TFRC for Voice: the VoIP Variant

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draft-ietf-dccp-tfrc-voip-02.txt

Slides: http://www.icir.org/floyd/talks.html

Graphics:

http://www.icir.org/floyd/papers/voipimages.pdf

VoIP: fairness in Bps.

- Standard TFRC has the goal of fairness in pps with TCP flows using the same packet size.
- The VoIP variant of TFRC has the goal of fairness in Bps with TCP flows using 1500-byte packets, (following RFC 3714).
- The VoIP variant assumes optimistically that the network limitation is in Bps, not in pps.

VoIP: fairness in Bps.

- In the TCP throughput equation, use the measured loss event rate and a packet size of 1460 bytes.
- Reduce the allowed transmit rate to account for the fraction of the VoIP bandwidth that would be used by 40-byte headers:
- Enforce a Min Interval between packets of 10 ms.
- For short loss intervals (at most two RTTs), count the actual packet loss rate (but don't increase the number of loss intervals).

Report at the last IETF: Issues remaining

- More exploration needs to be done.
- The problem:
  - VoIP TFRC, with small packets, sees different packet drops that it would have with larger packets. When is this a problem?
- For simulations with RED in byte mode (where small packets are less likely to be dropped than large packets):
  - Even the modified VoIP TFRC gets much more than its share of the bandwidth in times of high congestion.
  - Under investigation.
- Related work: "Congestion Control for Flows with Variable Packet Size", Widmer, Boutremans, and Le Boudec, 2004.

Assumptions:

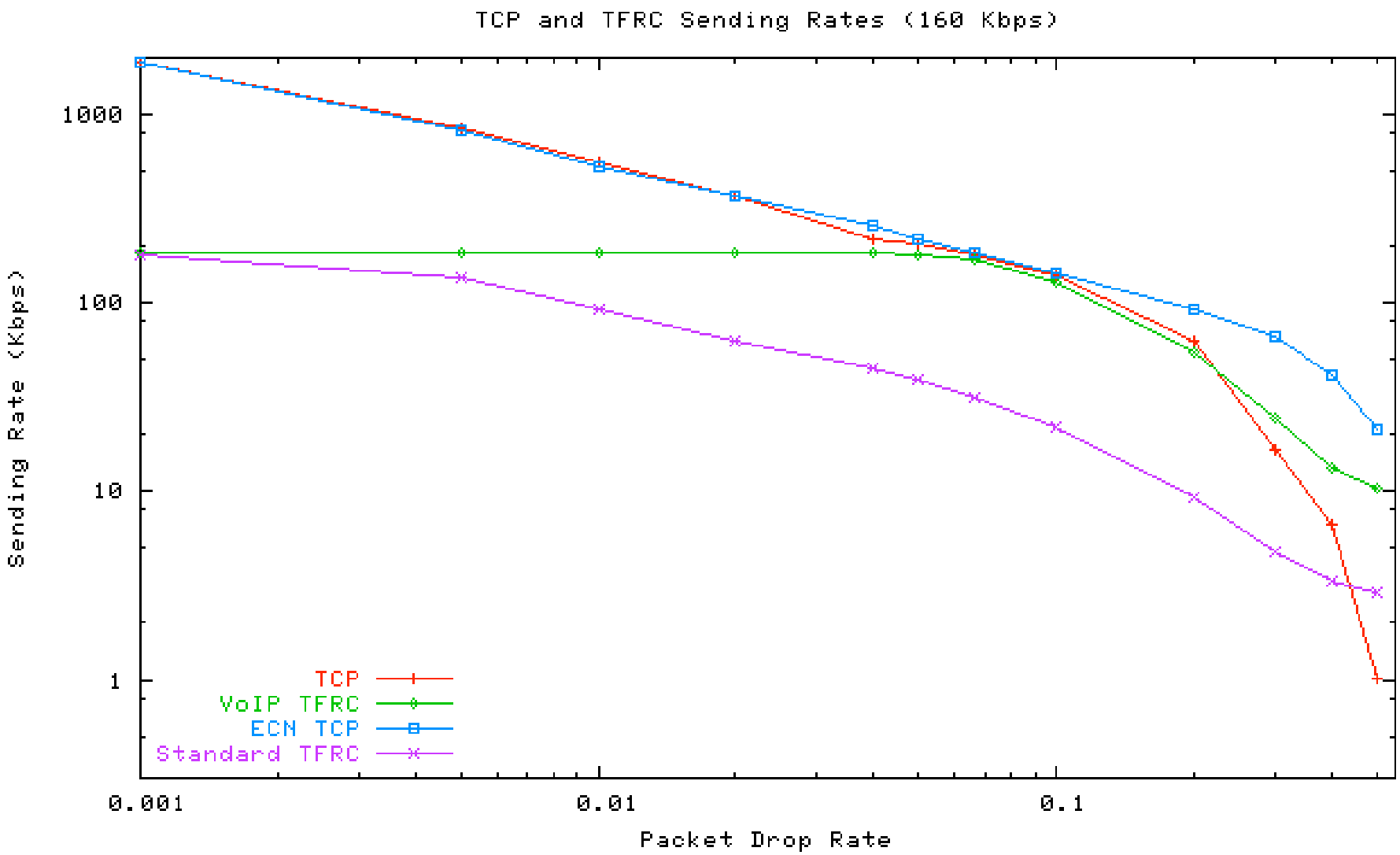
- The sender doesn't know the packet-marking mechanisms used by the routers.
  - E.g., Drop-Tail? Queue in bytes or in packets? AQM in byte mode or in packet mode?

