STREAMING
LEARNING CENTER

CASE STUDY

Streaming Workflow Assessment for a Regional Streaming Service

A confidential engagement involving codec optimization, packaging architecture, DRM workflows, and codec licensing strategy.

Executive Summary

A regional SVOD service was running four codec ladders developed over several years. Top rung quality varied by nearly five VMAF points depending on which stream the viewer watched. Their highest-volume content ran the lowest-quality ladder of the four. And the single most-watched rung on the platform, 720p at close to 50% of all viewing, was the weakest rung in that ladder.

The service was underspending and overspending at the same time in different parts of the same platform. VOD quality sat measurably below what premium competitors deliver, while one live ladder pushed its top rung beyond the point at which viewers can perceive a difference, paying for quality nobody saw. None of this was visible from inside, because the four ladders had never been compared at equal quality.

The Streaming Learning Center was engaged to evaluate the service's encoding, packaging, DRM, and delivery workflow. The work expanded to incorporate the business impact of emerging codec royalty programs. Over four months the engagement produced more than 6,500 test encodes and approximately 250 pages of technical analysis across three reports, accompanied by a 12-page executive summary that priced every recommendation against the client's own encoding costs, CDN rates, and measured viewing distribution.

Key Results

- **One suggested preset change could pay for the engagement.** Moving to a slower encoding preset, holding everything else constant, saved ~$18,000 per 100 million viewing hours against the faster alternative, at an added encoding cost of ~$1,700 across 4,000 hours of content. Adopting that single recommendation and nothing else would have recovered the cost of the engagement within months.

- **True bandwidth savings ran 53 percent higher than the file size comparison suggested.** The recommended AV1 configuration reduced file size by 8.8 percent. Weighed by the rungs actually viewed by service customers, real bandwidth savings were 13.4 percent, worth $31,355 per 100 million viewing hours. A standard codec comparison would have reported the 8.8%.

- **The live breakeven for one suggested modification was 40 concurrent viewers.** A configuration that nearly doubled per-channel transcoding cost recovered that cost via bandwidth savings when more than 39.5 viewers watched the channel. At 40 viewers and higher, the more expensive encoder is the cheaper option.

- **Royalty exposure reframed the advanced codec question entirely.** Assuming a $500,000 annual royalty obligation, the bandwidth savings delivered by AV1 and VP9 would require hundreds of millions to billions of viewing hours to offset, far more than existing levels. The bottom line? It may be cheaper to deliver optimized H.264 streams than AV1 or particularly VP9.

- **Quality rose while bitrate discipline improved.** On the highest-volume VOD ladder, top rung quality rose to ~VMAF 93, the most common target for premium services, the most-watched rung gained 6 VMAF points.

Engagement at a Glance

Engagement at a Glance	
Duration	~4 months
Test encodes	6,500+
Codecs evaluated	4
Technical reports	3
Technical documentation	~250 pages
Executive summary	12 pages
Areas analyzed	Encoding, Packaging, DRM, Licensing

Scope of the Engagement

The work was organized as a progression, with each phase building on the previous one.

1. **Establish a common quality target** by tuning each codec to comparable perceptual quality.
2. **Optimize encoding parameters** for each codec using objective quality metrics and bitrate analysis.
3. **Model operational impact** by incorporating encoding cost, CDN pricing, and the client's viewing distribution into each recommendation.
4. **Review packaging and DRM architecture** to identify opportunities to reduce complexity while maintaining compatibility.
5. **Evaluate codec licensing considerations** to understand how emerging royalty programs could affect future codec strategy.

Recommendations were developed only after completing each phase, ensuring that technical conclusions were supported by both engineering measurements and operational analysis.

What the Analysis Found

Five findings shaped every recommendation that followed. The first three describe quality and reach problems the client could not see from inside. The last two describe how the measurement method itself changes the answer. Each is summarized here and documented in the sections that follow.

The four ladders delivered significantly different quality levels.

Top rung quality ranged from 90.05 VMAF on one codec to 94.76 on another. Below 93, premium viewers see the shortfall. Above 95, the service is paying for quality viewers cannot detect. The client had ladders in both zones, because each had been developed independently and none had been normalized against the others. Until that was corrected, no comparative analysis of the four was valid.

The most-watched rung offered substandard quality

About 50 percent of all viewing occurred at 720p, more than any other rung. On the highest-volume VOD ladder, that rung sat at 40 percent of top rung bitrate. The working norm is 60 percent, and the client's other ladders ran between 56 and 60. Their busiest rung on their busiest ladder was the one starved of bitrate.

