



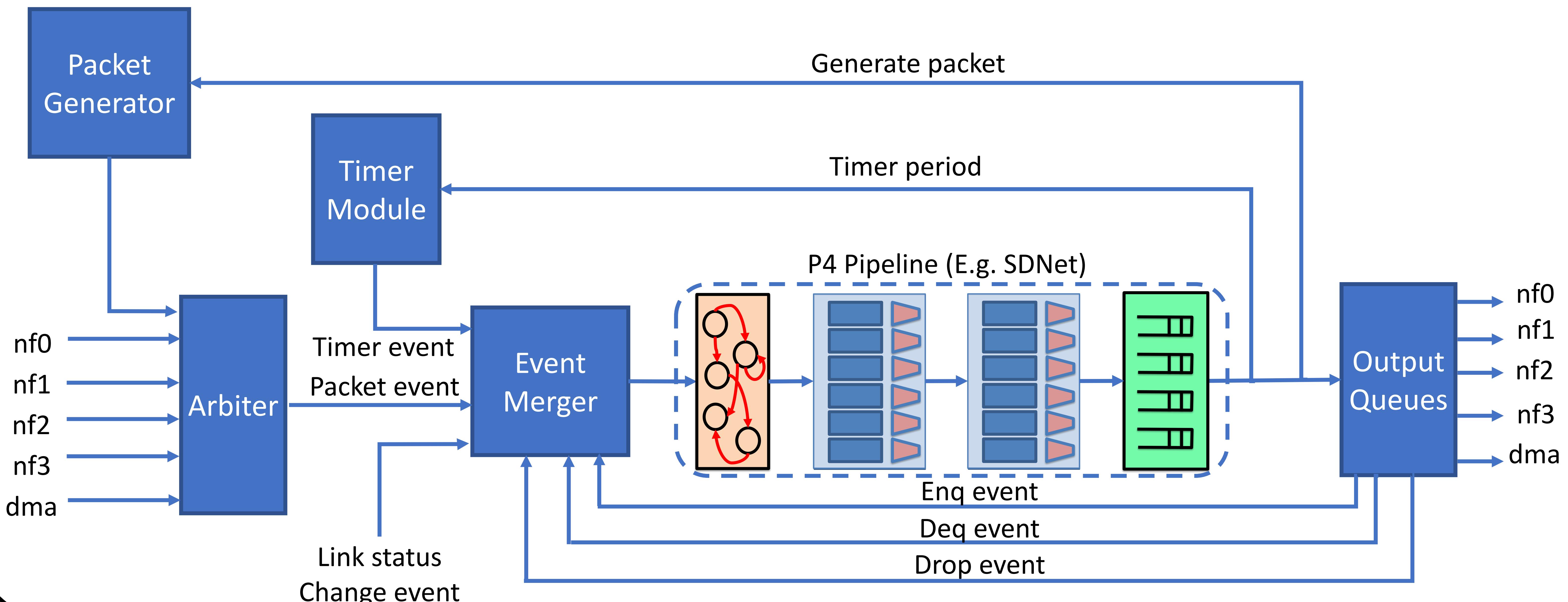
# Event-Driven AQM Using P4→NetFPGA



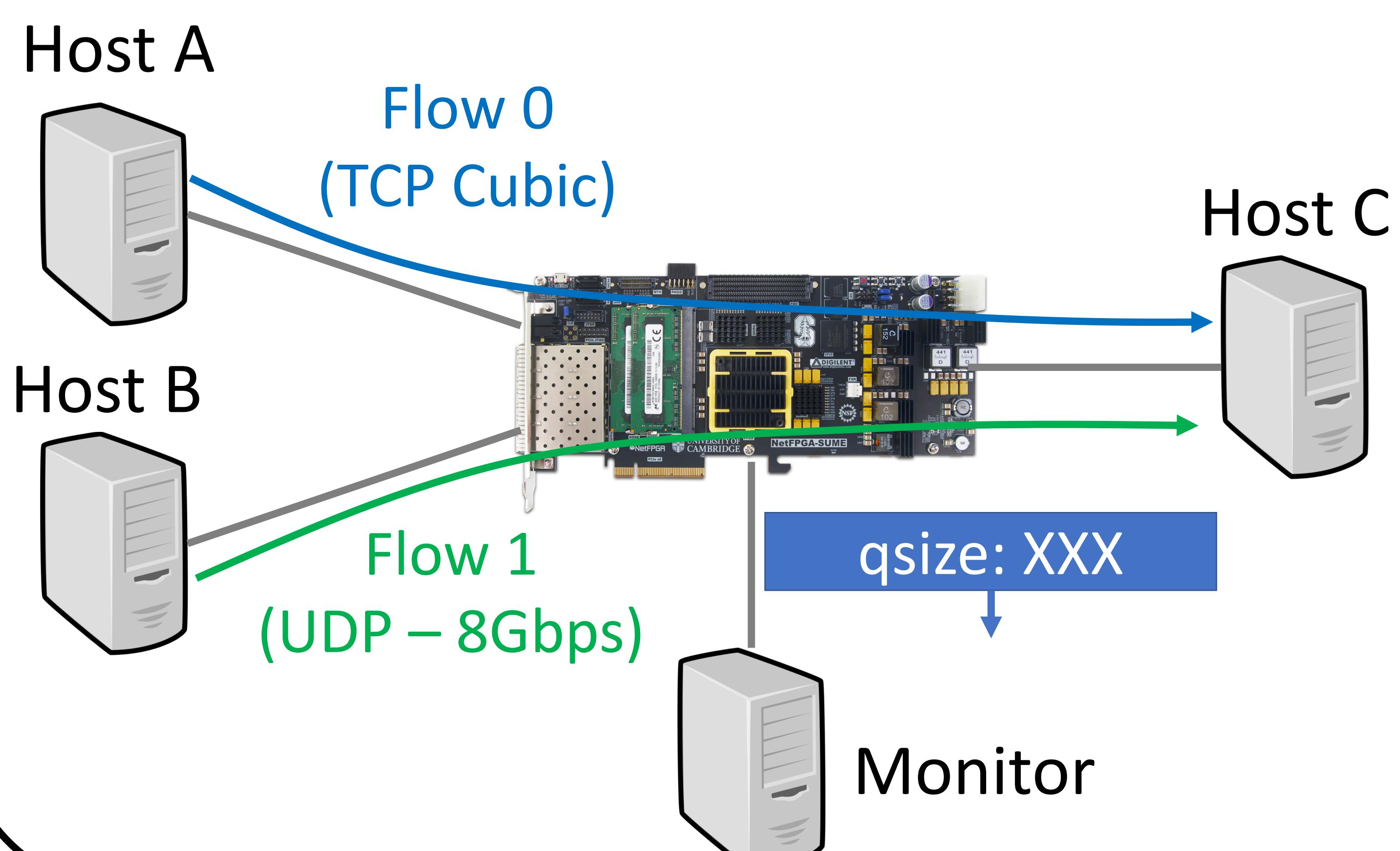
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## SUME Event Switch Architecture



