

Beamr Video Usage Guidelines

Scope

This document provides guidelines for the usage of the Beamr Video perceptual optimizer. Users are encouraged to read the Beamr Video User Manual in depth before referring to this document. Usage instructions are also available in the software by issuing the command:

```
beamrvideo --help
```

For any additional questions or clarifications, please email support@beamrvideo.com.

Technology Overview

Beamr Video is a patent-pending perceptual video optimizer, which reduces the bitrate of video streams without affecting their perceptual quality. The Beamr Video algorithms imitate the perceptual qualities of the human visual system, ensuring that the video stream is compressed to the maximum extent possible by removing redundancies, without creating any visual artifacts in the process. The optimizer controls standard H.264 video encoders, whose outputs are fully compatible with any media player or consumer device that supports the H.264 video codec. Beamr Video comes pre-installed with the H.264/AVC reference (JM) encoder, and other video encoders can be plugged into the Beamr Video environment as well.

Recommended Input Formats

Beamr Video supports both MP4 and MOV containers, with H.264 video streams, and AAC or AC-3 audio streams. Beamr Video also supports the elementary stream input formats H264, 264, AVC and BSF, and for these input formats it outputs an elementary stream in the H264 format. Additional formats may work with Beamr Video, but are not officially supported. Note that Beamr Video will process only the first video track and preserve only the first audio track from the input file. Also note that Beamr Video only supports progressive video and not interlaced video.

Input Stream Quality

Beamr Video generates the highest optimization ratios for high-quality video streams, such as those captured by video cameras or originating from Blu-ray discs. Using Beamr Video on lower quality streams typically results in lower optimization ratios. If Beamr Video detects that the quality of the input video stream is very low, and it cannot be further optimized without degrading visual quality, the input file will be copied to the output.

The table below summarizes the typical bitrate reduction ratios achieved by Beamr Video for various types of content.

Content Source	Bitrate reduction
BluRay Discs	50 - 75%
Consumer video cameras	50 - 70%
Video Download services	40 - 50%
Video Streaming services	20 - 40%

Balancing Bitrate, Performance and Quality

Beamr Video provides two flags that enable users to control the tradeoff between performance, output bitrate and quality.

The `--quality` flag controls the tradeoff between quality and bitrate. `--quality best` provides the best output video quality possible, resulting in output streams that are perceptually identical to the input video stream, even when viewed by an expert viewer. `--quality high` produces streams with a lower bitrate than `--quality best`, which are perceptually identical to the input video streams when viewed by an average user. The performance requirements of `--quality best` are slightly higher than `--quality high`.

When evaluating Beamr Video, it is recommended to try both quality modes. Typically, providers of streaming content use the `--quality high` flag, while movie studios and post-production companies use the `--quality best` flag.

The `--optimize` flag controls the tradeoff between performance and bitrate, and does not affect the quality of the output video. `--optimize bitrate` generates a video stream with the lowest possible bitrate, at the expense of higher CPU consumption, while `--optimize speed` optimizes the processing for highest performance (lowest processing time), at the expense of increasing bitrate. `--optimize balanced` provides a balance between low bitrate and high performance: Performance will be better than when using the `--optimize bitrate` setting, and bitrate will be lower than when using the `--optimize speed` setting. Usage of this flag depends on the use case: For one-time processing of popular content, or where processing time is not an issue, the `--optimize bitrate` can be used to provide the lowest bitrate possible. Customers with higher volume or tighter constraints on performance should use the `--optimize speed` or `--optimize balanced` settings.

If you combine `--optimize bitrate` with `--quality high`, you will get the lowest bitrate (= highest optimization gain) that Beamr Video can provide.

Optimizing Streaming Content

While Beamr Video cannot guarantee a specific output bitrate, it can still be very useful for optimizing streaming content. Reducing the bitrate of streaming content enables lowering the storage and delivery costs for the content providers, and provides a better experience for the end users. Alternatively, streaming content can be encoded in a higher bitrate than the target streaming bitrate, and then optimized with Beamr Video.

Many providers encode each content item into a set of bitrates and resolutions, and then

use Adaptive Bitrate (ABR) streaming techniques to select the most suitable version of the stream for each client based on available bandwidth and client capabilities. Beamr Video can accept this set of streams and optimize each one to the lowest bitrate possible, providing significant savings in the overall streaming experience.

Beamr Video places IDR frames in the output video stream in all locations that have IDR frames in the input video stream. This feature ensures that multi-bitrate ABR source streams that have synchronized IDRs to enable stream switching will remain synchronized after Beamr Video processing. Beamr Video also preserves the H.264 profile and level of the input stream, and the maximum number of consecutive B-frames. This ensures that playback devices compatible with the original stream will also be able to play back the Beamr Video optimized stream.

Processing Multiple Video Files

To speed up the optimization of your video files, you may want to process several of them at the same time, depending on the capabilities of your hardware. We recommend using a single core and 3 GB of RAM for each running instance of Beamr Video. To run several instances at the same time, you can use the Linux `dtach` command, for example:

```
dtach -c /tmp/1 beamrvideo --input /opt/beamrvideo/samples/sample.mov
```

This creates an instance of Beamr Video that is detached from the terminal you are working with, and assigns its output to `/tmp/1`. After issuing the command, you can press `]` to return to the terminal and run another instance of Beamr Video or perform some other tasks. To view the output of the detached instance use the `dtach -a` command. The following command will show the output of the Beamr Video instance that was detached using the previous `dtach -c` command:

```
dtach -a /tmp/1
```

If the Beamr Video instance has already completed processing, `dtach -a` will return an error "No such file or directory".

Note that Beamr Video limits the number of concurrent instances that are running on each server to the number of licenses that have been activated on that server.

Processing a Single File on Multiple Cores

Another way to speed up the optimization of video files is processing a single input file using multiple instances of `beamrvideo` that run on multiple cores in parallel. Processing a file on multiple cores in parallel involves dividing the file into multiple segments, processing several segments in parallel on different cores, and finally "stitching" the processed segments into the output file. Multi-core processing using `beamrvideo` is done using the `beamrvideo_mc` or `beamrvideo_mgr` commands. For details, see the "Multi-core Processing" section in the

Beamr Video User Manual.

Evaluating Beamr Video Output

When evaluating the optimized Beamr Video streams, they should be compared to the input video streams side-by-side, displayed at their native resolution (100% zoom), where each pixel in the video stream corresponds to a pixel on the screen. Evaluation should be performed at normal distance from a computer screen or a TV screen, by a group of individuals who have been screened for corrected vision and color vision. The best method of evaluation is performing a blind test, where viewers are shown two unmarked video streams, and are asked to determine which one of them has lower perceptual quality.

Support

If you have any questions about Beamr Video technology or the Beamr Video encoder, please contact support@beamrvideo.com.