

# Client-Driven Network-level QoE fairness for Encrypted 'DASH-S'

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Junyang Chen (Microsoft)

Mostafa Ammar (Georgia Tech)

**Marwan Fayed (Stirling)**

Rodrigo Fonseca (Brown)



UNIVERSITY OF  
**STIRLING**

**Life is unfair.**

The Internet

~~Life~~ is unfair.

# Two Types of Service:

Take as much as you **need!**

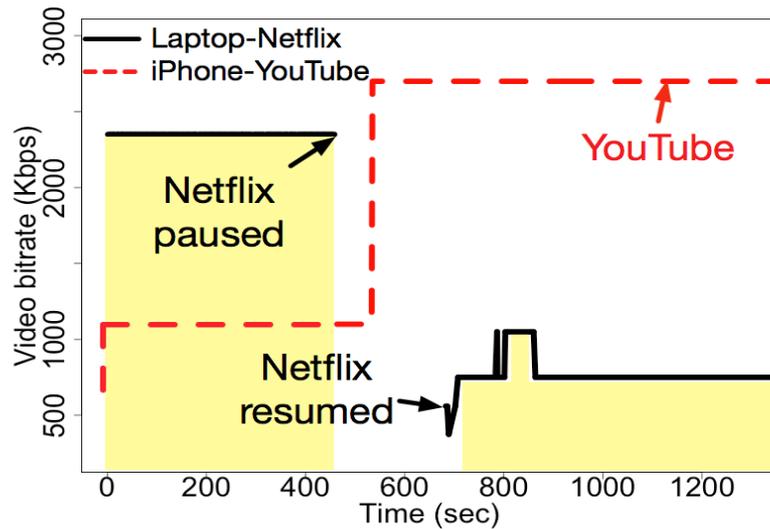
- Fixed (or predictable) rate
- UDP-class

Take as much as you **want!**

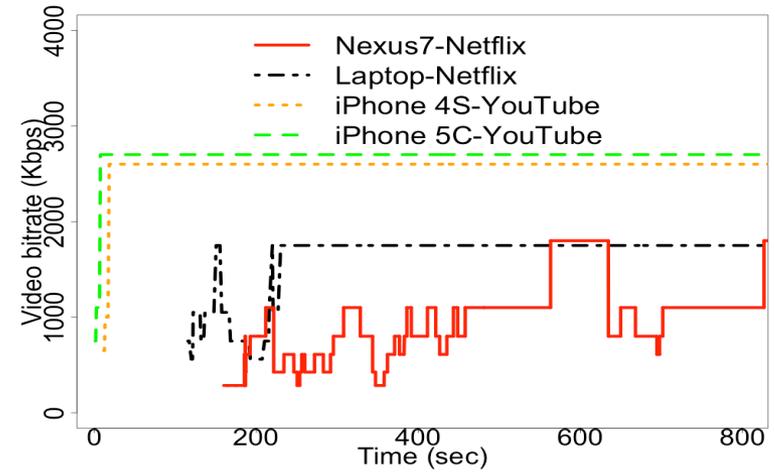
- But never more than 'fair' share
- TCP-class

