

RTP Circuit Breaker over LTE network

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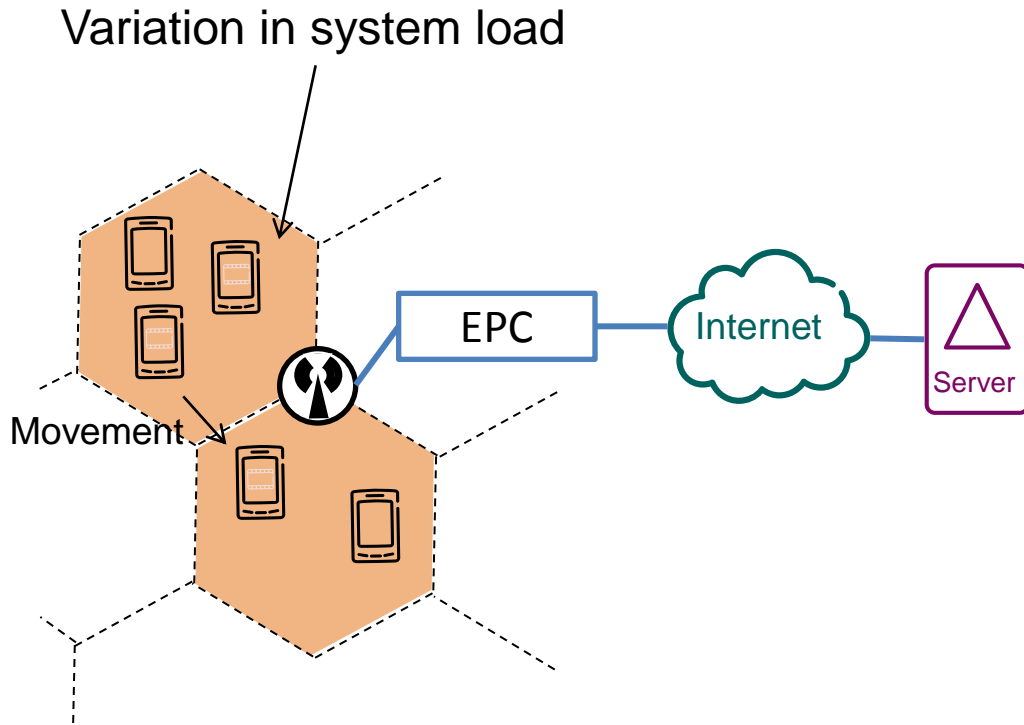
Agenda

- Short introduction to Circuit Breaker
- Test scenario
- Evaluation
- Conclusion

Circuit Breaker (CB)

- Described in <http://tools.ietf.org/html/draft-ietf-avtcore-rtp-circuit-breakers-03>
- Defines minimum set of RTP “Circuit breaker”
 - To stop RTP transmission to protect the network from excessive congestion
- Three triggers
 - Media Timeout
 - RTCP timeout
 - Congestion

SIMULATION SCENARIO

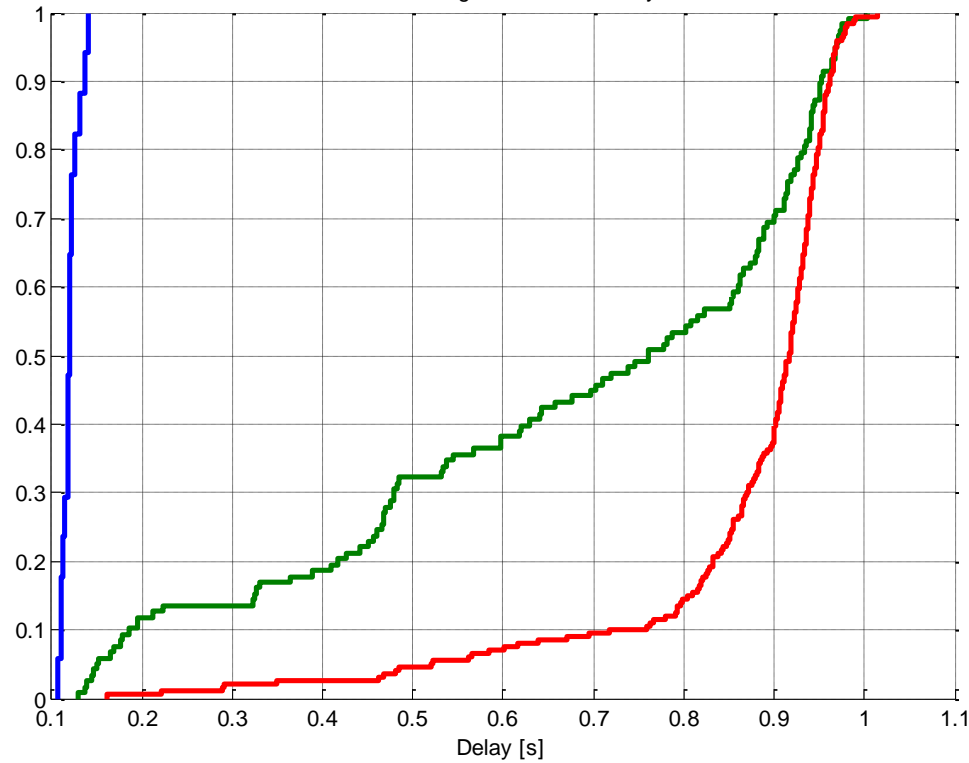


- Downlink simulation
- 7 base station*3 cells
- 3GPP case 1 SIMO
- Spectrum: 5MHz
- User arrival described through Poisson process
- AQM on
- Video only
- Video: Nominal bitrate 1500kbps
 - 30fps
 - Non-rate adaptive
- Video length 30 seconds

RTCP timeout will not happen as this is downlink only simulation.

