Delivering Fast and Beautiful Images

Doug Sillars

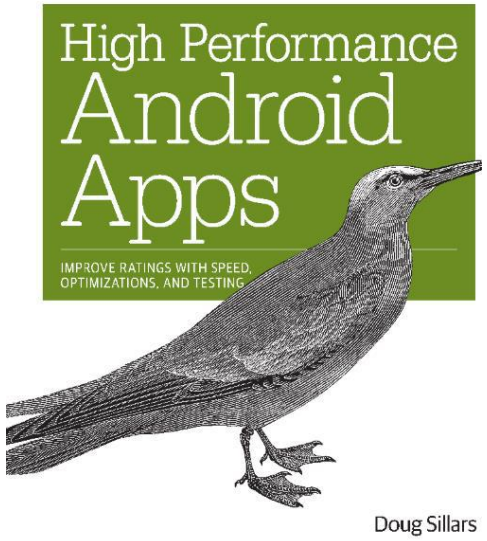
@DougSillars

DevDaysEU

May 15, 2019

Doug Sillars

Freelance Developer Relations
Performance Audits: Web/Native
Workshops:
Performance/Images/Video/AR



http://bit.ly/HighPerformanceAndroidApps

Contact Me:

@DougSillars

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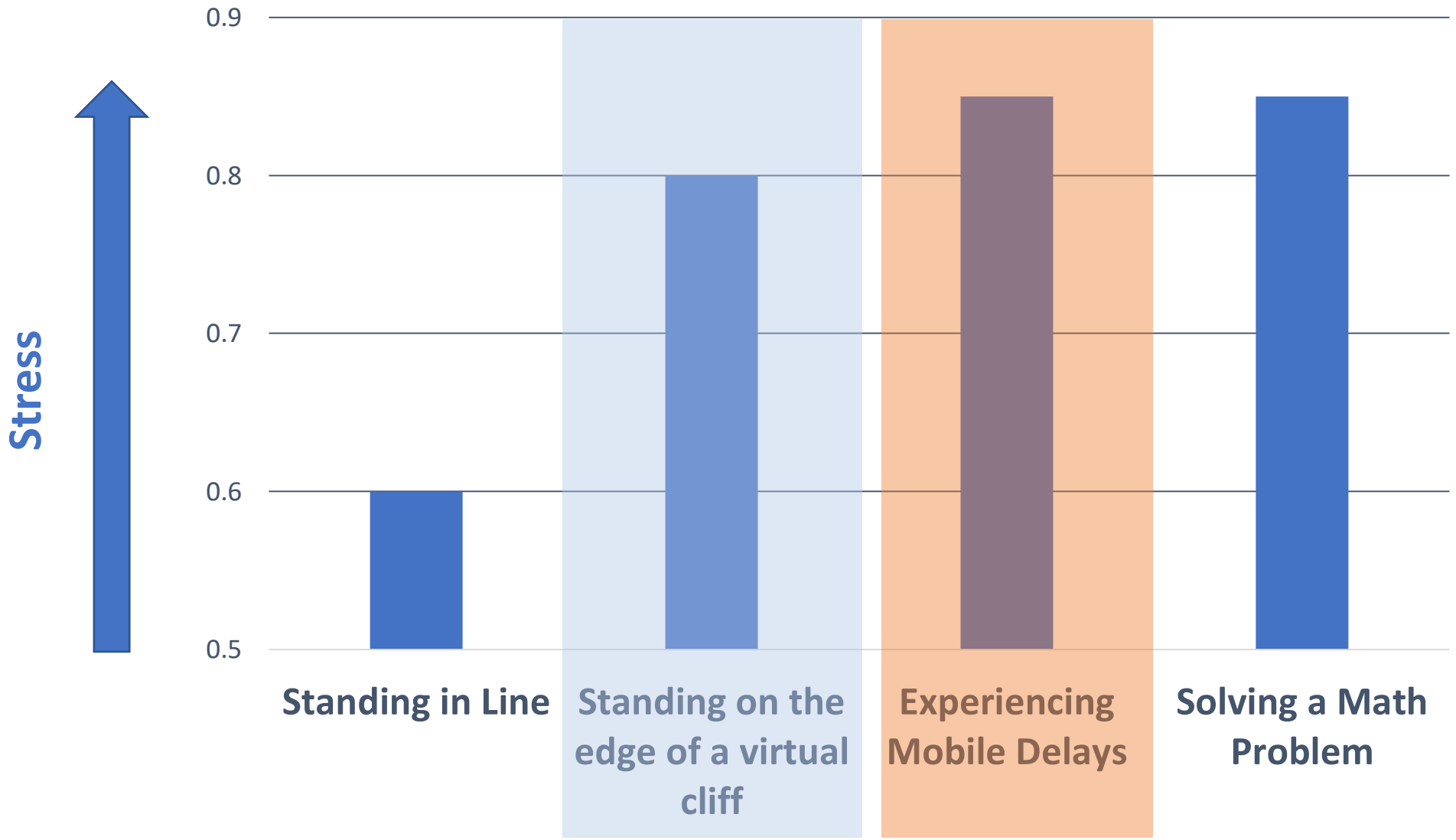
www.dougsillars.com



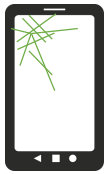
https://www.ericsson.com/res/docs/2016/mobility-report/emr-feb-2016-the-stress-of-steaming-delays.pdf

Large Downloads Induce Delays in Rendering

3s: 53% of Users Abandon Mobile Sites

500ms: 26% Frustration ↑
8% Engagement ↓

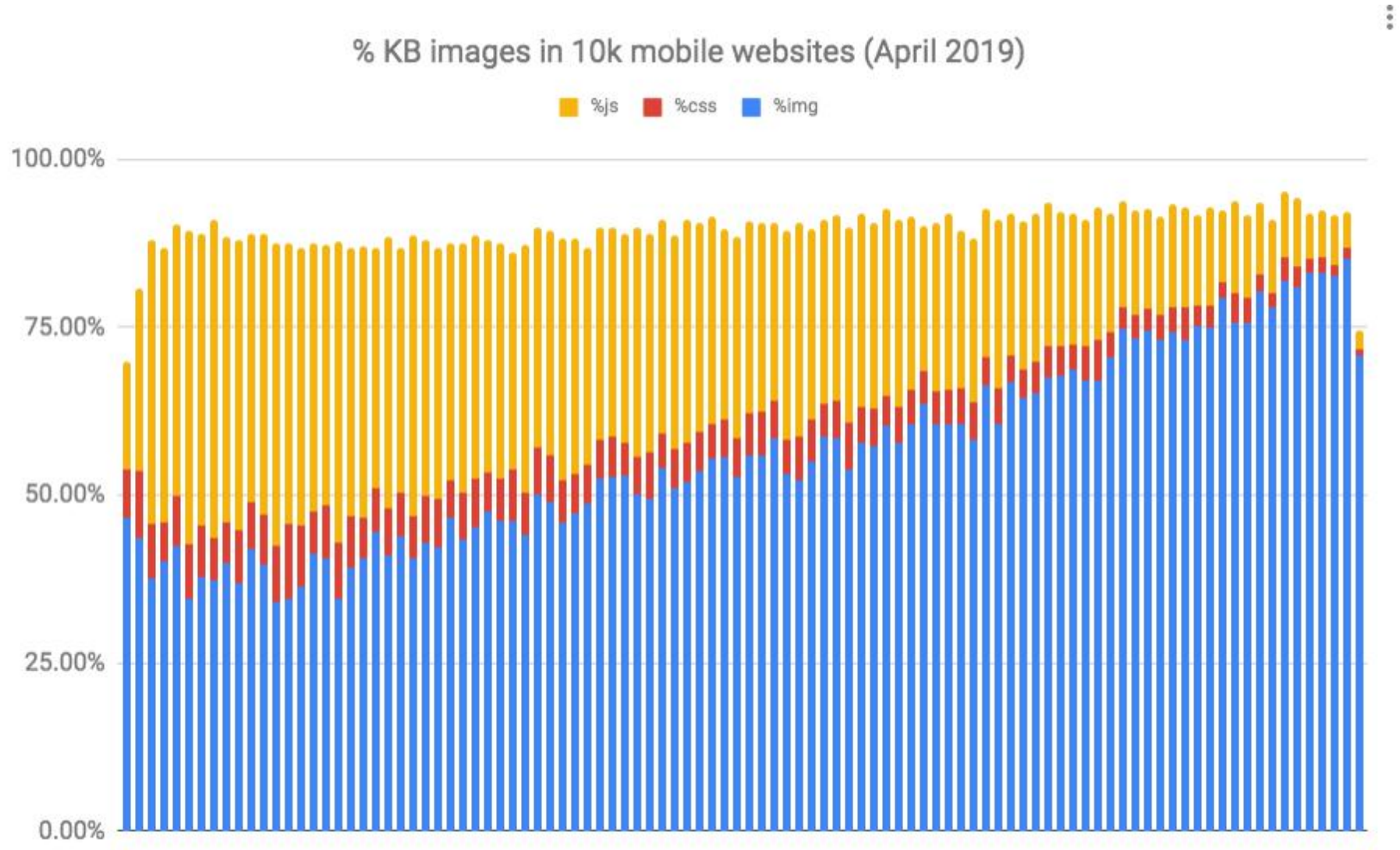
100ms: 1% Revenue ↓ Walmart & Amazon (Desktop 2001)



