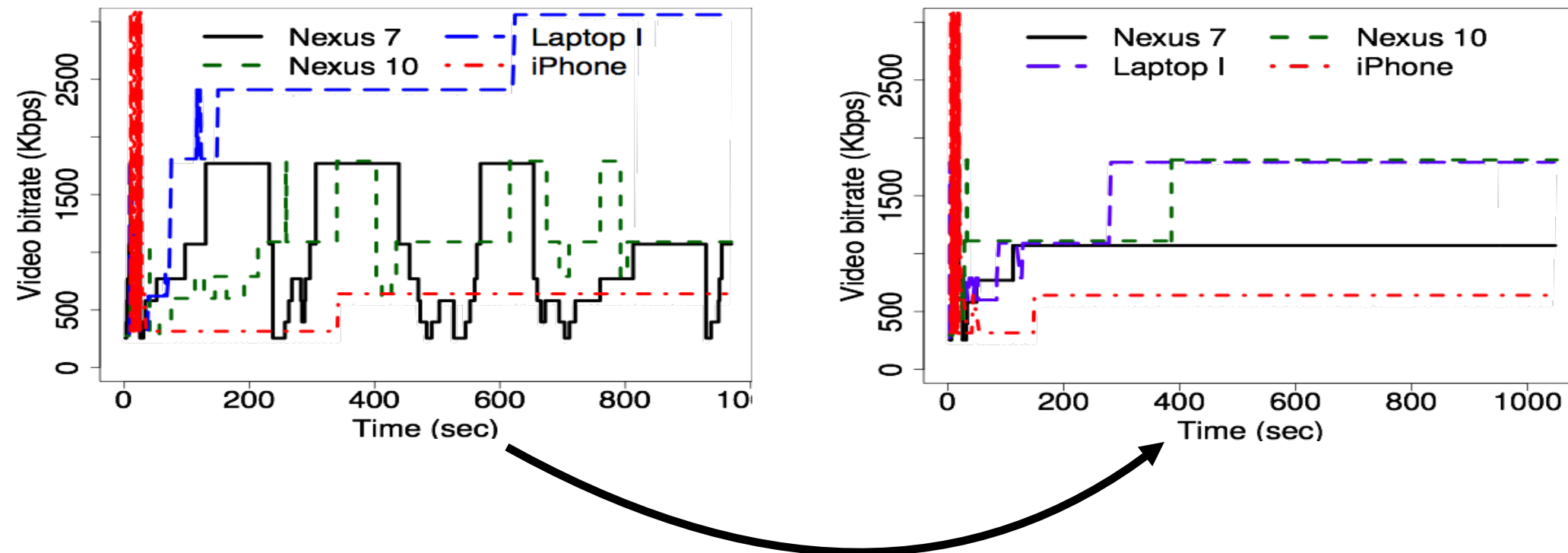# Equal bitrate, or any flow-rate definition of fairness, is ultimately unfair.

