Resource Sharing for Stateless Packet-Switched Networks

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Problem

- **High speed access**
  - Mobile Access Networks, Residential Access Networks, Multi-tenant Data Centers, etc.

- Appropriate *overprovisioning* of backhaul networks
  - Difficult & Costly

- **Scalable** bandwidth sharing supporting *QoS* is needed in *congestion situations*
  - Simple network nodes, no per-user states, service differentiation, rich set of policies, etc.
Per Packet Value (PPV) Resource Sharing

- Resource sharing policies for all congestion situations by **Throughput-Value Functions (TVF)**

  - **Packet Marker** at the edge of the network
    - Stateful, but highly *distributed*

- **Resource Nodes** (e.g. routers) aim at maximizing the total transmitted Packet Value.
  - Stateless and *simple*
PPV – Packet Marking

Simple TVF

<table>
<thead>
<tr>
<th>Bitrate [kbps]</th>
<th>Value</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>1000</td>
<td>yellow</td>
</tr>
<tr>
<td>800</td>
<td>100</td>
<td>red</td>
</tr>
<tr>
<td>3000</td>
<td>10</td>
<td>blue</td>
</tr>
<tr>
<td>10000</td>
<td>1</td>
<td>green</td>
</tr>
</tbody>
</table>

Source 1
- 2 Mbps

Source 2
- 6 Mbps

Bottleneck
- 1 Mbps

Filtered to 1 Mbps

Time [ms]

Throughput [kbps]

Filter yellow and red

1 Mbps
PPV – Packet Marking

Example simple per packet OV curve

Bitrate [kbps]

Per packet OV

Bitrate [kbps] Value Color
200 1000
800 100
3000 10
10000 1

Filter yellow and red

Source 1
2 Mbps

Source 2
6 Mbps

Bottleneck
1 Mbps

Filter by Value
Drop minPPV first scheduling [1]

PVPIE – PPV with PIE AQM [2]

CSAQM – PPV + CC indep. AQM [3]
What’s next?

Further readings


[2] S. Laki et al., Take Your Own Share of the PIE, In proc. of IRTF/ACM ANRW 2017


[4] S. Laki et al., Scalable Per Subscriber QoS with Core-Stateless Scheduling, Industrial demo at ACM SIGCOMM 2018

Similar approaches published recently


Industrial Demo at SIGCOMM 2018
PPV-based Core Stateless vBNG node implementation

PPV + AQM = CSAQM
Poster at ANRW@IETF-102 on Monday !!!
Interested? Let’s talk!
Or offline: lakis@elte.hu