Video Messaging and Compression

Why Compression is Essential to Video Messaging

and

How Crunch Video Optimizer can Reduce File Size by 34% With No Quality Loss

A white paper

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Introduction

Video messaging is exploding on instant messaging platforms with billions of videos sent each day. However, as users demand higher-resolution videos and fast responsiveness, it's clear that innovative compression technologies are needed to produce a high-quality user experience for video creators and consumers. This document explores this need for compression and details tests showing how the Crunch Video Optimizer can reduce producer and viewer latency by 34% without loss of quality.

Why Compression Is Essential

Sending videos on instant messaging platforms is an increasingly popular way of sharing videos among smartphone users. As smartphones get more powerful, consumers create and demand higher quality videos to share. There are, however, various limitations that may reduce the quality and increase the latency of video files sent from one device to another. These include processing time, file size, communication channel (Internet & cellular networks), and decoder buffering. Since shared videos are often forwarded and shared with others multiple times over cellular mobile networks, video file size can greatly impact the speed at which the video is delivered to the recipients.

The OpenSignal September 2018 State of Mobile Video report found that sending large video files across the public Internet or mobile broadband data connections can be subject to added latencies and even drops because those channels are often congested and rarely consistent in their available bandwidth and capacity. Unlike wired broadband, where subscribers often have a dedicated connection to the network, mobile networks operate through shared capacity. As the number of users and data demands change on any given cell, the mobile network is constantly redividing and redistributing its available capacity, which can create large fluctuations in individual connection speed from one moment to the next.

In a recent blog post on LinkedIn, Dr. Eslambolchi Hossein, the Open Labs Technical Advisor at Facebook, discussed how file size can impact video messaging performance, stating, "A very small increase in data payload therefore has a nonlinear effect on the overall delay in sharing and viewing video. Conversely, a small decrease in data payload can make the difference between a video being delivered or not, especially in emerging markets." He concludes, "Given how big an impact a small change in data size can have on the quality of experience, there is a need for a new class of video solutions that can run within the confines of the device and provide server-class optimization." The Crunch Video Optimizer is such a solution.

The Crunch Video Optimizer

Specifically, by reducing video bitrate without sacrificing quality, apps that deploy Crunch can deliver higher quality videos at the same available bandwidth, and/or allow more users and videos to utilize the existing infrastructure. To prove this, this report compares video files compressed with the WhatsApp iOS app and the Crunch Video Optimizer, choosing WhatsApp because of its prevalence globally and because WhatsApp accounts for over 1.5 billion video messages per day.

34% File Savings, No Quality Loss

To produce these tests, we encoded 20 mobile videos with the WhatsApp iOS app and the Crunch Video Optimizer on an iPhoneX. Then we compared the quality of the two outputs using the SSIM quality metric as computed by the Moscow State University Video Quality Measurement Tool. For reference, all videos were shot on an iPhone and averaged 23 seconds in duration.

We show these results in Table 1. The first set of columns (File Size) shows the file size produced by Crunch, WhatsApp, and the percentage difference. As you can see, the Crunch Video Optimizer produced files that were 34% smaller than WhatsApp. Despite this significant reduction, the SSIM value for WhatsApp and Crunch files were essentially identical as shown in the second set of columns (SSIM).

