The detailed proposal for ECN and TCP:

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L.A. IETF, March 30, 1998.

ECN Web page: http://ftp.ee.lbl.gov/floyd/ecn.html

Negotiating ECN-Capability between the two TCP endpoints:

The ECN-Echo bit (previously called the ECN Notify bit) uses bit 9 in the Reserved field of the TCP header.

- Host A sets the ECN-Echo bit in the TCP header of the SYN packet. The IP ECT bit (ECN-Capable Transport) is not set.

- Host B sets the ECN-Echo bit in the SYN-ACK packet. The IP ECT bit (ECN-Capable Transport) is not set.

- The ECT bit can now be set in the IP header of data packets for that flow.

Setting the ECN-Echo bit:

- When a TCP host receives a data packet with both the ECT bit and the CE (Congestion Experienced) bits set in the IP header, the TCP host sets the ECN-Echo bit in the TCP header for the returning ACK packet.

- As we will see later, the TCP host in fact sets the ECN-Echo bit in the TCP header for several returning ACK packets.

Responding to the ECN-Echo bit:

- In terms of congestion control, the TCP host responds as it would to a dropped packet, by halving the congestion window “cwnd” and reducing the slow start threshold “ssthresh”.

- Decreases in the congestion window occur at most once per window of data.

- This has been implemented in the ns simulator since 1994, and is also in several independent experimental implementations.

Congestion on the ACK-path:

• The internet draft specifies that, for the moment, the IP ECT bit would not be set for pure ACK packets (i.e., packets that do not contain data). This is an issue left for future research.

• The current research:
Hari Balakrishnan, Venkata Padmanabhan, and Randy H. Katz,
The Effects of Asymmetry on TCP Performance,
Proc. Third ACM/IEEE MobiCom Conference, Sep 1997.

This paper includes a proposal for Ack Congestion Control, for responding to ACK packets that have had the ECN bit set.

Robustness against dropped ACK packets with the ECN-Echo bit set:

● When TCP host A reduces its congestion window for any reason, it sets a Congestion Window Reduced (CWR) bit in the TCP header of the next data packet. (Bit 8 in the Reserved field of the TCP header. This would leave four free bits.)

● When TCP host B sends a packet with the ECN-Echo bit, the TCP host continues to send the ECN-Echo bit in all succeeding packets until it sees a data packet from TCP host A with the CWR bit set.

● Details are in the note “Implementing ECN in TCP”, Sally Floyd, January 1998.” on the ECN Web page.