

# Device-dependent QoE Fairness for Adaptive Video Streaming

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OR...

# Why Streaming Video is Suddenly Cool (to me)!

# Does equal bitrate == fairness?

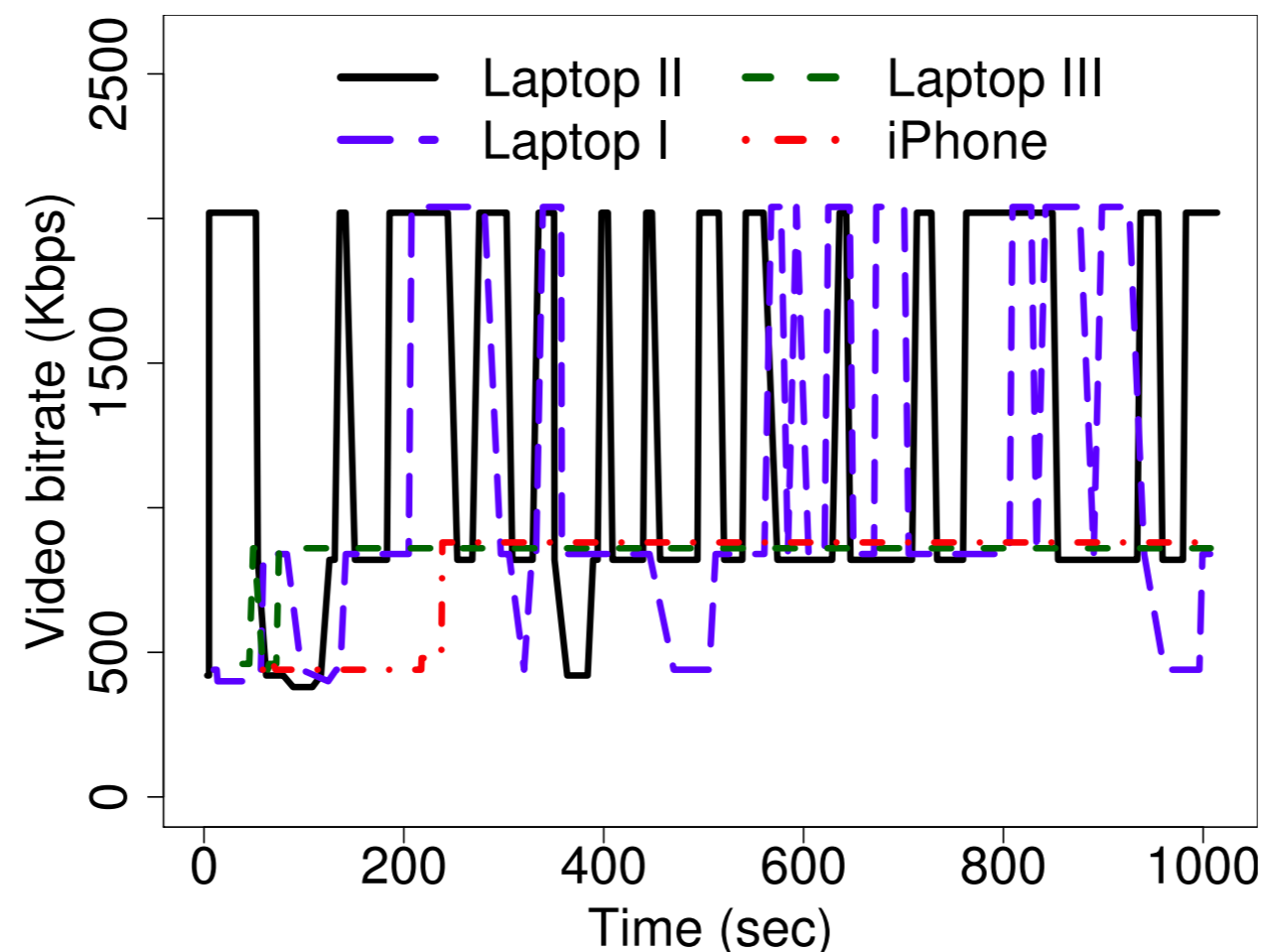


CLAIM: Traditional measures of throughput, delay, loss, fail to capture and represent user experience.

