Congestion control for lower latency and lower loss media transport

draft-ohanlon-rmcat-dflow-01

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Updates(1): 00 ➔ 01

• New sections
  – Delay Composition
    • transmission (or serialisation), propagation, processing, and queuing delays
  – Delay Measurement
    • How we measure it
  – Slow-start
    • Mentioned that delay-based approach is used there too
  – Loss-mode
    • A statement of intent
Updates(2): 00 ➞ 01

• Reworked a lot of the document
  – Added refs for previous work
  – Cleared up notation
  – Various clarifications
  – Corrected typos
Background

• Most existing congestion control is loss-based
  – Results in full queues => high delay and loss
    • E.g. TCP{new/Reno, Cubic}, TFRC, SCTP, TFWC

• Some delay-based schemes – But most don’t aim to *minimise* delay
  • E.g. CARD, Tri-S, Vegas, CTCP (partial), CxTCP, LEDBAT

• A few do now (but mostly unpublished)
  • Ghanbari fuzzy logic, Google RRTCC
DFlow: Objectives

• **Lower Delay**: Needed in today’s bufferbloated Net
  – Should stay below 150ms [ITU.G114] (not exceed 400ms)
• **Lower Loss**: Loss is bad for media (retransmit tricky)
  – Low delay usually implies low loss as queues not full
• **Smoothness**: Codec output generally smooth
  – Within constraints of: media, codec, and network path.
• **Fairness**: Should aim to be reasonably fair
  – Initially we aim for self fairness and we aim to tackle TCP fairness in later rev.
Objectives (Planned)

• **[Burst Management]**: Mechanisms to handle the bursty nature of media
  – E.g. Allow bursts when conditions permit
  – Providing for smoother quality

• **[Loss-based mode]**: Mechanisms to allow for ‘fair’ thruput against loss-based CC flows
  – Without additional network support (e.g. Codel, PIE) delay & loss would be largely beyond control.
Design Outline

• Loosely based on TFRC design
  – Rate-based, TCP equation, RTT smoothing, and ‘loss’ event rate smoothing

• Uses TCP equation to derive an operating rate

• Utilises ‘delay losses’
  – Based on relative delay and its derivative

• Employs ‘congestion event history’
  – Based on TFRC ‘loss event history’ mechanism
Simulation: DFlow

5xDFlow BW=1Mb/s RTT=120ms Target=50ms Q=35

Rate (Mbit/s) / Delay (secs)

Time (secs)

DFlow#0
DFlow#1
DFlow#2
DFlow#3
DFlow#4
Forward Delay
Simulation: TFRC

5xFRC BW=1Mb/s RTT=120ms Q=35

Rate (Mbit/s) / Delay (secs)

Time (secs)
Discussion

• This is work in progress and we’re seeking feedback/comments
• Work on planned objectives
  – Loss-mode for competition with TFRC/TCP
  – Burst management
• More simulations and testing