Analysis	File Size			SSIM		
File	WhatsApp	Crunch	Delta	WhatsApp	Crunch	Delta
Beach	5,188	3,945	-24%	0.935	0.937	0.003
Blue Angels	5,236	3,292	-37%	0.982	0.981	-0.001
Ducks	4,595	3,555	-23%	0.845	0.847	0.002
Ducks in lake	3,628	2,823	-22%	0.813	0.820	0.007
Flacc	6,254	4,006	-36%	0.955	0.955	0.000
Flacc Speech	2,478	1,514	-39%	0.944	0.941	-0.002
Flag	3,917	2,483	-37%	0.986	0.986	-0.001
Flyby	1,406	643	-54%	0.984	0.981	-0.003
flyby 2	4,886	3,328	-32%	0.986	0.985	-0.001
Food	3,524	2,195	-38%	0.955	0.954	-0.001
Indoor concert	8,281	6,765	-18%	0.953	0.955	0.002
Jan	2,832	1,790	-37%	0.970	0.969	-0.001
Lake	3,531	2,257	-36%	0.919	0.911	-0.008
Meet and greet	2,234	1,335	-40%	0.949	0.944	-0.004
Old time	6,185	3,806	-38%	0.950	0.947	-0.002
Outdoor Concert	5,990	4,753	-21%	0.929	0.931	0.002
Rainbow	1,857	917	-51%	0.975	0.973	-0.002
Stunt pilot	15,568	11,381	-27%	0.966	0.965	-0.001
Tree	2,511	1,849	-26%	0.850	0.856	0.006
Will	1,875	998	-47%	0.961	0.959	-0.002
Average	**4,599**	**3,182**	**-34%**	**0.940**	**0.940**	**0.000**

Table 1. File size and quality for WhatsApp and the Crunch Video Optimizer.

Take a moment and ponder the positive impact of 34% file savings on a scale of over 1.5 billion video messages a day. For service providers, this means delivering higher-quality videos faster and more reliably with less bandwidth usage, while for users it means decreased latency and a better quality of experience for both producers and consumers.

Applying These Numbers

Let's focus on the benefits that the Crunch Video Optimizer delivers to each user and viewer. Since the quality produced by WhatsApp and the Crunch Video Optimizer are identical, let's turn our attention to latency, which has four components; processing time, upload time, transfer time once in the cloud or mobile network, and download time. Because transfer time for messages in the cloud or over mobile networks is insignificant, we'll ignore this component for our analysis.

Regarding processing time, today, the Crunch Video Optimizer takes slightly longer to process than WhatsApp, though this is device dependent and the differential will become smaller over time as devices increase in speed. In addition, processing occurs only once, and videos are often retransmitted multiple times with the bandwidth savings realized each time.

One critical reference for instant messaging providers is how long it takes to upload the video file and receive receipt confirmation from the server. Table 2 measures this First User Experience for India, Brazil, and the United States. By way of background, upload and download times for each region were taken from OpenSignal's Mobile Network Experience Report January 2019, for each country and are included in the Appendix hereto. Overall, excluding processing time, the Crunch Video Optimizer would reduce the duration of the First User Experience by 34% which translates to 6.01 seconds in India, 2.73 seconds in Brazil, and 2.19 seconds in the US.

						Upload Time - in seconds					
			File Size MB)			India Overall		Brazil Overall		US Overall	
File name	Duration	Res.	WA	CMW	Saving	WA	CMW	WA	CMW	WA	CMW
Beach	26	1080	5.19	3.95	24%	22.01	16.73	10.00	7.60	8.02	6.10
Blue Angels	26	1080	5.24	3.29	37%	22.21	13.96	10.09	6.35	8.09	5.09
Ducks	21	1080	4.60	3.56	23%	19.49	15.08	8.86	6.85	7.10	5.50
Ducks in lake	18	1080	3.63	2.82	22%	15.39	11.97	6.99	5.44	5.61	4.36
Flacc	15	1080	6.25	4.01	36%	26.53	16.99	12.06	7.72	9.67	6.19
Flacc Speech	11	1080	2.48	1.51	39%	10.51	6.42	4.78	2.92	3.83	2.34
Flag	29	1080	3.92	2.48	37%	16.62	10.53	7.55	4.79	6.06	3.84
Flybye	7	1080	1.41	0.64	54%	5.96	2.73	2.71	1.24	2.17	0.99
flybye 2	26	1080	4.89	3.33	32%	20.73	14.12	9.42	6.42	7.55	5.14
food	16	1080	3.52	2.20	38%	14.95	9.31	6.79	4.23	5.45	3.39
indoor concert	43	1080	8.28	6.77	18%	35.13	28.70	15.96	13.04	12.80	10.46
Jan	14	1080	2.83	1.79	37%	12.01	7.59	5.46	3.45	4.38	2.77
Lake	18	1080	3.53	2.26	36%	14.98	9.57	6.81	4.35	5.46	3.49
Meet and greet	11	1080	2.23	1.34	40%	9.48	5.66	4.31	2.57	3.45	2.06
Old time	31	1080	6.19	3.81	38%	26.24	16.14	11.92	7.34	9.56	5.88
Outdoor Concert	30	1080	5.99	4.75	21%	25.41	20.16	11.55	9.16	9.26	7.35
Rainbow	8	2160P	1.86	0.92	51%	7.88	3.89	3.58	1.77	2.87	1.42
Stunt pilot	88	1080	15.57	11.38	27%	66.04	48.28	30.01	21.94	24.07	17.59
Tree	11	1080	2.51	1.85	26%	10.65	7.84	4.84	3.56	3.88	2.86
Will	8	1080	1.88	1.00	47%	7.95	4.23	3.61	1.92	2.90	1.54
Average	**23**		**4.60**	**3.18**	**34.12%**	**19.51**	**13.50**	**8.87**	**6.13**	**7.11**	**4.92**
Overall Savings - Time in seconds							**6.01**		**2.73**		**2.19**

