SACK TCP: The sender's congestion control algorithms for the implementation "sack1" in the LBNL's "ns" simulator.

Sally Floyd

Lawrence Berkeley National Laboratory

Contributors to code: Kevin Fall, Sally Floyd, Steve McCanne (LBL), and Jamshid Mahdavi (PSC)

The internet draft:

"The congestion control algorithms present in the de facto standard TCP implementations MUST be preserved."

- Accomodates out-of-order delivery.

- Congestion window algorithms.

- Use of time-outs.

The implementation in the "ns" simulator:

- Three dup acks required to trigger Fast Recovery.

- Reduce congestion window by half; don't Slow-start.

- Response to further dup acks.

Main difference from Reno: When multiple packets are lost from a single window of data.

3

Two states: Regular and Fast Recovery

Regular

Fast Recovery

3 duplicate acknowledgements
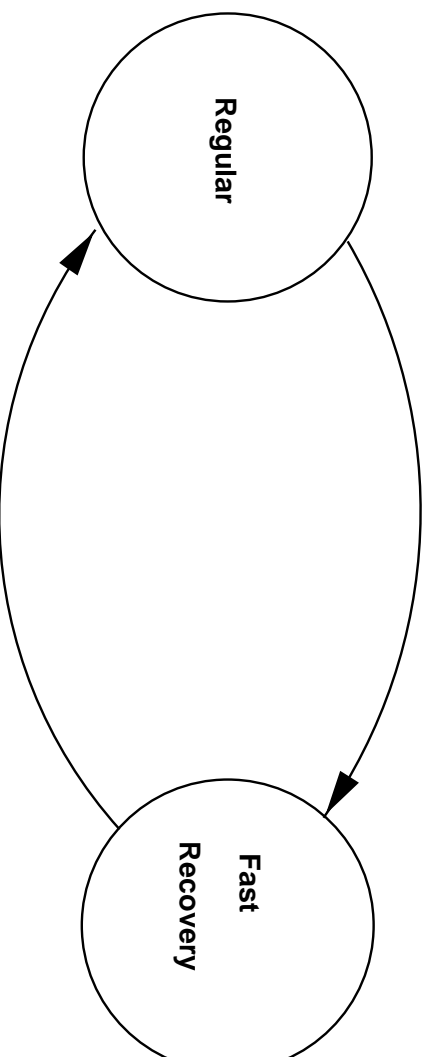
acknowledgement for everything that was sent
before Fast Recovery was entered

("recover_")

On entering Fast Recovery:

- Retransmit one packet.

- Cut the congestion window in half ("cwnd_").

- Estimate the number of packets in the pipe ("pipe_").

Behavior in Fast Recovery:

- When and how much to send: whenever the number of packets in the pipe is less than the congestion window.

- What to send: Fill "holes", one packet at a time, in sequence number order. If there are no holes, send new packets.

- If a retransmitted packet is itself dropped, then slow-start. (The current implementation in ns waits for a retransmit timer to detect the dropped packet.)

Behavior in Fast Recovery: receiving ack packets

● Duplicate ACKs: Decrement "pipe_", call "send".

● An ACK that ends Fast Recovery: Call "send".

● An ACK that does not end Fast Recovery:

Decrement "pipe_" by two packets, once for the retransmitted packet, and once for the original packet (now presumed to have been dropped). Call "send".

Behavior in Fast Recovery: details of sending data packets

- Send if the number of packets in the pipe ("pipe_") is less than the congestion window ("cwnd_").

- Use the SACK scoreboard to determine which packet to send.

- Increment "pipe_".

Details:

- MaxBurst parameter

- Overhead parameter - just for the simulator.

Ns simulator available from:

`http://www-nrg.ee.lbl.gov/ns`

These viewgraphs available from:

`ftp://ftp.ee.lbl.gov/talks/sacks.ps`

Papers available from:

`http://www-nrg.ee.lbl.gov`