Applications that might benefit from ECN:

- Avoiding unnecessary waits for retransmit timeouts.
  - Low-bandwidth telnet connections.

- Avoiding costs of detecting and recovering dropped packets.
  - Reliable multicast traffic.

- Avoiding unnecessary packet losses.
  - Unreliable, real-time traffic.

- ECN is somewhat more efficient than Fast Retransmit.
  - Larger TCP connections.

- Avoiding the delay of retransmitting a dropped packet.
  - Short web transfers.

- Avoiding the wait for retransmit timers to expire.

Applications that might benefit from ECN:
Performance results:

- ECN performance has been well-studied:

  - Jamal Hadi Salim and Umarz Ahmad, Performance Evaluation of Explicit Congestion Notification (ECN) in IP Networks, RFC 2884.
  - Prasad Bagal, Shivkumar Kalvanaraman, Bob Packet, Comparative Study of RED, ECN and TCP Rate Control, 1999.

And more...
Research on non-default ECN semantics:

- Non-default semantics could be signaled with the diffserv field.
ECN Implementations:

- Routers:
  - Kenjiro Cho's ALTQ, which runs on FreeBSD/NetBSD/OpenBSD.
  - Linux 2.3, 2.4.
  - Nortel's Open IP Environment 2.1.
  - Linux 2.4.

TCP Implementations:

- Others are planned...
- Experimental prototype from UCLA-ECN.
- Linux 2.4.

ECN Implementations:

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Routes:
Draft-ietf-tsvwg-ecn-00.txt is intended to obsolete:
- "A Proposal to add Explicit Congestion Notification (ECN) to IP": RFC 2481, Experimental.
- "IPsec with ECN": Approved for Informational.
- "TCP with ECN": The Treatment of Retransmitted Data Packets": Internet-draft-ietf-tsvwg-ecn-tunnels-00.txt.
- "ECN Interactions with IP Tunnels": Internet-draft-ietf-tsvwg-ecn-00.txt.
- "IPsec with ECN": RFC 2481, Experimental.
- "A Proposal to add Explicit Congestion Notification (ECN) to IP": Draft-ietf-tsvwg-ecn-00.txt is intended to obsolete:
- "The Addition of Explicit Congestion Notification (ECN) to IP":
TCP with ECN: The Treatment of Retransmitted Data Packets

The problem: a potential for denial-of-service attacks.

- An attacker capable of spoofing the IP source address could send a TCP packet within an arbitrary sequence number and both the ECT and CE bits set in the IP header.

TCP with ECN: The Treatment of Retransmitted Data Packets

The fix:

- Don’t set the ECT (or CWR) bit on window probe packets.
  
TCP window probes:

- Ignore the ECN field on arriving packets outside the receiver’s current window.

- Don’t set the ECT (or CWR) bit on retransmitted TCP packets, and TCP window probes:

  - The fix:
    
    - TCP window probes:
      
TCP window probes:

- Don’t set the ECT (or CWR) bit on window probe packets, but do respond to ECN indications on received window probe packets.
Broken Equipment, and Options for SYN Packets:

For TCP, ECN-Capability is negotiated between the two ends with ECN-setup SYN packets. TCP's ECN-setup SYN packets have been cited as a signature for a port-scanning tool.

• Other broken implementations do not respond TCP's ECN-setup SYN packet with a RST.

• Some broken implementations respond to TCP's ECN-setup SYN packet.

• TCP's ECN-setup SYN packets have been cited as a signature for a port-scanning tool.

• For TCP, ECN-Capability is negotiated between the two ends with ECN-setup SYN or ACK packets (using the ECN-Echo and CWR flags).

Detailed results are on the TBIT web page at "http://www.aciri.org/tbit/".
The Optional Procedure for SYN Packets:

Section 6.1.1.2 on "Robust TCP Initialization with no response to the SYN" is being removed from this internet-draft, and will be submitted as a separate, informational RFC.

Bug-fixes have been announced for the broken implementations that send a RST in response to an ECN-setup SYN packet, but so far deployment seems to be minimal.

Some work still has to be done to identify the bugs for the broken implementations that ignore ECN-setup SYN packets.

The Optional Procedure for SYN Packets:
We are asking for this Internet-Draft to be considered for Proposed Standard. We think it is time.