

On-demand video over Mobile Networks

Mark Watson

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Netflix facts

Exclusively on-demand subscription streaming

Global service (end of 2016)

> 30% peak US internet traffic (Sandvine)

Primarily DASH fragmented mp4, AVC and HEVC

Resolutions: < SD up to 4K

Bitrates: 100kbps - ~16Mbps

Proprietary HTTP adaptive streaming

Our own CDN (“Open Connect”)

The Netflix logo, consisting of the word "NETFLIX" in a bold, red, sans-serif font.

Mobile challenges

Data caps

Latency variation

Inconsistent throughput

MITM attacks

Edge caches

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Data caps

Surely a **business** issue ?

Data caps are for **rationing a scarce resource**

Price discrimination effect is marginal

This problem could have technical solutions too

Relies on users to ration themselves, which is hard

Service data usage is not transparent

Details users should not need to know

=> *Customer dissatisfaction*

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Data cap challenge

Resource allocation is a real-time problem

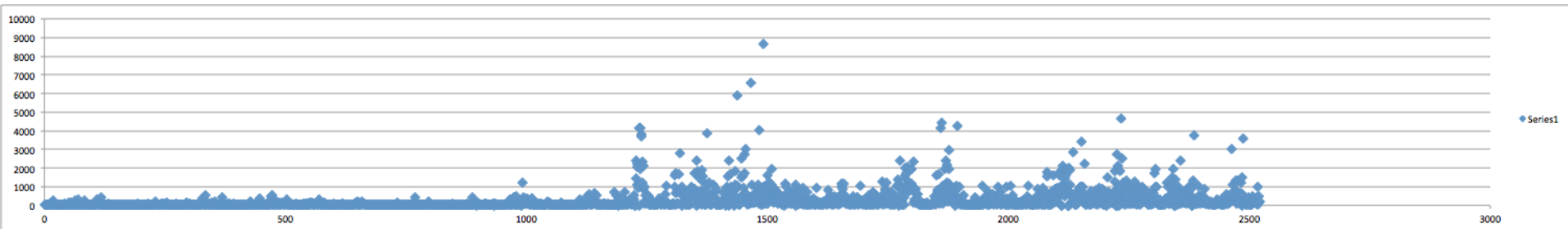
Find real-time resource allocation that
respects net neutrality
and
obviates the need for data caps

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Latency variation

Still an issue for cellular networks ?

Do we need specific TCP variants to cope with cellular latency variation ?



45 minute ping trace on US 280, Aug 2015

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Consistent throughput

For video, consistency in many conditions is more important than peak throughput in best conditions.

Adaptive streaming benefits from consistent averages over long periods (multiple seconds)

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MITM attacks

Deliberate or accidental traffic modification
Impossible to QA service in the presence of
such attacks

Likely to be less of a problem with HTTPS

Edge caches

On demand popularity follows a power law

CDNs for streaming rely on edge caches

Edge caches should be **close to the edge**

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