# Competition among video streams

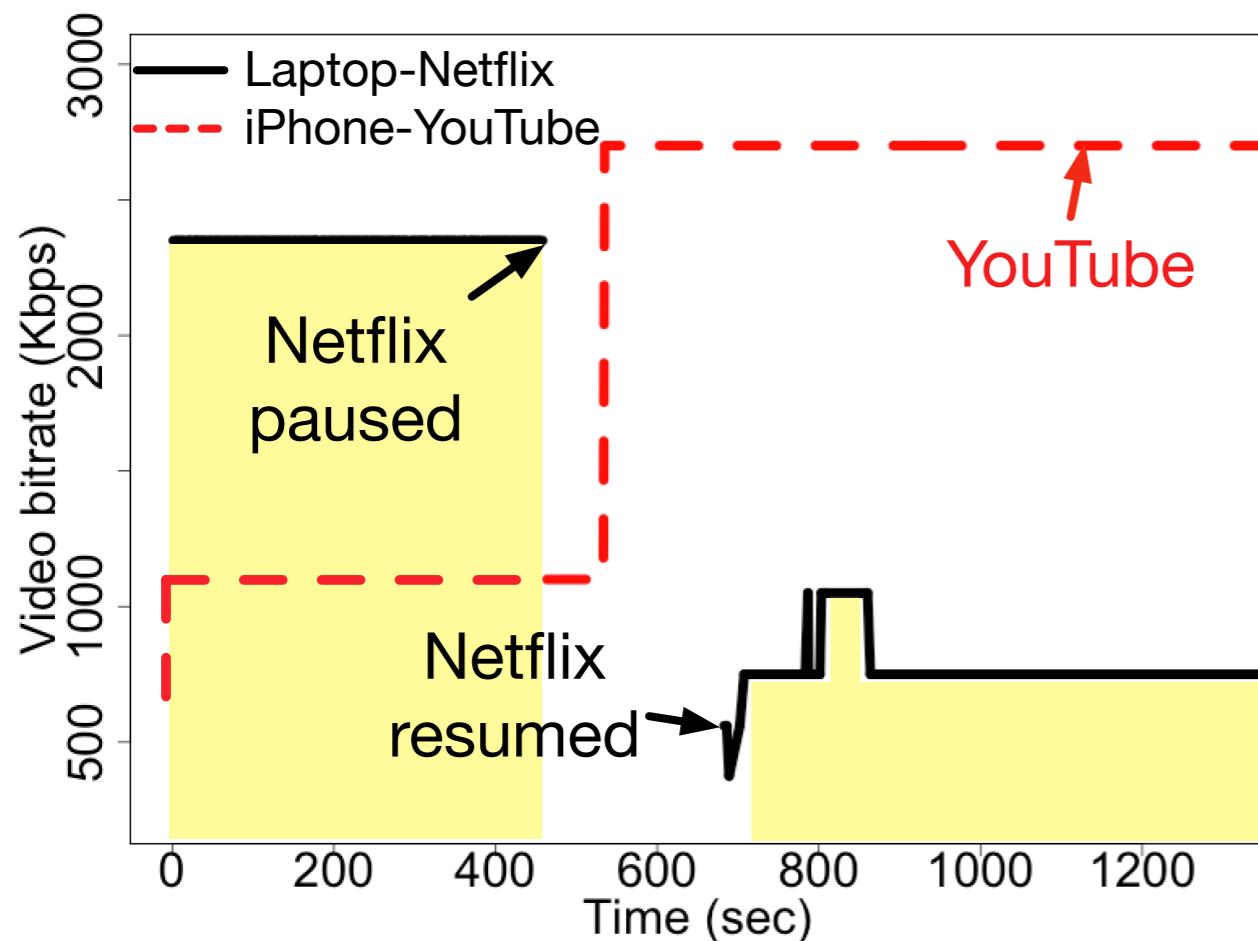
- Bitrate stability, and link utilisation are known to suffer...

