TCP for Large Congestion Windows

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The problem:

- TCP's average congestion window is roughly $1.2/\sqrt{p}$ packets.

- Maintaining an average cwnd of at least $1.2 * 10^k$ packets requires a packet loss/corruption rate of at most 10^{-2k}.
  – E.g., a *bit* coorruption rate of at most $1.5 * 10^{-2k-3}$.

- Given 1500-byte packets and a 100 ms RTT, filling a 10 Gbps pipe would correspond to a congestion window of $W = 83,333$ packets.
  – At least 1.6 hours between packet drops.

- How much better can we do, given only the current feedback from routers?

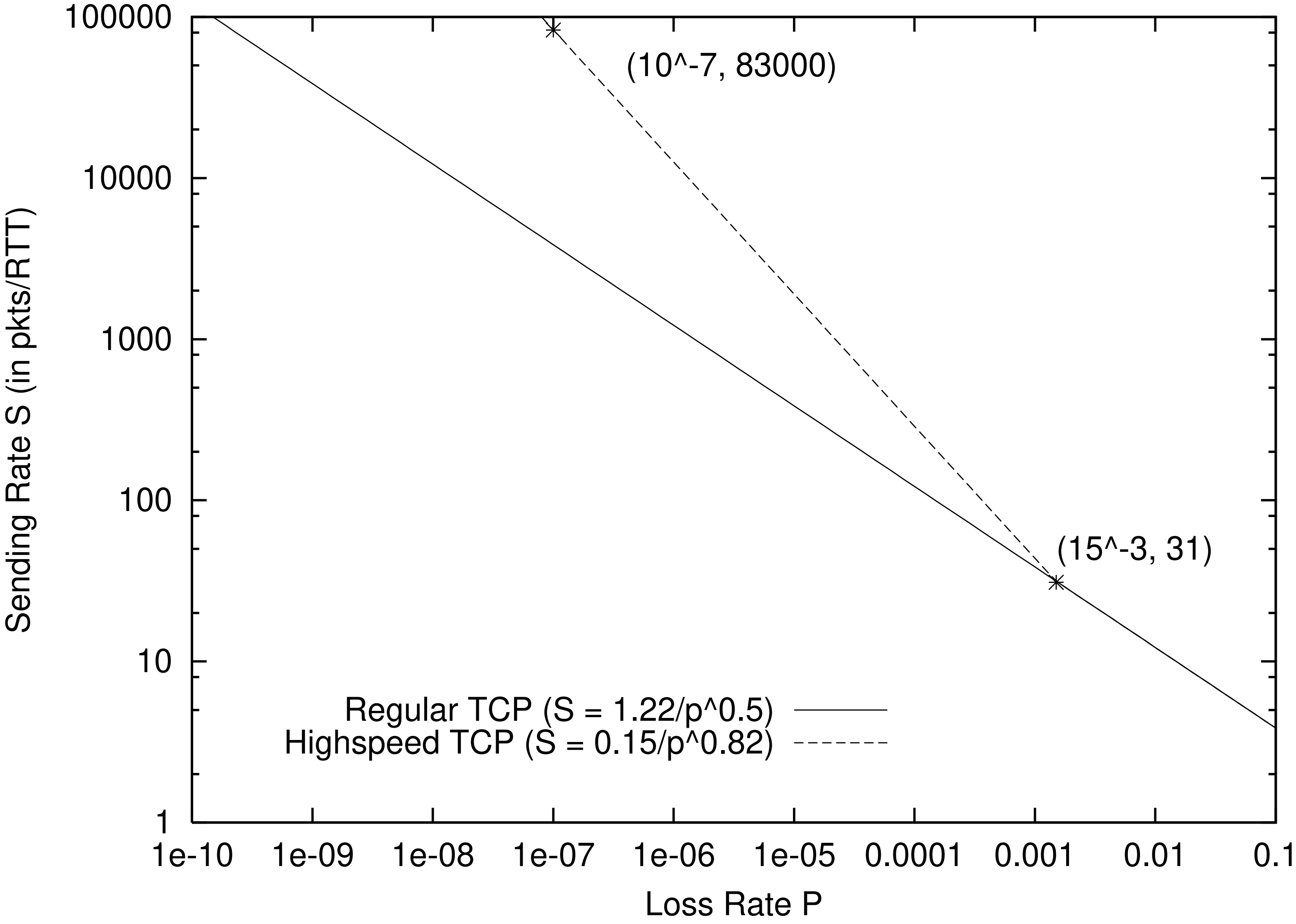
Is this a pressing problem?

- Nope. In practice, users do one of the following:
  - Open up N parallel TCP connections; or
  - Use MulTCP (roughly like an aggregate of N virtual TCP connections).

- However, we think it is possible to do much better, with:
  - Better flexibility (no N to configure);
  - Better scaling;
  - Better slow-start behavior;
  - Competing more fairly with current TCP

(for environments where TCP is able to use the available bandwidth).

