CN-SIM: Discussion About Simulation Metrics

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Introduction

- At the last Interim Meeting in Monterey we agreed to gather the following metrics in our simulations (see au-thaler-CN-metrics-070124.pdf):

Easy

- Queue depth (Max, Avg, StdDev)
- Time above highly congested point (TBD, time above Qsc, n * equilibrium point)
- Packets dropped in network
- % time paused
- Aggregate throughput for congested flows
- Aggregate throughput for innocent flows
- Signaling overhead
- Fairness

Not so Easy

- Completion time for innocent flows
- Completion time for congested flows
- Convergence time
- Reaction to short flows, flow length boundaries for benefit, flow length boundaries that cause harm?

Flow Completion Time

- Definition of Flow:

  Ordered sequence of frames originated by a source node and addressed to a destination node

- Definition of Flow Completion Time (FCT):

  Ideal: Difference between the arrival time of the last and the first BITS of a flow

  Approximate: Difference between the arrival time of the last and the first FRAMES of a flow

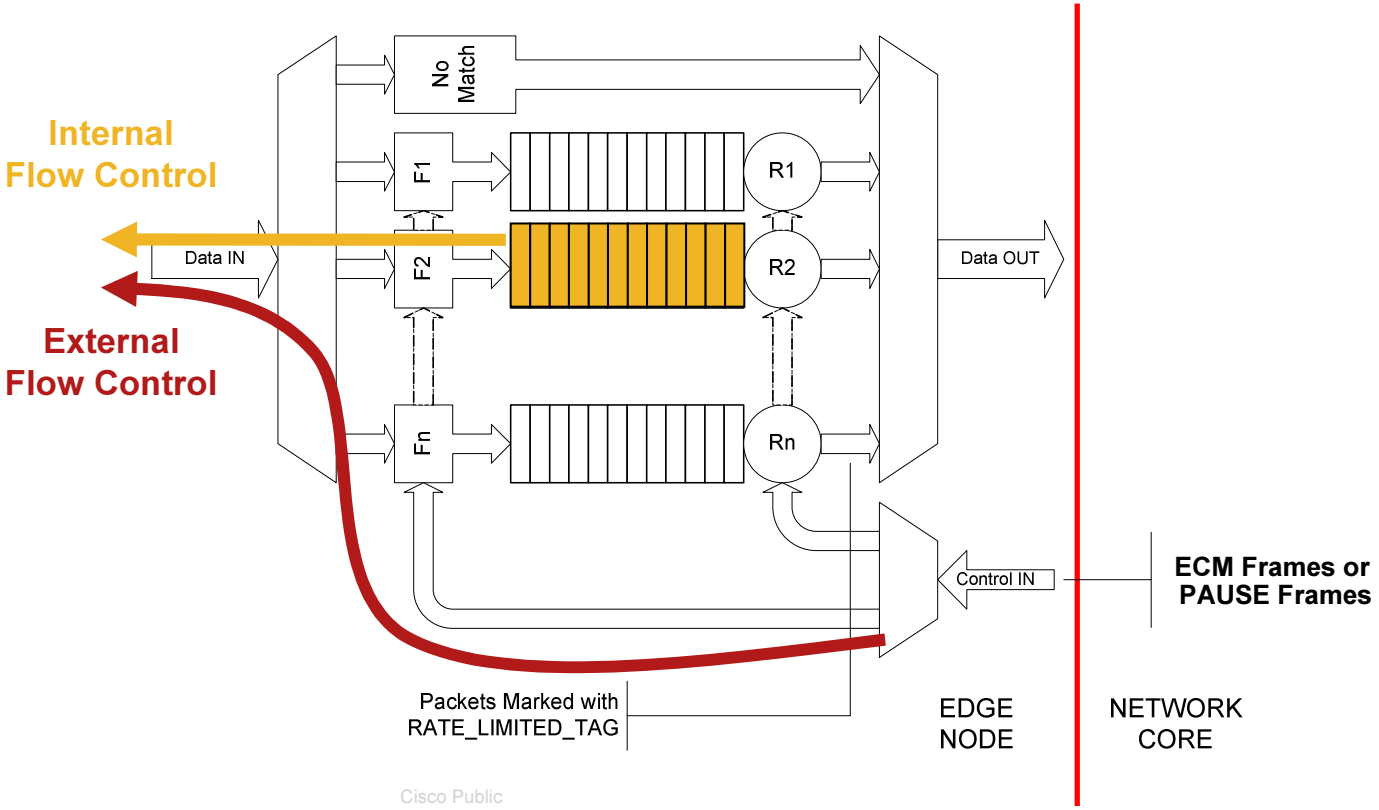
- The FCT can be computed IIF all the frames of flow are received by the destination node
- When PAUSE is not used, frames may be dropped, effectively compromising flows and FCT computation
- Proposal

  Compute FCT only for flows uncompromised flows (“good flows”)

  Count number of compromised flows (“bad flows”)

Flow Completion Time

- When PAUSE is used, frames cannot be dropped. Hence FTC can be computed for all flows
- However, FCT may be compromised because of blocking in NICs



