



Proposal for Fairness Index

Khaled Amer

**IEEE 802.17
Interim Meeting**

**Orlando
May 2001**

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 University 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

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

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:

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



Global Fairness Index

The global fairness index is:

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

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