4% Mobile Users Throw Their Phones

https://www.doubleclickbygoogle.com/articles/mobile-speed-matters
http://bit.ly/mobileWebStress
http://www.globaldots.com/how-website-speed-affects-conversion-rates/
https://www.mobilejoomla.com/blog/172-responsive-design-vs-server-side-solutions-infographic.html

Images Dominate the Web



HTTPArchive mobile websites 04/2019

4 Simple Image Optimizations

4 Simple Image Optimizations

1. Quality
2. Format
3. Sizing
4. Lazy Loading

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1. Quality
2. Format
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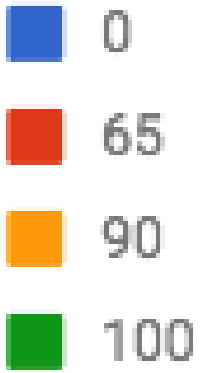

4 Simple Image Optimizations

WEBPAGETEST

http archive

Httparchive.org Webpagetest.org

4 Simple Image Optimizations

1. Quality
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Image Quality

Lighthouse:
Recommends 85% quality on all images

magick -quality 85 riga.jpg riga85.jpg

http://res.cloudinary.com/dougsillars/image/upload/q_85/v1520504964/IMG_20180301_114117_tzasan.jpg

https://developers.google.com/speed/docs/insights/OptimizeImages


100%
3.6 MB
http://res.cloudinary.com/dougsillars/image/upload/v1529005982/IMG_20180614_184507_ssuk1i.jpg


85%
1.87 MB
q_85
http://res.cloudinary.com/dougsillars/image/upload/q_85/v1529005982/IMG_20180614_184507_ssuk1i.jpg

Image Quality Use “In The Wild”

http archive

500,000 mobile sites
Analyzed 3/15/18

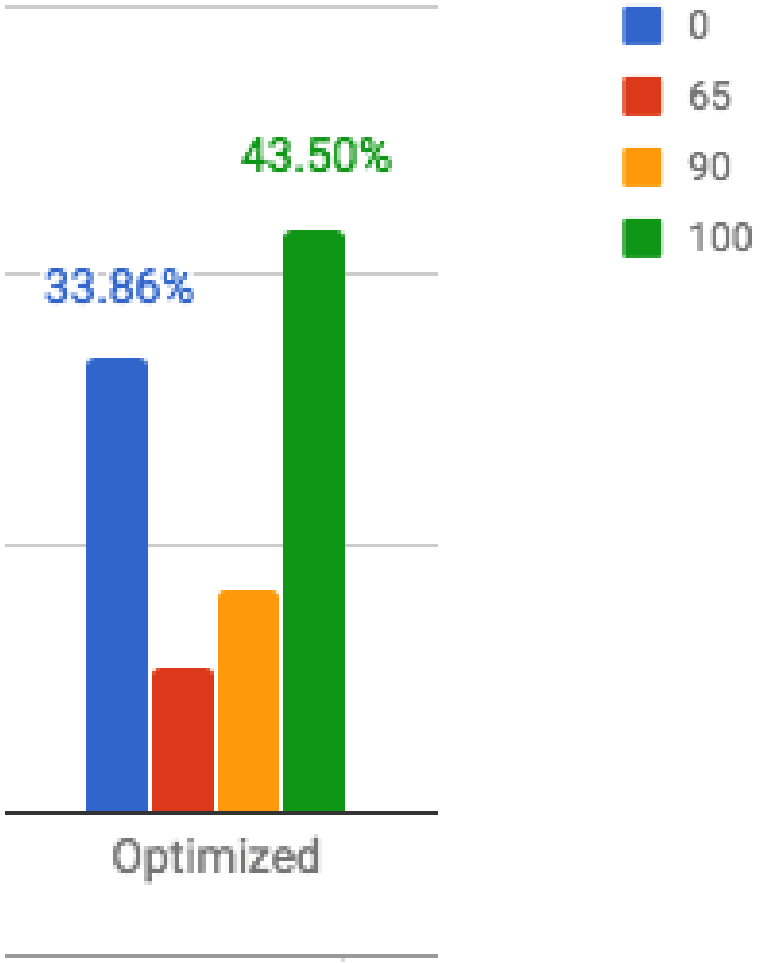
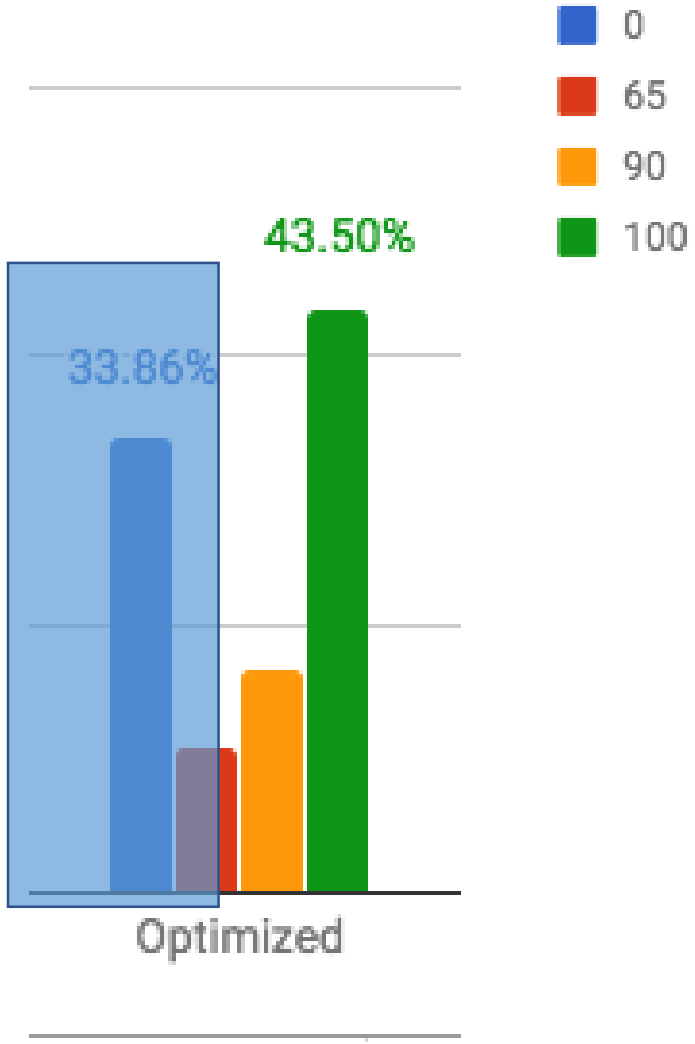


Image Quality Use “In The Wild”



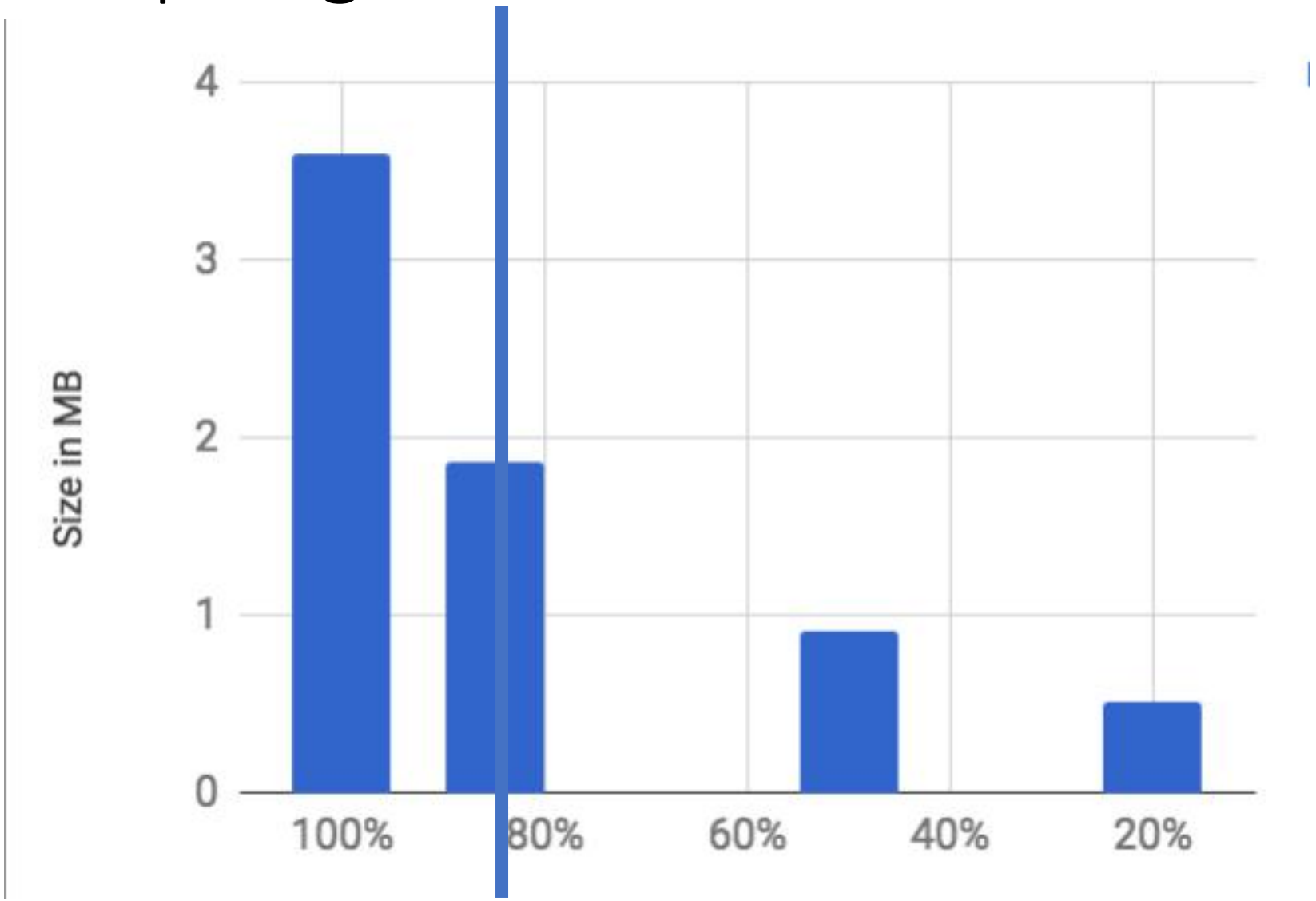
Median Savings (50th percentile):