Four YouTube videos  
compete for 6Mbps

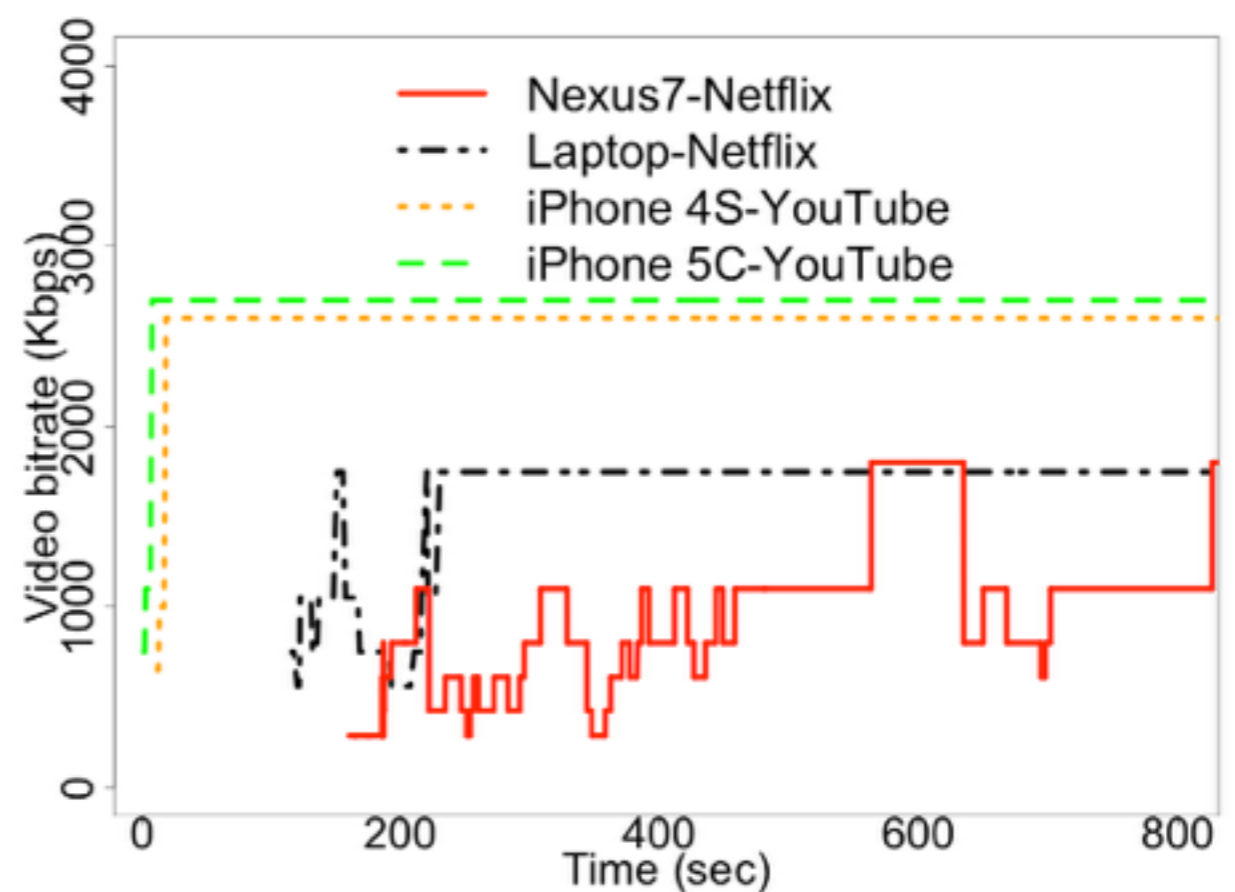


# Worse, is (un)Fairness!

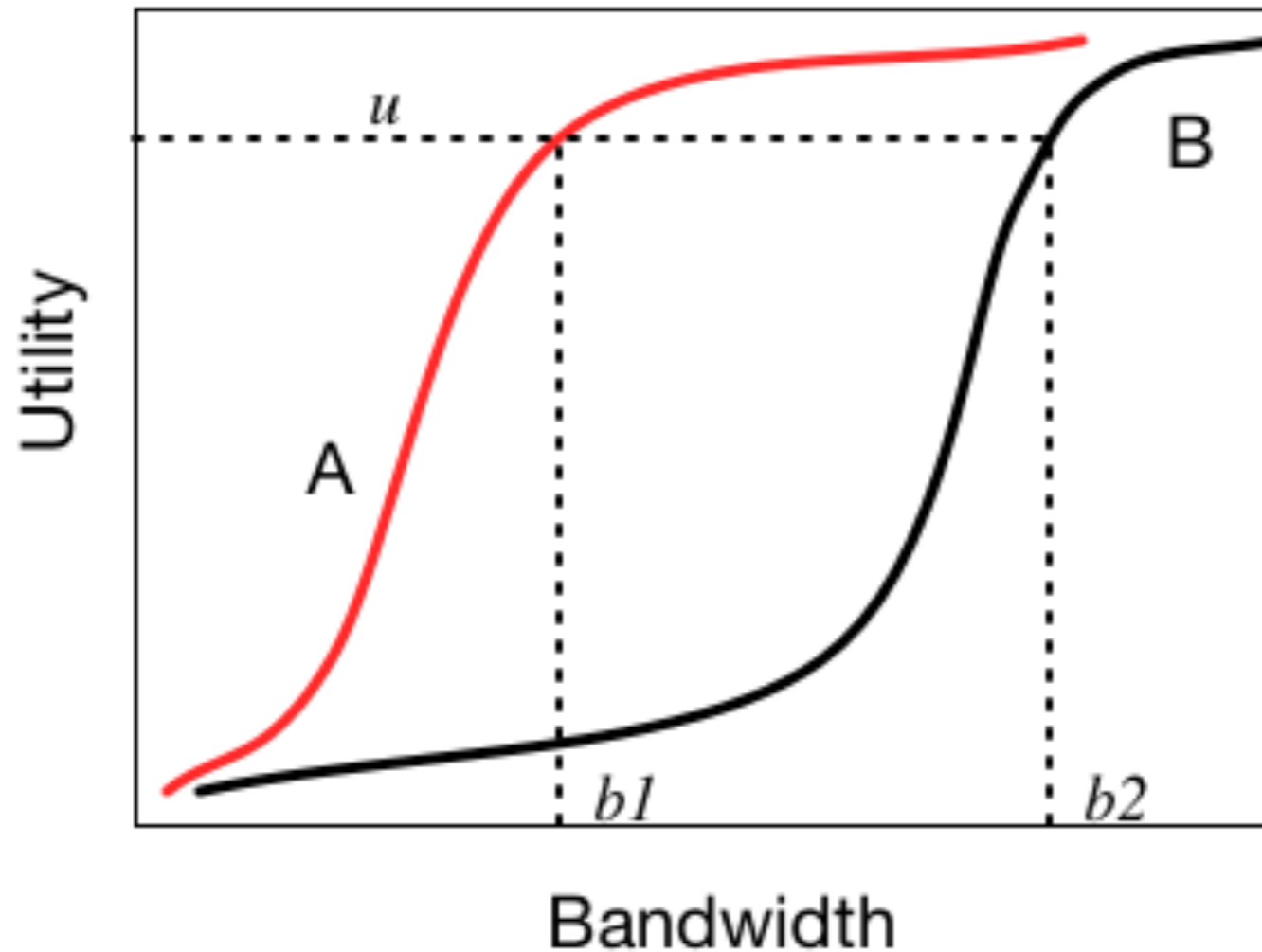
Two streams compete over 4Mbps



Four streams compete over 8Mbps

