PROCERA

Video Quality Management Guidebook

Strategies for traffic optimization

Video trends

Both mobile and fixed data networks are experiencing a rise in video traffic which already represents more than 50% of the traffic in many markets. Projections are that it will account for 85% of total traffic by 2017.

It is no secret that the growing popularity of services like Netflix have already had a big impact on networks. In Australia one operator's traffic increased to 25% of its total within 4 weeks of launch.
Source: mashable.com

Simultaneously there is a strong trend towards encrypting payload transfers. Big players including YouTube and Netflix are already moving in this direction, using SSL or encrypted files over HTTP to transport their data.

Because of encryption, detailed information on used codecs and resolutions are hidden and transcoding is no longer possible.

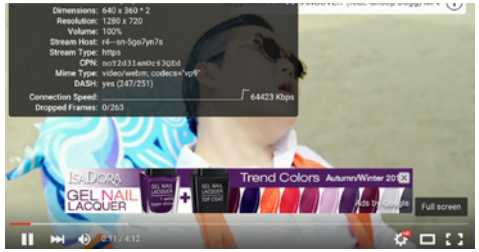
Video traffic behaviour

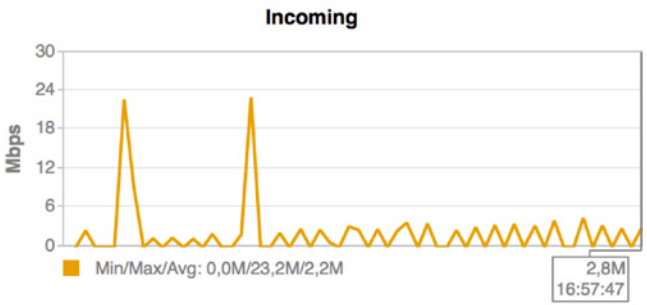
Due to the dynamic nature of video codecs, quality will automatic up/down scale resolution depending on the available bandwidth. Codecs will use the maximum download speed to build up a big buffer, or complete content, and discard it if subscriber stops watching early.

From content provider perspective it is preferable to download as much as possible as quickly as possible:

- Reducing risk of buffer under-run on client side
- Temporary network glitches go unnoticed
- Less overhead with fewer up/down scale resolution events
- The load on their servers – a low number of high-speed transfers is more efficient than a high number of low-speed transfers

An example from YouTube is shown here. You can clearly see bursts blocks of data. 1 minute of viewable content is loaded in 11 seconds using 64 Mbps for a video in 720p quality.





OPPORTUNITY TO MANAGE VIDEO TRAFFIC

There are great optimization opportunities:

High speed buffering waste

Many video services tend to buffer a large amount of data quickly. This data is wasted if the user stops viewing after a few seconds. Some services buffer 100% of the video while others buffer a fixed, smaller time interval such as 1 minute.

Congestion management

During times of network congestion it may benefit the overall subscriber experience if the resolution of streamed content is downgraded.

Adjust the video quality to the receiving device

The content provider will try to send the maximum quality possible to the devices. However, the difference between 1080p and 720p on a smart phone is not discernible to the naked eye; it makes little sense to utilize extra network capacity for this.

What does YouTube do?

"To give you the best viewing experience possible on your computer, YouTube adjusts the quality of your video stream from standard definition (such as 240p or 360p) to high definition (720p or 1080p), based on the speed of your Internet connection (bandwidth). This is why you may notice that the quality of your video changes as you watch videos."

Source: YouTube

YouTube automatically selects resolution based on initial burst speed.

Minimum Bandwidth	Resolution
700 Kbps	240p
1000 Kbps	360p
2000 Kbps	480p
4000 Kbps	720p
6000 Kbps	1080p

WHAT DO OTHER CONTENT PROVIDERS DO?

