ABR Video Shaping

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Why do Some Access Networks Throttle Video?

- Bandwidth is a shared and limited resource.
  - Bandwidth on network paths that rely on RF spectrum are even more limited
- Video is becoming the dominant form of media on the Internet
  - Dedicated video platforms.
  - Social media platforms dominated by short-form videos aka “reels”.
- Despite continuous capacity investments it is hard to keep up with demand for data.

Where does this happen?

Satellite operators (geo stationary)

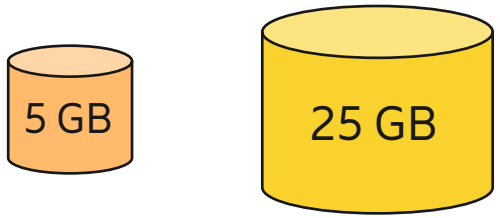
Cellular operators (large regional differences),

Few wireline operators.

Network Management Through Tiered Subscriptions

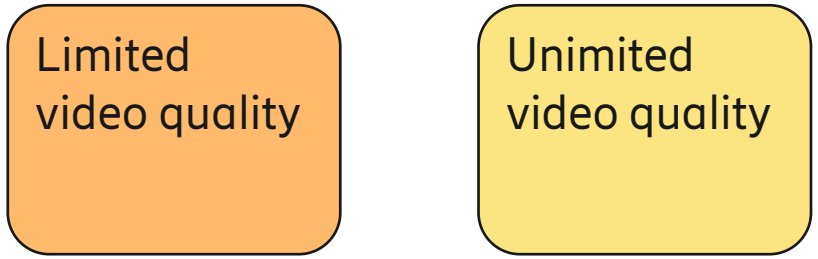
Data Cap

- Limited data buckets
- Pay more, get more data

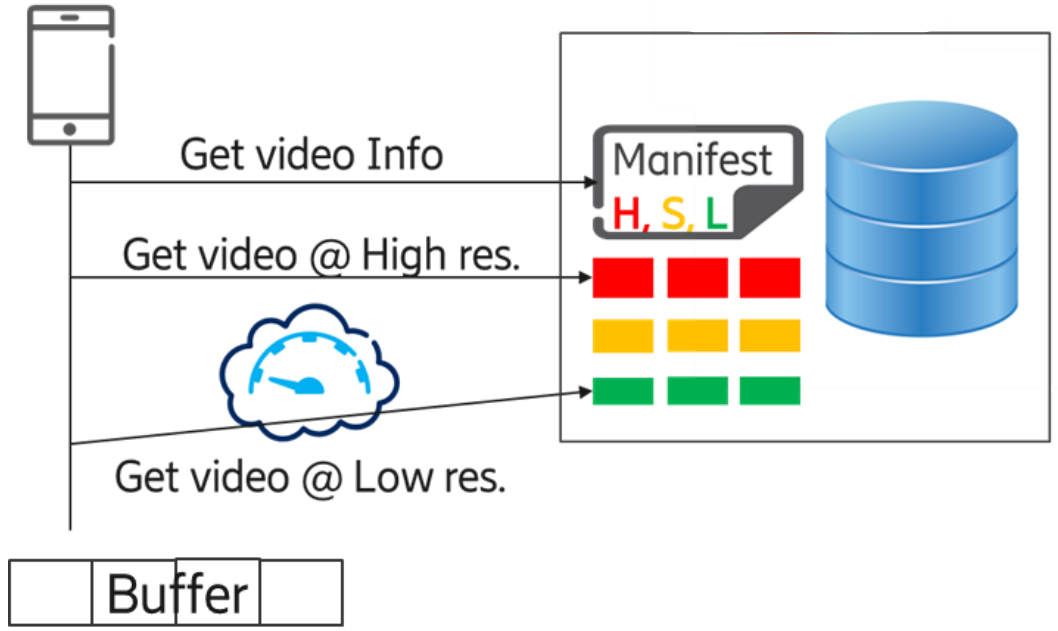


Bitrate Cap

- Unlimited data buckets
- Pay more, get higher resolution media content.