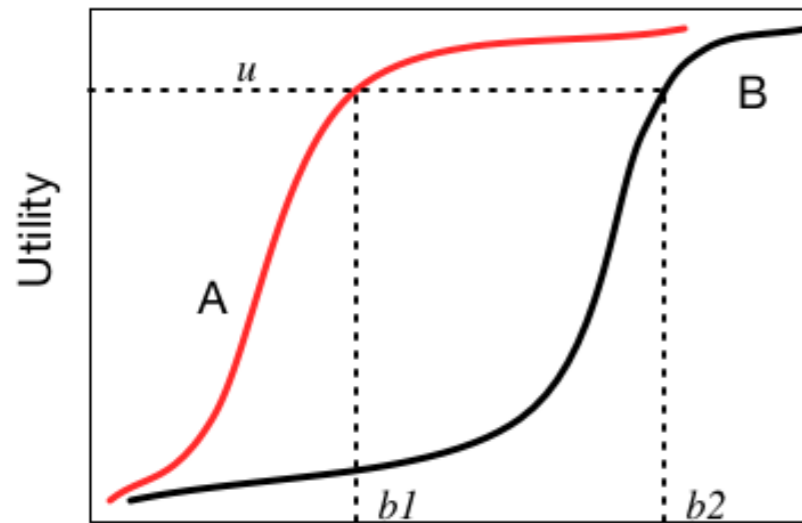


# An Old Idea: Bandwidth utility

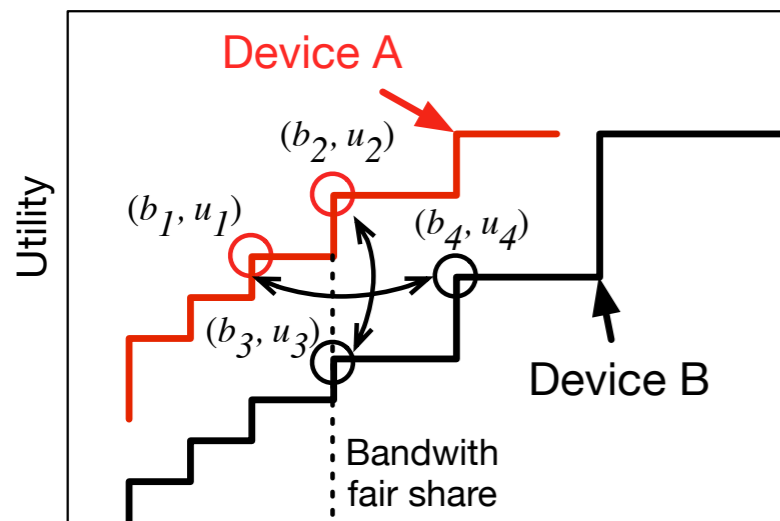


S. Shenker, "Fundamental design issues for the future Internet", in IEEE Journal on Selected Areas in Communications, 1995