# (un)Fairness!

Two streams compete over 4Mbps

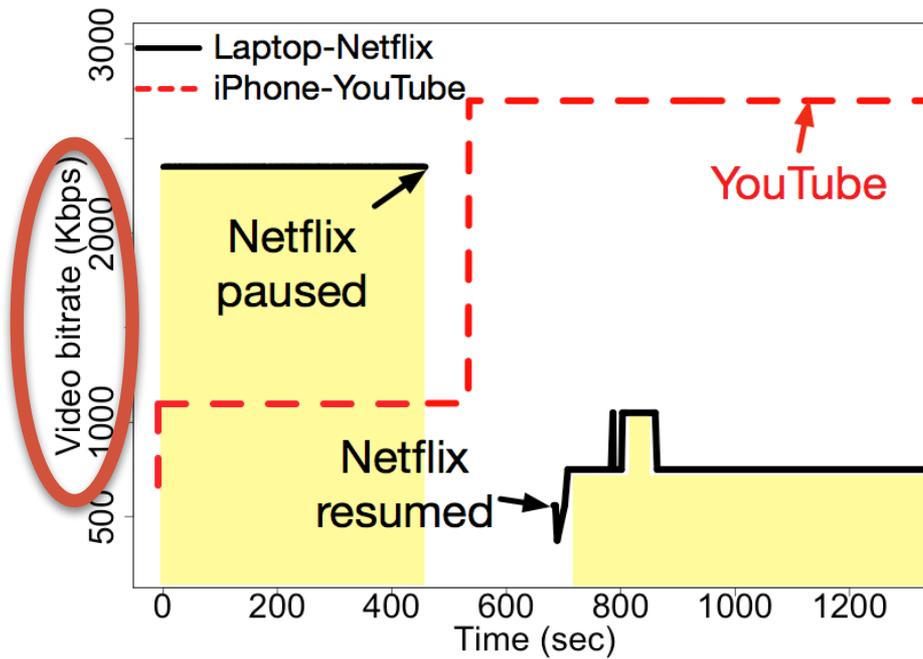


Four streams compete over 8Mbps



# (un)Fairness!

Two streams compete over 4Mbps



**\*NOT\*** to be confused  
with transmission rate

# Nothing we do will matter

## The Cost of the “S” in HTTPS

David Naylor<sup>\*</sup>, Alessandro Finamore<sup>†</sup>, Ilias Leontiadis<sup>‡</sup>, Yan Grunenberger<sup>‡</sup>,  
Marco Mellia<sup>†</sup>, Maurizio Munafò<sup>†</sup>, Konstantina Papagiannaki<sup>‡</sup>, and Peter Steenkiste<sup>\*</sup>

<sup>\*</sup>Carnegie Mellon University

<sup>†</sup>Politecnico di Torino

<sup>‡</sup>Telefónica Research

{dnaylor, prs}@cs.cmu.edu    {finamore, mellia, munafo}@tlc.polito.it  
{ilias, yan, dina}@tid.es

### ABSTRACT

Increased user concern over security and privacy on the Internet has led to widespread adoption of HTTPS, the secure version of HTTP. HTTPS authenticates the communicating end points and provides confidentiality for the ensuing communication. However, as with any security solution, it does not come for free. HTTPS may introduce overhead in terms of infrastructure costs, communication latency, data usage, and energy consumption. Moreover, given the opaqueness of the encrypted communication, any in-network value added services requiring visibility into application layer content, such as caches and virus scanners, become ineffective.

This paper attempts to shed some light on these costs. First, taking advantage of datasets collected from large ISPs