Bottom rungs were pricing out mobile viewers

Sports content at the lowest rung exceeded 800 kbps because of the rate control schema, making it inaccessible to some mobile viewers on constrained connections. Halving the frame rate on the bottom rungs of 50 fps sports content reduced bitrate by roughly 200 kbps and improved quality. This was a reach problem rather than a cost problem, and it would not have surfaced in any cost analysis.

File size savings systematically understated delivered savings

The gap between file size reduction and real bandwidth reduction was 8.8 percent against 13.4 percent, because the recommended configuration delivered its largest gains at the rungs where this client's viewers actually watch.

The Work in Detail

The five phases below are presented in the order they were performed. Each documents the measurements behind the findings above, and the reasoning behind the recommendations that came out of it.

Establishing a Common Quality Target

The client's four encoding ladders had been developed independently over several years, and each achieved a different quality target. The spread between the highest and lowest top rung approached five VMAF points, which would be noticeable by most viewers.

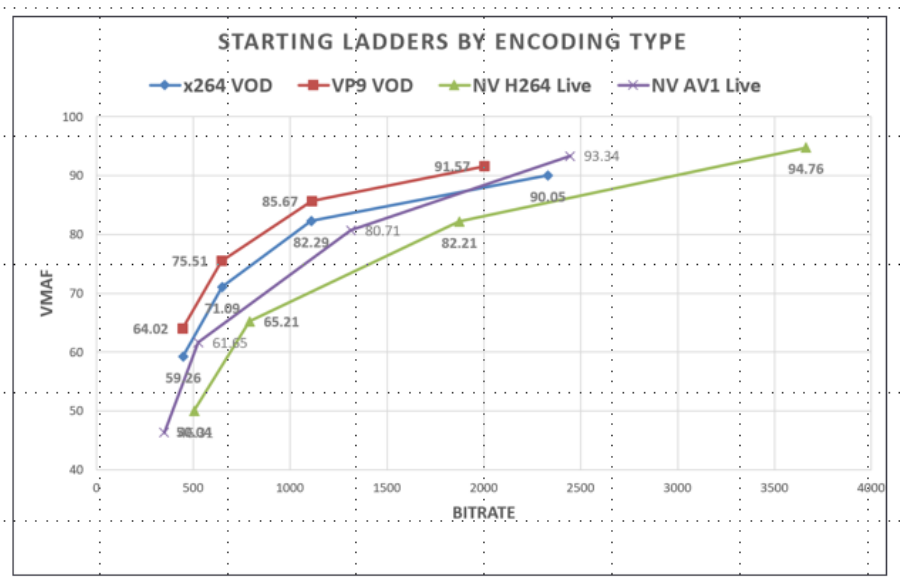

Figure 1. The original encoding ladders showed significant differences in viewer experience based the codec and whether the stream was VOD or live.

Each ladder was retuned to a target of VMAF 93 at the top rung, providing the optimal balance of efficiency and quality. Objective metrics guided the tuning, with VMAF as the primary measure and key findings verified through PSNR and SSIM spot checks and visual inspection. After normalization the spread fell below 0.75 VMAF points.

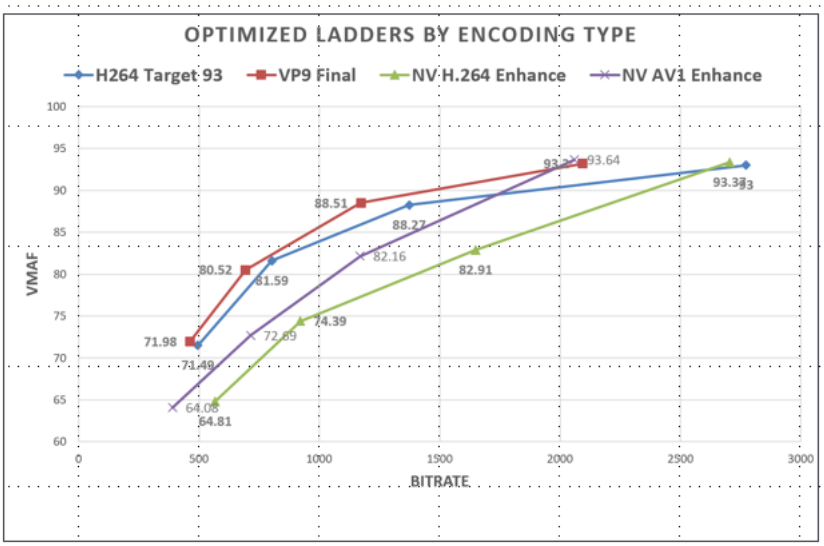

Figure 2. Normalized encoding ladders. After tuning, all four codecs produced comparable perceptual quality, providing a consistent baseline for subsequent optimization.