- 2.83 seconds faster page load
- 419KB less data


50%
914 KB
q_50
http://res.cloudinary.com/dougsillars/image/upload/q_50/v1529005982/IMG_20180614_184507_ssuk1i.jpg

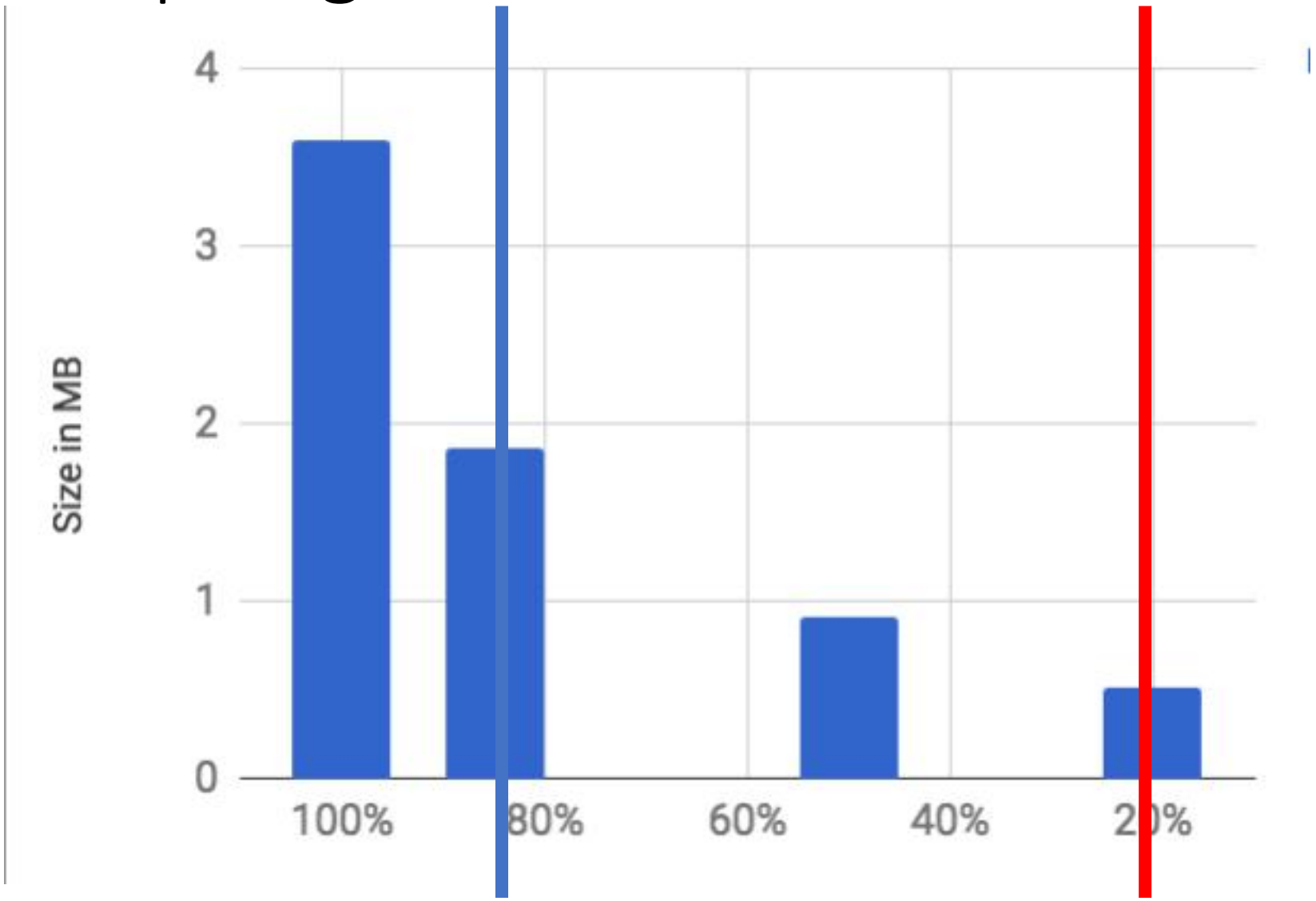

20%
513 KB
q_20
http://res.cloudinary.com/dougsillars/image/upload/q_20/v1529005982/IMG_20180614_184507_ssuk1i.jpg

Graphing the Results



https://developers.google.com/speed/docs/insights/OptimizeImages

Graphing the Results



https://developers.google.com/speed/docs/insights/OptimizeImages

Automate Quality vs. File Size

- Butteraugli
- SSIM: Structural SIMilarity

```
cjpeg-dssim jpegoptim riga.jpg
```

http://res.cloudinary.com/dougsillars/image/upload/q_auto/v1529005982/IMG_20180614_184507_ssuk1i.jpg

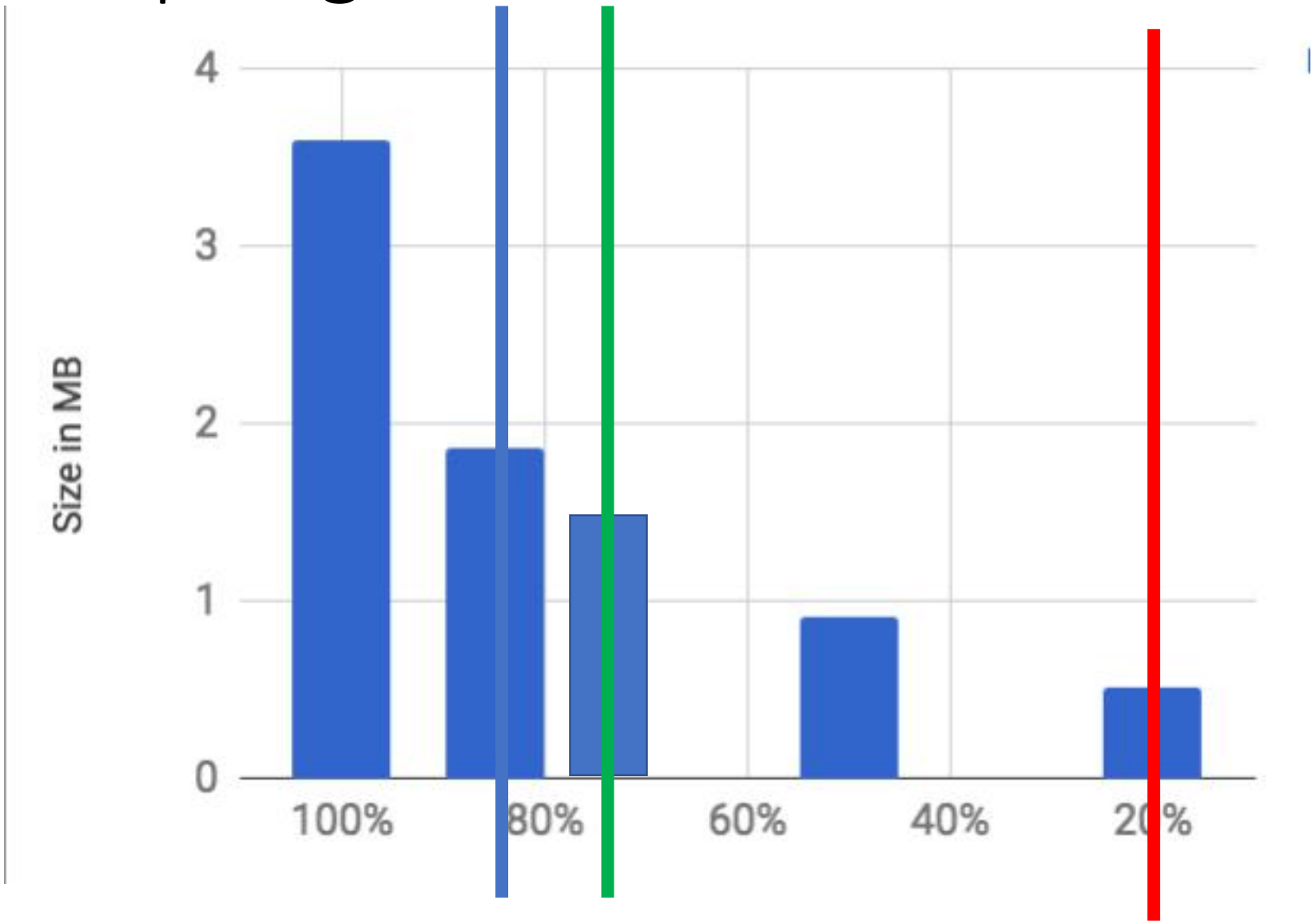
https://github.com/technopagan/cjpeg-dssim

