TCP and SCTP RTO Restart

draft-hurtig-tcpm-rtorestart-02

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Motivation

• In some cases TCP/SCTP must use RTO for loss recovery
  – e.g., if a connection has 2 outstanding packets and 1 is lost
• Some solutions exist, but they are not always applicable
  – Limited Transmit (RFC 3042)
    • requires: unsent data, no ack loss
  – Early Retransmit (RFC 5827)
    • requires: 2 outstanding segments, no ack loss, no reordering
Motivation

• Thus, some flows have to use RTO for loss recovery
• However, the effective RTO often becomes \( RTO = RTO + t \)
  – Where \( t \approx RTT + \text{delACK} \)
• The reason is that the timer is restarted on each incoming ACK (RFC 6298, RFC 4960)
Impact

• Standard approach no problem when congestion window is large

• Actually, it can be beneficial
  – lower risk for spurious RTOs
  – gives FR more time to detect loss
    • smaller congestion window reduction using FR

• This is not the case for short-lived/thin flows
  – congestion window low anyhow
TCP and SCTP RTO Restart

• To allow retransmissions after exactly RTO seconds, the timer is restarted as:
  – \( RTO = RTO - t \)

• The modified restart is only used when
  – the number of outstanding segments < 4;
  – and there is no unsent data ready for transmission.

• Thus, only flows incapable of FR can use the modified RTO restart
Faster Recovery Needed?

• One extra RTT could lead to performance problems for short-lived (e.g. web) and thin streams
  – Thin streams are flows that only use a fraction of the available bandwidth (e.g. signaling, online games, chat, VoIP, …)

• Example: Anarchy Online [1]
  – Approx. 1% packet loss
  – Most loss recovered using RTOs
  – Maximum tolerable latency about 500 msec [2]

Performance

- **Initial simulations**
  - Ns-3 (with real Linux TCP)
  - Short-lived flows
  - Multiple clients served by one host
  - Large set of bw’s and delays
- **Results show that**
  - Loss recovery times are reduced with approximately 1 RTT on average
  - The amount of spurious RTOs is slightly higher than for regular TCP (<1% more)
- **New experiments underway**
  - Congestion losses
  - New RTO management alg.
  - To investigate burst situations more thoroughly

Results from 200 concurrent flows with 100 ms RTT
Changes between -01 and -02

• Smaller text changes
• No longer a requirement to store the transmission time of each segment
  – Sufficient to “remember” only the last four
Open issues and possible solutions

• Increased aggressiveness
  – Might trigger spurious RTOs when bursts are sent

• Possible mitigations
  – Careful version of the algorithm
    • Disables modified restart during bursty transmission
  – noRestart approach (suggested by Mark Allman)
    • Don’t restart the timer if no data is available for transmission and less than four segments is outstanding
    • Same effect as modified restart for small windows
    • More conservative for larger windows