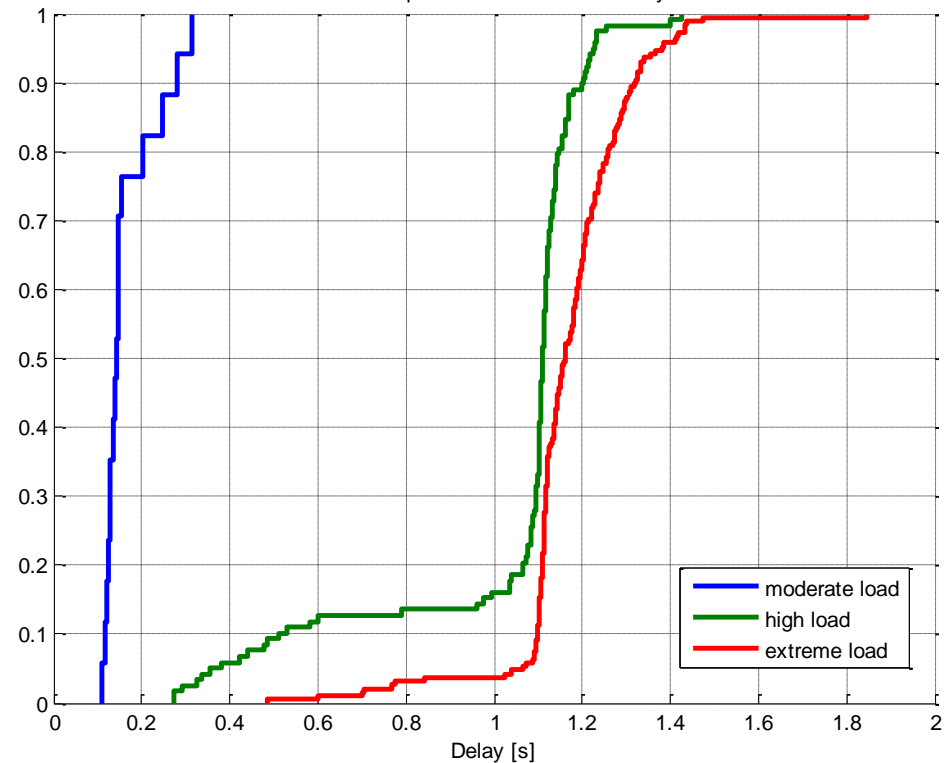
Media quality (without CB)