-Bob Briscoe, ACM CCR 2007.
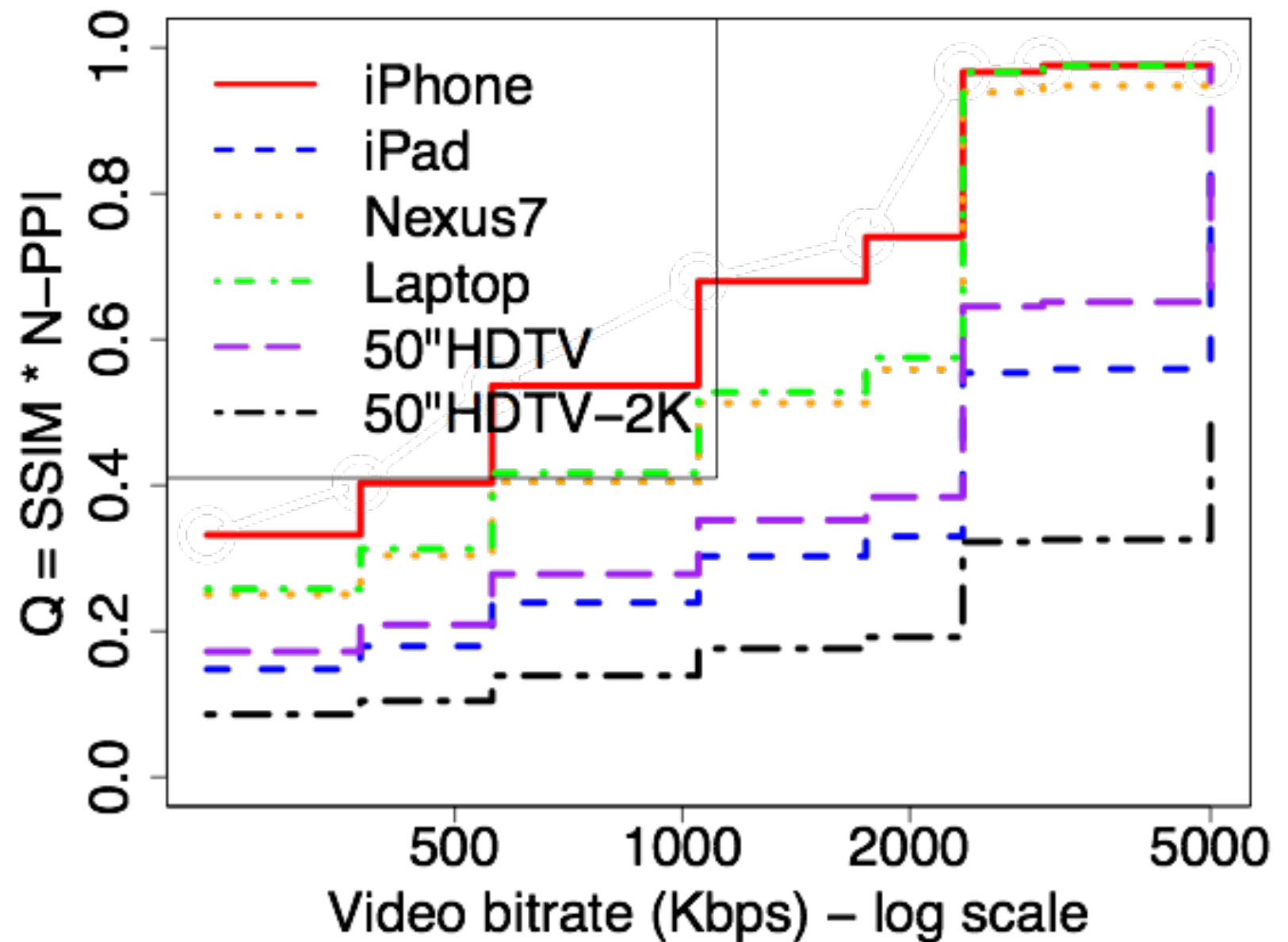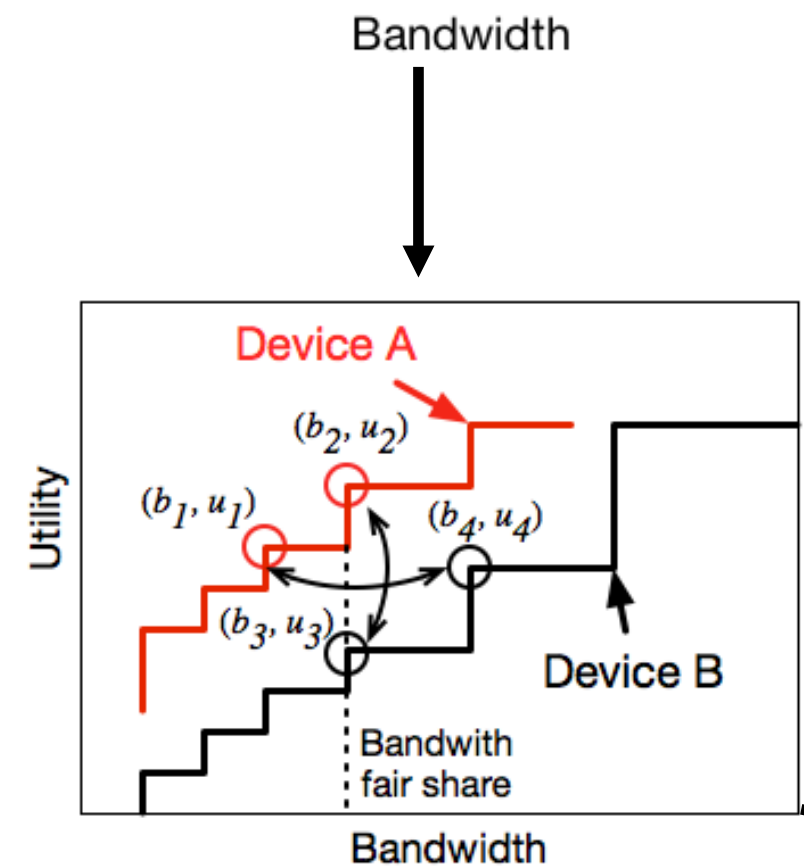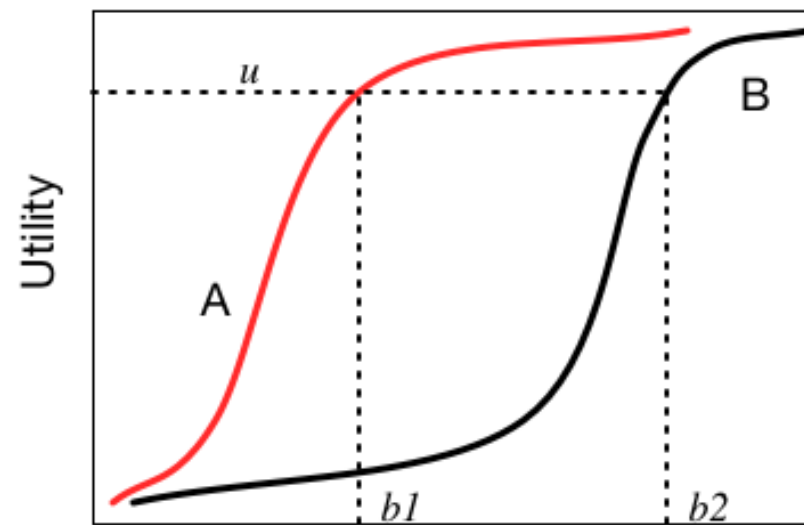
**Four Netflix clients sharing a 6Mbps link**



# "There exists no metric in transport/network to reflect the user experience of streaming video at the application layer."

