LightFlow
by epic labs

LightFlow Quality Index

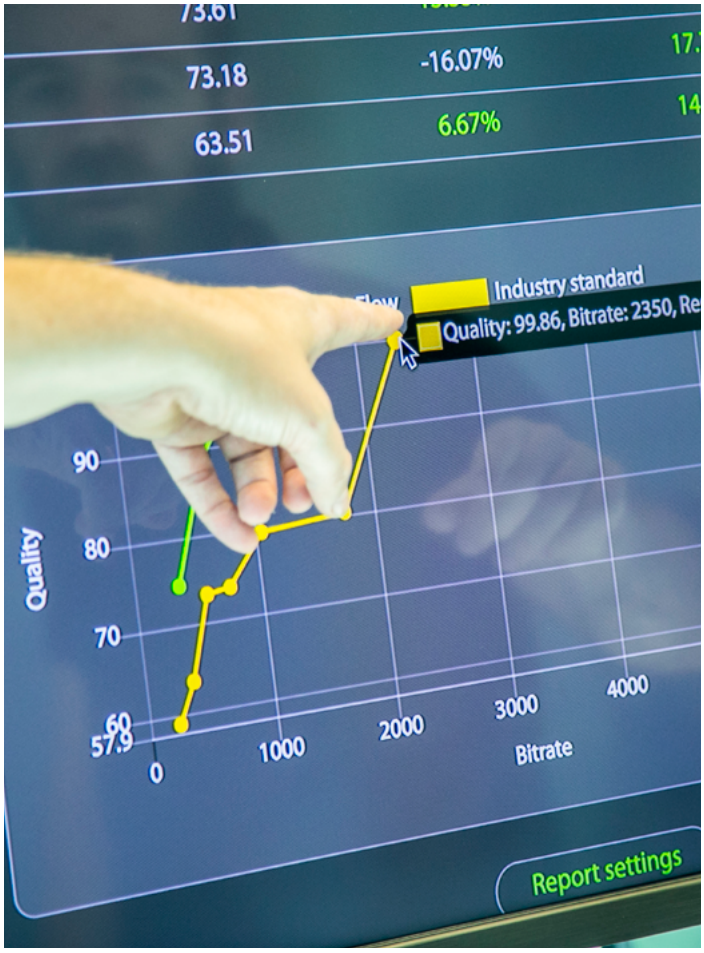
Year after year, distributed video over the internet is increasing dramatically. We can see how OTT platforms are growing their share in a ramp-up without limits, in contrast to the most traditional television channels of the broadcast environment. However, the challenge is that, as opposed to cable or traditional TV broadcasted through a dedicated network, OTT content is delivered over the Internet, which was never designed for massive delivery, as growing audience requires.

OTT vs RF

In the beginning, online video publishers and players used to pay less attention to quality, but today it is something that has completely shifted. If the content is king there' s no doubt that quality of experience is queen. For this reason, every bit of data in a stream is gold. One hand, a few more bytes while encoding a video signal may be the difference between a crisp image and something blurry, but on the other hand, delivering more information over the Internet may compromise network conditions or the playback jobs so it can be the difference between a smooth experience and a disaster.

Ultimately, every effort should be focused on video quality, since at the end of the day, the viewer's quality of experience will determine the success of every initiative.

For this reason, each unit of data, no matter how small, must be efficiently used with the aim of enhancing the viewers' experience, both in perceived video quality and in the playback. To do this, it is essential to identify the most effective bitrate/resolution ratios for each content, and also the best way to encode/transcode it.



Stream Optimization

The most common method for stream optimization process is performing many encoding jobs of a single video and then selecting the most appropriate for its distribution after testing the resulting quality of them all. This is an extremely inefficient way to work in terms of costs and resources, which requires a great computational capability and of course, a lot of time. Once this is finished, is necessary to choose a broad set of renditions in order to fill all necessary cases. Additionally, this task must be repeated for every individual video asset increasing the workload and inefficiencies. Alternatively, the resulting set of renditions can be taken as a valid for every additional video asset, which is far from optimal, since each video behaves differently

LightFlow provides the best settings for each individual stream of video with no need to encode it and test it out. The results and the decisions made are based on a video analysis at a previous stage to the encoding, which predicts the behavior of that particular content at different bitrate and resolution configurations.