CDF of average video frame delays



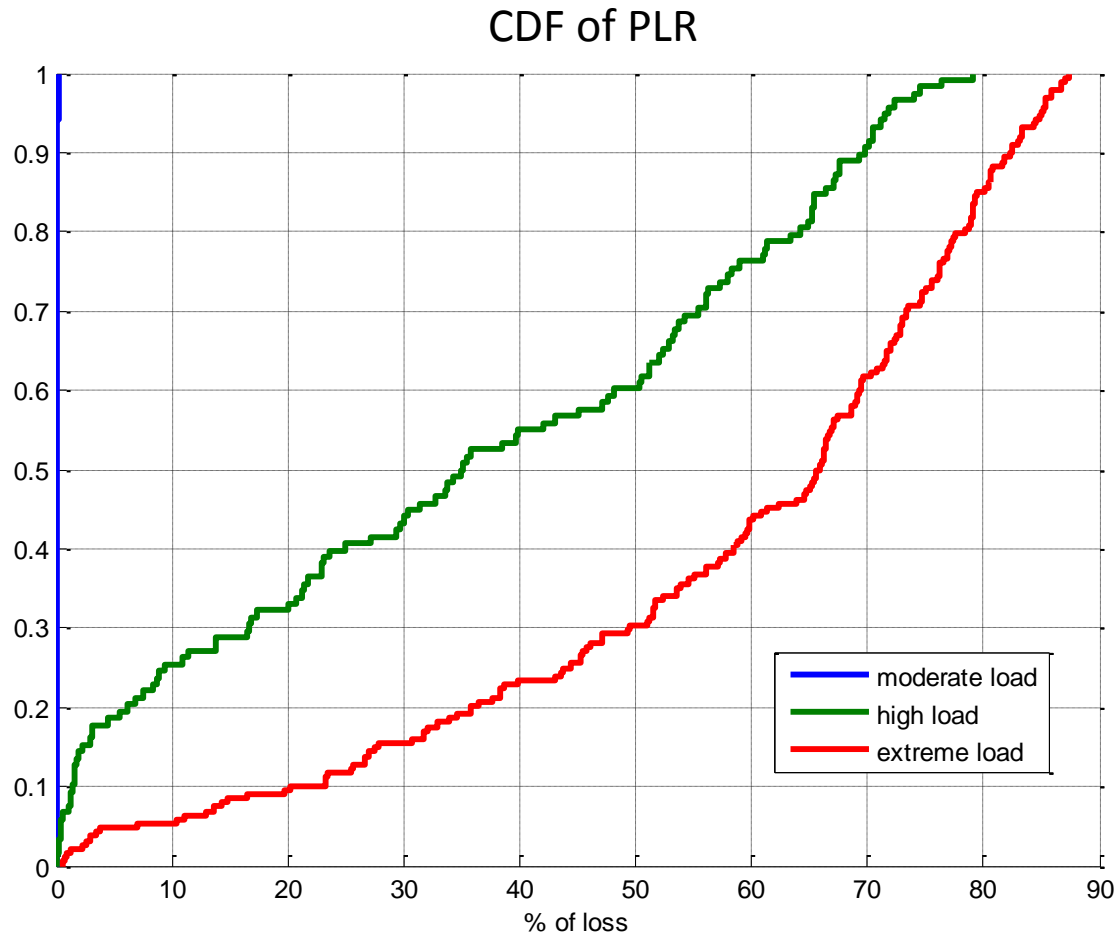
CDF of avg. video frame delay

CDF of 98 percentile video frame delays



CDF of 98 %tile of video frame delay

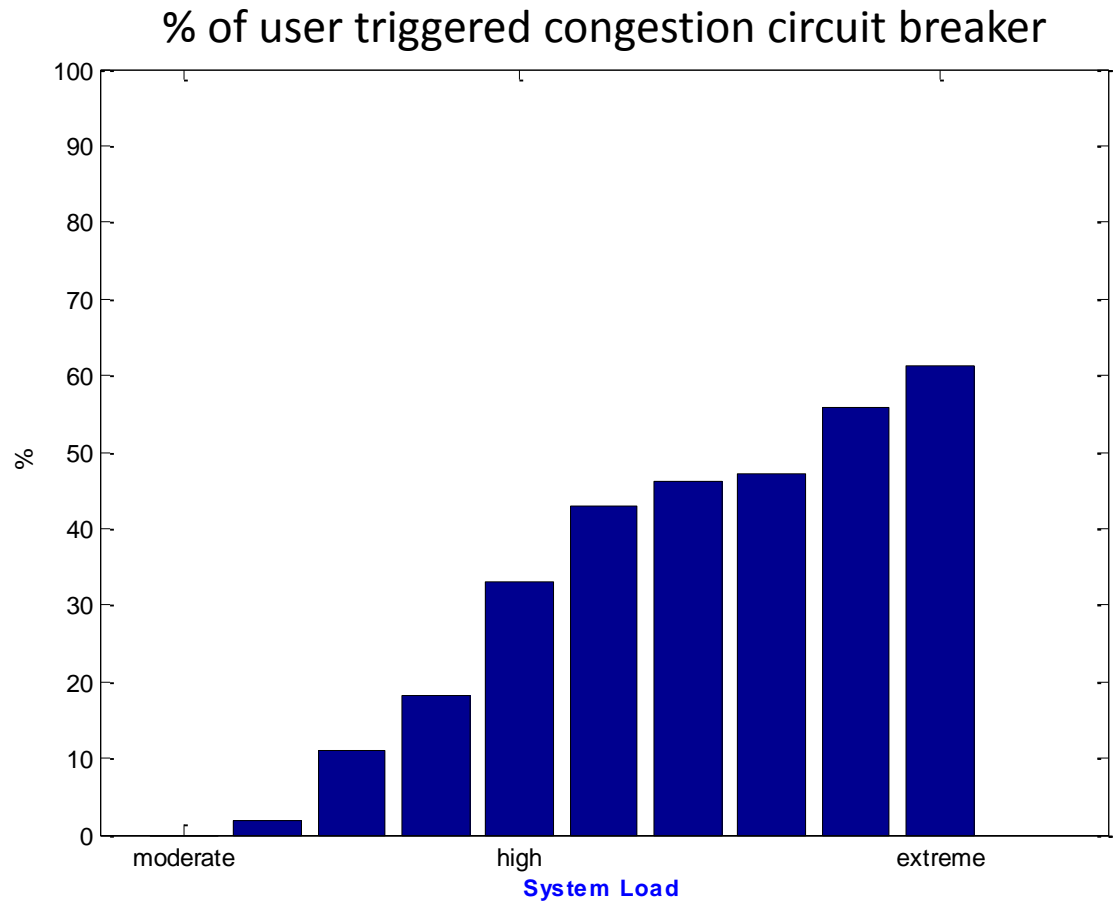
Media quality (Without CB)