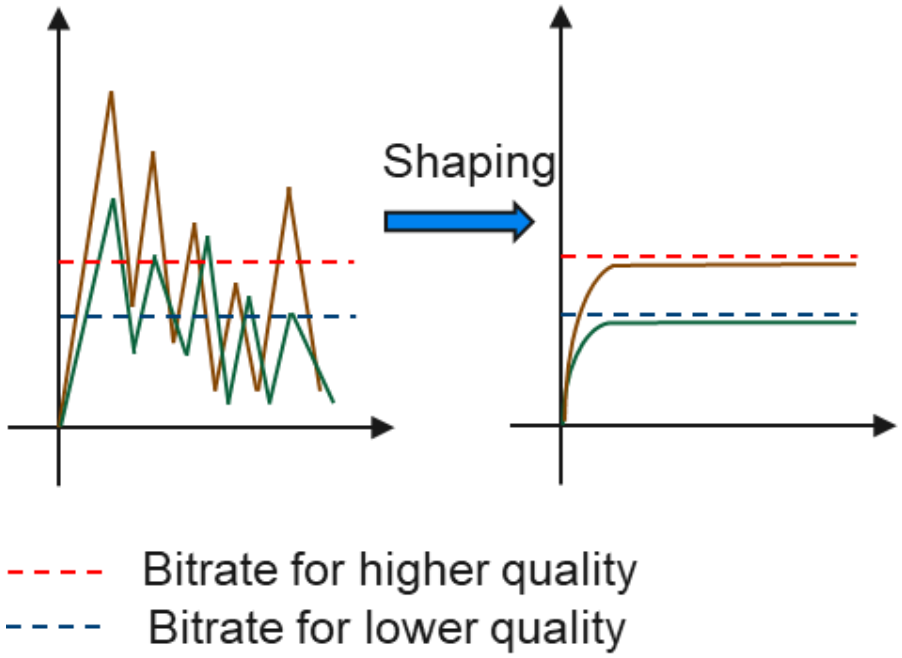


Adaptive Bitrate (ABR) Video



- Dynamic video resolution based on estimates and prediction of network capacity.
- Video divided into segments; each segment available in multiple resolutions and video qualities.
- Client selects resolution of next segment based on estimated network capacity and size of its playout buffer.

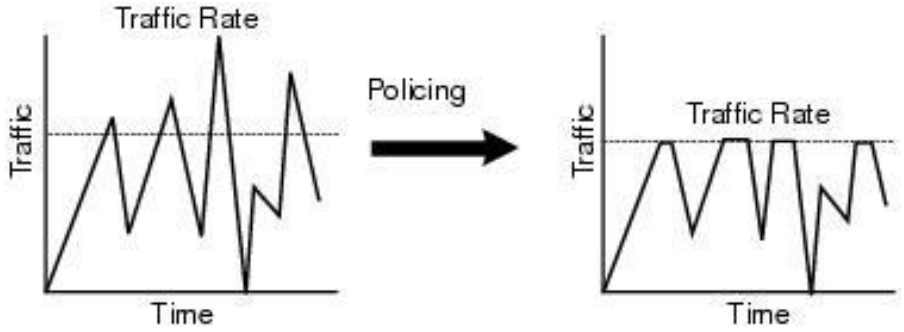
ABR Video Shaping



- Detect a video flow through deep packet inspection or heuristic methods.
  - Often implies trial decryption of QUIC Initial packets.
- Throttle the flow with a shaper or policer.
- Bitrate determined based on:
  - Subscription policy
  - Network state
- ABR client measures network capacity and fetches segments with restricted quality.

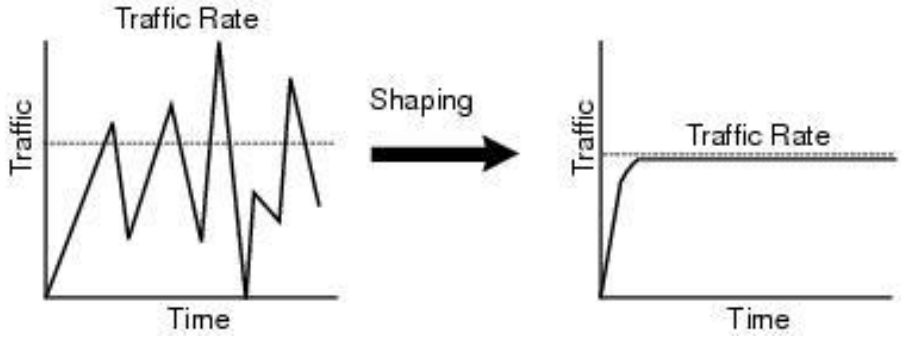
Policing and Shaping

A shaper or policer is an artificial bottleneck where out-of-policy packets are either dropped or buffered.



Packet loss in bursts at low RTTs.

Might allow traffic peaks – erratic and hard to predict loss patterns



Adds delay

Might allow traffic peaks – adds delay variation.

More costly due to buffering.

Issues with ABR Video Shaping

- Shapers and policers are designed to enforce a network policy.
  - User experience is not the primary objective.
- Tuning shapers and policers for video is difficult.
  - QoE impacts of tuning decisions are often not well known.
- Video detection is increasingly difficult as protocol fields gets increasingly encrypted.
  - Heuristic alternatives to DPI are fragile and error-prone.
- Different communication service providers work with different vendors
  - Each network behaves differently.
  - Applications builds heuristics to detect the presence and kind of shaping in networks.
  - Some networks work directly with application providers using proprietary mechanisms.

Is this as good as it gets?