Proposal for Fairness Index

Khaled Amer

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Motivation

- Need uniform measure to quantify fairness of various proposed architectures
- This proposal is for a fairness index for bandwidth allocation only
- We may need a fairness index for latency too

Proposal Basis

- Proposed fairness index is based on paper presented at SIGCOMM ‘95 Cambridge MA by:
  - George Varghese
    - Washington Universiy in St Louis
  - M. Shreedhar
    - Microsoft Corp
- Some additions/modifications have been made

Assumptions

- Sent (i,t): total number of bytes sent by flow i in time interval t
- Sent (t): total number of bytes sent by all n flows in time interval t
- Fairness quotient for flow i is the ratio of the bytes sent by flow i to the bytes sent by all flows

Fairness Quotient for flow i

$$FQ_i = \frac{\textbf{sent (i, t)}}{\textbf{sent (t)}}$$

More Assumptions ...

- Assume some quantity f_i settable by a network manager which expresses the ideal share to be obtained by flow i

Ideal Fairness Quotient for flow i

$$IFQ_i = \frac{f_i}{\sum_{j=1}^{n} f_j}$$

Definition of Fairness Index

- Now we measure how far a fair queuing implementation departs from the ideal by measuring the ratio of the actually fairness quotient achieved to the ideal fairness quotient

Fairness Index i

The fairness index of a flow i is:

$$FI_i = \frac{F\ Q_i \sum_{j=1}^{n} f_j}{f_i}$$

Global Fairness Index

The global fairness index is:

$$FI = \sum_{k=1}^{m} \sum_{i=1}^{n} abs(1 - FI_i)$$

where:

k represents the node number in the ring

i represents the flow number in node k

Possible Extensions

- May need to add extensions to quantify fairness in allocating BW available in excess of all the f_j values
- May want to consider normalized value instead of the just the double summation