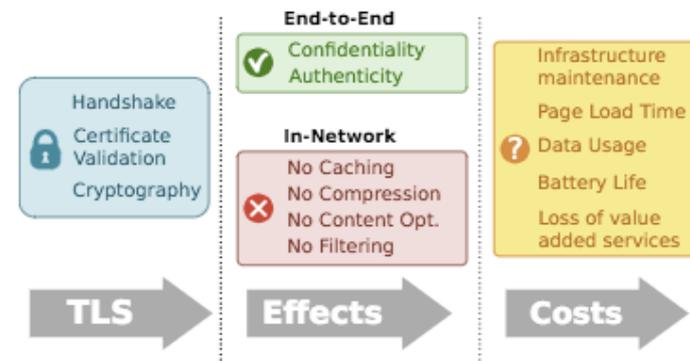
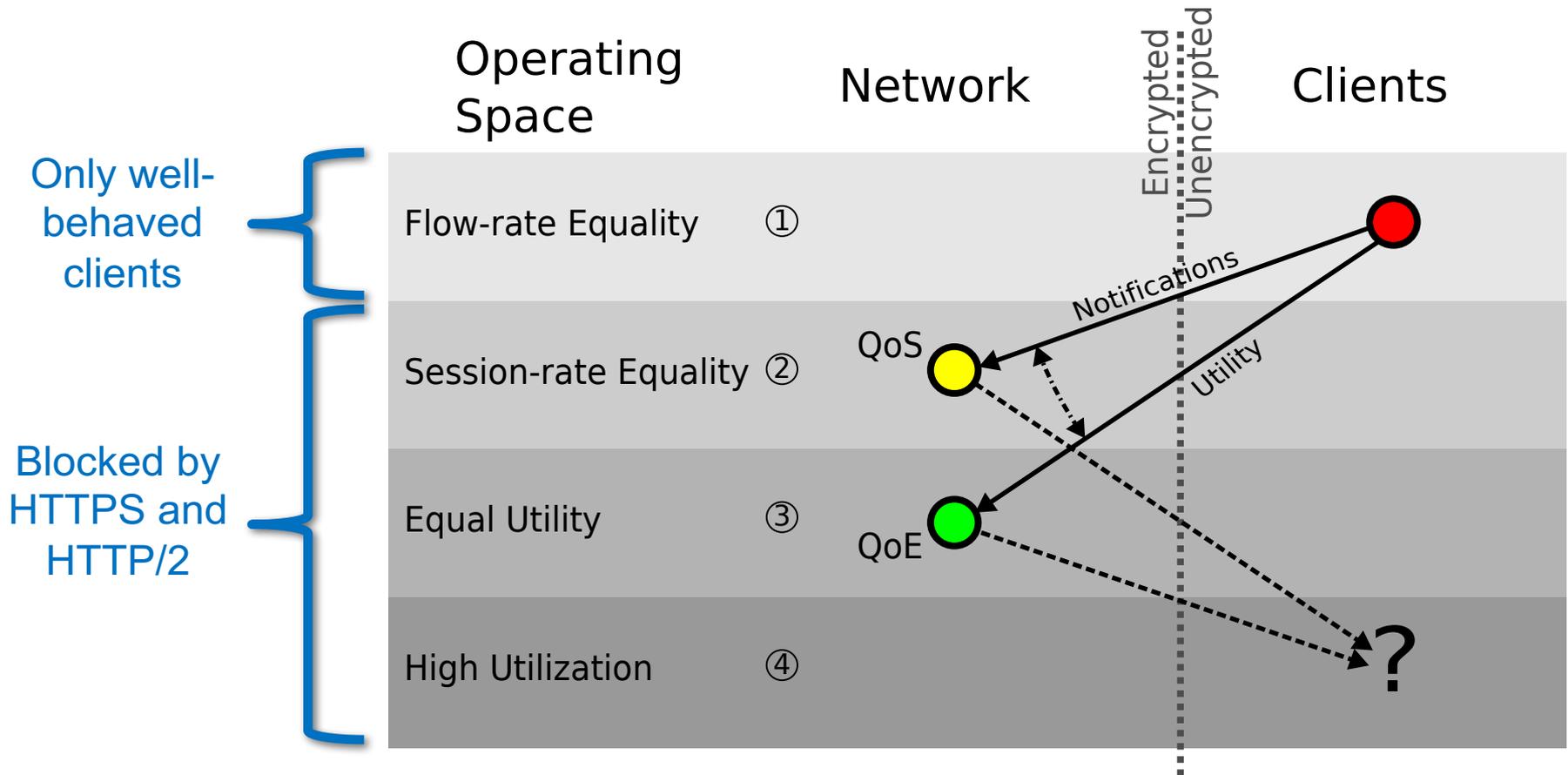
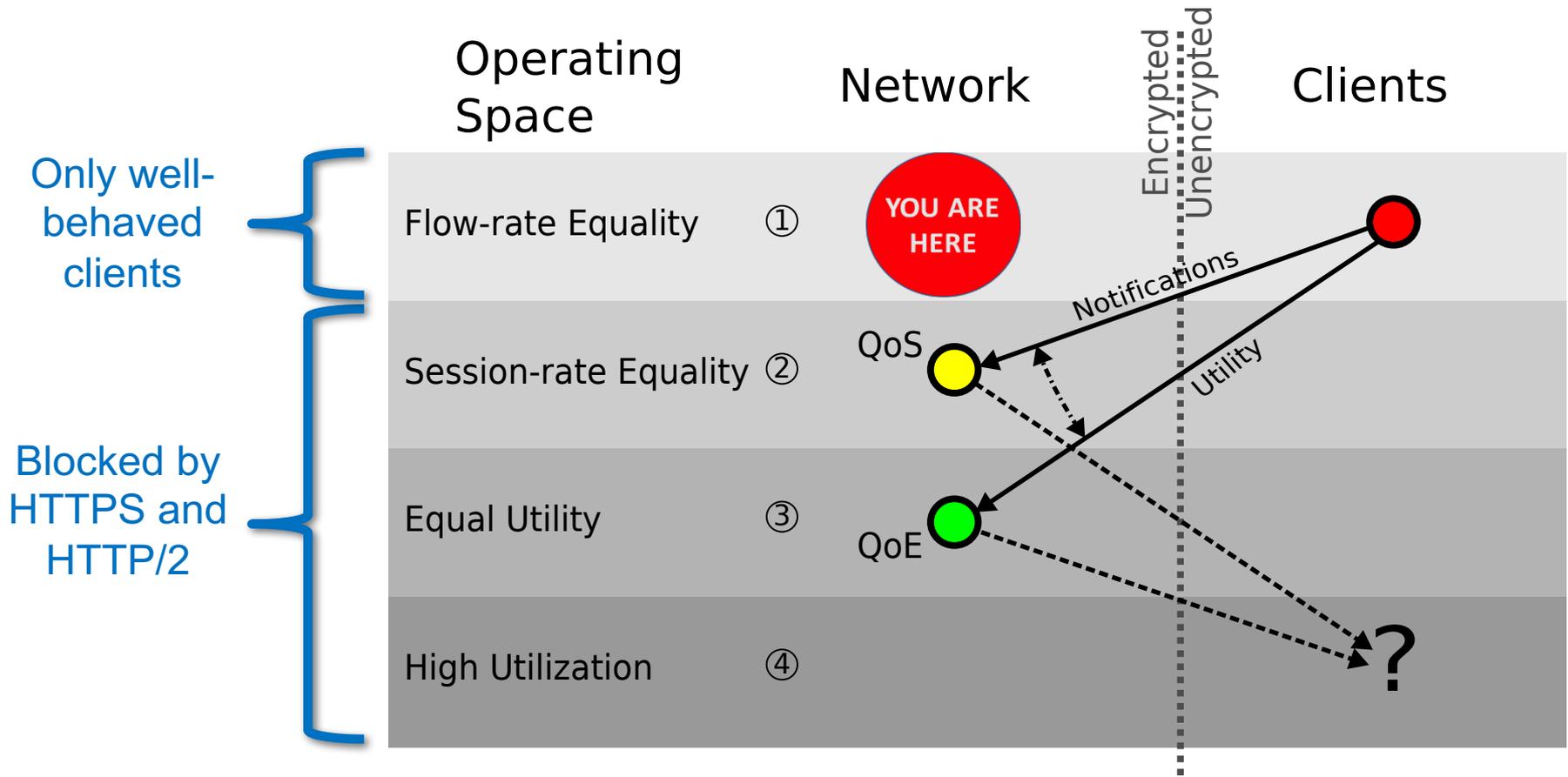