SSIM

1.46 MB

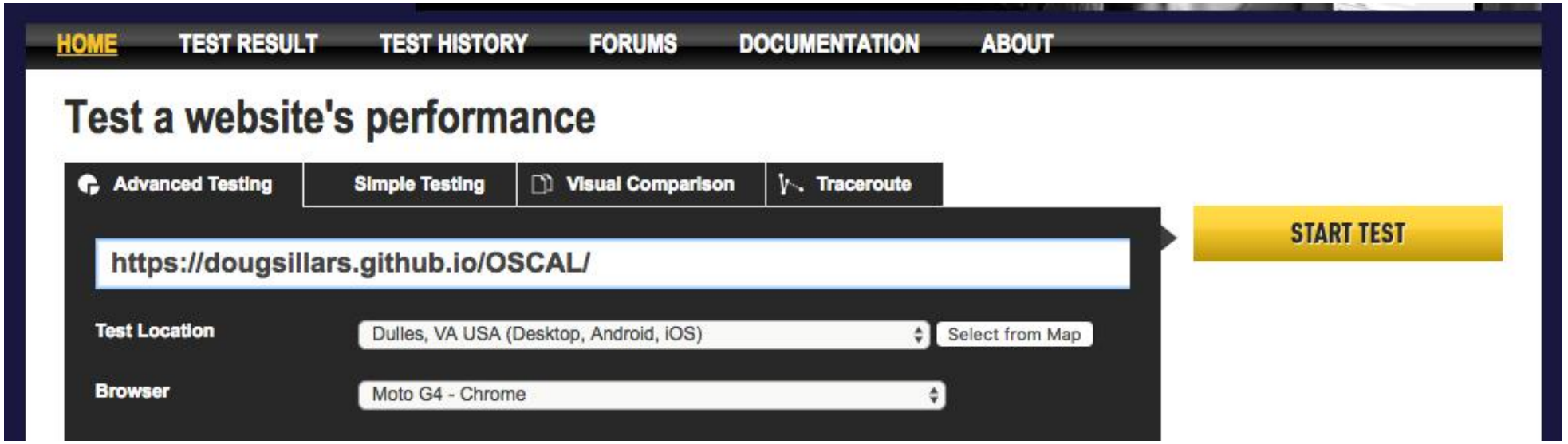

http://res.cloudinary.com/dougsillars/image/upload/q_auto/v1529005982/IMG_20180614_184507_ssuk1i.jpg

Graphing the Results



https://developers.google.com/speed/docs/insights/OptimizeImages

Results:



- **Test Load on Motorola G4:**

	Load Time (ms)	TotalBytes
Full	21786	3761729
85%	11830	1967615
SSIM	9457	1538613

4 Simple Image Optimizations

1. Quality
2. Format
3. Sizing
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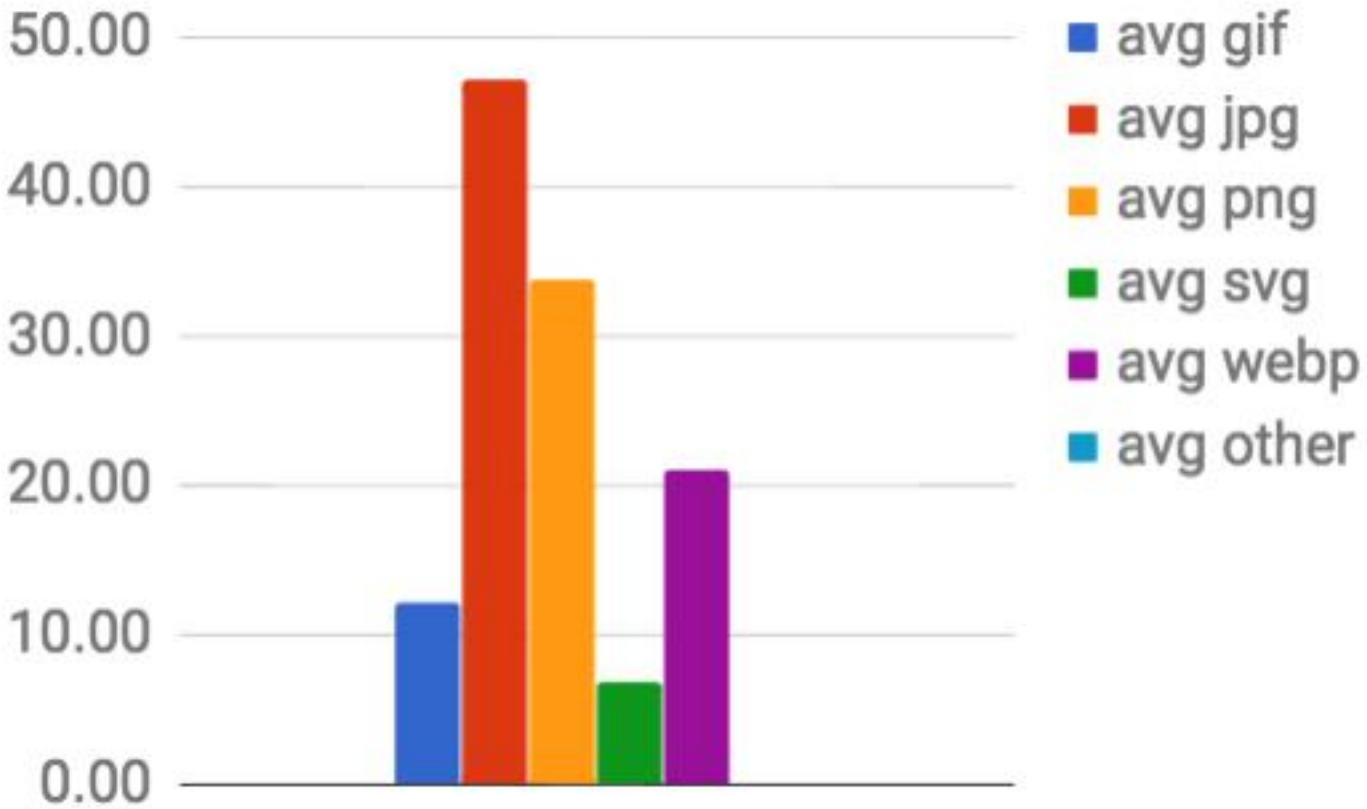
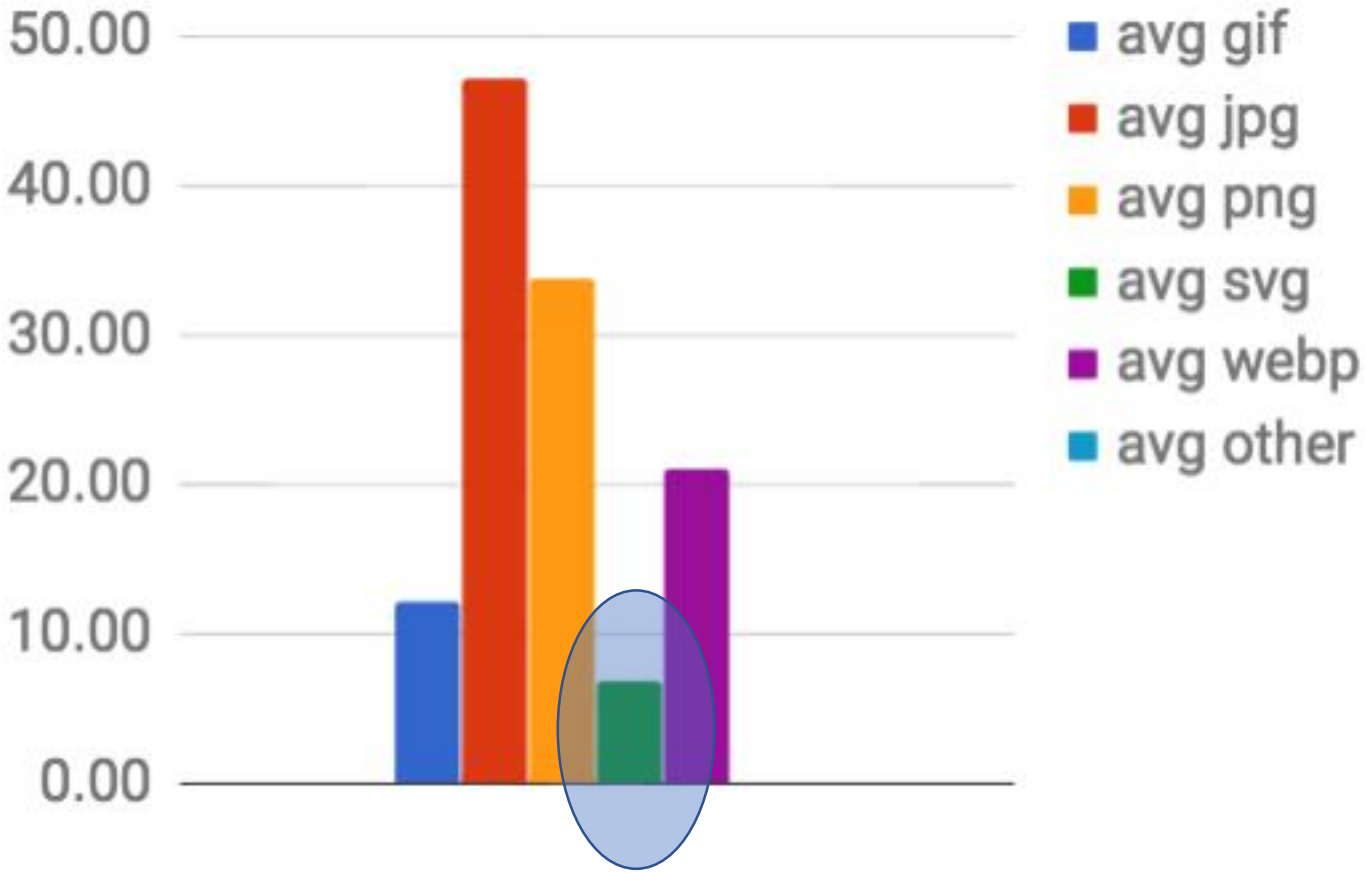
Image Formats – Average Size