Using Machine Learning techniques and leveraging our expertise on video encoding and delivering over the Internet, LightFlow is capable of automating the same exact job than a quality for encoding professional expert would do.

This operation is performed by LightFlow at very high speed. One hour of content is analyzed in about a minute, namely, 1.7% of the video length. Finally, LightFlow creates a set of renditions, ABR ladders and some specific encoding parameters per each content, in an aim to maximize video quality perception while reducing bitrate, based on the content itself.

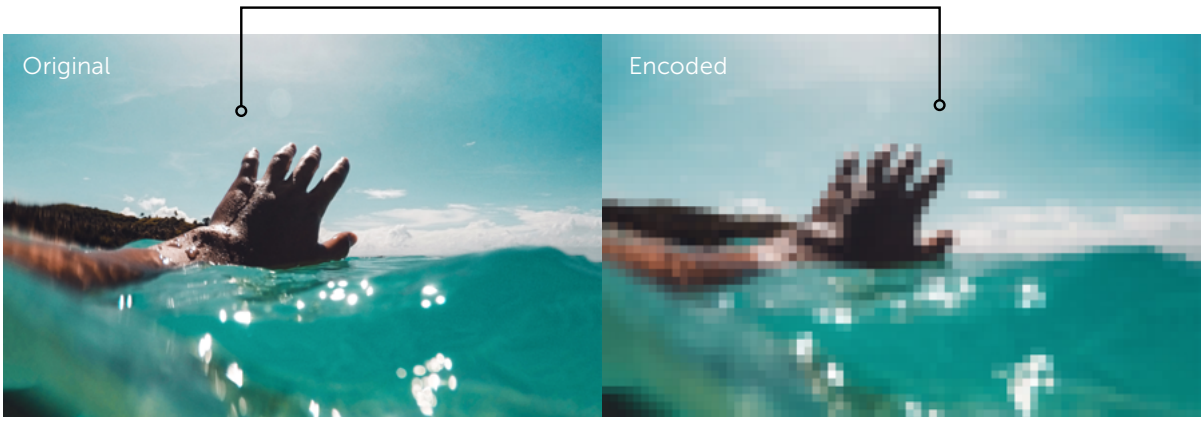
LQI - Measuring encoding quality.

LQI is a predictive measure of quality that is based in artificial intelligence. The underlaying algorithm has been trained with millions of hours of video encoded with variable parameters. LQI evaluates a video stream overall QoE performance, considering quality and playback.

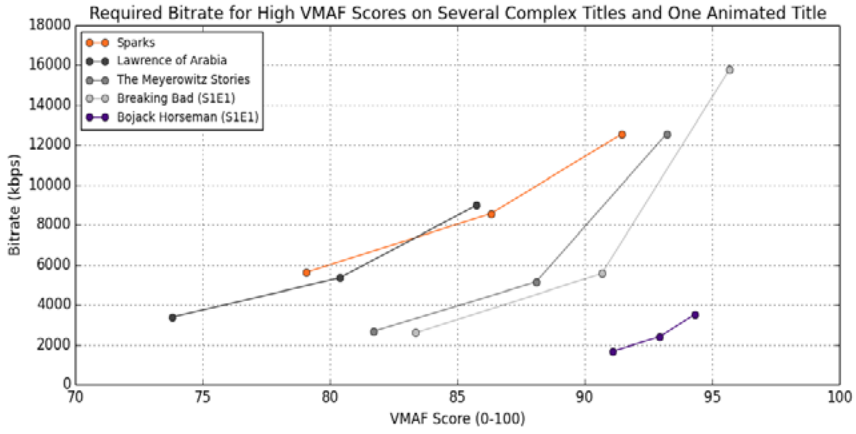
LQI differs from other commonly used quality metrics. PSNR and SSIM basically compare differences between the original and the encoded video, through arithmetic pixel-to-pixel calculations. Therefore they don't factor in human perception. Netflix's VMAF improves those metrics by introducing real viewers' opinion about perception, albeit it incurs in significant time and computing costs. In every case, the three algorithms require both, the original and the encoded video.

