Summary of draft-zhang-pcn-performance-evaluation and draft-charny-single-marking

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Outline and Scope

• Performance comparison of admission control
  – Single-marking vs. draft-briscioe-style virtual-queue based admission
  • New results since last meeting
• Summary of Termination performance
  – The same algorithm for draft-brsicoe and single-marking
• Other single marking tradeoffs
• Impact of single marking on other drafts
• Note: recent proposals (draft-babiarz- and draft-westberg) need separate comparative evaluation
  – Work on alignment of performance criteria and simulation setups in progress
High-level Results: Admission Control (Previously reported)

<table>
<thead>
<tr>
<th>Marking Parameters</th>
<th>Virtual Queue</th>
<th>Single Marking Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp vs. Step: no difference</td>
<td>Relatively insensitive</td>
<td>Token Bucket Depth: Relatively insensitive</td>
</tr>
<tr>
<td>Upper/Lower Threshold: relatively insensitive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute or Relative RTT Difference</th>
<th>Virtual Queue</th>
<th>Single Marking Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Effect on bottleneck utilization</td>
<td></td>
<td>No Effect on bottleneck utilization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EWMA weight and CLE</th>
<th>Virtual Queue</th>
<th>Single Marking Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insensitive</td>
<td></td>
<td>Relatively Insensitive</td>
</tr>
</tbody>
</table>
## High-level Results: Admission Control (New in these drafts)

<table>
<thead>
<tr>
<th></th>
<th>Virtual Queue</th>
<th>Single Marking Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ingress-Egress Aggregation</strong></td>
<td>No effect</td>
<td>• Over-admission at low aggregation (synchronization effect)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sensitive to bursty flow arrivals at low aggregations</td>
</tr>
<tr>
<td><strong>Multi-Bottleneck</strong></td>
<td>• No effect at bottleneck</td>
<td>• No effect at bottleneck</td>
</tr>
<tr>
<td></td>
<td>• Unfair to long-haul aggregates</td>
<td>• Unfair to long-haul aggregates</td>
</tr>
</tbody>
</table>
# High-level Results: Termination Control

<table>
<thead>
<tr>
<th>Sanity check on SingleLink topology</th>
<th>Worked as Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTT Difference</td>
<td></td>
</tr>
<tr>
<td>• Absolute Difference: No effect</td>
<td></td>
</tr>
<tr>
<td>• Relative Difference: Visible over-termination, though not significant</td>
<td></td>
</tr>
<tr>
<td>Multi-Bottlenecks</td>
<td>Worked as Expected, long-haul aggregates are more affected</td>
</tr>
<tr>
<td>Ingress-Egress Aggregation</td>
<td>Visible over-termination at low aggregation (synchronization)</td>
</tr>
</tbody>
</table>
Marking Synchronization

• Cause: for periodic traffic and certain parameter combinations marking is not well distributed among flows sharing the bottleneck
  – some flows are always marked and some are never marked
  – most relevant for CBR, but visible for near-CBR portions of other traffic types

• Relevant only to excess-rate token bucket marking/metering when ingress-egress aggregation is low
  – Detrimental to excess-rate admission: overadmission
  – Beneficial to termination: less over-termination than theoretical worst case
Is it a simulation artifact?

• Probably Not!

Single Marking Admission

Termination
Multi-Bottleneck Admission
Unfairness to long-haul flows (Beat-Down Effect)

- Common problem for Single-Marking and VQ admission
  - is a known property of many MBACs and likely to be a problem for all other admission control proposals
- Is probably of limited practical worry
  - for its effect to be significant needs large demand overload of long duration
  - overload is not large under "normal" conditions
  - in exceptional condition utilization control is more important than fairness
Conclusions of Performance Evaluation

• Admission
  – At reasonable ingress-egress aggregations (~10 flows or more) performance of both schemes is comparable
  – At low ingress-egress aggregation single marking performance degrades
    • over-admission
    • sensitivity to call arrival assumptions
  – Both schemes unfair to long-haul flows for Multi-Bottleneck

• Termination
  – Performs as advertised in most scenarios
  – Occasional over-termination – but typically tolerable
Single Marking Tradeoffs

• Pros (or why we may want single marking)
  
  Single codepoint
  
  One metering/marking scheme in the forwarding path of core equipment
  
  Easy (easier?) deployment path
  
  Can be viewed as an intermediate step for dual-marking

• Cons (or why we should not do just single marking):
  
  some configuration restrictions
  
  unclear how to do anti-cheating in multi-domain case
  
  lower accuracy in the multipath case
  
  some traffic engineering tradeoffs
  
  some performance tradeoffs at very low ingress-egress aggregation levels
Impact on PCN Architecture and Encoding Documents

• Architecture
  No changes to architecture required in the core
  Addition of a single configuration parameter at the edges
    already planned for inclusion in the architecture draft
  Proposed optional renaming of marking-related terms

• Encoding
  Any encoding choice suitable for dual marking works for single-marking
  Allows additional encoding options
    already in the current encoding draft
What Next?

• WG needs to decide whether single-marking needs to be allowed/accommodated in various WG documents. *We argue – YES!*

• This is part of more general decisions: which/how many of the proposed approaches should be chosen? Need definition/performance criteria to aid the decision process (work in progress)

• Smaller decision: should naming of the marking be associated with function (admission/termination) or semantics (excess rate/queue threshold/excess-rate-proportional/other). *We argue naming should reflect semantics to help interoperability if more than one marking algorithm can support a given function*
Relationship to Other PCN Proposals

• Core functionality
  a subset of core functionality needed for draft-brisoe
  a special case of core functionality required for termination of draft-babiarz
  coexistence with draft-westberg to be understood

• Edge functionality
  a trivial superset of the edge functionality of draft-briscoe
  differs substantially from edge functionality of draft-babiarz and draft-westberg