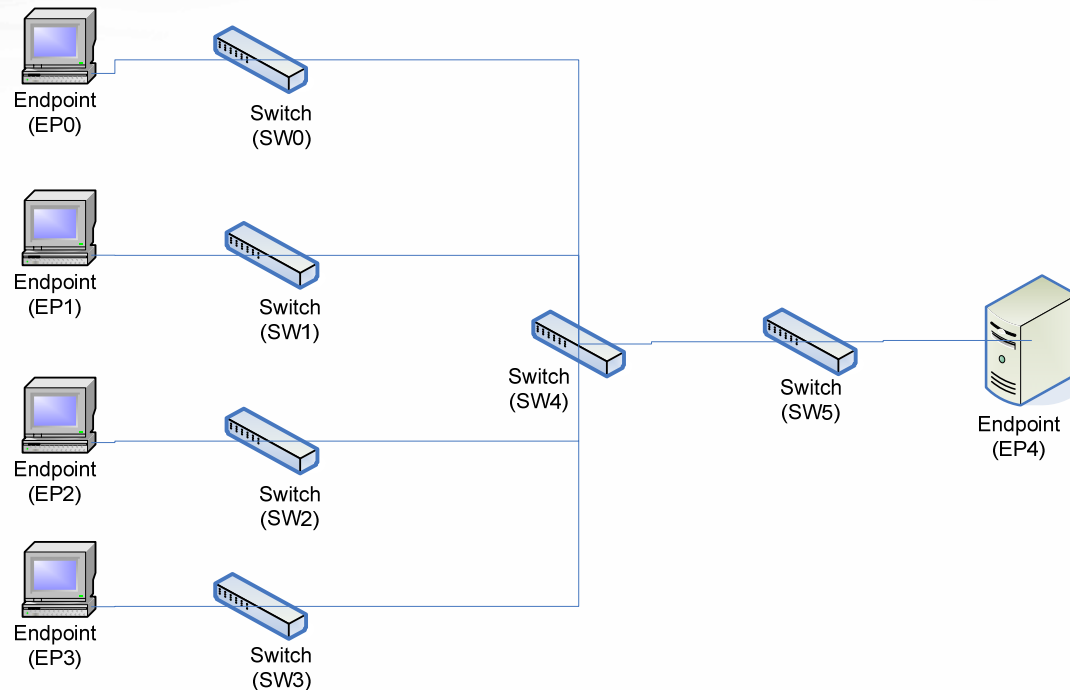# BCN Calibration Simulation Results
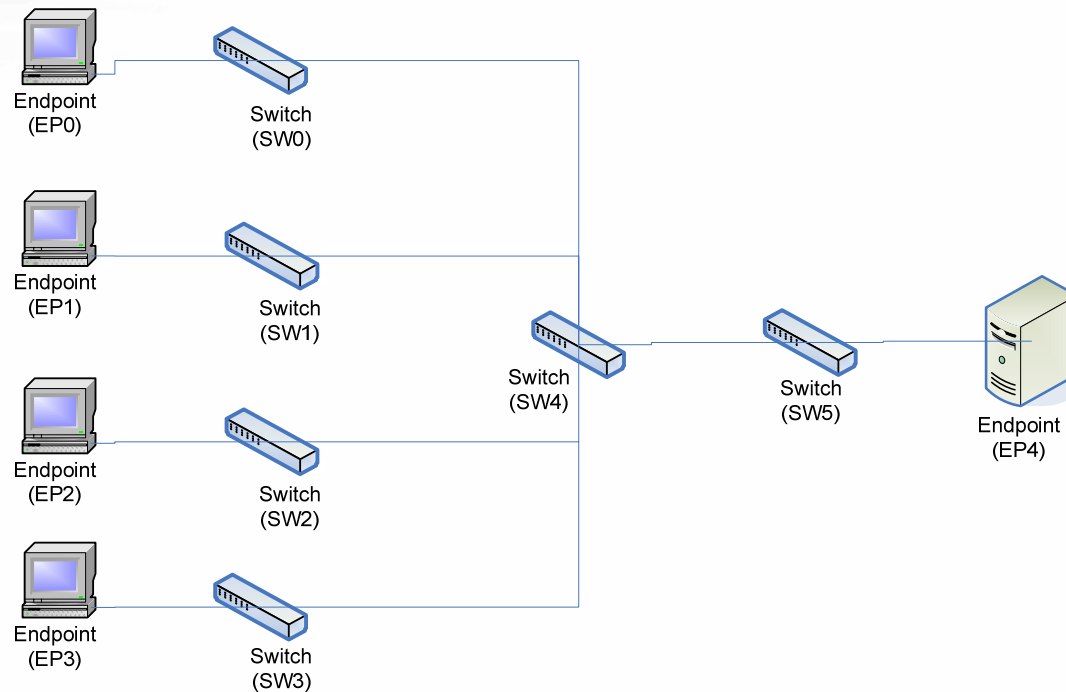
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Topology