Figure 1: The HTTPS adoption impact chain.

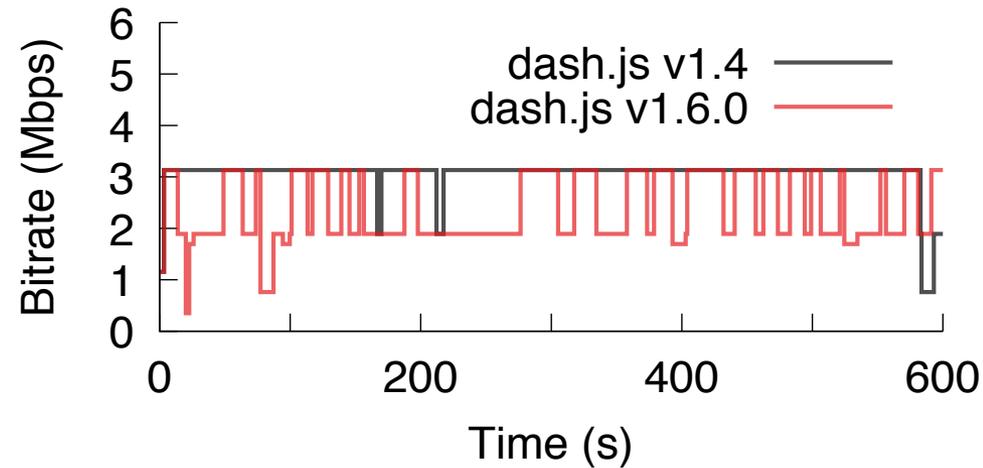
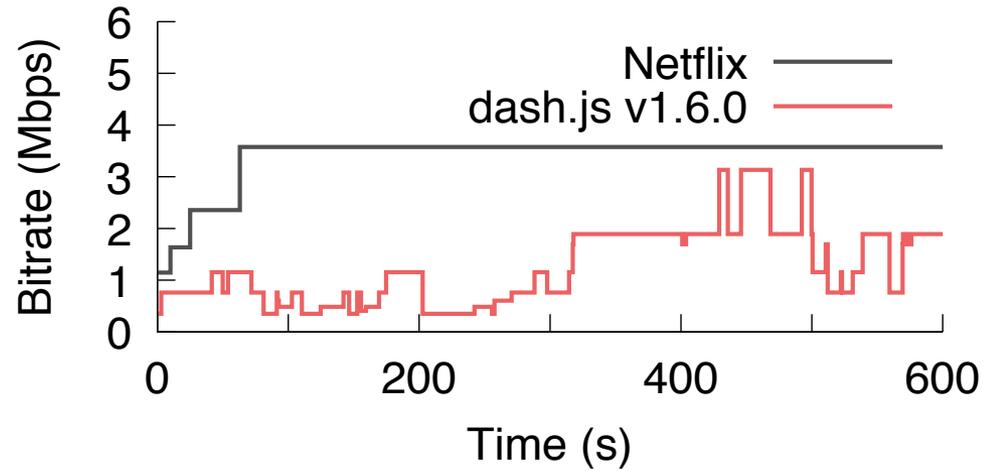
# A case for client interaction



