CN Simulation Ad Hoc Report

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CN-SIM Ad-Hoc: Overview

- Meetings:
  - 6 Weekly meetings help since July 2006 IEEE 802.1 Plenary meeting
- Participation:
  - 15+ members actively participated in the calls
  - Representing 10+ companies
- Goal:
  - Achieve baseline models for BCN before September Interim meeting
- Status:
  - Consistent results across 4 independent simulation environments for baseline topology

Thank you all for great team work!

CN-SIM Modeling Teams

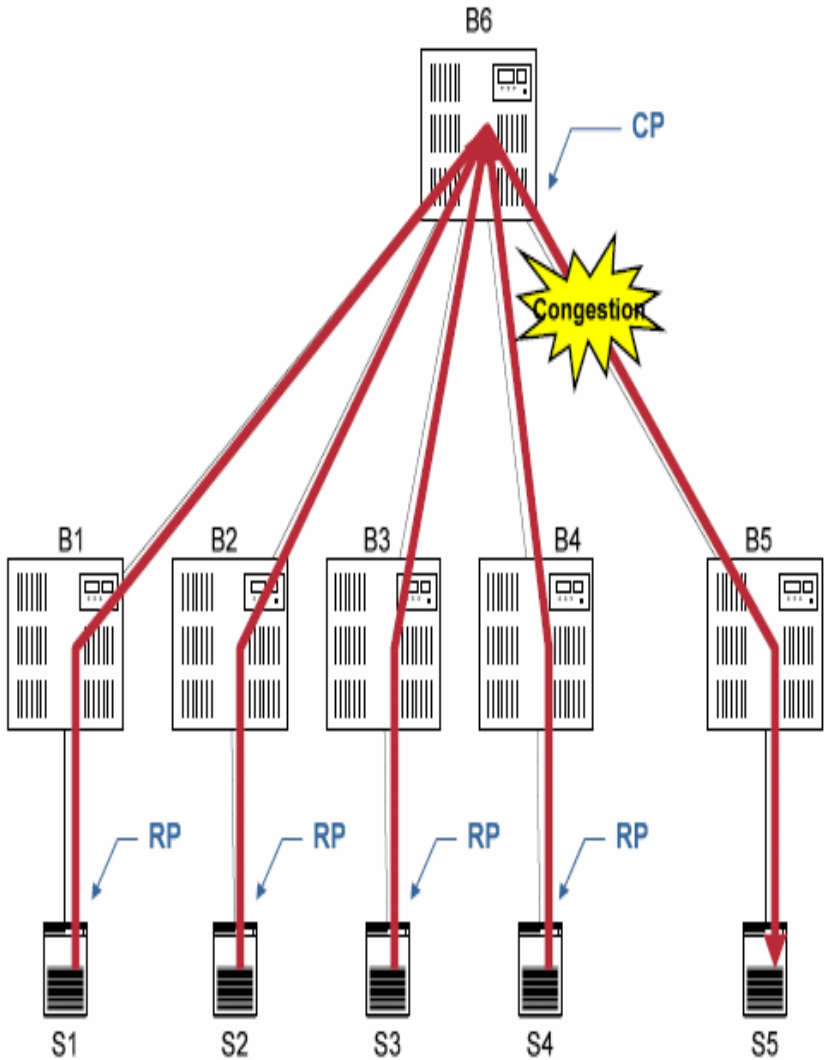
- We had four simulation teams with independent environments
  - Bruce Kwan: Broadcom
  - Zhi-hern Loh/Uri Cummings: Fulcrum
  - Davide Bergamasco: Cisco
  - Tanmay Gupta: Intel

- Pat Thaler created excel based traffic model for BCN for comparing the results with theoretical best outputs

Baseline Model Discussion

- Group agreed that it is necessary to:
  - Have common bridging model for simulation
    - Use 802.1 (output queued bridge) model
  - Use simple topology and workload for creating baseline simulations
  - Weekly review of individual results for getting consistency
  - Common baseline important for
    - calibrating individual simulation models
    - Agreement over protocol, device models and workload across all the environments

Baseline Simulation Topology



- Single congestion point
- Use Output queued model for bridges
- RP function in the end stations
- Link Capacity = 10Gbps
- Buffer Size (150 KB) (CP & RP)
- Link Length = 100m (.5 µS)
- Switch Latency = 1 µS
- Station processing = 2 µS
- Loop Latency = 8 µS

Simulation Scenario and Workload Characteristics

- Scenario:
  - Runs = 25
  - Duration = 100 mS
  - Initial Transient (all 4 sources start) t = 5 mS
  - Final Transient (2 sources stop) t = 80 mS
  - Sampling jitter = 20 KB
- Workload:
  - S1-S4 send to S5
  - 100% UDP traffic
  - Fixed length 1500B packets
  - Bernoulli temporal distribution
  - offered load at End Point = 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 x 10-1 * (1500/64) = 12.42
- Gd = 6.09 x 10-3
  - Computed as 1/2*[1/((1+2*W)*Q_eq)]
  - Gd = 2.6 x 10-4 * (1500/64) = 6.09 x 10-3
- Ru = 1 Mbps

Measurements

- Throughput
  - On congested link
  - On uplinks
- Buffer Utilization
  - Congested Link
  - Rate Limiter Queues

- Fairness Indices & Max Error
  - Maximum Error: $\max\left(\left|\frac{R_i - T_i}{T_i}\right|\right)$
  - Jain's Fairness index: $\frac{(\sum R_i / T_i)^2}{N \sum (R_i / T_i)^2}$
  - Alternative Fairness index: $\sqrt{\Sigma\left(\frac{R_i - T_i}{T_i}\right)^2}$

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

Results from various simulations

- Davide Bergamasco (Cisco):
http://www.ieee802.org/1/files/public/docs2006/au-sim-bergamasco-baseline-sim-scenario-092106v5.pdf

- Bruce Kwan (Broadcom):
http://www.ieee802.org/1/files/public/docs2006/au-sim-kwan-bcn-calibration-092106.pdf

- Zhi-Hern Loh (Fulcrum):
http://www.ieee802.org/1/files/public/docs2006/au-sim-loh-bcn-fairness-index-09202006.pdf

- Tanmay Gupta (Intel):
http://www.ieee802.org/1/files/public/docs2006/au-sim-gupta-baseline-092106.pdf

Summary status for Baseline modeling

- Common understanding of BCN protocol, parameters and device models is achieved
- Jain fairness index for all the models is nearly matching
  - One anomalous result is being debugged
- "no-drop" is achieved using BCN in baseline topology in the "stable" zone
- Packets get dropped during initial burst period (allowing for control loop delay)
  - Pause being reviewed as complimentary mechanism to BCN
  - Early results for BCN+PAUSE shared

Next Steps

- Study Pause and BCN together in baseline
  - Define device model for PAUSE
  - Define PAUSE configuration parameters and statistics
- Validate following topologies and workloads
  - Multi-hop congestion with same workload
  - TCP+UDP workload
  - Parallel efforts for simulation
- Anything else?