- The sender can't assume that packets or bytes are being dropped with some relatively stable dropping probability p.
  - This is not necessarily the case.

Configured *packet* drop rates:

- Table 1: The TCP throughput equation:
  - Somewhat too aggressive for packet drop rates of 40-50%.
- Tables 2, 5: Configured *packet* drop rates:
  - Standard TFRC with small packets doesn't do well;
  - VoIP TFRC with small packets achieves reasonable fairness with large-packet TCP.

Configured *packet* drop rates:

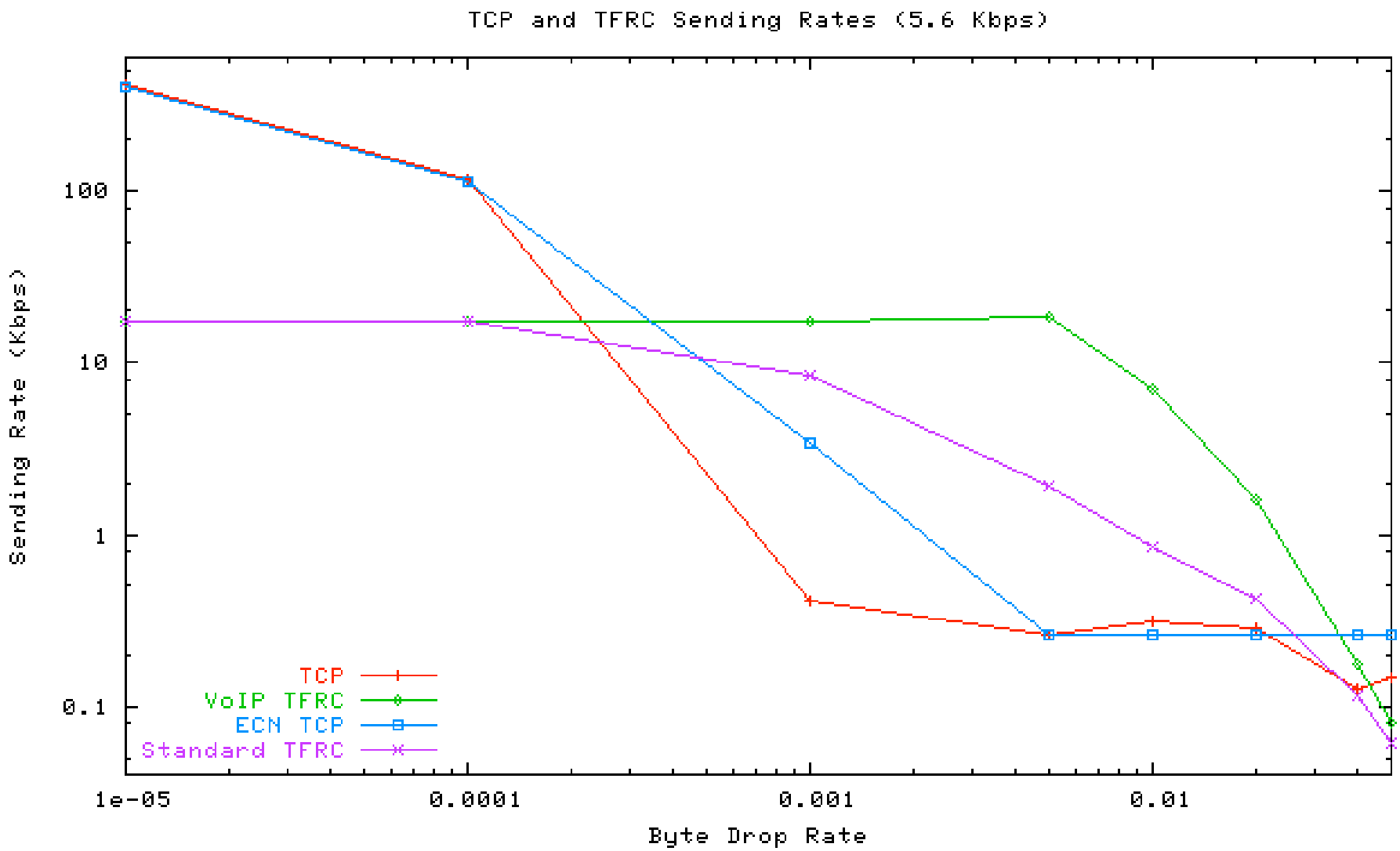


Configured *byte* drop rates:

- Table 3: Configured *byte* drop rates:
  - Even Standard TFRC with small packets gets more bandwidth than large-packet TCP.
  - VoIP TFRC with small packets gets even more than its "share" of the bandwidth.
  - Reason: small-packet flows see much lower *packet* drop rates than the large-packet flows.

- Table 4: With a byte drop rate of 0.001:
  - 77% of the 1500-byte TCP packets are dropped;
  - 5% of the 56-byte TFRC packets are dropped.

Configured *byte* drop rates:



Simulation results:

- Table 6: A Drop-Tail queue in packets.
  - Similar drop rates for large-packet and small-packet flows.
- Table 7: A Drop-Tail queue in bytes.
  - Small-packet flows have much lower drop rates.
- Tables 8-13: RED in packet mode and in byte mode.
  - In byte mode, small-packet flows have lower drop rates.

What next?

- (1) Is it ok to have congestion control for small-packet flows that lets small-packet flows receive much more bandwidth than large-packet TCP flows in environments where small packets are less likely to be dropped than large ones?

- (2) Real-world experiments to explore relative packet drop rates for large-packet and small-packet flows.
  - Ping, or TCP, with data packets of 20, 200, 512, and 1460 bytes.

- (3) Explore VoIP TFRC in environments with mostly small-packet traffic.

Extra Viewgraphs:

Measuring Congestion:

- Packet size in a Drop-Tail world:
  - Queue measured in bytes, packets, or in-between?
  - Smooth or bursty sending rates?
  - High or low levels of statistical multiplexing?

- RED in packet mode:
  - Same packet drop rate for big and small packets.
  - TFRC measures the loss interval in packets.

- RED in byte mode:
  - Same byte drop rate for big and small packets.

The state of TFRC in NS:

- Includes the VoIP variant.
- Includes RFC 3390 initial sending rates
- Includes overhead for packet headers.
- More updating is needed.
  - Add RFC 3390 sending rates after idle periods.
  - Add Faster Restart.