# A case for client interaction



# 1: Flow-rate is unenforceable!



# What we probably want...

## 2: Session-rate Equality

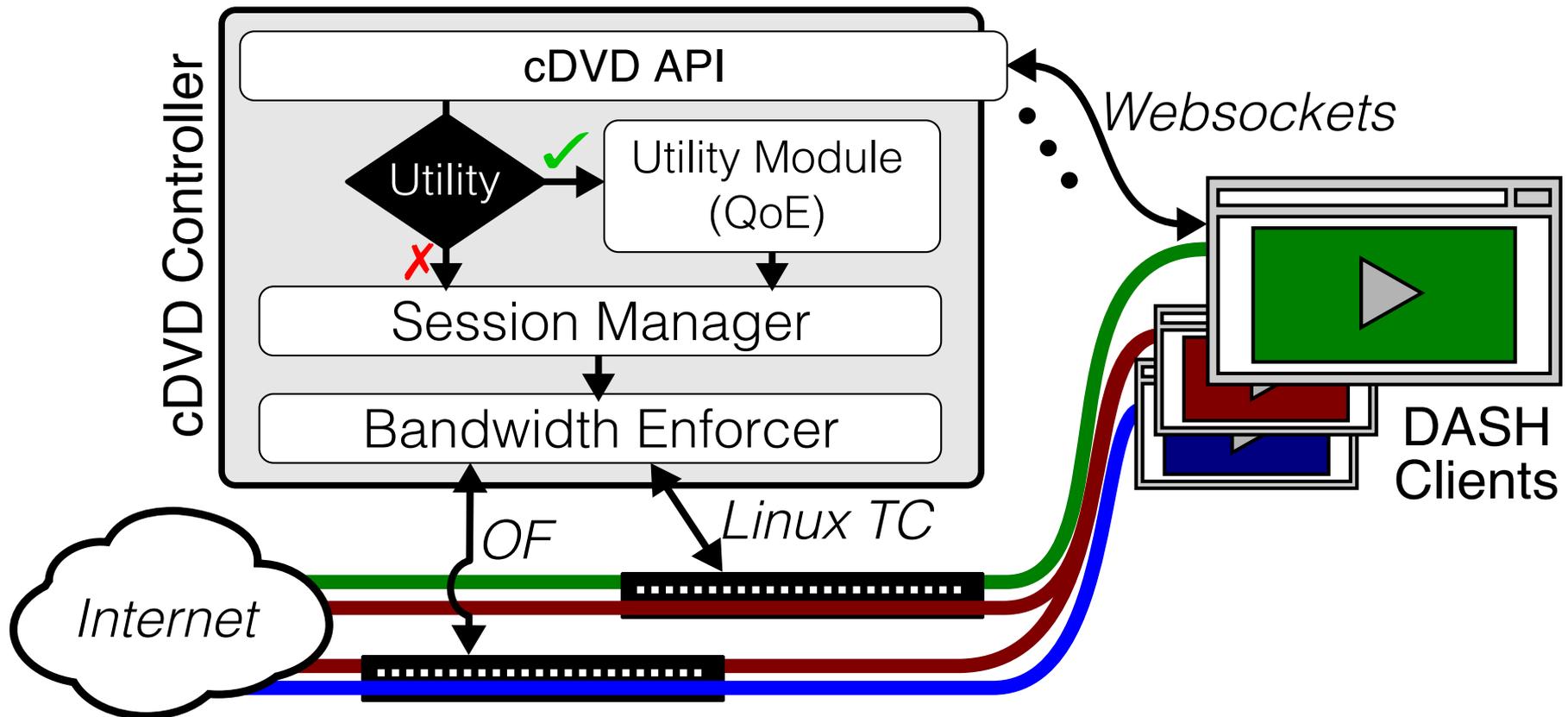
- TCP-fairness per client
- (Really just QoS)

