

```
# Function to get Multiplier value
sub getMultiplierValue
{
  my $complexityValue = $_[0];
  if ($complexityValue >= 7000) { return 1.5; }
  if ($complexityValue >= 5000) { return 1.25; }
  if ($complexityValue >= 4000) { return 1.00; }
  if ($complexityValue >= 3500) { return 0.9; }
  if ($complexityValue >= 3000) { return 0.8; }
  if ($complexityValue >= 2500) { return 0.7; }
  if ($complexityValue >= 2000) { return 0.6; }
  return 0.5;
}
```

Save Bandwidth and Improve Viewer Quality of Experience with Source Adaptive Bitrate Ladders

In Brief:

Product: Cambria FTC Encoder
Feature: Source Adaptive Bitrate Ladder

Description: Adjusts data rates of encoding ladders to match encoding complexity

Works with: HLS and DASH templates

What is it?

Source Adaptive Bitrate Ladder (SABL) is a Cambria FTC feature that adjusts the data rate of the clip according to its encoding complexity. By using SABL, Cambria encodes easy-to-compress clips, like talking heads, at a lower data rate than high-motion videos, like action movies. Since the data rate is customized for all clips, quality is maintained irrespective of content.

How Does It Work?

When enabled, Cambria runs a fast constant rate factor (CRF) encode of the file to gauge encoding complexity. Briefly, CRF is an encoding technique that lets you select the desired quality level rather than a data rate. While encoding with CRF, x264 adjusts the data rate to deliver the selected CRF quality level. In this fashion, the data rate produced during the CRF encode is a measure of the encoding complexity of the file; the higher the data rate, the harder the file is to encode; and vice versa.

Cambria takes that result and adjusts your encoding ladder up or down based upon a script that you create (or modify from one included with Cambria), like the one shown in the figure above. With this script, if the data rate of the CRF-encoded file result was 7000 or higher, Cambria would boost the data rate of each step in your encoding ladder by 1.5x. If the data rate was 2000 or lower, it would adjust the data rate downwards to 60%.

Title	SABL Data Rate	Bandwidth Reduction	PSNR Original	PSNR - SABL	Quality Reduction
Elektra Movie (2 min clip)	3,870	-10.00%	42.10	41.96	-0.34%
El Ultimo Movie (5 min)	2,150	-50.00%	47.10	45.23	-3.98%
Freedom	5,375	25.00%	40.42	41.29	2.15%
Iron Man Cartoon (2 min)	3,010	-30.00%	44.78	42.45	-5.19%
New Clip	3,870	-10.00%	41.63	41.31	-0.78%
Screencam	2,150	-50.00%	52.70	47.52	-9.84%
Talking Head	2,150	-50.00%	44.69	43.45	-2.78%
Tutorial	2,150	-50.00%	53.78	50.73	-5.67%
Zoolander movie (2 min)	5,375	25.00%	37.58	38.42	2.23%
Tears of Steel	3,870	-10.00%	40.66	40.21	-1.12%

Technical Details

Let’s explore SABL’s effectiveness. The table above is from Streaming Media Magazine’s Cambria review and shows the 1080p output for ten files encoded with SABL. The original target data rate in all cases was 4.5 Mbps. SABL data rate shows the actual output data rate, and the bandwidth reduction is percentage savings for each file.

PSNR is a benchmark used to gauge video quality, and the table shows both the original PSNR produced at 4.5 Mbps and the PSNR value after encoding with SABL. Note that PSNR values in excess of 45 decibels (dB) are seldom noticeable by the viewer, so if SABL pushed PSNR values beyond 45 dB, the extra bandwidth would not be worthwhile.

On the other side of the quality spectrum, PSNR values below 35 dB often predict the presence of visible artifacts. So, if SABL produced PSNR scores close to or below 35 dB, it would be concerning.

Looking at the table, the results are all positive. For example, with the cartoon El Ultimo, Cambria dropped the data rate by 50% while keeping the PSNR at 45.24 dB, and achieved similar results with the Screencam and Tutorial clips.

In the two clips where Cambria increased the data rate, the music video “Freedom” and the short Zoolander clip, the increase didn’t push the data rate beyond 45 dB.

Technical Summary

SABL assesses the encoding complexity of clips and adjusts the data rate up or down as needed. In these tests, SABL never reduced the data rate to a level that would produce artifacts, and never increased the data rate to a level that wouldn’t be perceivable by the viewer.

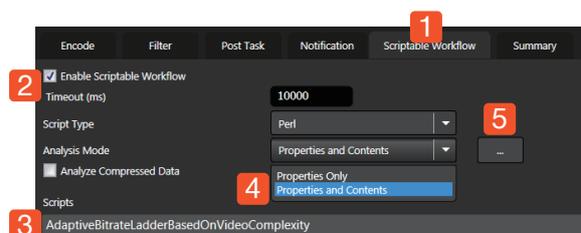
SABL and Encoding Time

The CRF encodes take extra time, though this will depend on the length and resolution of the clip, the power of your computer and other factors.

Working with SABL

Here’s an overview. SABL is implemented via a scriptable workflow in the Cambria FTC encoder. Capella supplies sample scripts in the Scripts folder in the Documents library installed with Cambria, including the AdaptiveBitrateLadder script shown in the Figure on page 3 (labeled with the number 3).

The scripts are written in Perl, but you don’t need to be a programmer to use or edit them. Once you load the script, you can make and save simple edits in the Cambria interface. Here’s the procedure for loading and implementing the script.



1. Click the Scriptable Workflow tab in the Preset Editor.
2. Click the Enable Scriptable Workflow checkbox.

3. On the bottom of the Scriptable Workflow tab, you'll see a plus sign. Click that, press the Load button, and navigate to the Scripts folder in the Capella\Cambria folders which should be in your Documents folder. Choose and load the AdaptiveBitrate script, and click OK to close the dialog.

4. In the Properties and Contents drop down list box, choose Properties and Contents.

5. Click the Ellipsis menu to the right of the Properties and Contents list box to open the Script Contents Analysis dialog, shown on the right. You shouldn't have to adjust anything here, but make sure Peak Complexity is checked. Note the two duration values, which you'll learn more about in a moment.

Click OK to close the dialog and run your encodes as normal.

Common SABL Options

Most users adjust two settings. First are the duration settings shown in the Duration field. By default, SABL measures complexity over windows of 10 and 30 seconds, using the 30-second value to adjust the encoding ladder, so a single hard-to-encode sequence of 30 seconds can impact the data rate of the entire clip. A more aggressive approach would be to lengthen this to 60 seconds.

Some users also change the impact of the measurement on the encoding ladder, for example adding the top two rungs shown on page 1 that increased the data rate when values exceeded 5,000.

To adjust the duration, you'll have to change both the script and the dialog above. To change the impact on the encoding ladder, you'll adjust the script itself.

You can edit the script within Cambria by selecting it in the Scriptable Workflow tab (number 3 above) and clicking Edit on the bottom of the window.

For more extensive script modifications, you can download the Scriptable Workflow Guide from http://bit.ly/SABL_docs. You can also contact your support representative for guidance or support.