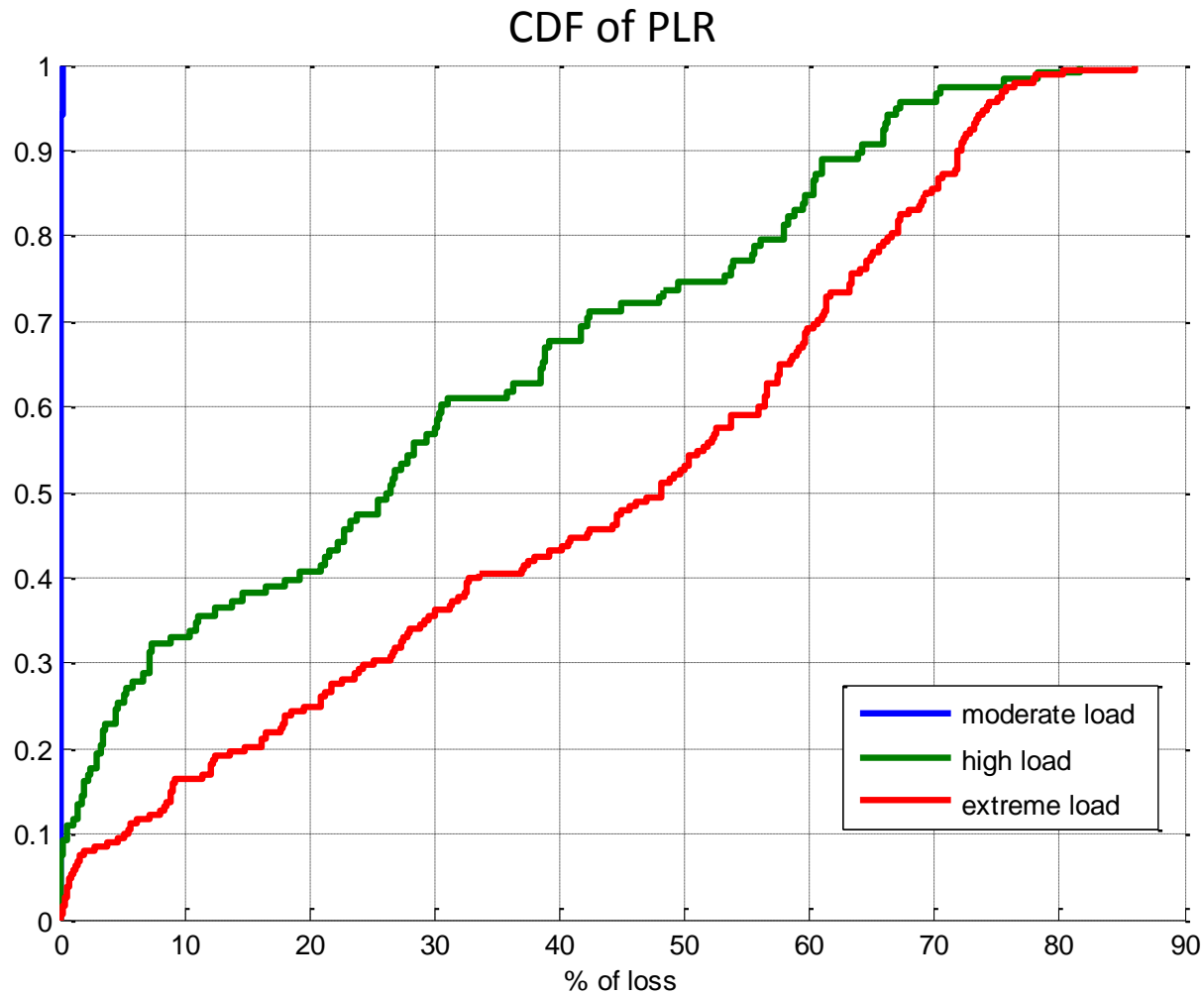
Media quality is very poor in high and extreme load

Did CB triggered?

- Yes
- Triggers
 - Media timeout? NO
 - Congestion? YES



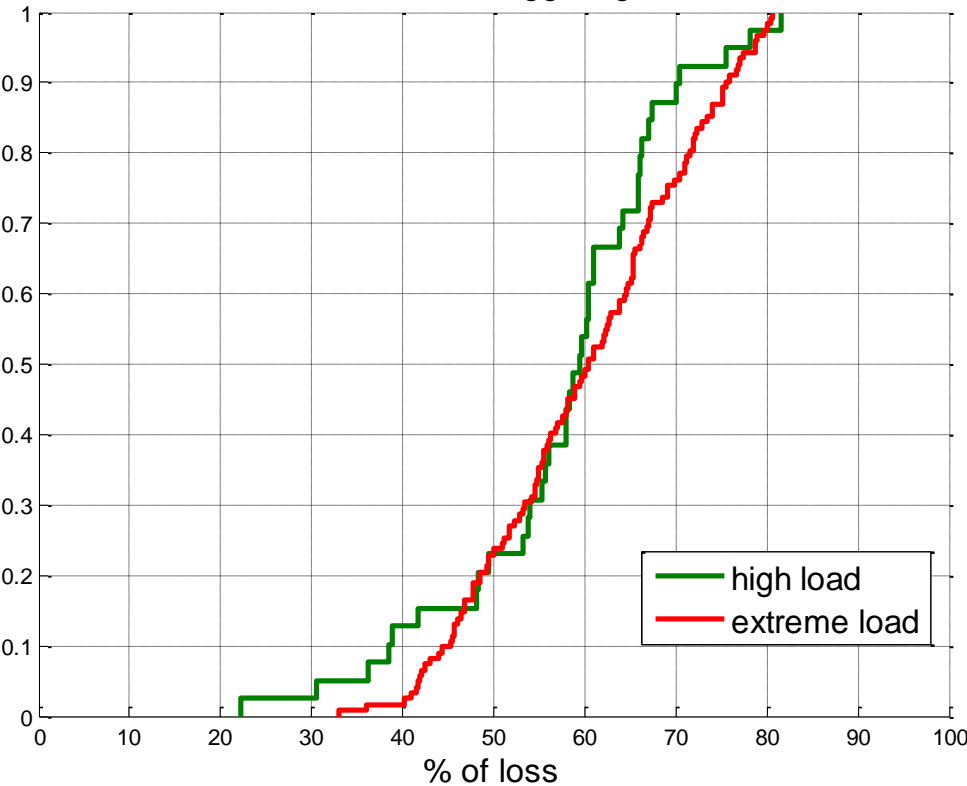
Media quality (CB enabled)



