flow rate fairness
dismantling a religion
<draft-briscoe-tsvarea-fair-00.pdf>

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today’s shares are just the result of a brawl

- flow rate fairness is not even wrong
  - it doesn’t even answer the right questions
  - it doesn’t allocate the right thing
  - it doesn’t allocate between the right entities

- how do you answer these questions?
  1) how many flows is it fair for an app to create?
  2) how fast should a brief flow go compared to a longer lasting one?
fair allocation... of what? among what? of ‘cost’ among bits

- cost of one user’s behaviour on other users
  - congestion volume = instantaneous congestion...  
  - ...shared proportionately over each user’s bit rate  
  - ...over time

- instantaneous congestion
  \[ p = 10\% \]

- congestion volume, \( v = x(t) \cdot \Delta t \cdot p(t) \)
  \[
  v_1 = 200\text{bps}^{-1} \times 50\text{ms} \times 10\% + 300\text{bps}^{-1} \times 200\text{ms} \times 10\% \\
  = 1\text{kb} + 6\text{kb} = 7\text{kb}
  \]
  \[
  v_2 = 300\text{bps}^{-1} \times 50\text{ms} \times 10\% + 200\text{bps}^{-1} \times 200\text{ms} \times 10\% \\
  = 1.5\text{kb} + 4\text{kb} = 5.5\text{kb}
  \]

- as \( \Delta t \to 0 \), integrates easily & correctly over time and over flows
  \[ \equiv \text{volume of data each user sent that was dropped (if loss-based)} \]
  \[ \equiv \text{volume of data each user sent that was congestion marked (if ECN-enabled)} \]

Toy scenario for illustration only: strictly...
- a super-linear marking algorithms to determine \( p \) is preferable for control stability
- the scenario assumes we're starting with full buffers
enforcement of fairness

- if it’s easy to ‘cheat’, it’s hardly a useful fairness mechanism
  - whether intentionally or by innocent experimentation

- if every flow gets equal rate
  - the more flows you split your flow into, the more capacity you get
  - fairness per source-destination pair is no better
    - Web/e-mail hosting under one IP addr
    - stepping stone routing (cf bitTorrent)

- by design, cost allocation among bits is immune to such cheating