Flow Completion Time

- Proposal

  For external flow control (i.e., PAUSE triggered), nothing can be done, so just live with it

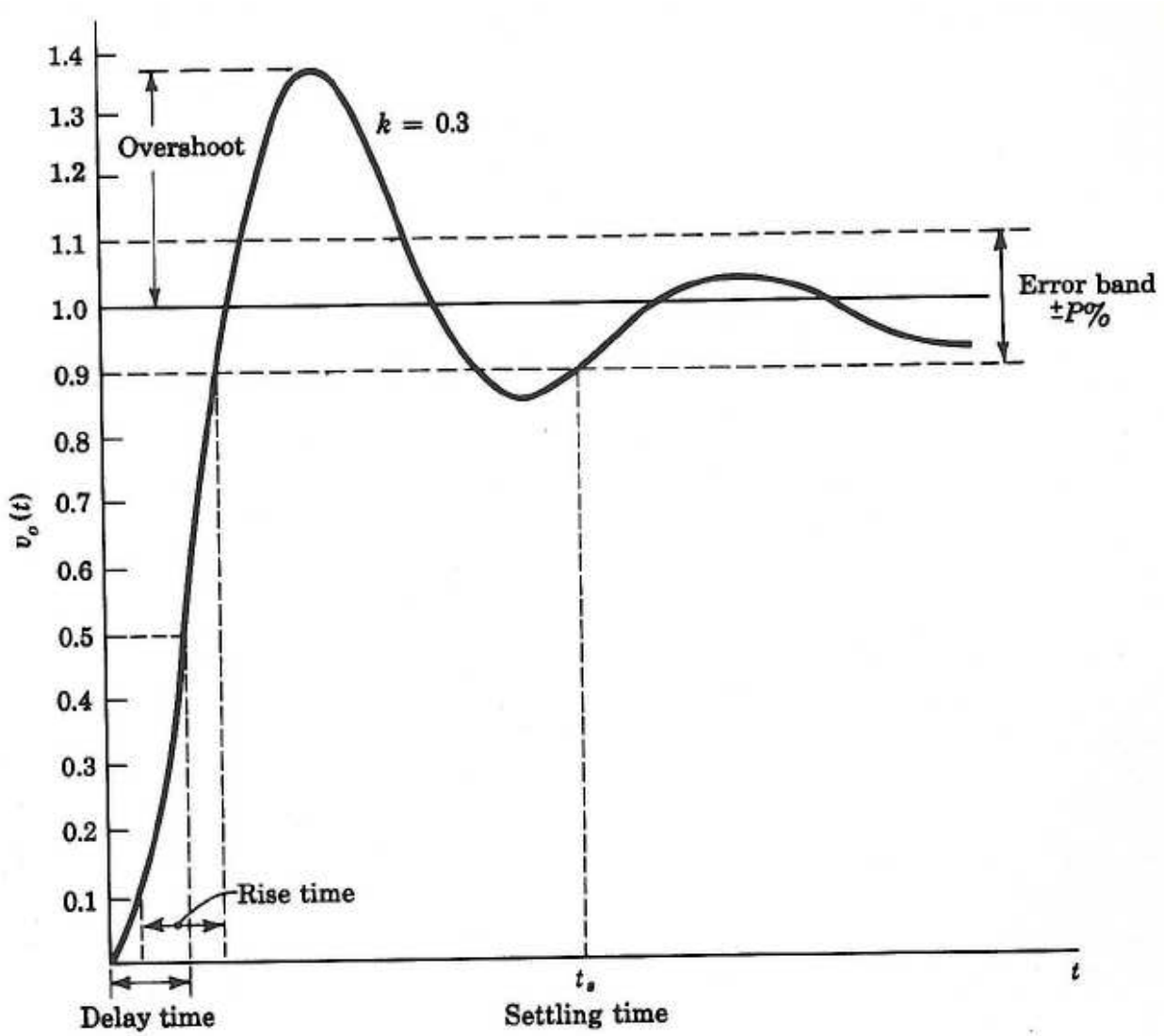
  For internal flow control, block only the flows mapped to a RL whose queue exceeds a certain threshold (i.e., selective flow control)

  This complicates the source architecture because multiple traffic generators (or a “multithreaded” traffic generator) are required within the same node

Convergence Time

- In Monterey, Bruce Kwan presented some very good material regarding the estimation of transient duration (au-sim-kwan-transient-duration-012407.pdf)
- The "*Initial Data Deletion*" methodology was used to determine when the initial transient was over
- Although extremely accurate, such methodology is quite labor-intensive and time-consuming
- Proposal
  - Use a far less accurate but simpler transient estimation technique commonly used in electronics and control theory to conduct quick assessments
  - Use the Initial Data Deletion methodology to "dig deeper", if needed

Convergence Time



Queue Settling Time t_s

$t_s \in [0, T]$ such that

$|Q_{len}(t) - Q_{eq}| < \alpha\, Q_{eq}$

for any $t > t_s$

Where $\alpha \in [0, ½]$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