TCP ACK Rate Request (TARR) option

draft-gomez-tcpm-ack-rate-request-03

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Motivation

- Delayed ACKs
  - Intended to reduce protocol overhead
  - But may also contribute to suboptimal performance
- “Large” cwnd scenarios (i.e. cwnd >> MSS):
  - Saving up to 1 of every 2 ACKs may be insufficient
    - Performance limitations due to asymmetric path capacity
    - Computational cost and network load
- “Small” cwnd scenarios (i.e. cwnd up to ~1 MSS):
  - Data centers: BDP up to ~1 MSS
    - Delayed ACKs will incur a delay much greater than the RTT
  - Transactional data exchanges, or when cwnd decreases
    - Immediate ACKs may avoid idle times, allow faster cwnd growth

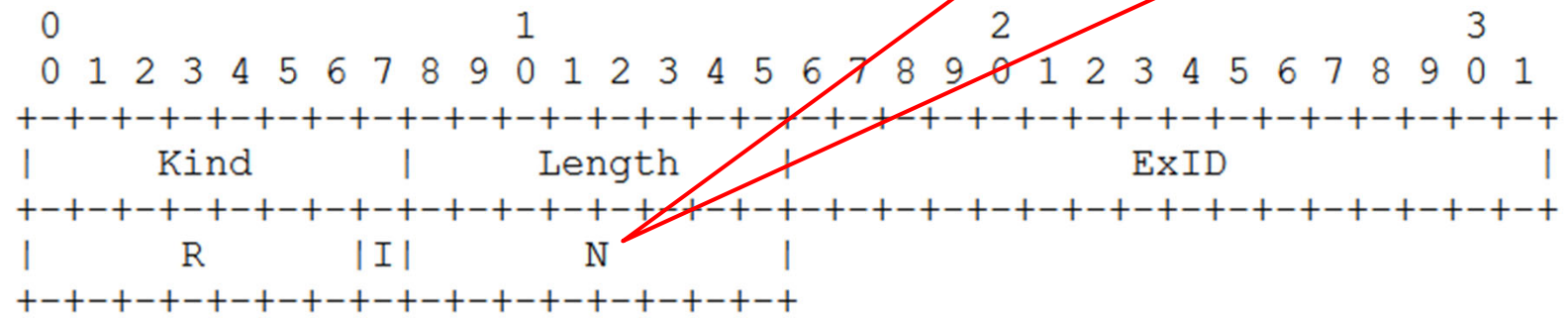
Status

- Related prior discussion
  - Sender control of TCP ACKs
  - Converged to defining a new TCP option serving two purposes:
    - Requesting a given ACK rate
    - Requesting immediate ACKs
- Version -03
  - Aims to address comments from (many thanks!):
    - Yoshifumi Nishida
    - Michael Scharf
    - Jonathan Morton
    - Bob Briscoe

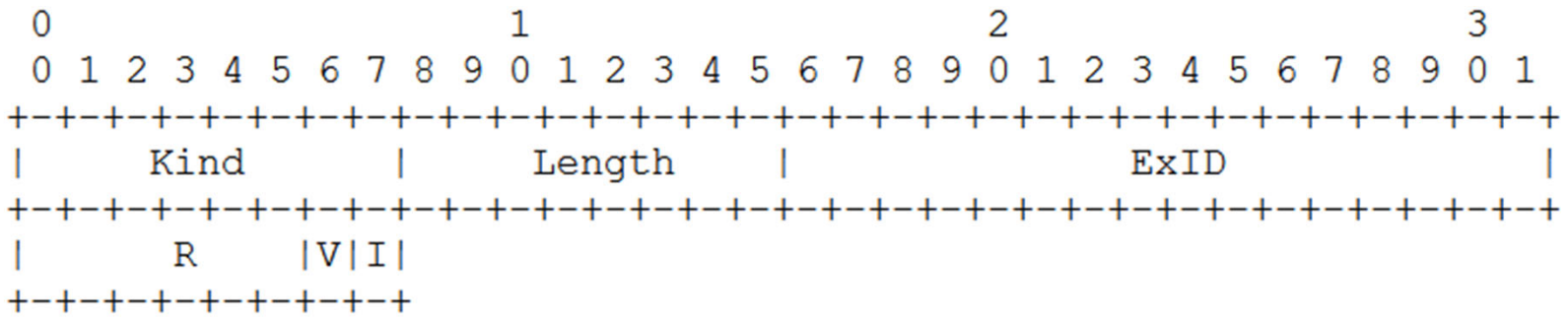
Updates in -03 (I/V)

- When R=0, sender requests immediate ACKs for the next N segments
- However, mostly redundant

- Main format
  - OLD:



  - NEW:



Updates in -03 (II/V)

- Two possible encodings for the R field:
  - OPTION 1:
    - Binary encoding of the requested ACK rate
    - The maximum value of R is 63
  - OPTION 2:
    - 4 leftmost bits represent a mantissa (m)
    - 2 rightmost bits represent an exponent (e)
    - The requested ACK rate is R = (m+1)*2^(2*e)
    - The maximum value of R is 1024

Updates in -03 (III/V)

- Section 3:
  - A TARR-option-capable receiving TCP SHOULD modify its ACK rate to one ACK every R received data segments from the sender
    - Reasons why not a MUST: lack of resources, security…
    - R=1: the receiving TCP SHOULD send an ACK immediately
    - R=0: not defined
  - Upon reception of a SYN carrying the TARR option, a TARR-option-capable endpoint MUST include the TARR option in the SYN-ACK sent in response
    - Question: due to lack of SYN space, including TARR only in response to the SYN-ACK?
  - A TCP segment carrying retransmitted data is not required to include a TARR option
  - Question: is the Ignore Order feature considered useful?
    - If RACK not supported, long loss detection time

Updates in -03 (IV/V)

- New section 5: changing the ACK rate during the lifetime of a TCP connection
  - ACK rate may depend on cwnd (may change during a connection)
    - cwnd should settle in congestion-avoidance phase
    - Routing, path capacity, path load changes may impact the BDP (thus cwnd and the ACK rate)
  - Ability to suppress DelACKs to allow measuring the RTT for each packet in some intervals; allow different ACK rate afterwards
  - Linux receiver heuristic to detect slow start and supress Delayed ACKs until its end
    - Some slow start variants may confuse the heuristics.
    - Explicit end of slow start signal may be useful to avoid slow start sender behavior ossification
  - Reducing ACK load when ACK decimation is detected by the sender

Updates in -03 (V/V)

- Security considerations
  - TCP-AO may be used to protect TCP segment header
  - Guidance and attack mitigation given in RFC 5961 is RECOMMENDED for a TARR receiver
    - TARR option MUST be ignored on a packet deemed invalid
  - A TARR receiver might opt not to fulfill a request to avoid or mitigate an attack:
    - A large number of senders requesting immediate ACKs simultaneously after a large number of data segments sent

Next steps

- Continue improving the document
  - Further feedback will be appreciated
- Looking for collaboration
  - Implementation
    - Running code
  - Co-authorship

Thanks!
Questions? Comments?

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