Table 2. Impact of the Crunch Media Optimizer on the First User Experience.

Table 3 adds download time to upload time to assess the overall reduction in latency delivered by the Crunch Video Optimizer, again on a country-by-country basis. Since download speeds are generally much faster than upload speeds, the 34% bandwidth reduction saves fewer seconds upon download than upon upload, totaling 2.2 seconds in India, .91 seconds in Brazil, and .62 seconds in the US. As shown in the Table, processing time excluded, the Crunch Video Optimizer would reduce overall latency by 8.21 seconds in India, 3.64 seconds in Brazil, and 2.81 seconds in the US.

Overall Latency	India Overall		Brazil Overall		US Overall	
	WA	CMW	WA	CMW	WA	CMW
Upload	19.51	13.50	8.87	6.13	7.11	4.92
Average savings		**6.01**		**2.73**		**2.19**
Download (per viewer)	7.12	4.93	2.96	2.04	2.00	1.38
Average savings		**2.20**		**0.91**		**0.62**
Total latency reduction		**8.21**		**3.64**		**2.81**

Table 3. Crunch Media Optimizer impact on viewers and resends.

Regarding retransmission, we couldn't find statistics regarding how many video messages are sent to multiple recipients or forwarded, but it appears to be very frequent. One indicator is that WhatsApp recently restricted all users on the latest versions of WhatsApp to forward messages to only five chats at once. Clearly, many (if not most) videos are sent to multiple recipients, forwarded by those recipients, or both. This multiplies the aforementioned savings each time the originator sends the video to another contact, and each time that contact retransmits the video to their contacts. Once again, since the video is

processed only once, the processing time differential is irrelevant for all but the initial transmission.

Beyond upload and download time, the OpenSignal report found that mobile networks do not deliver consistent throughput which could cause stalling. Specifically, since video files are divided into packets for delivery over the network, a loss or delay in one or more packets could cause additional latency or even a drop or non-delivery. Since smaller files require fewer packets, the files produced by the Crunch Video Optimizer should arrive with more reliability and with less chance for error than larger files delivered via more packets as produced by other technologies. In this fashion, the Crunch Video Optimizer decreases latency and improves reliability with no loss in video quality.

Conclusion

As Facebook's Dr. Hossein indicated, a small decrease in file size can have a significant beneficial impact on quality of experience. This paper proves that the Crunch Media Optimizer can reduce video bandwidth by 34% with no quality loss, making the Crunch Media Optimizer worthy of consideration for all video messaging apps.

Visit Crunch MediaWorks website to learn more about the Crunch Media Optimizer.

Appendix I: Upload and Download Speed by Country

These performance numbers from the OpenSignal Network Experience report for each country.

	India	Brazil	US
Upload speed (Mbps)	1.89	4.15	5.18
Download speed (Mbps)	5.16	12.45	18.43