That single step changed the conclusions of everything downstream. Codec efficiency rankings, cost per delivered hour, CDN savings, and every breakeven calculation in the engagement rest on comparing equivalent quality. Without it, the analysis would have produced confident numbers built on an invalid comparison.

Optimizing Codec Performance

With comparable quality established, the next phase identified the encoding parameters that delivered the target quality at the lowest bitrate. Each codec was optimized independently. Tested options included codec presets, rate control modes, GOP structure, CQ and CRF settings, scaling filters, buffer sizing, and other codec-specific parameters.

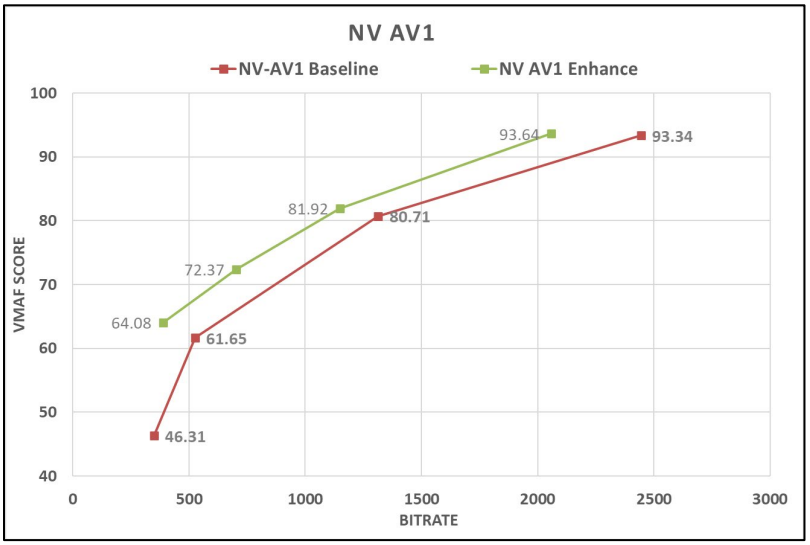

Figure 3. AV1 optimization results.

Parameter testing also produced findings the client could apply independently of any full configuration change. Genre-specific quality settings outperformed a single uniform setting across all content, because anime, sports, and general entertainment compress very differently under identical parameters. Appropriate rung spacing was prioritized, since rungs too far apart strands viewers in a low-quality experience and rungs too close together produce redundant renditions and unnecessary stream switching.

For each codec, the analysis produced a recommended “Enhanced” configuration that was compared to the original in quality and cost. The quality comparison for AV1 is shown in Figure 3. In particular, low rung quality was improved by deploying larger resolutions than the original ladder, boosting VMAF quality by roughly 18 VMAF points at the same bitrate. The analysis also produced similar quality for most other rungs at significantly lower bitrates.

Modeling Deployment Costs

The optimized configurations established bitrate and throughput for each codec. The next phase priced the cost of deploying each one in production.

The analysis combined three client-specific inputs. Encoding performance, including bitrate and throughput measured during optimization. The client's own encoding and CDN costs. And the distribution of viewing across the encoding ladder. Rather than assuming a generic viewing profile, the analysis used the client's measured distribution, so that bandwidth savings reflected how their content is actually consumed. VOD and live required different treatment.

	Baseline	Enhanced	View %	Baseline	Enhanced
1080p	2445	2058	38.3%	935	787
720p	1314	1169	46.3%	609	542
480p	526	714	6.1%	32	43
360p	350	390	9.4%	33	37
	4636	**4331**	**1**	**1609**	**1409**
GB/hour				**0.6904**	**0.6046**
Cost/hour	**$0.0023**			**$0.00159**	**$0.00139**
Savings per hour					**$0.000197**

Encoder Cost	
Base price	$5,000
Five year hosting @$25/mo	$1,500
Total	$6,500
Cost per hour (24/7/365*5)	$0.1484
Throughput - Baseline	**22.2**
Cost per hour - Baseline	$0.0067
Throughput - Enhanced	10.2
Cost per hour - Enhanced	$0.0145
Delta	$0.0078
Breakeven	**39.5**

Figure 4. Live breakeven example. The Enhanced configuration cut throughput but required additional transcoding hardware for the same channel count. Amortized over five years, the additional cost would be recovered once more than 39.5 simultaneous viewers watched each channel.

