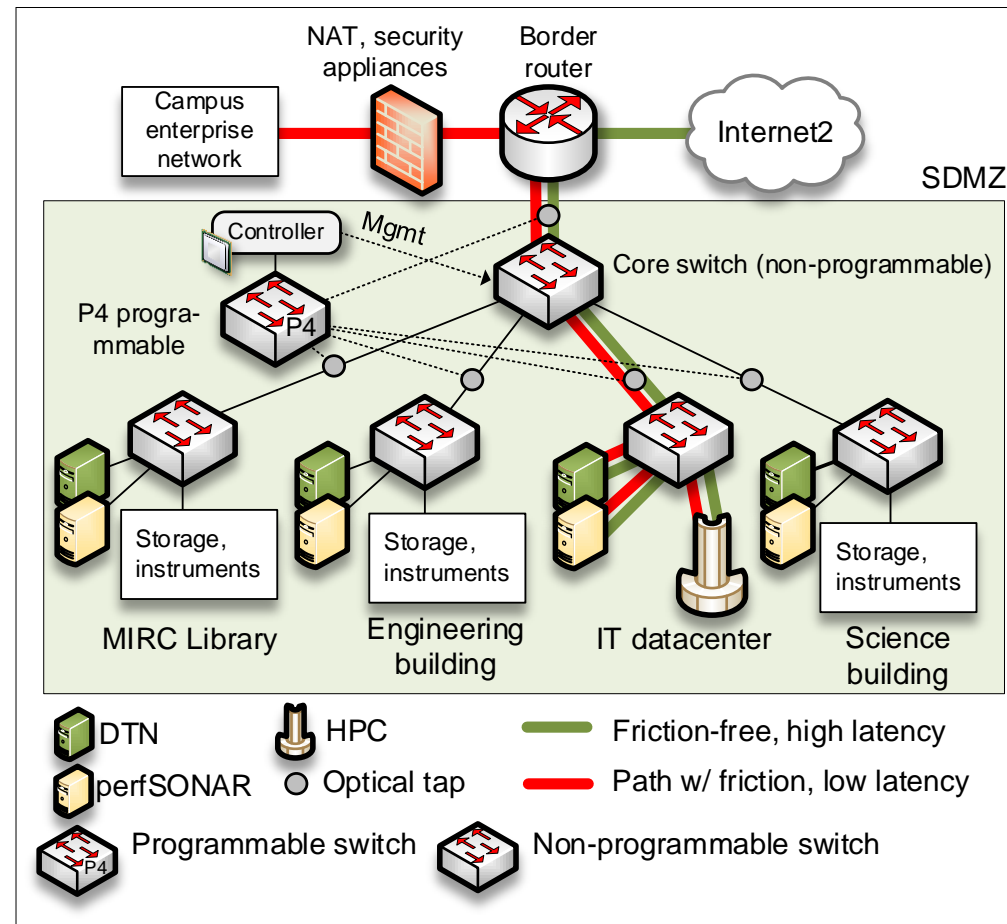
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