HTTPArchive mobile websites 15/02/18

Image Formats – Average Size



HTTPArchive mobile websites 15/02/18

Scalable Vector Graphics (SVG)

Images drawn as shapes
infinitely scalable

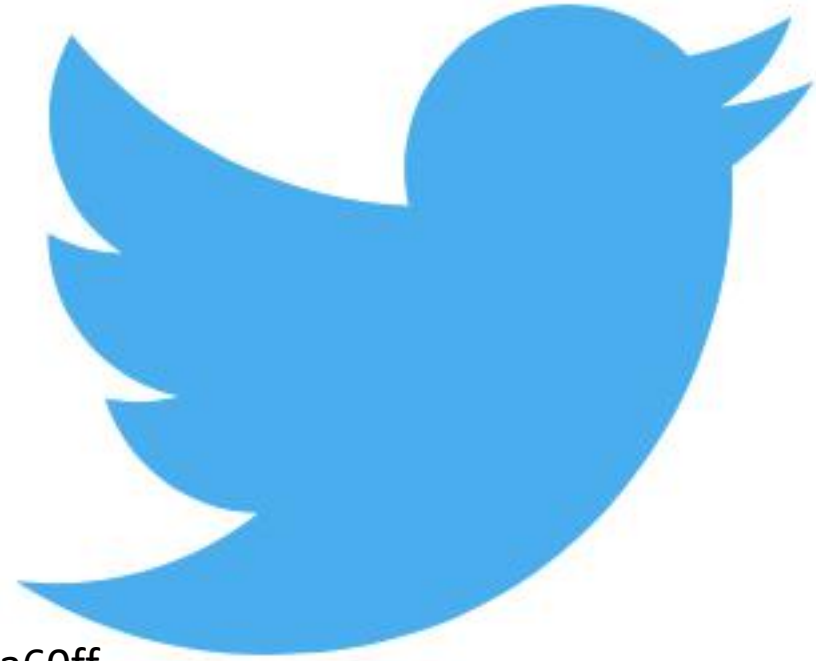
XML - Can be added inline to HTML document

https://gist.github.com/hail2u/2884613?short_path=66a60ff

Scalable Vector Graphics (SVG)

Images drawn as shapes
infinitely scalable

XML - Can be added inline to HTML document



https://gist.github.com/hail2u/2884613?short_path=66a60ff

Scalable Vector Graphics (SVG)

Scalable Vector Graphics (SVG)

~/Desktop/map-marker-circle.svg

```
<style type="text/css">
    .st0{fill:#B12657;}
</style>
<switch>
    <foreignObject requiredExtensions="&ns_ai;" x="0" y="0" width="1" height="1">
        <i:pgfRef  xlink:href="#adobe_illustrator_pgf">
        </i:pgfRef>
    </foreignObject>
    <g i:extraneous="self">
        <circle class="st0" cx="17.5" cy="17.5" r="10.7"/>
        <path class="st0" d="M17.5,35.1C7.9,35.1,0,27.2,0,17.5C0,7.9,7.9,0,17.5,0s17.5,
             M17.5,3C9.5,3,3,9.5,3,17.5c0,8,6.5,14.5,14.5,14.5s14.5-6.5,14.5-14.5C32.1,
    </g>
</switch>
<i:pgf  id="adobe_illustrator_pgf">
    <![CDATA[
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kZUZHnUuDVBGroAUW0BVVmZcPNw/v//d//GrL15cffXud/cv3HE+TH/3d9fv719+ePf+pwf59PCz
N2++/+7De370o1//+GDSccZNVz/LX9Ybf3v//rvX797+9GDN0ciXd/z1j37+/evvDr94993/8/39
6/cvf3z40Y/x1W9ef3hzjy+/efnti29evv/j/fsXr16/f/Xm/vjdn77+cXs7Hnfz8gPusz+x809M
Piw/nZfD1S/4/cu3f3r53Xev/198a6LLDp+d3n3/9qvXb78+vfvf+HA+vPDxgP97seC7//761/ff
dTcc55CiSSangHvDcbbWx3lx+Cf+ZYyz2Vh8tRyXGNMScR+edPPu1fff3L/98Kv3717df/fd9bs3
795/99PD9Z9fvj384uXX+Obl4d/u37x59x+H05uXr/44YZHCl3ev39xjPb55+eFgHFfn6mfGfnn6
/vWbr/75+29+d4+VcjbyY/elPPJfvsOz8Fj+nR+nL3/2DT754v7DB8wAL+QKX//i3/7v7Tgwq3r9
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mFN5Jjbs6Bcfb7V8miA+cwa9y8H6xMh4X5mOYg0tGBlSed175+z+9vv+8vvvvrp/g+Gvv79781KWVS5z/wE09O7N
9x+EzHN7A/bv5y//fE8iMLKv6csT1v4t3vP2A4b75evff/mncji+/PrDT00qty1f/vLb+7e/efdb
mQo24ODiIR/MMoPOw3IAuXMMIGG3Dsqc/1vfdPXmw/37t9iM9rZP9+jbt199WQ/1/VfbxwVd5PB/e
5p1Ai78Cdf7y/WtM/KcvQDl4rTWFcP/p/euvznSbLIYi/5HlPWId+ceYxc6LXZ76ySJ/QMAhG2+f
8klZGWzzB0yk7ZX98voXmzM1H3/xBeaCqV+/+4a09h35CncTx+zNu6/Ld+vf5Rv8/Ptvy7qUfQdZ
/ur967d85vTTP8k3+8lvvvsdX//...  [cut off]
```

Scalable Vector Graphics (SVG)

	KB
Original	946

Scalable Vector Graphics (SVG)

	KB
Original	946
Optimized	1

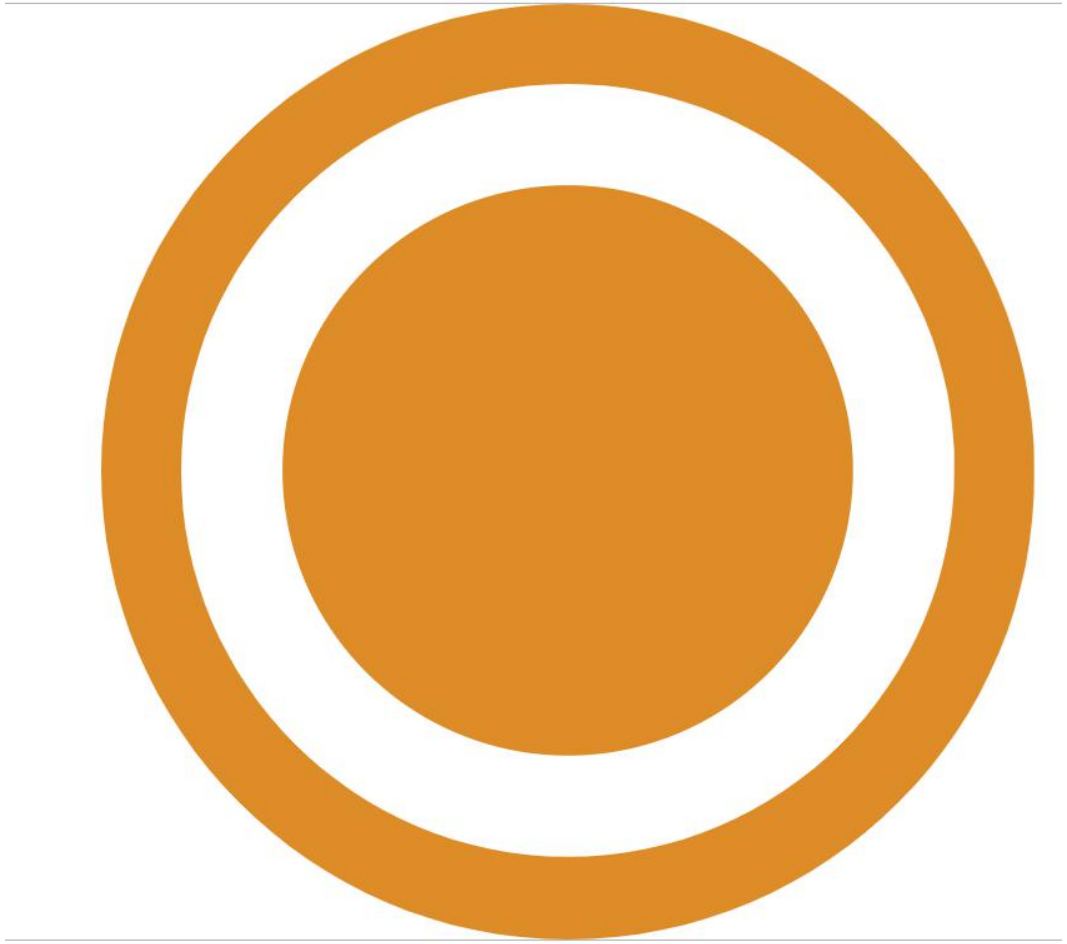
Scalable Vector Graphics (SVG)

	KB
Original	946
Optimized	1
GZip	687 bytes

Scalable Vector Graphics (SVG)

