Single PCN Threshold Marking by using PCN baseline encoding for both admission and termination control

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Outline

• Motivation
• How to divide three states of congestion
• How to mark according to congestion
• Admission control
• Termination control
• Simulation results – Admission control –
• Simulation results – Termination control –
Motivation

- Making an algorithm by PCN baseline encoding
- Explicitly detecting whether PCN traffic is more than PCN-Admissible-rate or not
- Explicitly detecting whether PCN traffic is more than PCN-Supportable-rate or not
Marking and control operations

PCN traffic rate

100%

All the packets PCN-threshold-marked

Terminate some admitted flows & Block new flows

Marking.frequency: 1

PCN-Supportable rate (threshold-rate)

Some packets PCN-threshold-marked

Block new flows

Marking.frequency: 1/N

PCN-Admissible rate

No packets PCN-marked

Admit new flows

not defined

0%
To achieve all the packets marked

PCN traffic rate

100%

All the packets PCN-threshold-marked

Terminate some admitted flows & Block new flows

Marking.frequency: 1

PCN-Supportable rate (threshold-rate)

Some packets PCN-threshold-marked

Block new flows

Marking.frequency: 1/N

0%

PCN-Admissible rate

No packets PCN-marked

Admit new flows

not defined
To achieve all the packets PCN-marked

Supportable rate

TBthreshold

Ordinary Threshold marking

Marking ratio

0% 100%

0 1.0

PCN-Supportable rate

PCN traffic rate

All the packets PCN-threshold-marked

PCN traffic rate
To achieve some packets marked

PCN traffic rate

100%

PCN-Supportable rate
(threshold-rate)

All the packets PCN-threshold-marked
Terminate some admitted flows & Block new flows
Marking.frequency: 1

Some packets PCN-threshold-marked
Block new flows
Marking.frequency: 1/N

PCN-Admissible rate

No packets PCN-marked
Admit new flows
not defined

Marking.frequency: 1/N
To achieve some packets marked (step:1/2)

Supportable rate

Token equal to the bit of the arrived packet

TBthreshold

Marking ratio

0

1.0

0%

100%

PCN-Supportable rate

PCN traffic rate
Marking frequency

- When \( N = 1 \) (ordinary marking, marking frequency = 1),
- \[ M \ M \ N \ N \ M \ N \ M \ M \ N \ N \ M \ N \]
- \[ 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \]
- \[ N \quad N \quad N \quad N \quad M \quad N \quad N \quad N \quad N \quad M \quad N \]
- When \( N = 3 \) (marking frequency = 1/3)

- M: marked packet
- N: not marked packet
To achieve some packets marked (step:2/2)

- Supportable rate

- TBthreshold.threshold

- one-N-th packets are marked (marking.frequency: 1/N)

- TB2.threshold

- every packet is marked (marking.frequency: 1)

- Marking ratio

- 1.0

- 0

- PCN-Supportable rate

- 100%

- PCN traffic rate
To achieve no packets marked

PCN traffic rate

100%

All the packets PCN-threshold-marked

Terminate some admitted flows & Block new flows

Marking.frequency: 1

PCN-Supportable rate (threshold-rate)

Some packets PCN-threshold-marked

Block new flows

Marking.frequency: 1/N

PCN-Admissible rate

No packets PCN-marked

Admit new flows

not defined

Marking.frequency: not defined

Terminate some admitted flows & Block new flows

Marking.frequency: 1

Admit new flows

not defined

Marking.frequency: not defined

Admit new flows

not defined

Marking.frequency: not defined

Admit new flows

not defined

Marking.frequency: not defined

Terminate some admitted flows & Block new flows

Marking.frequency: 1
To achieve no packets marked

Admissible rate

Marking switch is OFF.

TB1.threshold

Marking switch is ON.

PCN traffic rate

Marking ratio

PCN-Admissible rate

PCN-Supportable rate

0% 100%
Example of Token buckets implementation

Admissible rate

Marking switch is OFF.
Marking switch is ON.

Supportable rate

one-N-th packets are marked (marking.frequency: 1/N)
every packet is marked (marking.frequency: 1)
Admission control

1. Egress measure the CLE per Ingress
2. Egress sends the CLE to Ingress
3. Ingress receives the CLE
4. If the CLE is greater than CLE threshold then Admission stop.
5. If the CLE is less than CLE threshold then Admitting new flows
   – CLE threshold should be chosen less than AR/(N*SR).
Flow Termination Control

- Almost the same as that of CL
1. Egress detects L-sequential marked packets.
2. Egress starts measuring receiving PCN rate during some interval.
3. Egress sends the received PCN rate to Ingress.
4. Ingress starts measuring sending PCN rate during some interval.
5. Ingress terminates flows equal to the quantity: sending PCN rate – receiving PCN rate + $y\%*\text{receiving PCN rate}$.
6. Go back to 1.
The difference between CL and STM

STM

CL

The quantity by STM termination

The quantity by CL termination

y % of receiving PCN rate

Sending PCN rate

Receiving PCN rate

Ingress

Egress

Non-marked rate in CL
Impact to marking behaviour

• TBthreshold.threshold is not intermediate depth of the token bucket.
• This algorithm uses marking one-Nth packet in threshold marking.
Basic evaluation – admission control -

<table>
<thead>
<tr>
<th>Type</th>
<th>Over Admission %</th>
<th>Standard deviation %</th>
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<tbody>
<tr>
<td></td>
<td>STM</td>
<td>CL</td>
</tr>
<tr>
<td>CBR</td>
<td>0.285</td>
<td>0.028</td>
</tr>
<tr>
<td>VBR</td>
<td>1.017</td>
<td>0.979</td>
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<tr>
<td>SVD</td>
<td>4.308</td>
<td>4.476</td>
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</table>
Basic evaluation – termination control -

<table>
<thead>
<tr>
<th>Traffic</th>
<th>Load</th>
<th>Over Termination %</th>
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</thead>
<tbody>
<tr>
<td>Type</td>
<td>(x Link</td>
<td>STM</td>
</tr>
<tr>
<td></td>
<td>speed)</td>
<td></td>
</tr>
<tr>
<td>CBR</td>
<td></td>
<td>5.54</td>
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<tr>
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<td>1.0</td>
<td>6.95</td>
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<tr>
<td>SVD</td>
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<td>17.34</td>
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<tr>
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<td>SVD</td>
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<td>16.94</td>
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<tr>
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<td>3.86</td>
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<tr>
<td>VBR</td>
<td>3.0</td>
<td>30.82</td>
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<tr>
<td>SVD</td>
<td></td>
<td>38.21</td>
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