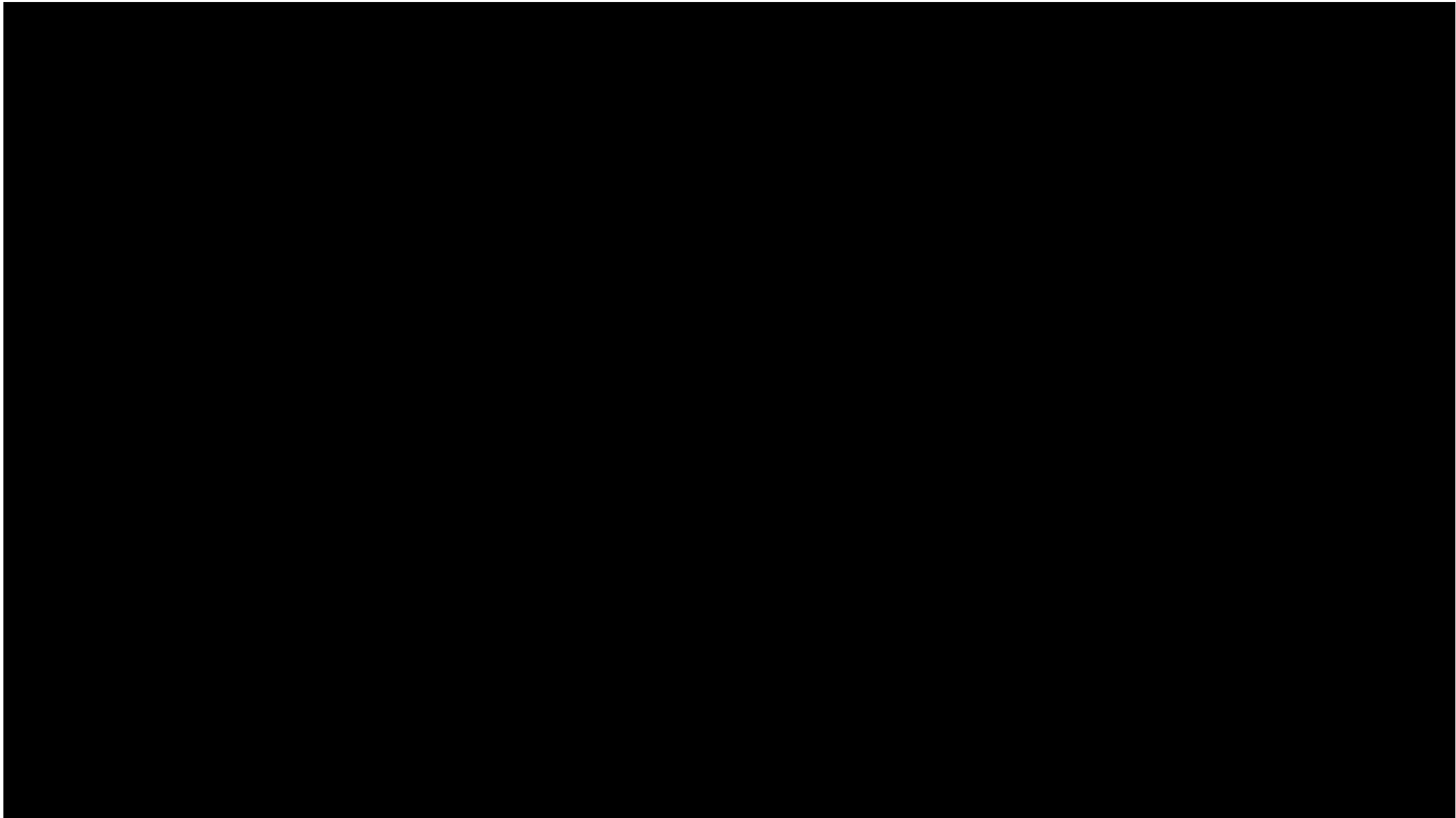
September 18, 2023

