Elasticity Detection: A Building Block for Delay-Sensitive Congestion Control

Prateesh Goyal
MIT CSAIL
prateesh@csail.mit.edu

Akshay Narayan
MIT CSAIL
akshayn@csail.mit.edu

Frank Cangialosi
MIT CSAIL
frank@csail.mit.edu

Deepti Raghavan
MIT CSAIL
deeptir@mit.edu

Srinivas Narayana
MIT CSAIL
alephtwo@csail.mit.edu

Mohammad Alizadeh
MIT CSAIL
alizadeh@csail.mit.edu

Hari Balakrishnan
MIT CSAIL
hari@csail.mit.edu

ABSTRACT

This paper develops a technique to detect whether the cross traffic competing with a flow is elastic or not, and shows how to use the elasticity detector to improve congestion control. If the cross traffic is elastic, i.e., made up of buffer-filling flows like Cubic or Reno, then one should use a scheme that competes well with such traffic. Such a scheme will not be able to control delays because the cross traffic will not cooperate. If, however, cross traffic is inelastic, then one can use a suitable delay-sensitive congestion control algorithm, which can control delays, but which would have obtained dismal throughput when run concurrently with a buffer-filling algorithm.

We use the elasticity detector to demonstrate a congestion control framework that always achieves high utilization, but which can also achieve low delays when cross traffic permits it. The technique uses an asymmetric sinusoidal pulse patternand estimates elasticity by computing the frequency response(FFT) of the cross traffic estimate; we have measured its accuracy to be over 90%. We have developed Nimbus, a protocol that explicitly switches between TCP-competitive and delay-sensitive modes using the elasticity detector. Our results on emulated and real-world paths show that Nimbus achieves throughput comparable to or better than Cubic always, but with delays that are much lower when cross traffic is inelastic. Unlike BBR, Nimbus is fair to Cubic, and has significantly lower delay in all cases; for example, on real-world paths, Nimbus has 11% lower throughput but at 40-50 ms lower packet delay.

ACM Reference Format:
Prateesh Goyal, Akshay Narayan, Frank Cangialosi, Deepti Raghavan, Srinivas Narayana, Mohammad Alizadeh, and Hari Balakrishnan. 2018. Elasticity Detection: A Building Block for Delay-Sensitive Congestion Control. In *ANRW '18: Applied Networking Research Workshop, July 16, 2018, Montreal, QC, Canada.* ACM, New York, NY, USA, 1 page. https://doi.org/10.1145/3232755.3232772

ANRW '18, July 16, 2018, Montreal, QC, Canada

ACM ISBN 978-1-4503-5585-8/18/07.
https://doi.org/10.1145/3232755.3232772