TRANSPORT PROTOCOL FEEDBACK OVERHEAD ISSUES AND SOLUTIONS

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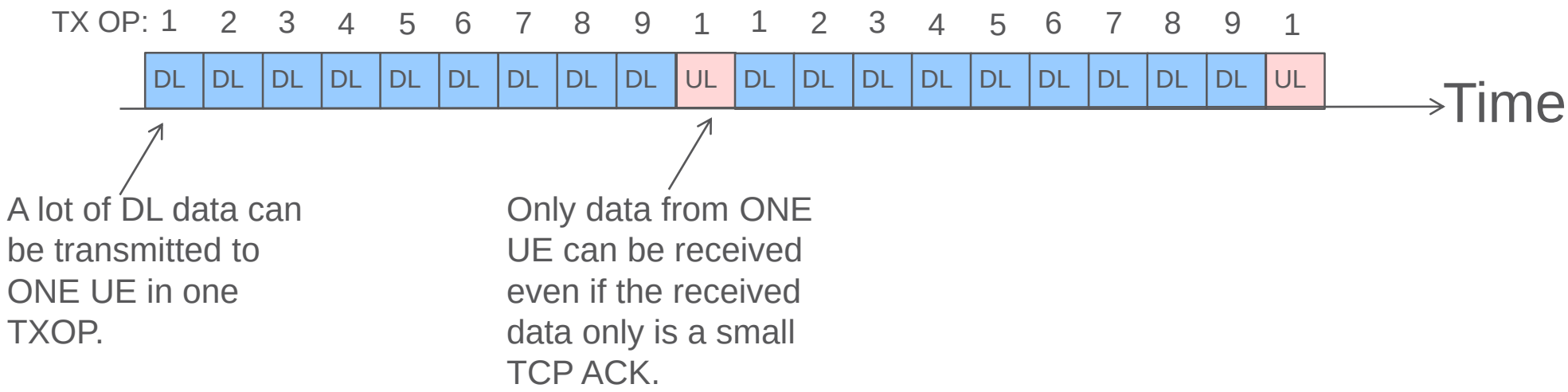
PROBLEM

- Congestion control ACK overhead can become a limiting factor.
  - Typically data in DL (network → terminal) and ACKs in UL (terminal → network)
- ACK packets are generally small
  - But can consume a lot of bandwidth anyway
- Problem is most prevalent with asymmetric access
  - Example TDD (Time Division Duplex): 9 slots for DL transmission, 1 slot for UL transmission

TODAY

- Linux TCP : Delay ACKs, typically every 2nd segment is ACKed
- Handheld devices may have lower ACK rate
  - Down to 1 ACK per 9 segments measured
- QUIC: 1 ACK per 2nd segment ?
- ACK thinning in networks

RADIO EXAMPLE: TDD (9DL/1UL)
SYSTEM CAN SCHEDULE ONE UE PER TX OP



- Full bandwidth used by TCP ACK transmission despite small size of ACK packet
- Other DL/UL TDD allocations possible (7DL/3UL) → waste of resources
- Techniques such as digital beamforming can limit problem
- But still.. do transport protocols need all these ACKs?

TDD - Time Division Duplex UE – User Equipment DL – DownLink UL - UpLink TX OP – Transmission Opportunity

SOLUTIONS

- Desired : an answer to the question:
  - How much can the ACK rate be reduced without performance degradation?
  - Under what circumstances can it be reduced ?
- Use ideas from ACK congestion control (RFC5690)
  - Is immediate ACK needed for out of order segments if RACK is used ?
- Is packet pacing helpful ?
- Applicability to:
  - TCP : Consider draft-tcpm-accurate-ecn
  - QUIC, SCTP
- Interest in working with this ?
  - A BCP ?

COMMENTS WELCOME

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