On the contrary, LQI takes a different approach. Since LQI is based on machine learning, it does not require the set of encoded output streams to perform its measurements. Therefore, the encoding tasks are not part of the evaluation process, saving precious time and computing resources. LightFlow quickly analyzes a video before it is encoded and predicts what will the perceptual quality be with different combinations of bitrates, screen resolutions and specific encoding parameters. In such way, LQI accurately predicts, for each individual video, the perceived quality by a viewer when she plays it. Not only the efficiencies are obtained in terms of saving computing time upfront but also, based on LQI results, only the optimal renditions will be finally encoded.

Vmaf, PSNR and SSIM compare both assets once encoded.

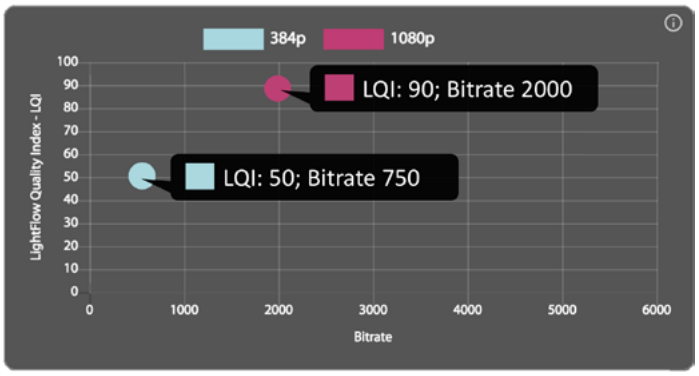


NETFLIX



LightFlow analyzes content without the need of encoding, using machine learning techniques to get the results.

The artificial intelligence is founded in this principle: to take the correct decisions on the basis of past experiences. LightFlow's neuronal network has been trained using millions of hours of video balancing different genres, types of footage and encoding settings as independent variables, and using metrics of quality (including, among others, a combination of VMAF, SSIM and PSNR) as dependent variables.



LQI: provides a metric (0-100) to evaluate video QoE from viewer perspective.

As a result of all this learning process, once a video is analyzed, LightFlow gives to each rendition an LQI score from 0 until 100, being the latter the best possible quality of the encoded video, that is, that the perceived quality is the same as the original and the playback is optimum. It is important to note that LQI is specific for each maximum resolution. I.e. while a rendition of 1080p / 4.000 Mbps may score LQI=100 for a Standard HD (where maximum resolution is 1080p) the same rendition could score LQI=79 if the content is 4K (where maximum resolution is 2160p).

1. Hundreds of thousands of hours of diverse video footage analyzed

2. Artificial Intelligence engine infers enconding vs. quality behavior

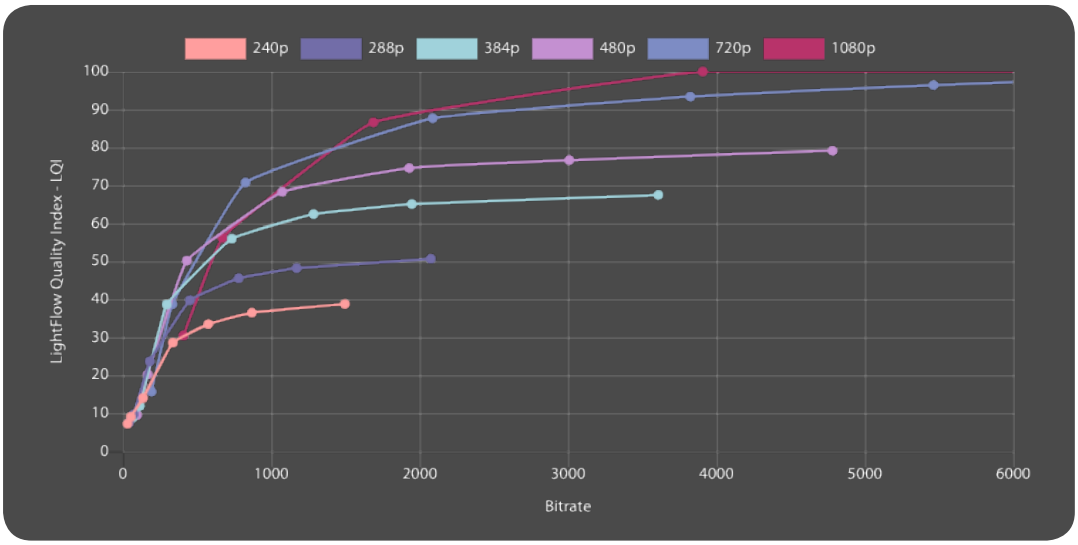
3. Neuronal Network associates each video with its optimal encoding parameters