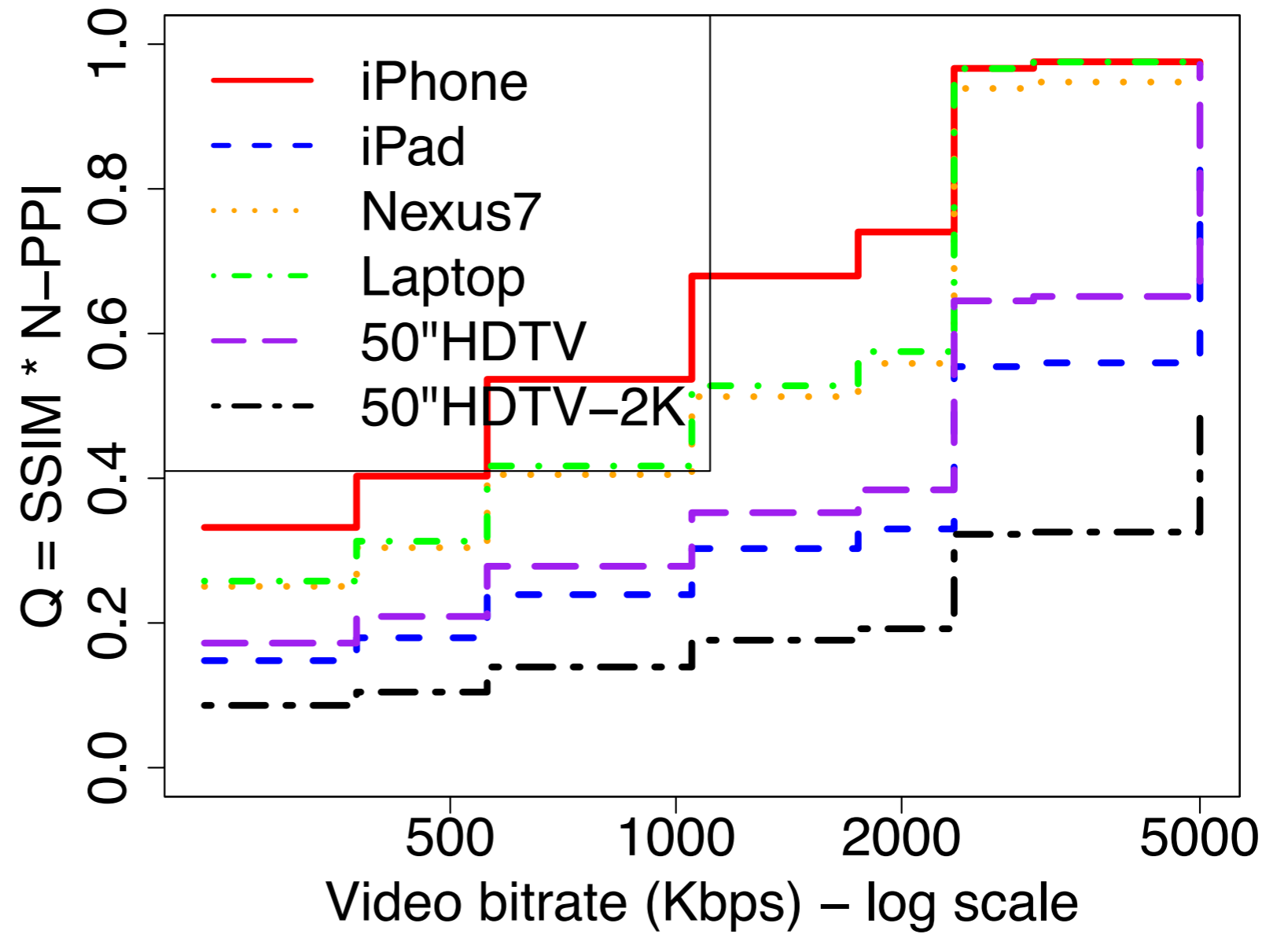
# Useable QoE: PPI-based Function



Bandwidth



Bandwidth



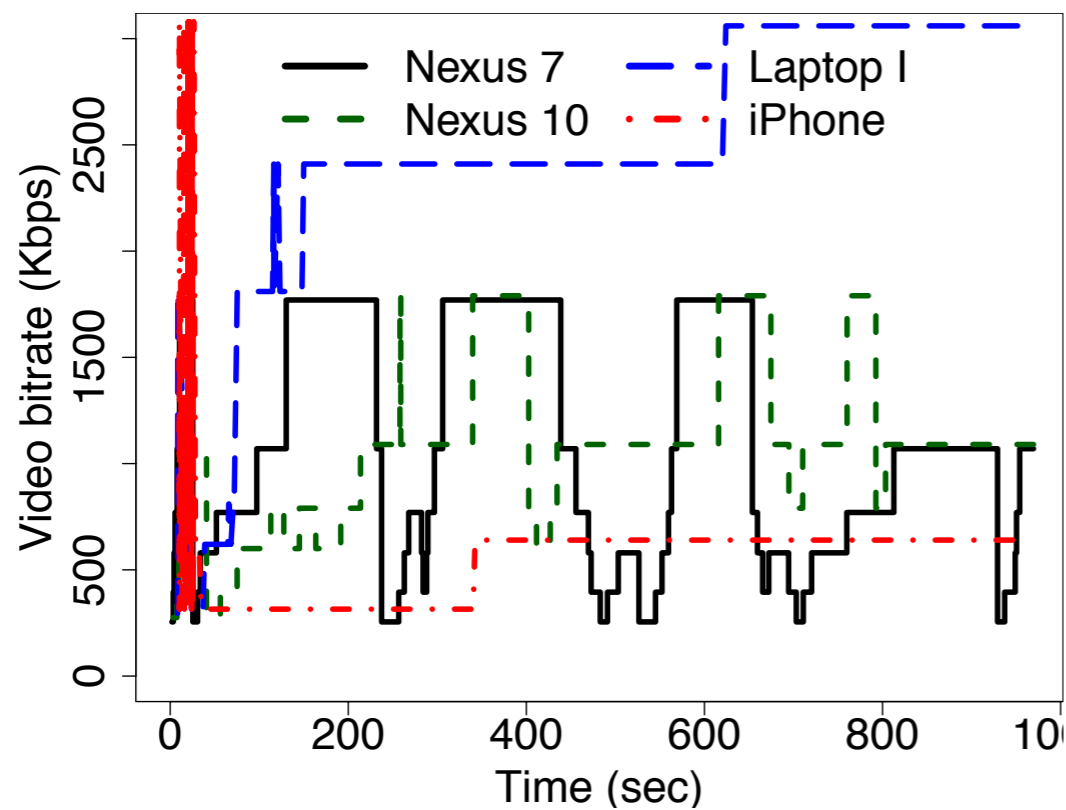
Video bitrate (Kbps) - log scale



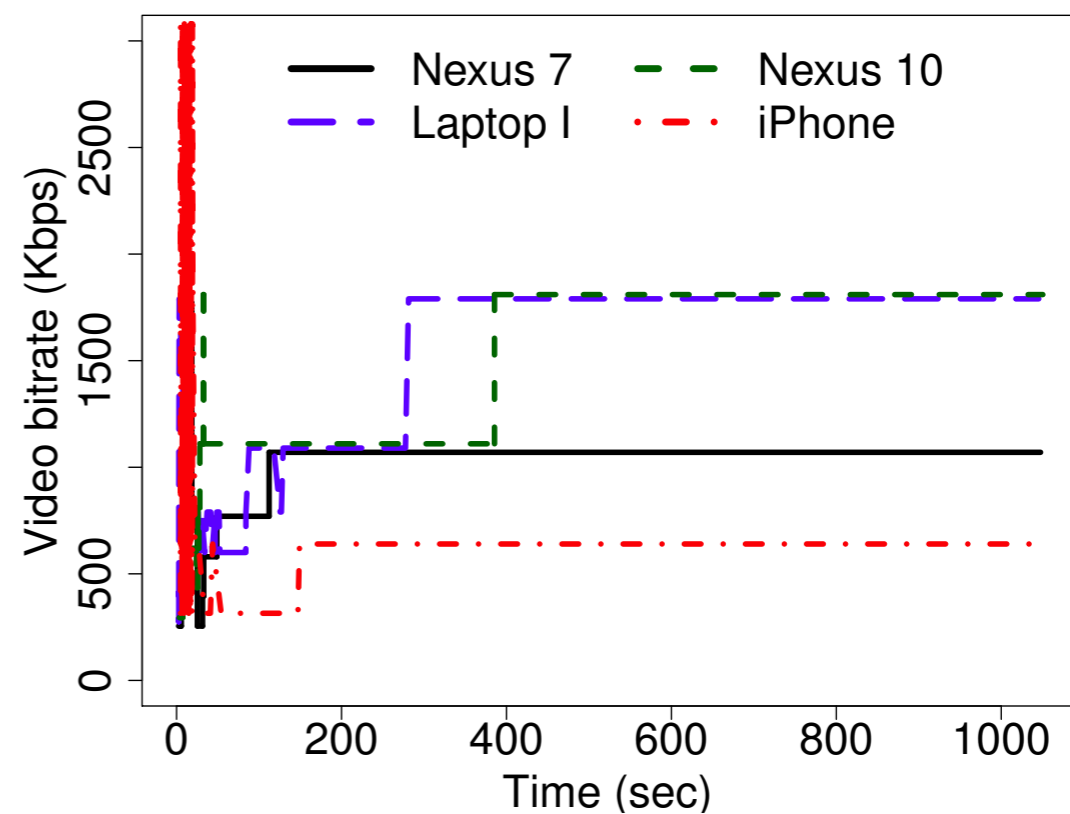