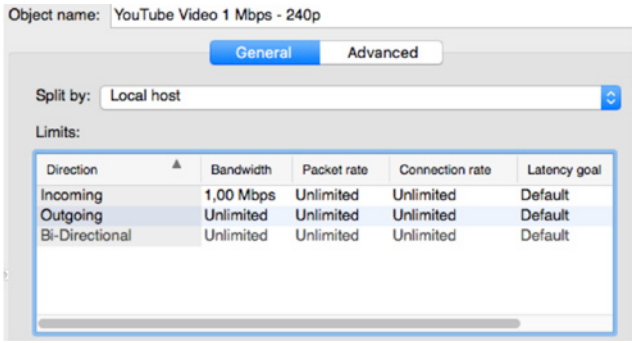
Service	Automatic up/down scale	Default to HD if available
YouTube	Yes	Yes
Vimeo	No	No
Netflix	Yes	Yes
BBC iPlayer	Yes	Yes
SVT Play	Yes	Yes
Pornhub	No	Yes
Xvideos	No	Yes
Facebook	No	No
Dailymotion	Yes	Yes

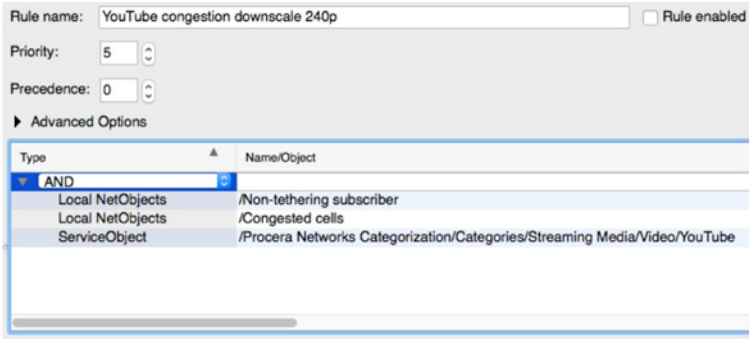
What can operators do?

Operators can use smart, per-subscriber shaping to manage the bandwidth used for OTT video services. They can applying a smart shaping policy on YouTube traffic to manage the bursts at the start of a viewing session. The magnitude of these bursts can be restricted, leading to automatic selecting of a lower resolution.

YouTube will only try to increase resolution if bursts result in high bandwidth. It is in the best interest of the video service provider to identify the available bandwidth and adjust their content bandwidth accordingly.

Today, most video services are very good at automatic adjustments.

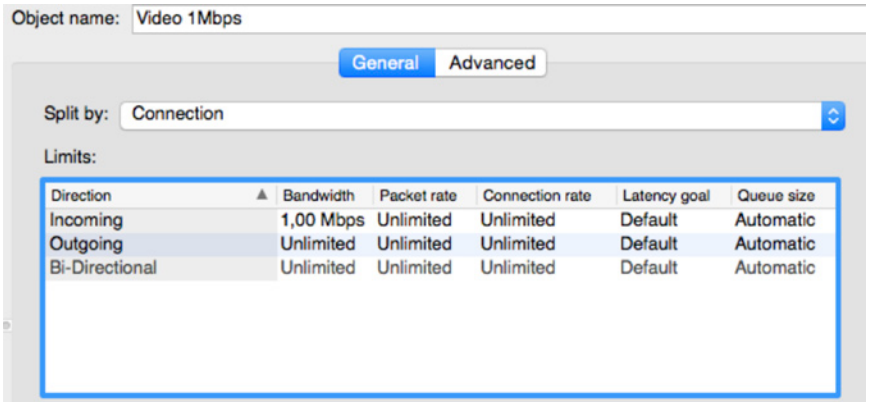




PER CONNECTION SHAPING VS. PER STREAM SHAPING

In some scenarios, multiple users share the same subscriber identity, for instance, in cases where tethering is enabled on the mobile device or fixed line connections with routers.
In these cases limiting the overall video traffic on a per subscriber-line basis may not provide optimal user experience if several users try to stream in parallel. For the best experience it is preferrable to give each video stream connection a specific bandwidth, so having two connections in parallel allocates twice the bandwidth.