Note that LQI measures the differences between the original and the encoded video, so if the quality in the original is mediocre, then the encoded video will also have a poor quality as it will also be identical to the original if it scores an LQI of 100.

LightFlow encoding decisions are taken based on LQI score and the bitrate needed to obtain such LQI. In other words, if a rendition "n" at 1080p / 3Mbps provides LQI=98, and the rendition "n+1" at 1080p / 6Mbps provides LQI=100, LightFlow will wisely decide to suggest the rendition "n", since the Δ in quality is virtually unappreciable while the delivery savings are as large as 50%

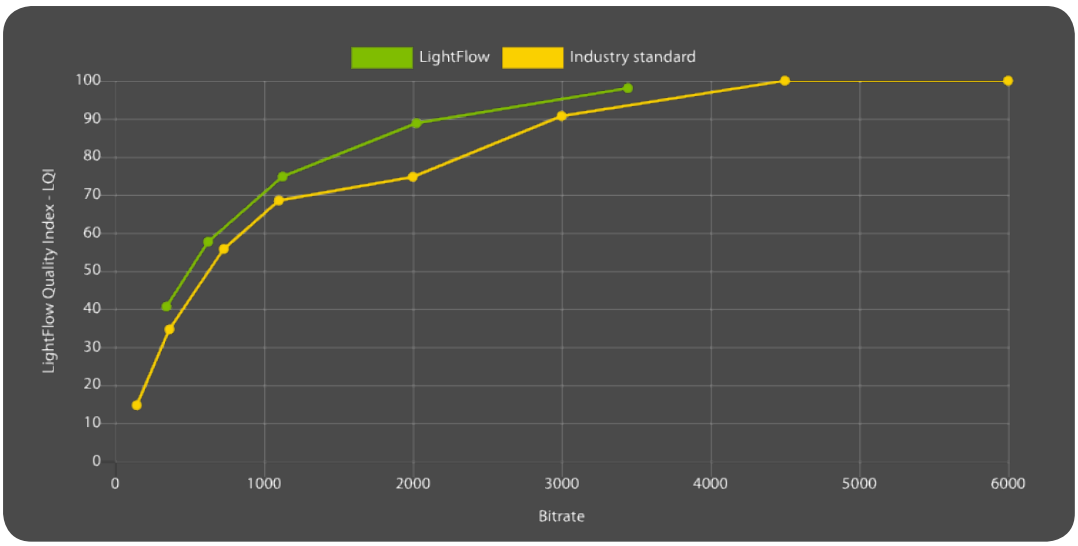
The Metrics

Every time LightFlow performs an analysis for one video it creates two charts (accesible from the dashboard in **https://lightflow.media**). The first one is the result of an analysis of a particular content and its behaviour in several resolutions. The chart below represents, a bitrate/quality convex hull that shows how LQI evolves with bitrate. LighFlow uses these curves to decide which the optimal bitrate/resolution combinations are.