# QoE Utility + Max-min Fairness

Four Netflix clients sharing a 6Mbps link

Without HomeShaper



With HomeShaper

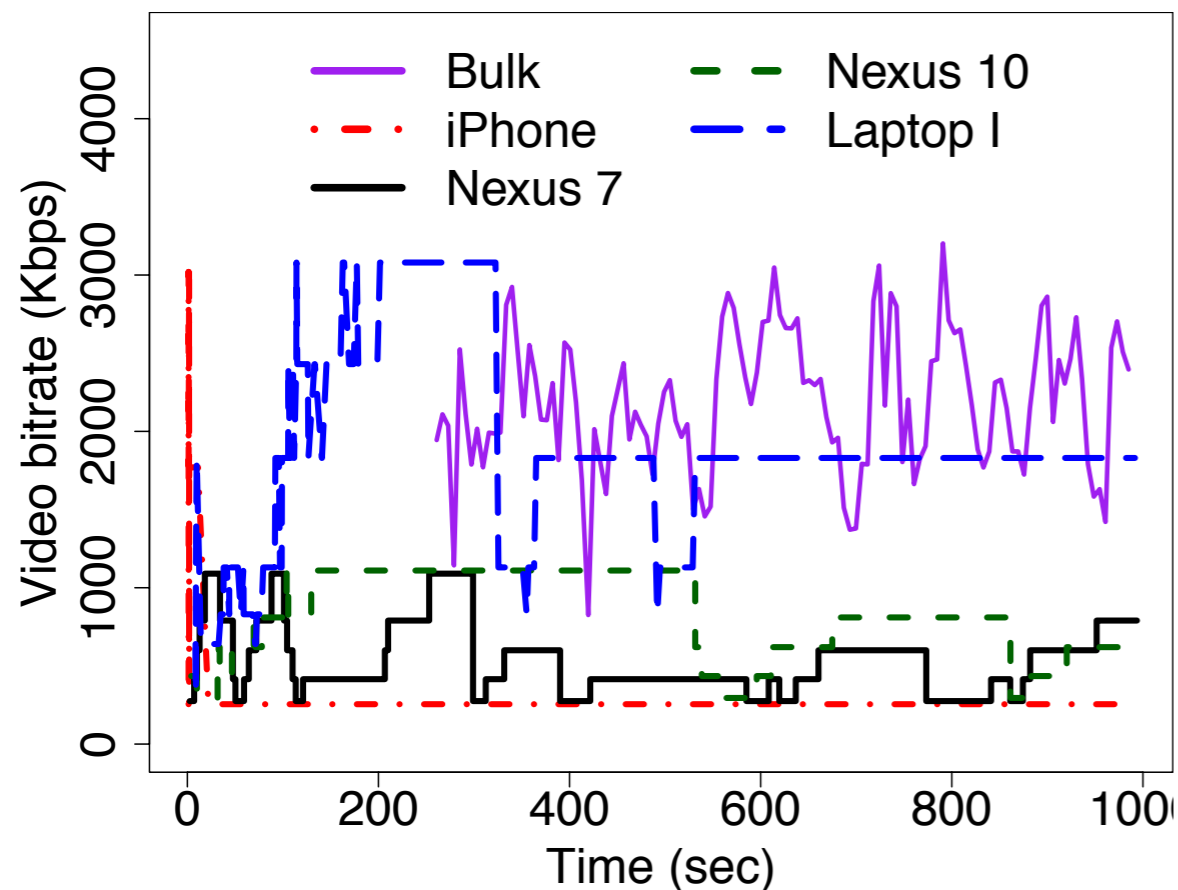




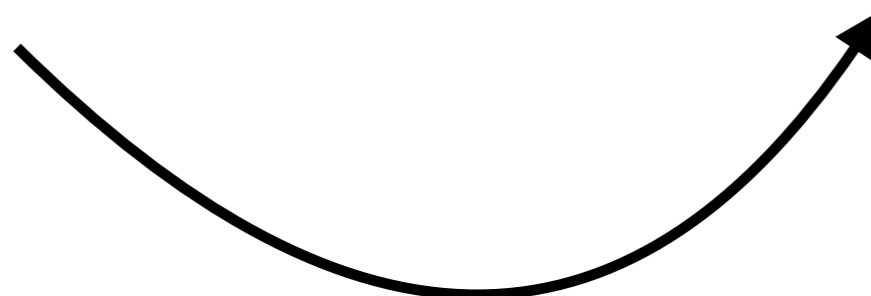