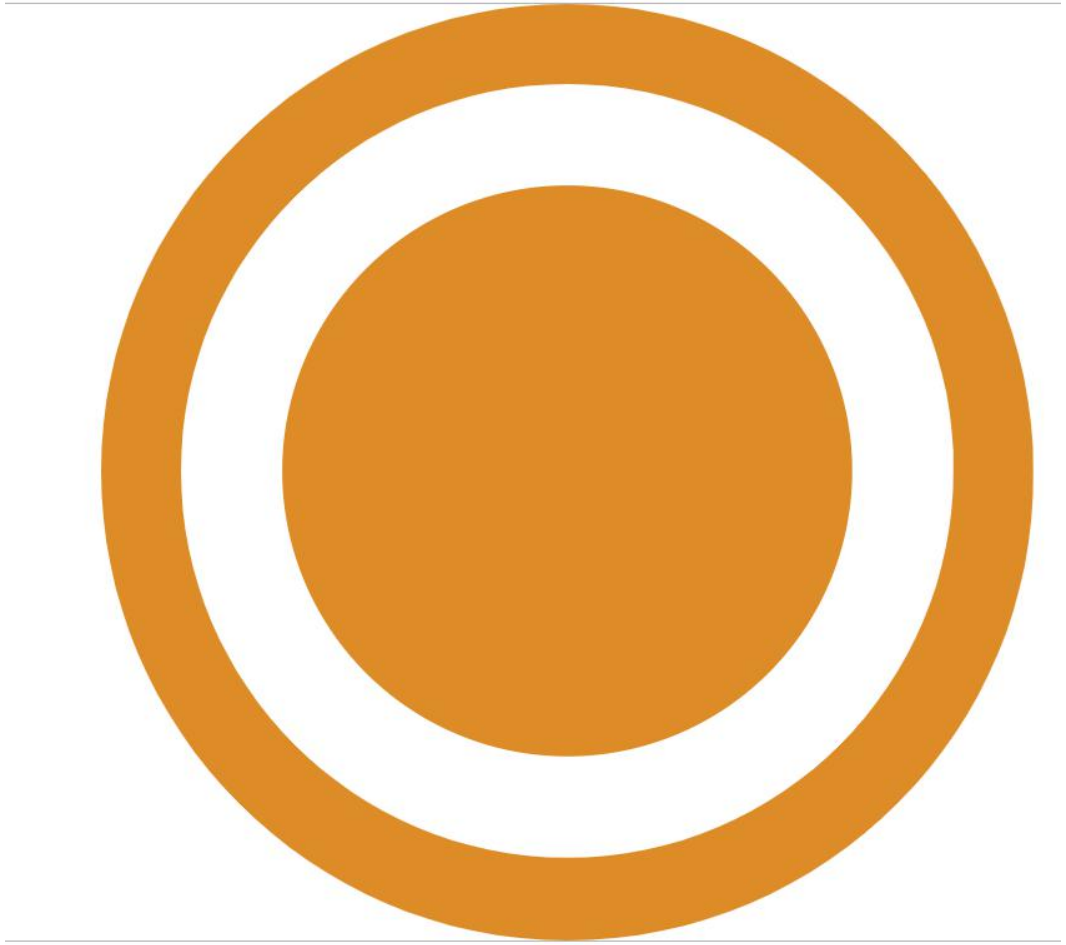
	KB
Original	946
Optimized	1
GZip	687 bytes
Brotli	525 bytes

Scalable Vector Graphics (SVG)



	KB
Original	946
Optimized	1
GZip	687 bytes
Brotli	525 bytes

Scalable Vector Graphics (SVG)



```
<style >
        .svgorange {
        filter: invert(.5) sepia(1)
saturate(5) hue-rotate(5deg);
        }
</style>
<img class="svgorange" src ="map-
marker-circle.svg">
```

https://medium.com/@union_io/swapping-fill-color-on-image-tag-svgs-using-css-filters-fa4818bf7ec6

Scalable Vector Graphics (SVG)