Fine-grained Measurements

Granular RTT calculation



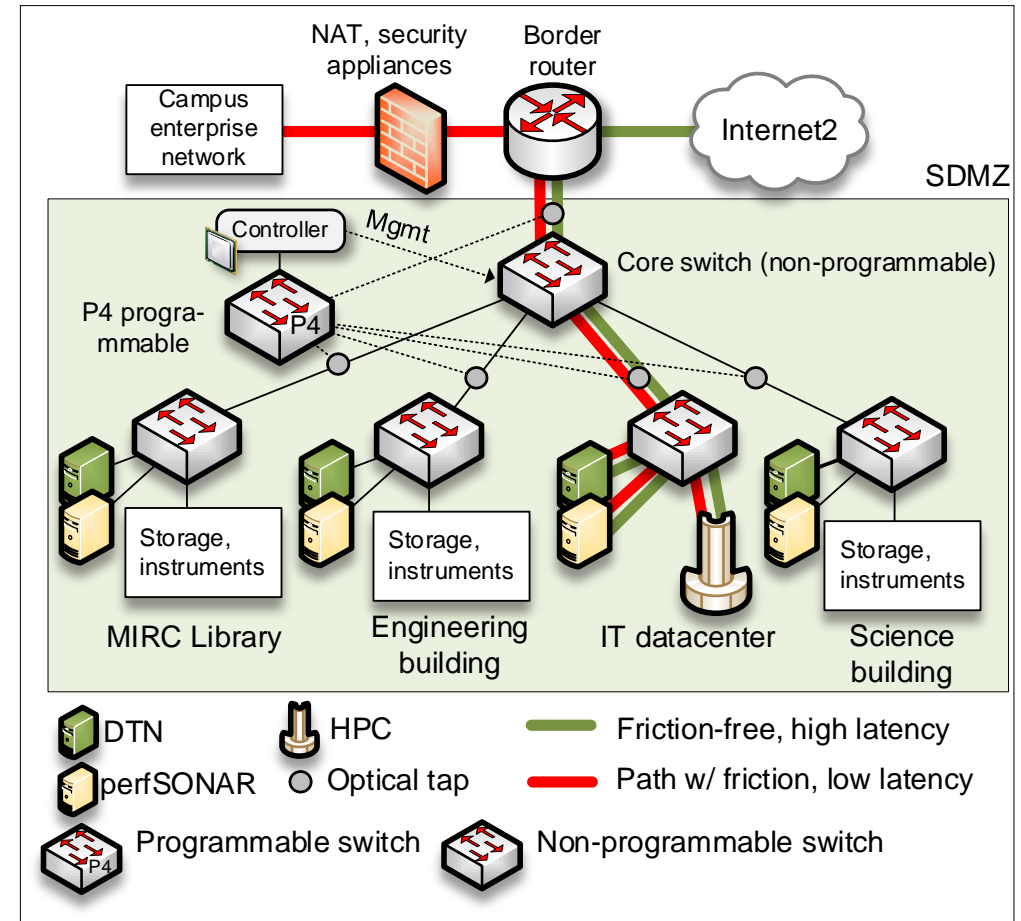
Fine-grained Measurements



Fine-grained Measurements

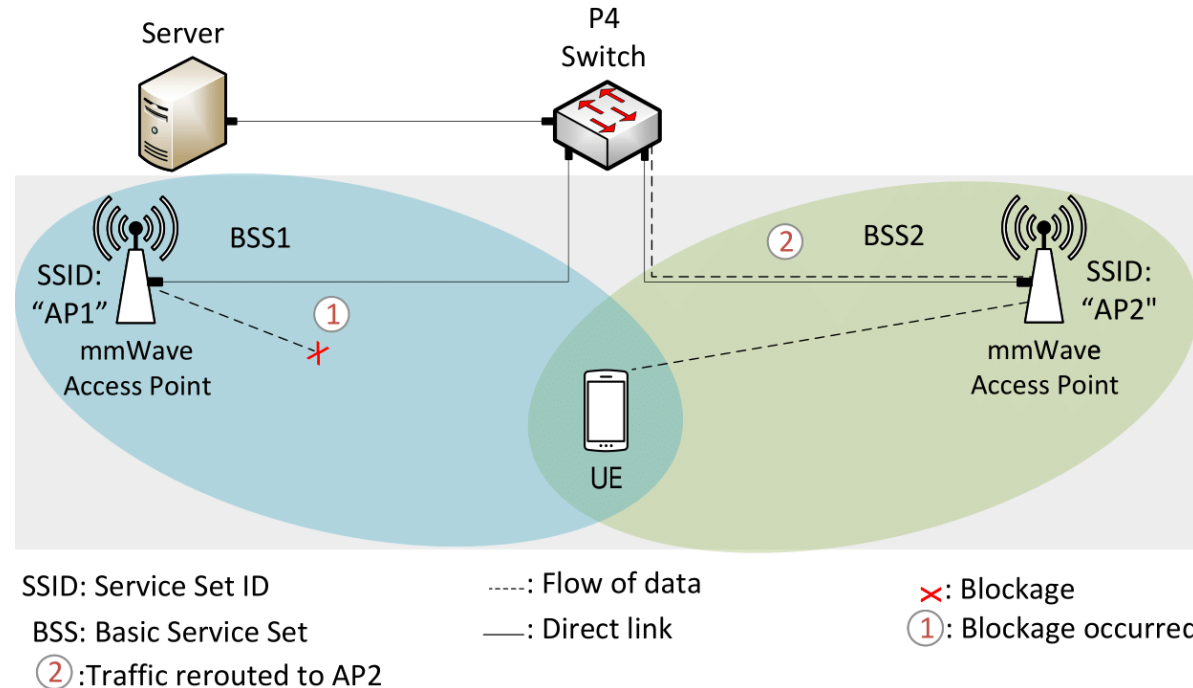
Granular RTT calculation - Applications