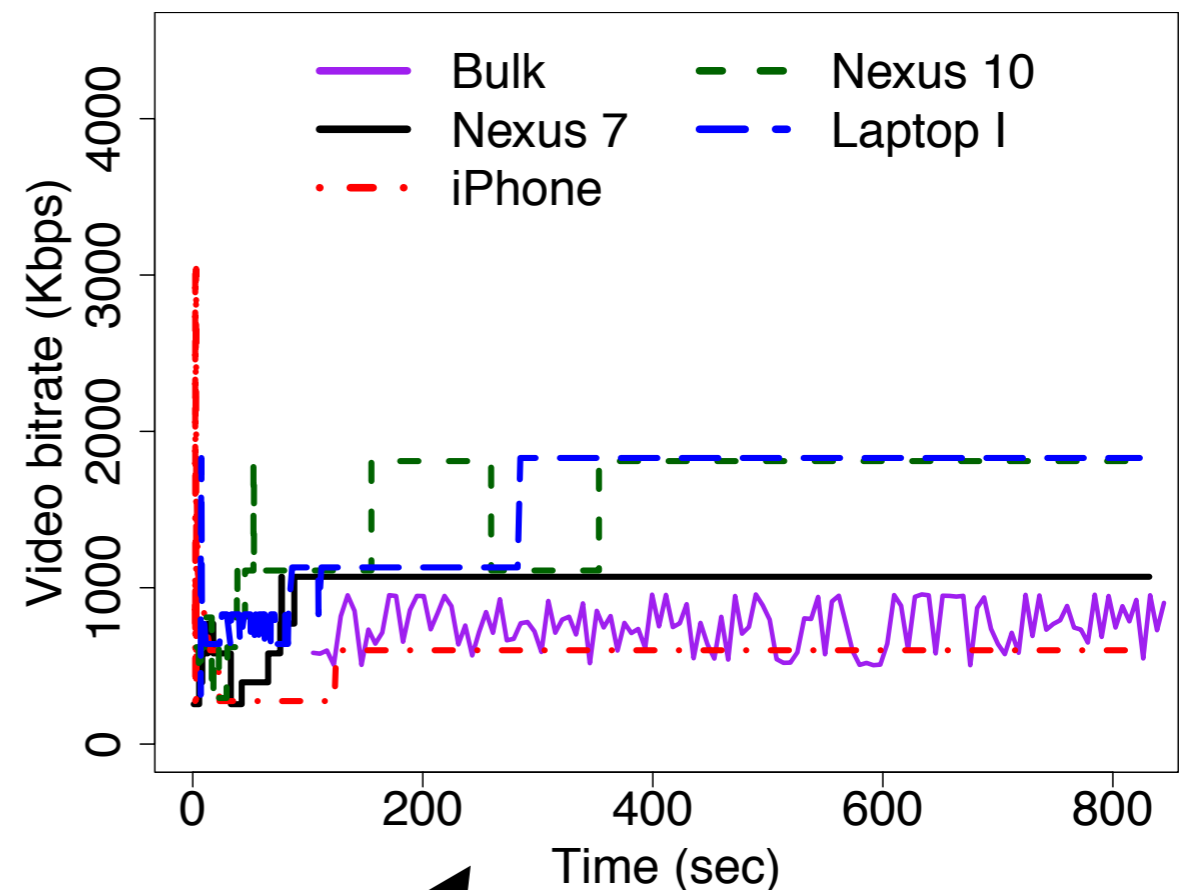
# QoE Utility + Max-min Fairness

...now with bulk download.

Without HomeShaper



With HomeShaper



# Summary

- Introduced “network-friendly” QoE metrics.
- QoE max-min fairness for competing adaptive video flows
- Algorithm for computing QoE max-min bitrate allocation (if it exists)
- Design, implement, and evaluation in HomeShaper.

# In the End...



We have throughput, latency, and loss:

Are these still enough?