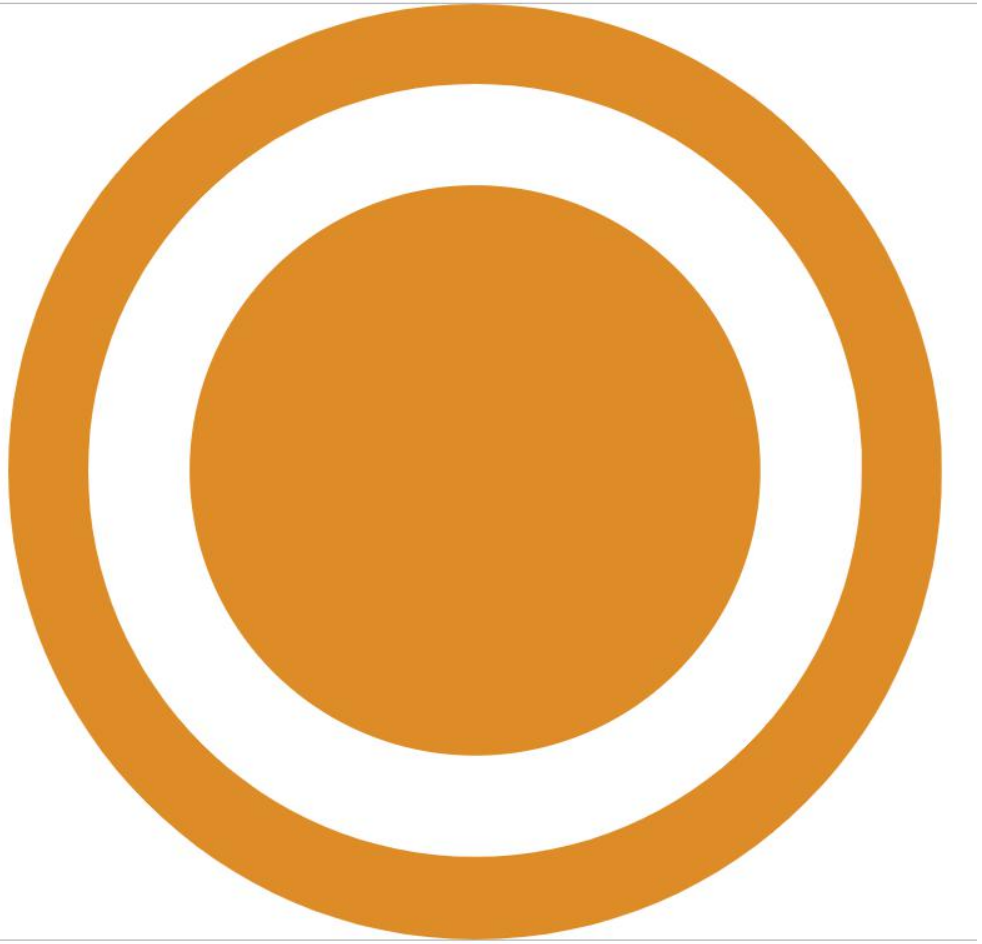


Image Formats – Average Size

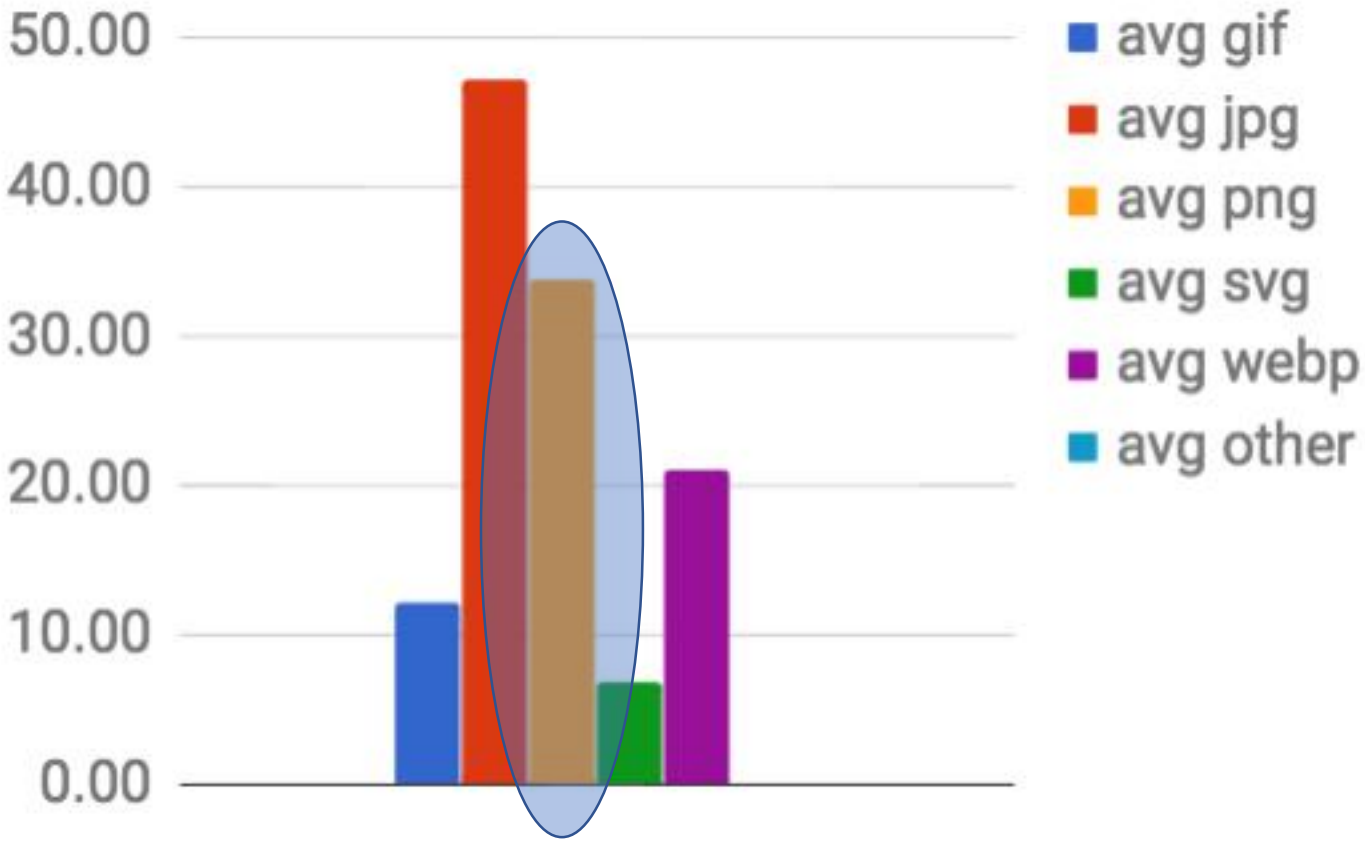


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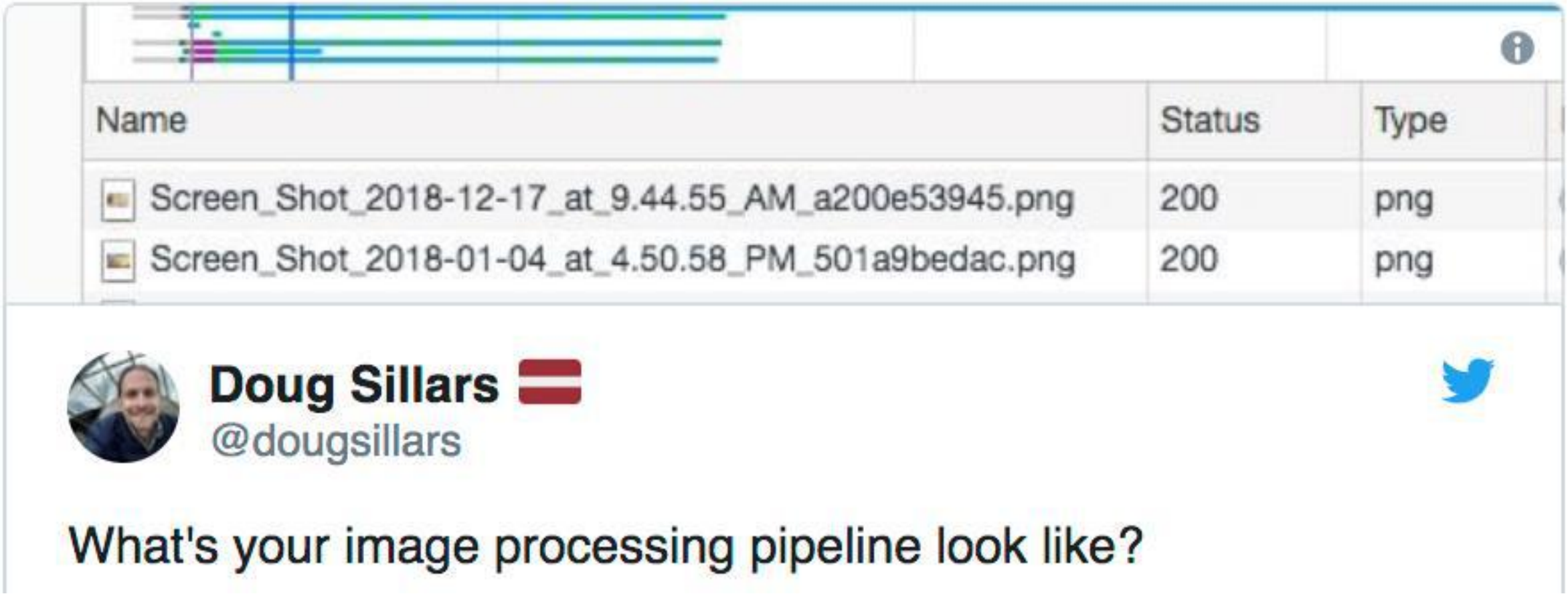
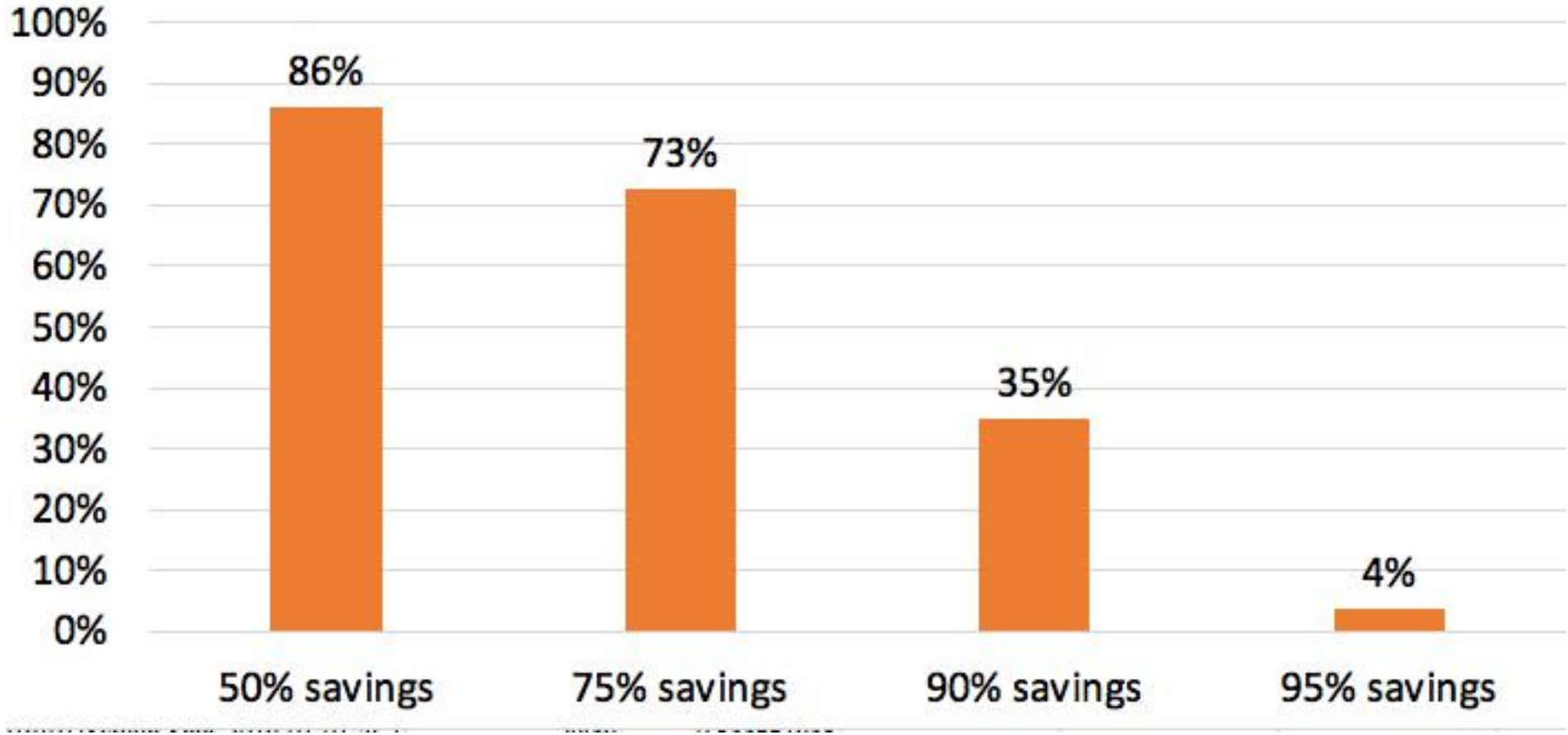
Image Formats – PNGs



