Advancing RFC 4138

<draft-ietf-tcpm-rfc4138bis-00>

<draft-kojo-tcpm-frto-eval-00>

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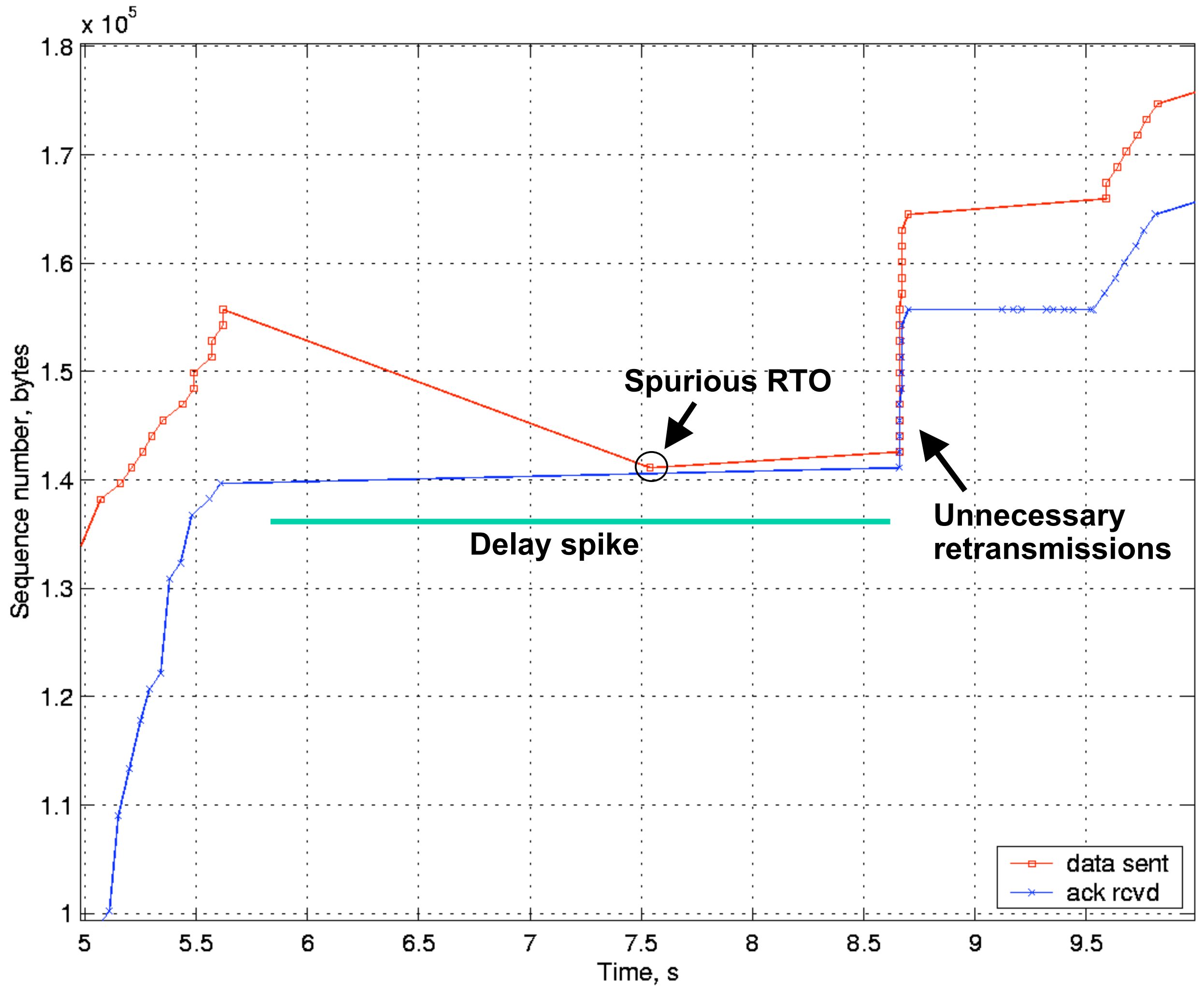
Spurious Retransmission Timeouts

- Delay spikes occur on wireless networks due to
  - handoffs
  - link-layer error recovery
  - bandwidth variation
- Delay spike may trigger TCP retransmission timer
- Problems:
  - Regular TCP sender retransmits whole window unnecessarily in slow start
  - Wasted network resources
  - Dishonors packet conservation principle
  - In many cases severe performance penalty to the TCP flow



F-RTO History

- Experimental RFC 4138, Aug 2005
- A number of known F-RTO implementations are out there
- Experimentations have been carried with several implementations showing positive results
- Proposals to advance to PS have been expressed earlier several times
- Advancing to PS was discussed in IETF-67 & IETF-68
  - Internet-Draft *"Evaluation of RFC 4138"* <draft-kojo-tcpm-frto-eval-00.txt>
    - Points out the problems with regular RTO recovery and usefulness of F-RTO
    - Evaluates F-RTO to show it is not harmful to the network, corner cases included
    - Summarizes experimentation results

F-RTO: Detecting Spurious RTO

- F-RTO slightly modifies TCP sender behavior
    - After RTO retransmission try to send a couple of new segments
    - If new acknowledgements for non-retransmitted segments flow in, assume RTO was spurious
    - Otherwise new segments trigger DupACKs, and sender should assume genuine RTO
- No TCP options required
- Compatible with existing TCP implementations
- Does not cause network congestion
- Might not detect spurious timeout in some cases
    - If F-RTO does not detect spurious RTO, it performs as standard TCP

Evaluation Report

- Test runs in emulated wireless network
  - Linux implementation
  - Different delay & loss scenarios to verify that F-RTO works as expected
- Test runs in real W-CDMA network
  - HP-UX server at fixed end
  - Different terminal mobility patterns
  - Amount of unnecessarily retransmitted data reduced by 82%
  - F-RTO detected 71% of the spurious timeouts
    - In 28% of cases F-RTO could not be applied because there were no new data to send
    - In 0.7 % of cases advertised window limited sending of new data
    - In 0.3 % of cases duplicate ACKs prevented F-RTO
- Microsoft report at IETF-68 about their positive experiences
  - Based on expirements -> F-RTO enabled by default in Vista

Current Progress and Next Steps

- Revised RFC 4138 targeting at PS
  - Specify basic algorithm and TCP only
  - Leave the following as experimental and do not include in the Standards Track specification
    - F-RTO with SCTP
    - SACK-Enhanced variant of F-RTO
- Response
  - Proposal: simple response will be outlined in this document
    - Do not retransmit outstanding segments after detecting spurious RTO
    - Follow RFC 2581 on congestion control
  - Possible to apply other proposed responses documented in separate RFCs