## 3: Experience Equality

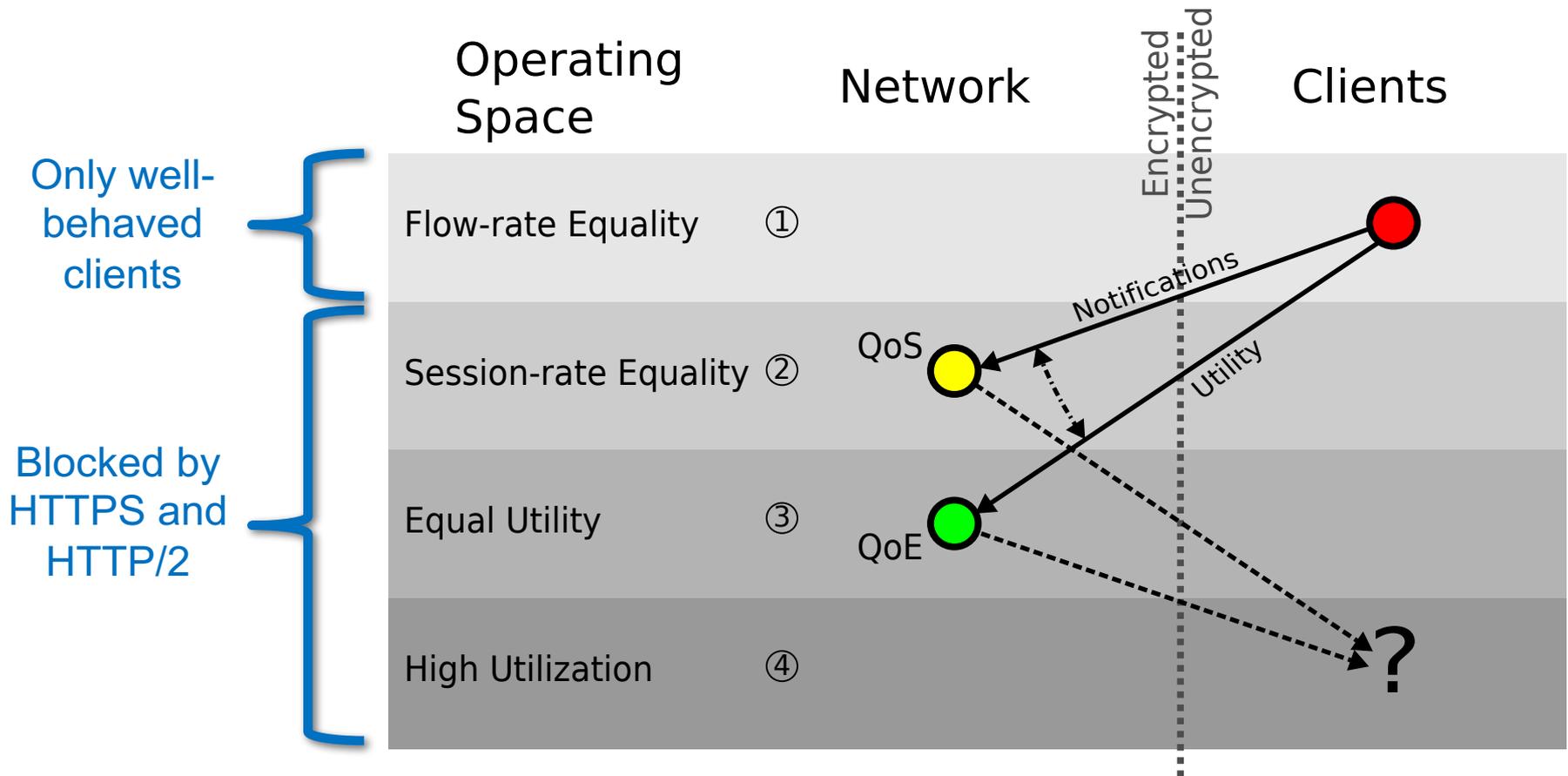
- 'QoE fairness'
- Equal utility

Both cases need a client-facing API

# From VHS (2015) to cDVD (2016)



# WIDE Open Questions!





# A Clearer Picture