The approach: use a modified response function.

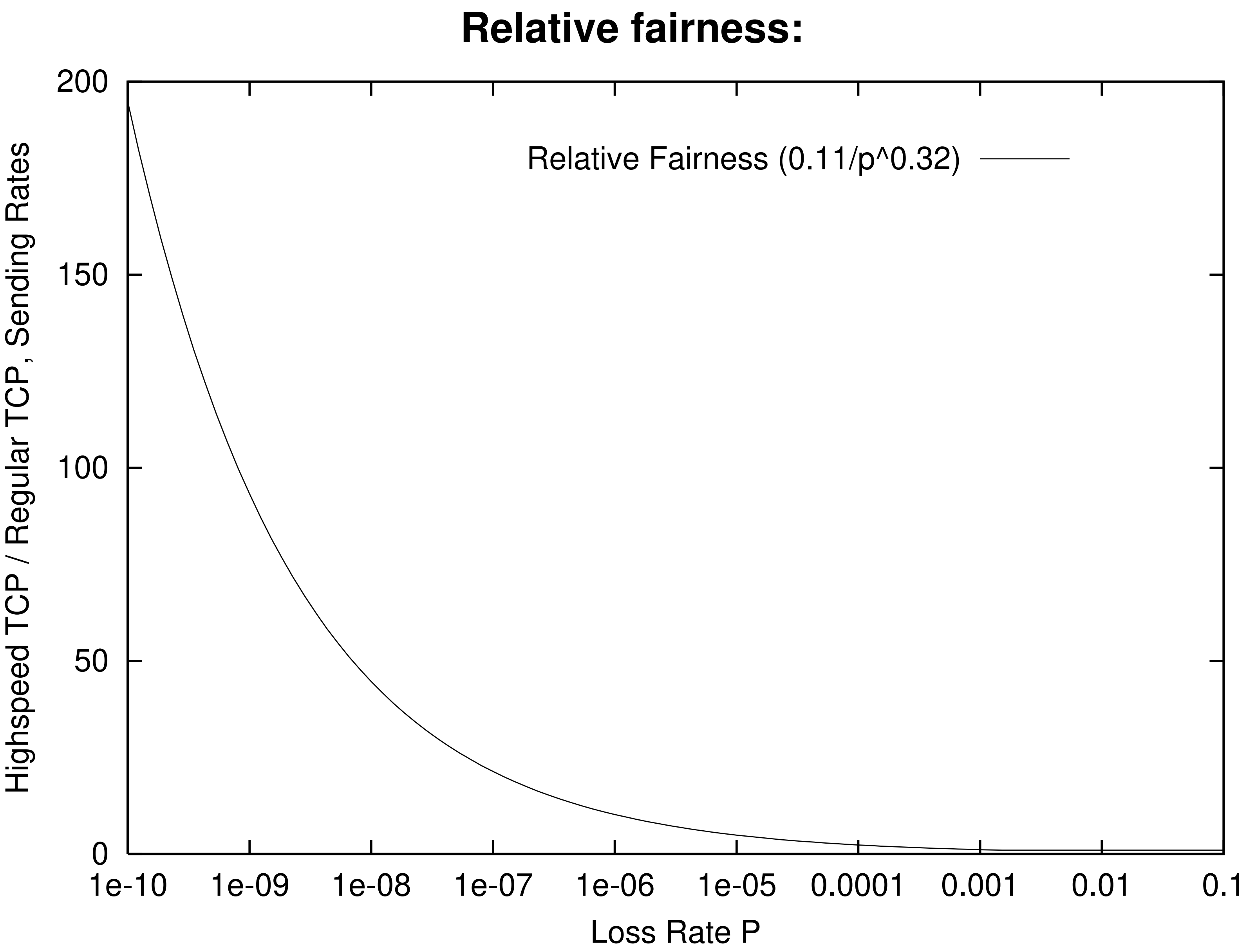


Simulations in NS:

- ./test-all-tcpHighspeed in tcl/test.

- The parameters specifying the response function:
  - Agent/TCP set low_window_ 31
  - Agent/TCP set high_window_ 83000
  - Agent/TCP set high_p_ 0.0000001

- The parameter specifying the decrease function at high_p_:
  - Agent/TCP set high_decrease_ 0.1


Relative fairness:
Relative Fairness (0.11/p^0.32)
Highspeed TCP / Regular TCP, Sending Rates
200
150
100
50
0
1e-10
1e-09
1e-08
1e-07
1e-06
1e-05
0.0001
0.001
0.01
0.1
Loss Rate P

Another issue: modifying slow-start:

- Slow-starting up to a window of 83,000 packets doesn't work well.
  - Tens of thousands of packets dropped from one window of data.
  - Slow recovery for the TCP connection.

- The answer:
  - Agent/TCP set max_ssthresh_ N
  - During the initial slow-start, increase the congestion window by at most N packets in one RTT.