- Calculating the optimal buffer size (a function of the average RTT of all large flows crossing the switch)
- Detecting bad routing decisions, hijacking, reflected in large RTTs

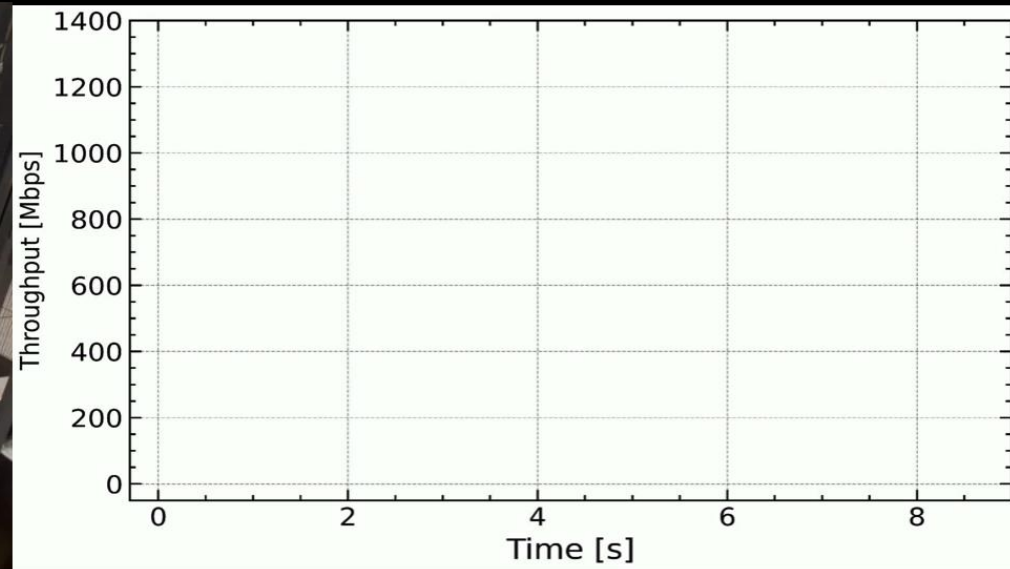
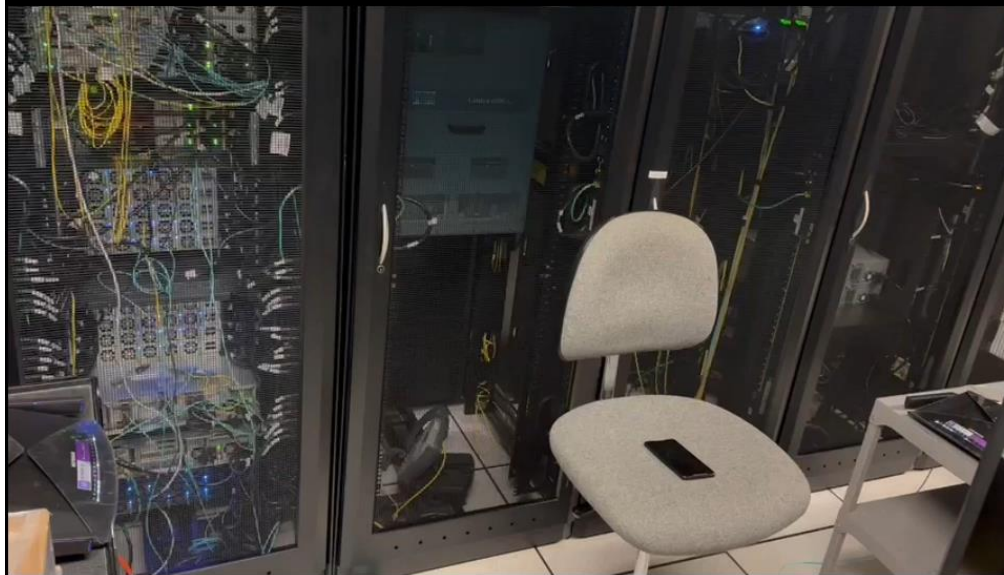