## Demo Topology



## Benefits of Events

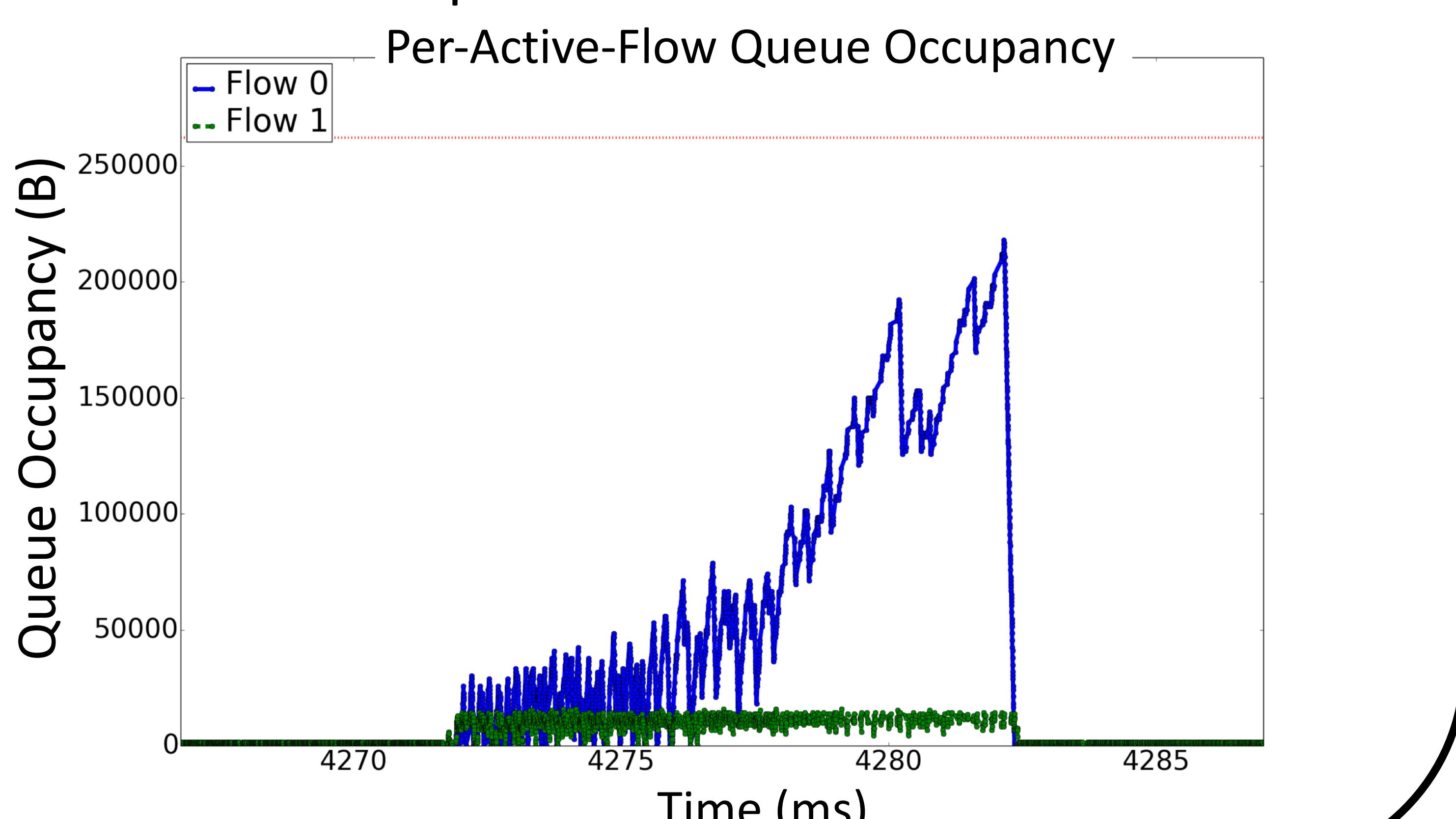
- Perform periodic tasks:
  - Update state, generate packets
- Update state multiple times:
  - Derive congestion signals

### Congestion Signals

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Queue size</li> <li>• Queue service rate</li> <li>• Queueing delay</li> <li>• Packet loss volume</li> <li>• Rate of change of queue size</li> </ul> | <ul style="list-style-type: none"> <li>• Timestamp of buffer overflow/underflow events</li> <li>• Per-active-flow buffer occupancy</li> </ul> |
|--|---|

## Queue Occupancy Tracing

- Sample queue occupancy every 400ns
- Send sample and timestamp to monitor if sample is different than previous one



## Simple Fair-RED (FRED) Prototype [1]

- Isolate adaptive TCP flow from non-adaptive UDP flow
- Compute and query per-active-flow queue occupancy
  - Enqueue, dequeue, and packet events
  - Register array supports up to 3 read-modify-write operations
  - Packet operations are prioritized
  - Enqueue & dequeue operations update queue occupancy state during IDLE cycles
- Configurable per-flow drop threshold

## References

- [1] Lin, Dong, and Robert Morris. "Dynamics of random early detection." *ACM SIGCOMM CCR*. Vol. 27. No. 4. ACM, 1997.