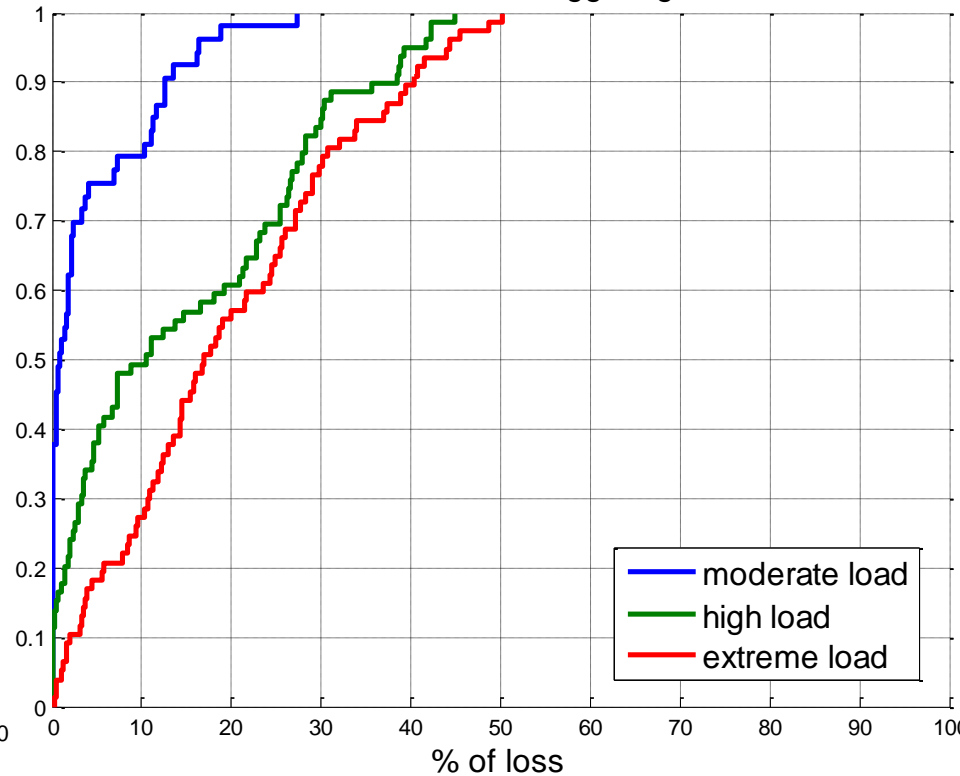
Small amount of improvement

PLR (CB enabled)