This is available today by using “Split by Connection” shaping policies and can be combined with tethering detection. This works very well for single connection services such as YouTube, Vimeo, etc., but is naturally not recommended for services using multiple connections (including BitTorrent-based video-streaming services) as that session overall will not be shaped.



HOW ABOUT QUICK BUFFERING?

One theory is that providing higher speed during the first few seconds and/or MB of the video stream allows the video playback to start rapidly.

However, practical tests with YouTube show that this may have the opposite effect where YouTube automatically detects a higher available bandwidth which is later not sustainable. Buffering stalls then occur and YouTube subsequently switches to lower resolution in order to resume the video.

The best experience has been observed when shaping the full traffic from the first GET-request, allowing YouTube to automatically select the optimal video stream quickly. However, if needed, Procera still supports excluding the beginning of the connection from shaping by using the Virtual Services attributes “age” and “clientbytes”.

Congestion management

When congestion occurs, one mitigation strategy is to reduce the need for data. By downscaling the resolution with shaping, the need for data is reduced and congestion is eased.
If one reduced all subscribers to a video bandwidth equal to 720p or 360p (depending on congestion level) one would expect that instead of having stalled buffers on high definition streams, all subscribers would receive a lower resolution video stream with fewer buffer stalls as a result.

Automatic lower resolution videos are less likely to cause customer complaints and churn, compared to frequent buffer stalls.

CONGESTION DETECTION

Congestion most frequently occurs in the access radio network. To detect congestion accurately, a 3rd party feed of cell-congestion levels via file imports is the easiest method - if already available. Unfortunately this is not real-time and therefore does not produce the best results.

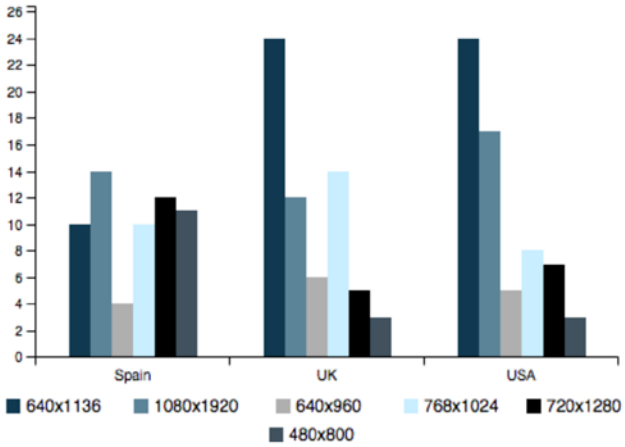
Instead, automatic detection based on RTT/packetloss levels/active subscribers close to real-time (5-15 second resolution) is possible with Procera Dynamic LiveView.

When congestion has been detected, video resolution downscaling should be enabled for a longer period of time to avoid ping-pong effects. Where congestion is relieved, video downscaling is disabled and congestion reoccurs.

Practical example of how it works: www.youtube.com/watch?v=E0m5QOdN9bM

Devices

2015 HANDSET RESOLUTION %



Today still a large portion of devices does not support native HD resolution. Video apps on low-res devices would normally not try to stream high-res content, but high speed buffering waste may still happen.

Procera Device Perspectives

The Device Perspectives add-on to the Procera solutions will Map the unique Mobile vendor TAC code and match this to a database to retrieve detailed device meta/data including vendor, model and resolution of the display. This database includes resolutions for ~20,000 different devices.

Normally a video service will not try to stream a resolution that is higher than its physical display resolution. However shaping the bandwidth to the resolution closest to the display resolution will minimize wasted buffers when closing the video early.

If neither width or height is bigger than 1080 then it's a device is not likely to request 1080p-video content and shaping the to a lower resolution is relatively safe.