The second chart created by LightFlow sets a head-to-head comparison between the accepted industry standard renditions (in yellow) and the optimized renditions recommended by LightFlow (in green). It is important to note that not only LightFlow provides efficiency gains by recommending smarter renditions but it also generates a lower number of renditions

Both have LQI on the Y-axis and Bitrate on the X-axis.



A rendition ladder enables a video publisher to optimize the quantity of bits it takes to to stream a video with the least perceptible change in quality. In the image above, we can see how higher bitrates do not necessarily represent a perceptual increase in quality. LightFlow will choose the highest quality at the lowest possible bitrate.

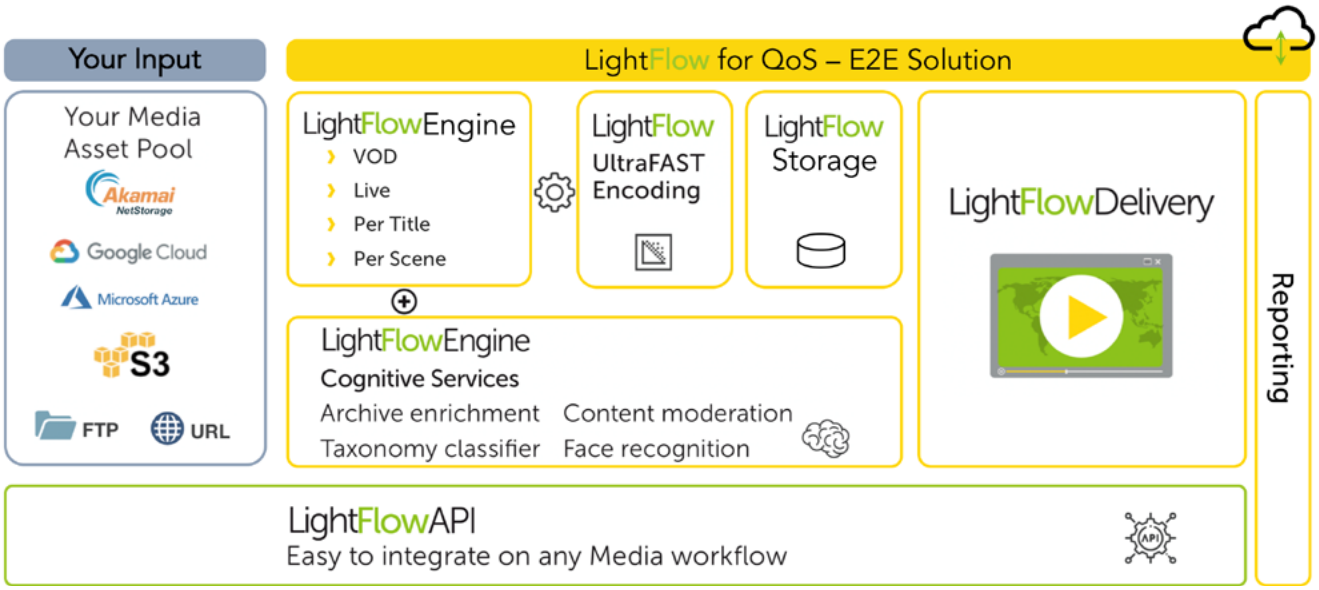
For the specific content showed above, the Industry Standard recommends 8 renditions, the highest one reaching 6 Mbps. LightFlow recommendations is limited to just 5 renditions –with its derived storage savings–, where the highest one peaks in 3.5 Mbps, providing significant delivery savings for every target quality.

It's LightFlow an encoder?

The answer is no. The analysis described in this paper operates in one step before encoding. Therefore, the smart encoding parameters recommended by LightFlow may be used to instruct client's preferred commercial encoder governing its encoding process.

LightFlow's API-based architecture allows clients to seamlessly integrate it with their workflow, regardless of the chosen deployment model. Ultimately, the existing media workflow will remain unaffected with the only addition of the stream optimizer component.

Alternatively. LightFlow can be deployed as an out-of-the-box end to end solution. If this is the case, the different components will interoperate as the diagram below shows.



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