CDF of PLR from users triggering circuit breaker

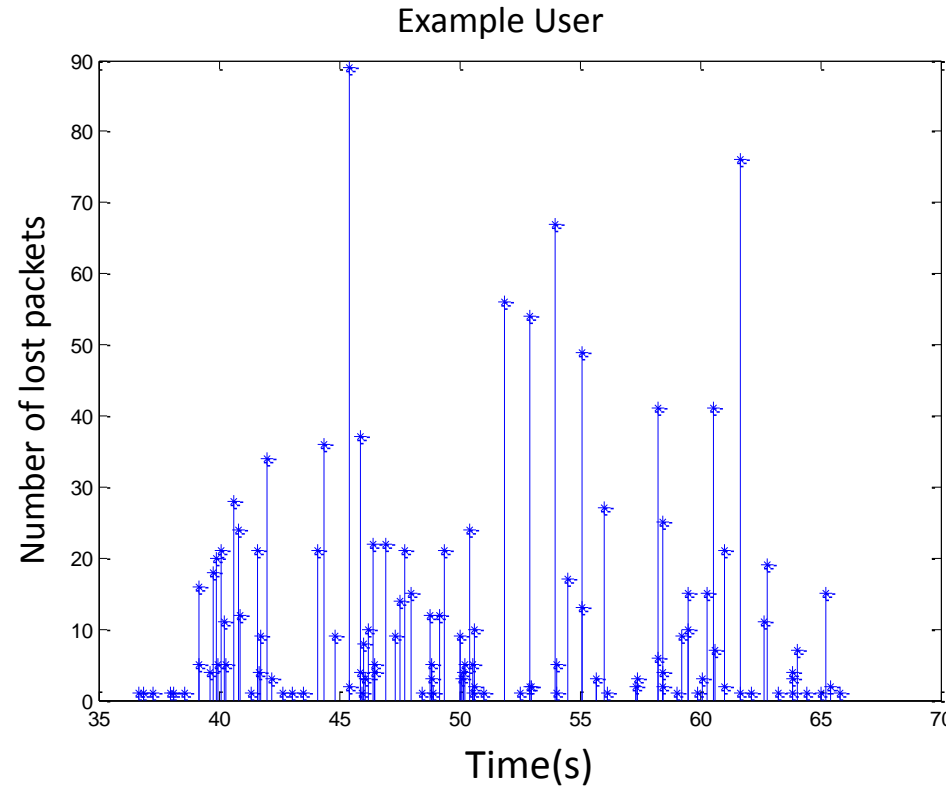
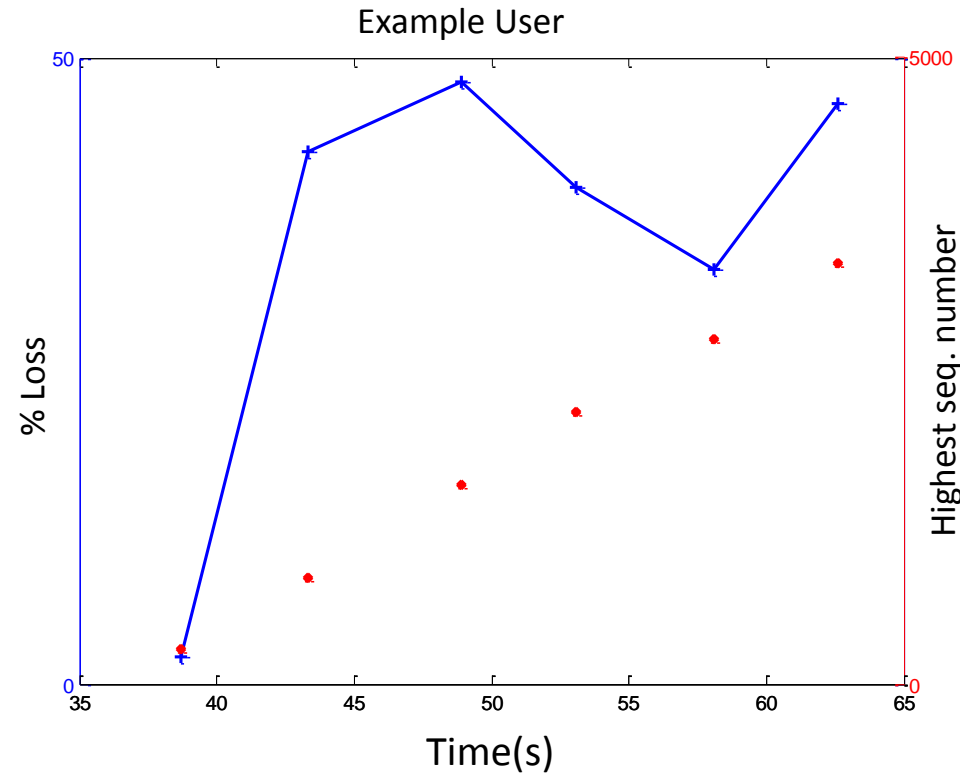


CDF of PLR from users NOT triggering circuit breaker



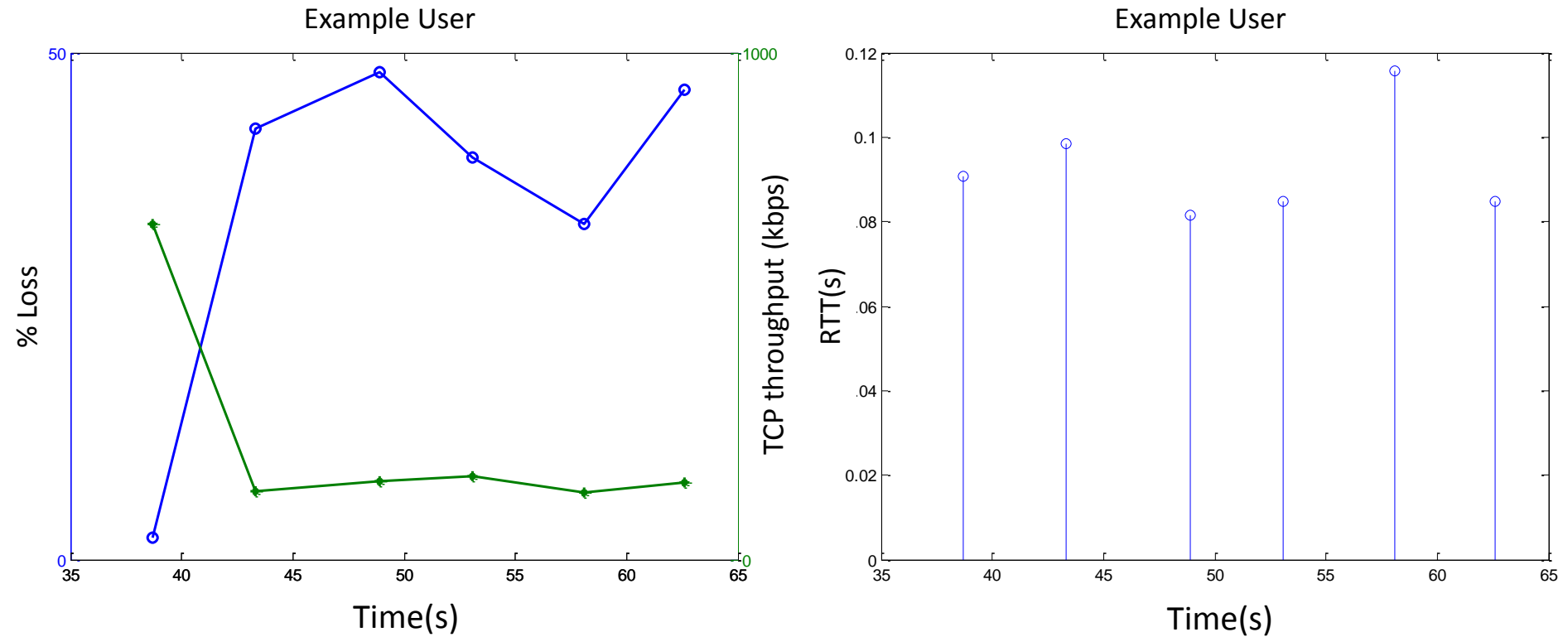
- CDF of PLR in CB triggered user shows the loss was very high
 - Highly unlikely any of those were false trigger
- PLR in non CB triggered user also shows high losses
 - Some of them should have triggered CB