Examples:

- iPhone 6+ (1080 x 1920) – shape Youtube to 7000 Kbps (1080p)
- iPhone 4 (960 x 640) – shape Youtube to 5000 Kbps (720p)
- Galaxy 3 (240 x 400) – shape Youtube to 1000 Kbps (240p)

Video Traffic Management Solution

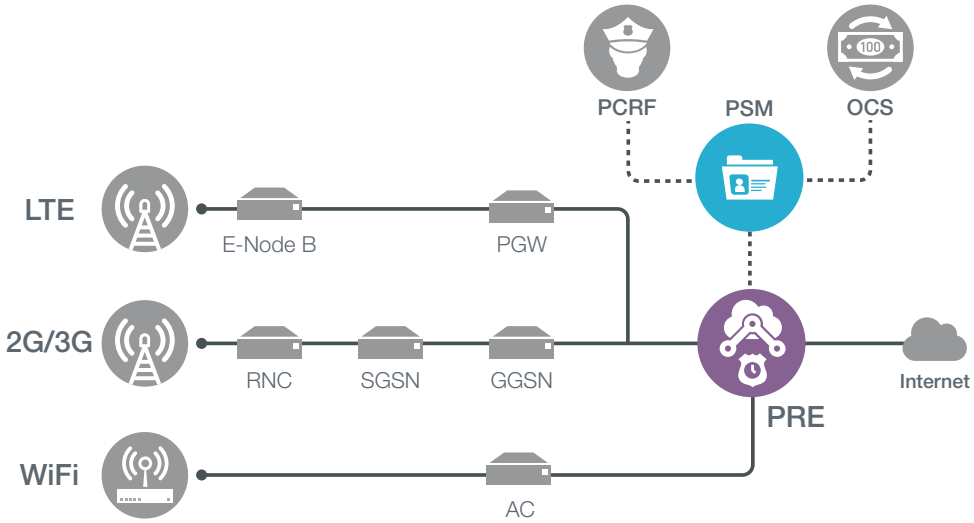
Procera's Traffic Management Solution based on the PacketLogic platform provides operators with the ability to take control of their video traffic.

The solution includes PacketLogic Rules Enforcement (PRE), deployed anywhere on the network. It utilizes the Datastream Recognition Definition Language (DRDL) signature database to identify applications, with weekly updates to keep unknown traffic at a minimum.

DRDL supports over 2500 signatures (Nov 2015) with over half of those signatures covering encrypted applications.

PRE links with PacketLogic Subscriber Manager (PSM) to handle subscriber or device specific rules and can be integrated with 3GPP compliant Policy and Charging Rule Function (PCRF) and Online Charging Systems (OCS) to enable monetization.

Traffic management solutions are offered on hardware platforms scaling from 5Gbps to 600Gbps throughput, supporting many millions of subscribers. PacketLogic/V is available for virtualized deployments and runs on Commercial Off-The-Shelf (COTS) hardware, using Intel processors and can run on VMware or KVM hypervisors.



ABOUT PROCERA NETWORKS

Procera Networks, the global Subscriber Experience company, is revolutionizing the way operators and vendors monitor, manage and monetize their network traffic. Elevate your business value and improve customer experience with Procera's sophisticated intelligence solutions. For more information, visit proceranetworks.com or follow Procera on Twitter at @ProceraNetworks.

PROCERA

CORPORATE OFFICES
Procera Networks, Inc.
47448 Fremont Blvd Fremont,
CA 94538
P. +1 510.230.2777
F. +1 510.656.1355

CORPORATE OFFICES
Procera Networks
Birger Svenssons
Väg 28D 432 40 Varberg, Sweden
P. +46 (0)340.48 38 00
F. +46 (0)340.48 38 28

ASIA/PACIFIC HEADQUARTERS
Unit B-02-11, Gateway Corporate Suite,
Gateway Kiaramas
No. 1, Jalan Desa Kiara,
Mont Kiara 50480 Kuala Lumpur,
Malaysia