mmWave Blockage Detection

- Programmable switches monitor the inter-arrival time (IAT) of the packets
- Using the measurements, the programmable switch detects the blockage and then notifies the end user to handover
- The system was implemented and tested on a Tofino hardware switch and off-the-shelf mmWave-compatible devices

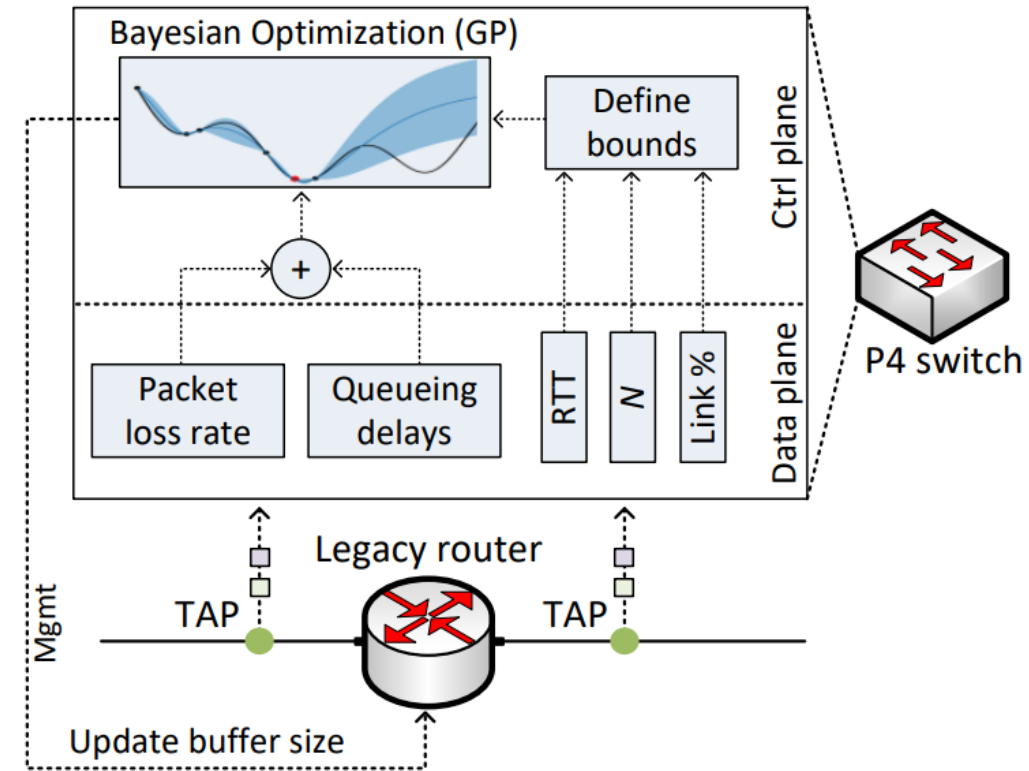


Proposed System



Dynamic Buffer Sizing

- The buffer size is dynamically modified
- A P4 switch is deployed passively to compute:
 - Number of long flows
 - Average RTT
 - Queueing delays
 - Packet loss rates
- The control plane sequentially searches for a buffer that minimizes delays and losses
- The searching algorithm is Bayesian Optimization (BO) with Gaussian Processes



Dynamic Buffer Sizing