For VOD, the additional cost of encoding each asset was compared against projected bandwidth savings during playback to determine the viewing hours required to recover the added encoding cost. For live, reduced throughput increases the number of encoding servers needed to support the same channel count, creating a capital expense. Measured throughput was used to estimate required hardware, and that cost was amortized over the expected service life of the equipment before computing breakeven.

The same method applied to VOD produced the aforementioned preset finding. In an otherwise identical configuration, the slower preset added ~$1,700 in encoding cost across 4,000 hours of content and saved ~$18,000 in delivery cost across 100 million viewing hours. The breakeven was ~1,100 viewing hours per title, low enough that the decision was effectively automatic for any title with meaningful traffic.

Reviewing Packaging and DRM

The next phase reviewed packaging and DRM architecture to determine whether the recommended codec strategy could be implemented without adding unnecessary operational complexity.

The assessment examined both live and VOD workflows, including HLS and DASH delivery, DRM and non-DRM packaging, manifest generation, segment formats, and the packaging tools used throughout production. The objective was to identify structural issues, compatibility constraints, and opportunities to simplify while maintaining support for the client's existing device base.

The review found that operational complexity was appropriately driven primarily by DRM requirements and device compatibility. The existing packagers were used appropriately throughout, and the architecture reflected a deliberately conservative approach intended to maximize compatibility across Apple, Android, smart TV, and legacy devices.

Opportunities for future simplification were identified. Non-DRM live workflows already used a single CMAF segment set shared between HLS and DASH, demonstrating that the existing toolchain could support unified packaging where DRM constraints do not apply.

Evaluating Content Royalty Exposure

The final phase examined how emerging content royalty programs affect the codec recommendations developed in the earlier phases. For the record, the client distributed all video at 1080p at standard dynamic range (SDR), and deployed AV1 and VP9 to reduce bandwidth costs.

Two patent pools now assert royalties on content encoded with HEVC, VVC, AV1, and VP9, plus multiple individual patent owners. Neither pool has been tested in court, and no comparable rulings exist for AV1 or VP9. But content-level assertion is not hypothetical. Video patents have been asserted against major streaming services targeting delivery and encoding, and multi-jurisdictional actions have concluded with announced multi-year licenses covering video technologies used in streaming services and devices. Those cases involved H.264 and HEVC (and after the engagement, AV1).

The analysis measured the client's own bandwidth savings against that exposure. Using their CDN rate and the per-hour savings measured during the encoding phases, and an illustrative $500,000 combined annual royalty obligation, VP9 would require multi-billion viewing hours to offset, which was far more than actual. AV1 would require ~700 million. Replacing VP9 with HEVC improved the arithmetic but still required ~1.5 billion viewing hours.

Rate schedules were not available when the project was completed. We recommended that once rates were published, the client should compare the royalty to the bandwidth savings delivered by the codecs. If the bandwidth savings didn’t exceed the royalty, deploying an advanced codec made no economic sense.

This analysis is commercial and financial modeling for planning purposes. It is not legal advice. License terms, essentiality, and actual exposure should be reviewed by qualified patent counsel.

Conclusions

The engagement produced recommendations covering encoding, packaging, DRM, and codec strategy for both live and VOD workflows. Each recommendation was supported by objective quality measurement, measured encoding performance, and cost models built on the client's own encoding costs, CDN pricing, and viewing distribution.

The three final reports documented the analysis behind those recommendations. The accompanying executive summary organized them into implementation priorities for each workflow. Some could be implemented immediately. Others identified architectural changes and industry developments to revisit as device support, packaging practice, and codec licensing evolve.

The resulting methodology provides a repeatable process for evaluating future codec and workflow decisions. By establishing comparable quality, optimizing encoding performance, quantifying deployment cost against actual viewing distribution, and treating licensing exposure as a first-order input rather than a footnote, future technology decisions can be evaluated within the same framework as requirements and business conditions change.

About the Consultant

Jan Ozer holds a law degree and a CPA, and has been encoding video since the mid-1990s. That combination is the basis of this work. Codec decisions sit at the intersection of compression engineering, corporate finance, and patent licensing, and are rarely modeled across all three before deployment.

Ozer is an established authority on H.264, HEVC, VP9, and AV1 compression. His books include Video Encoding by the Numbers: Eliminate the Guesswork from Your Streaming Video and Learn to Produce Video with FFmpeg in 30 Minutes or Less. He is a longtime contributing editor to Streaming Media Magazine.

He has tracked video codec licensing policy since 2008, and has been quoted in both IAM and IP Fray. He published the industry's first structured comparison of the Access Advance and Avanci patent pools. He no longer practices law or accounting.