- Short Range, High-Speed Datacenter-like Network
  - Link Capacity = 10 Gbps
  - Egress Port Buffer Size = 1 Mbyte
  - Switch Latency = 1 us
  - Link Length = 100 m (.5 us propagation delay)
  - Endpoint response time = 1 us
  - Loop Latency = 8us

Workload

- Traffic Type: 100% UDP (or Raw Ethernet) Traffic
- Destination Distribution: EP0-EP3 send to EP4
- Frame Size Distribution: Fixed length (1500 bytes) frames
- Arrival Distribution: Bernoulli temporal distribution
- Offered Load/Endpoint = 49%

BCN Parameters

- Qeq
  - 16 (1500-byte frames)
  - 375 * 64 byte pages

- Frame Sampling
  - Frames are sampled on average 150 KB received to the egress queue

- W = 2

- Gi = 12.42
  - Computed as $(Linerate/10) * [1/((1+2*W)*Q\_eq)]$
  - Gi = $5.3 \times 10^{-1} * (1500/64) = 12.42$

- Gd = 6.09×10^{-3}
  - Computed as $1/2*[1/((1+2*W)*Q\_eq)]$
  - Gd = $2.6 \times 10^{-4} * (1500/64) = 6.09 \times 10^{-3}$

- Ru = 1 Mbps

Simulation Runs

- Simulation
  - Duration: 100ms
  - Initial Transient @ t = 5ms (source start)
  - 2 flows stop @ t=80ms
  - Sampling Jitter: 20KB

- 300 simulation runs with different seeds

- Compute throughput for each flow during 78ms – 80ms and 20ms-80ms

- Fairness statistics computed across different simulation runs.

Simulation Statistics

- Variables
  - Ri: rate of individual flows
  - Ti: target rate (= 2.5 Gbps)
  - N: number of flows (= 4)

- Definitions
  - Maximum Error: $\max\left(\left|\dfrac{R_i - T_i}{T_i}\right|\right)$

  - Jain's Fairness index: $\dfrac{(\sum R_i / T_i)^2}{N \sum (R_i / T_i)^2}$

  - Alternative Fairness index: $\sqrt{\dfrac{\Sigma(\dfrac{R_i - T_i}{T_i})^2}{N}}$

- Statistics collected across multiple runs

Fairness Statistics Result
20ms – 80ms

# of Runs	Alternative Fairness Index (Min, Mean, Max, Std)	Jain Fairness Index (Min, Mean, Max, Std)	Max Error (Min, Mean, Max, Std)
25	(0.04, 0.17, 0.31, 0.073)	(0.91, 0.97, 1.00, 0.025)	(0.00, 0.25, 0.52, 0.12)
100	(0.04, 0.19, 0.35, 0.070)	(0.89, 0.96, 1.00, 0.026)	(0.00, 0.28, 0.59, 0.11)
200	(0.04, 0.20, 0.40, 0.071)	(0.86, 0.96, 1.00, 0.026)	(0.00, 0.29, 0.66, 0.11)
300	(0.04, 0.19, 0.40 0.069)	(0.86, 0.96, 1.00, 0.025)	(0.00, 0.28, 0.66, 0.11)

Fairness Statistics Results
78ms – 80ms

# of Runs	Alternative Fairness Index (Min, Mean, Max, Std)	Jain Fairness Index (Min, Mean, Max, Std)	Max Error (Min, Mean, Max, Std)
25	(0.02, 0.14, 0.27, 0.065)	(0.93, 0.98, 1.00, 0.018)	(0.00, 0.22, 0.40, 0.10)
100	(0.02, 0.16, 0.36, 0.065)	(0.89, 0.97, 1.00, 0.021)	(0.00, 0.24, 0.51, 0.10)
200	(0.02, 0.16, 0.36, 0.063)	(0.89, 0.97, 1.00, 0.020)	(0.00, 0.24, 0.51, 0.10)
300	(0.02, 0.16, 0.36, 0.062)	(0.89, 0.97, 1.00, 0.020)	(0.00, 0.23, 0.54, 0.10)