-Marwan Fayed, right here, right now. ☺

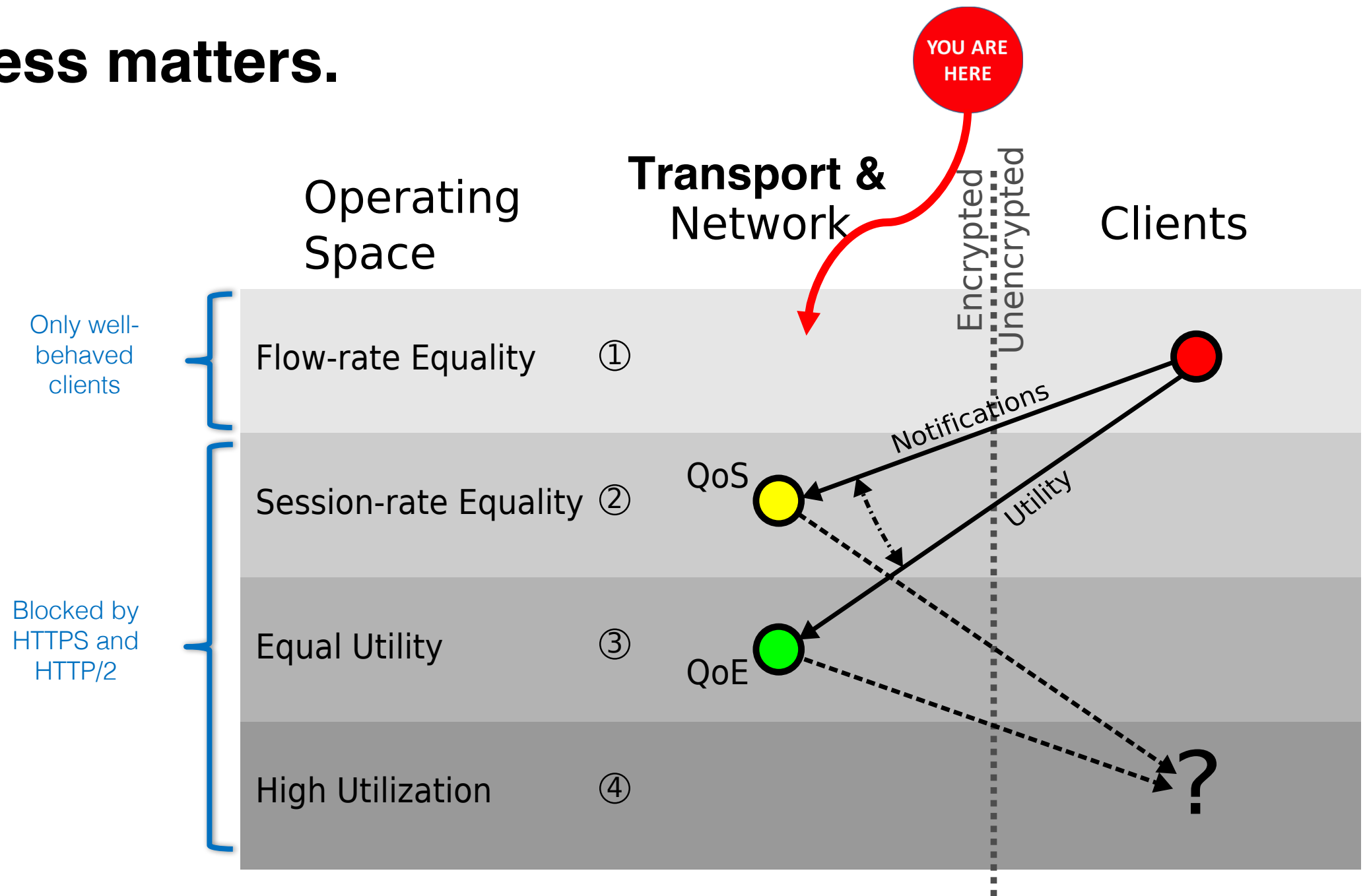# API: Bandwidth Utility for Streaming Video



| Netflix | Res. | 320 × 240 | 384 × 288 | 512 × 384 | 512 × 384 | 640 × 480 | 720 × 480 | 1280 × 720 | 1280 × 720 |
|---------|------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|
| | Bitrate | 235 | 375 | 560 | 750 | 1050 | 1750 | 2350 | 3000 |

# DASH: No Input→ No Fairness

**1. QoE-fairness matters.**

2. DASH-`S':

3. W I D E  Open Questions Remain!

(Incentives, **Utility**, **Feedback** and utilization, Upstream bottlenecks, **API Expressiveness** and Scale.)