Example user- Loss pattern



NO media timeout possibility

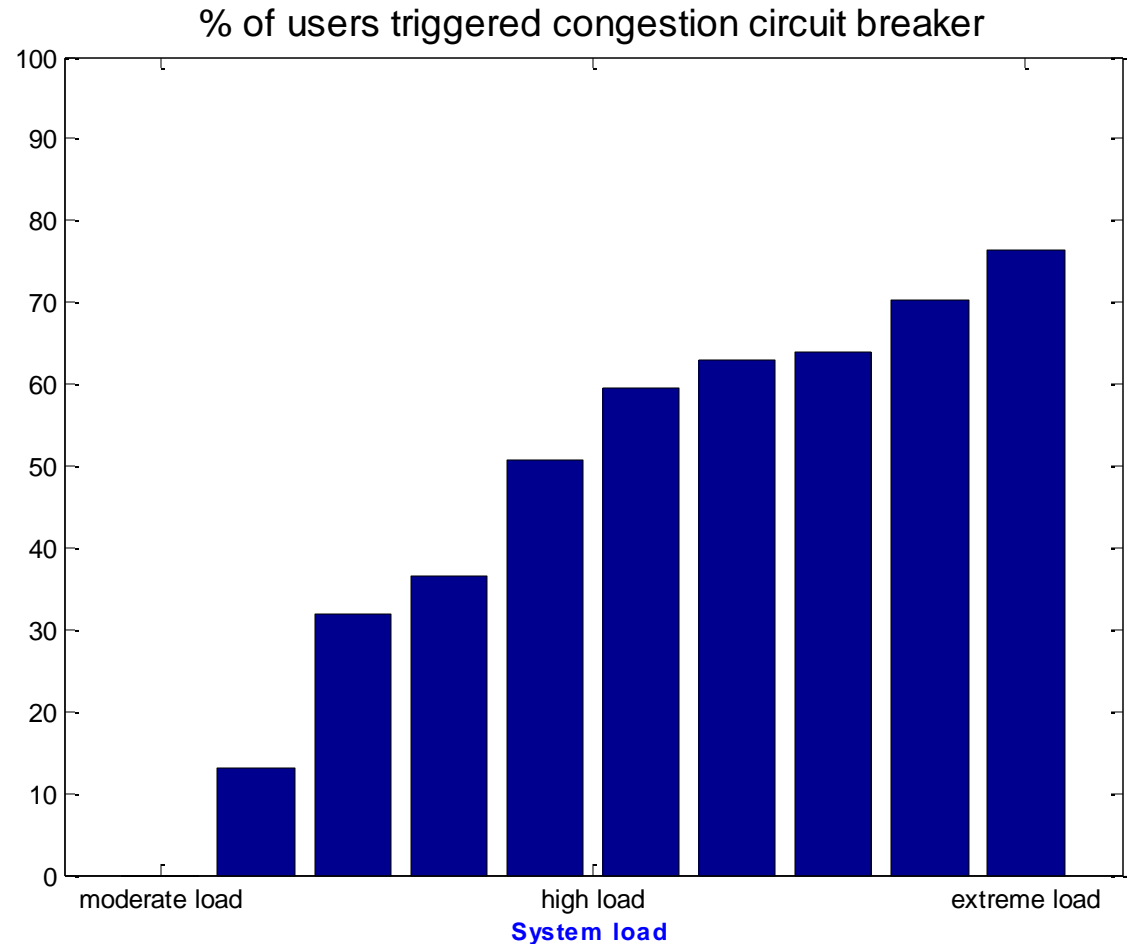
Example user



Low RTT resulting in high TCP throughput estimation

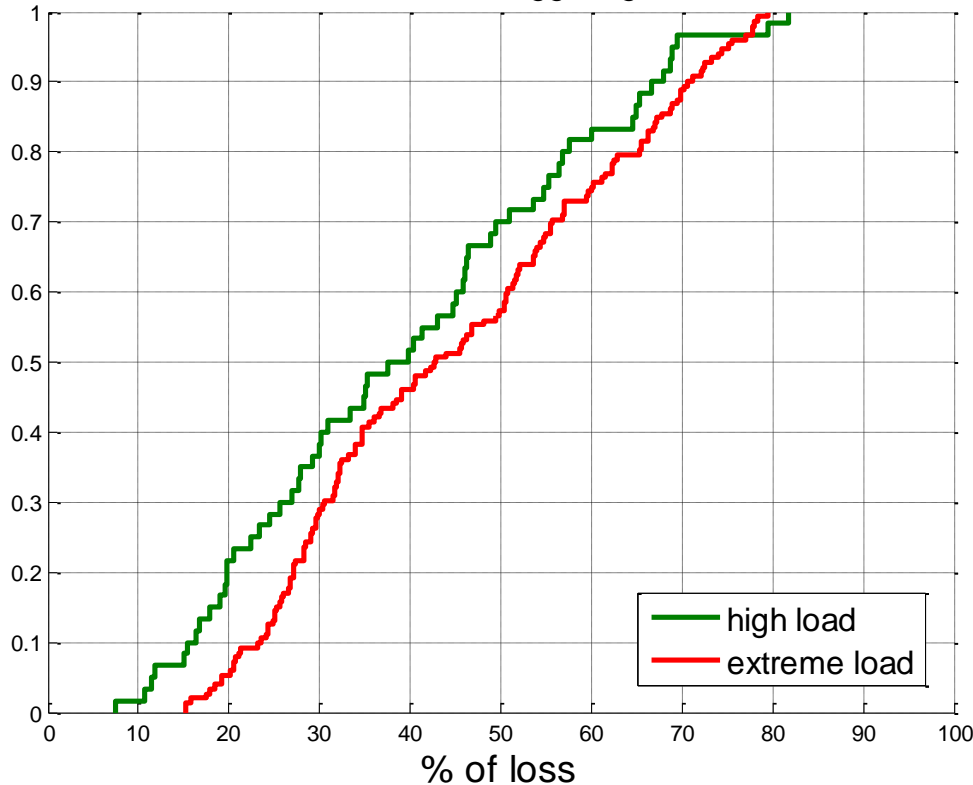
CB with complex TCP throughput equation (RFC 5348)

- Increases % of circuit breaker triggered users

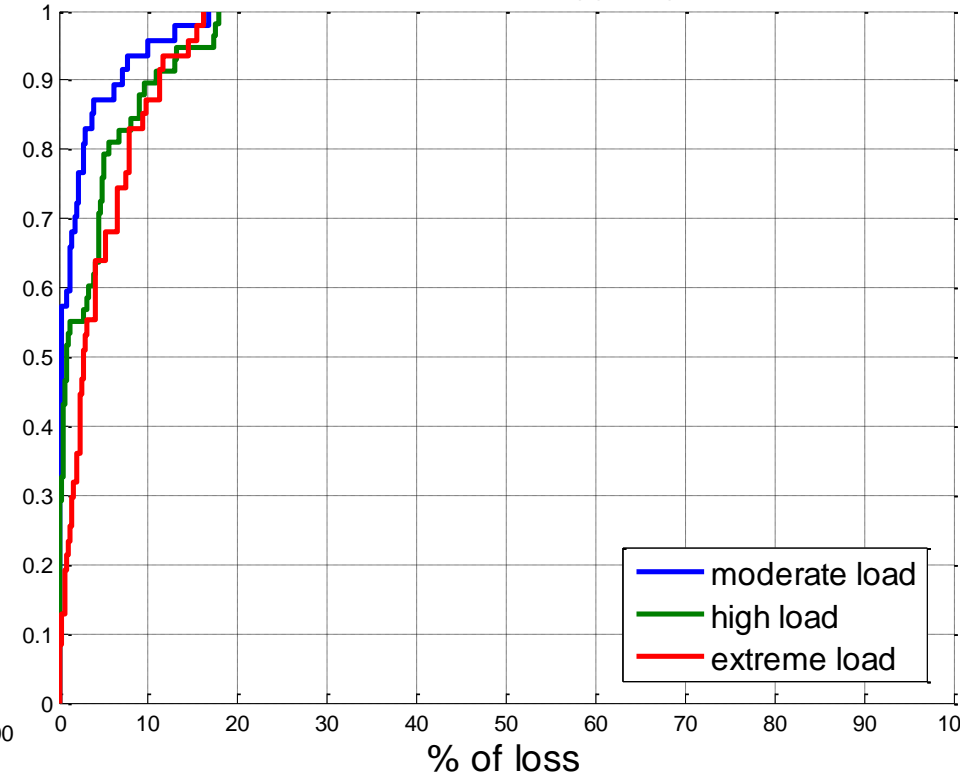


PLR (complex TCP X_Bps equation)

CDF of PLR from users triggering circuit breaker



CDF of PLR from users NOT triggering circuit breaker



Circuit breaker becomes more sensitive

Conclusion

- We need to compliment triggers to address the effect of AQM
 - Low RTT but high loss rate
- › It is unlikely that media timeout will occur for consecutive 2 RTCP interval with RTP AVP in LTE network.
 - › Limited burst length of packet loss in LTE network
- › Use of complex TCP throughput equation makes the current congestion circuit breaker more sensitive

Next Steps

- Modify current proposal of circuit breaker triggers
 - Scaling RTCP interval
 - Use different order of magnitude than 10xTCP throughput to trigger congestion circuit breaker.
- Consider additional circuit breakers
 - High loss
 - High RTT