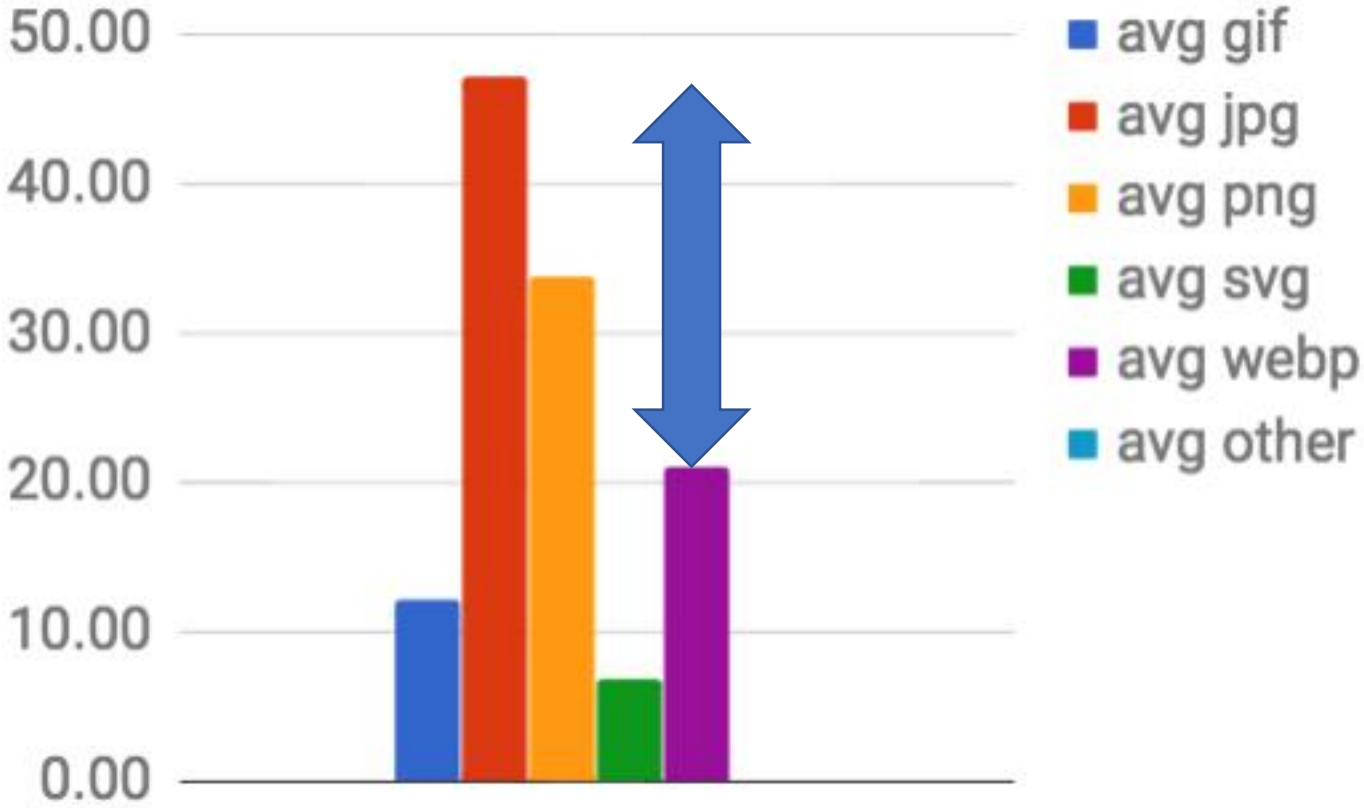
https://dougsillars.com/2019/02/10/using-screenshots-in-production/

Image Formats – Screenshots -> JPG



https://dougsillars.com/2019/02/10/using-screenshots-in-production/

Image Formats – Average Size



HTTPArchive mobile websites 15/02/18

File Format: WebP

WebP image format - UNOFF

Image format that supports lossy and lossless compression, as well as animation and alpha transparency.

Usage: Global

% of all users: 72.15% + 0.28% = 72.43%

Current aligned | Usage relative | Date relative | Apply filters | Show all | ?

IE	Edge *	Firefox	Chrome	Safari	Opera	iOS Safari *	Opera Mini *	Android Browser *	Blackberry Browser	Opera Mobile *	Chrome for Android	Firefox for Android	IE Mobile	UC Browser for Android	Samsu Interr
			4-8		10.1			2.1-3							
			1 9-22		1 11.5			1 4-4.1							
6-10	12-16	2-62	23-69	3.1-11.1	12.1-55	3.2-11.4		4.2-4.4.4	7	12-12.1			10		4-6
11	17	63	70	12	56	12	all	67	10	46	70	63	11	11.8	7.2
	18	64	71-73	TP											
		65													

https://caniuse.com/#feat=webp

SSIM + WebP

986 KB

http://res.cloudinary.com/dougsillars/image/upload/q_auto,f_auto/v1529005982/IMG_20180614_184507_

File Format: Web

```
<picture>
        <source width = "100%" type="image/webp" srcset=”riga.webp">
        <img width = "100%"     src=”riga_cjpeg_dssim.jpg"
                alt=”Riga, Latvia">
</picture>
```

	Load Time (ms)	TotalBytes
Full	21786	3761729
85%	11830	1967615
SSIM	9457	1538613
WebP	7031	1014535

Image Format Use “In The Wild”

http archive

500,000 mobile sites
Analyzed 3/15/18

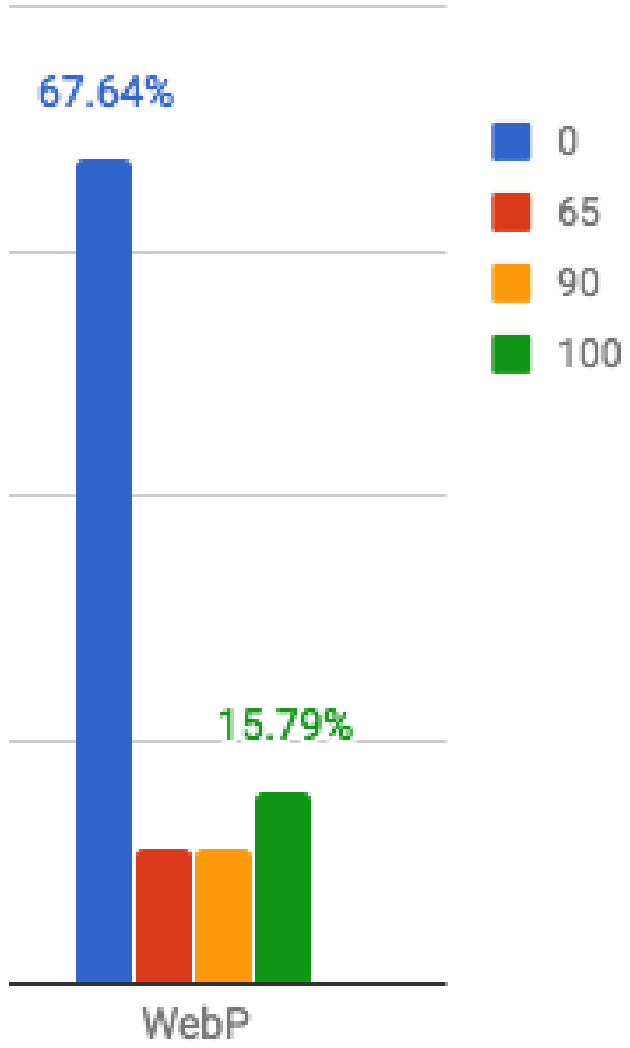
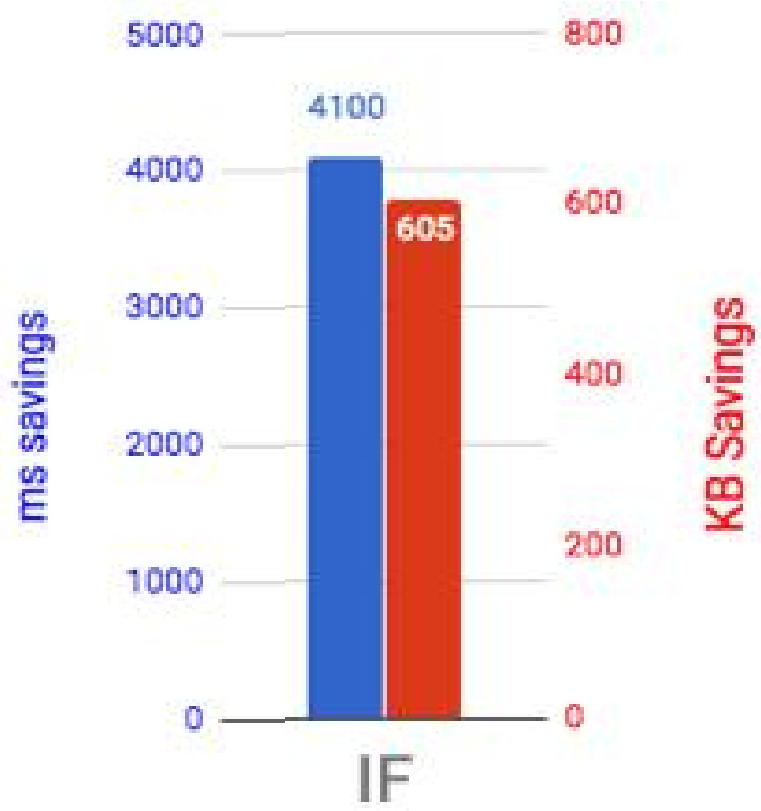


Image Format Use “In The Wild”

http archive

500,000 mobile sites
Analyzed 3/15/18



4 Simple Image Optimizations

1. Quality
2. Format
3. Sizing
4. Lazy Loading

Image Sizing

	Dimensions	KB
Original	3120x4160	1633
SSIM/Webp	3120x4160	804

-

Image Sizing

	Dimensions	KB
Original	3120x4160	1633
SSIM/Webp	3120x4160	804

Image Sizing

	Dimensions	KB
Original	3120x4160	1633
SSIM/Webp	3120x4160	804

-

Image Sizing

	Dimensions	KB
Original	3120x4160	1633
SSIM/Webp	3120x4160	804

624

832

-

Image Sizing

	Dimensions	KB
Original	3120x4160	1633
SSIM/Webp	3120x4160	804

12,979,000 pixels

\- 519,000 pixels

12,460,000 pixels

Image Sizing

	Dimensions	KB
Original	3120x4160	1633
SSIM/Webp	3120x4160	804

624

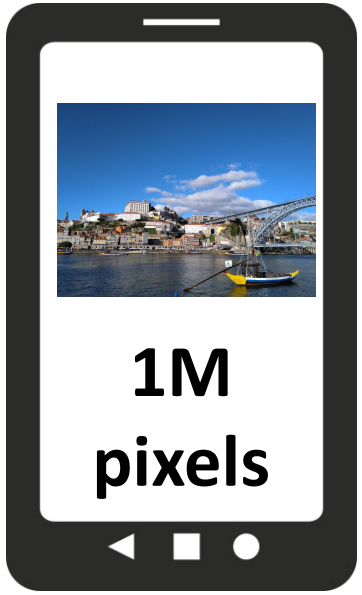
832

12,979,000 pixels

\- 519,000 pixels

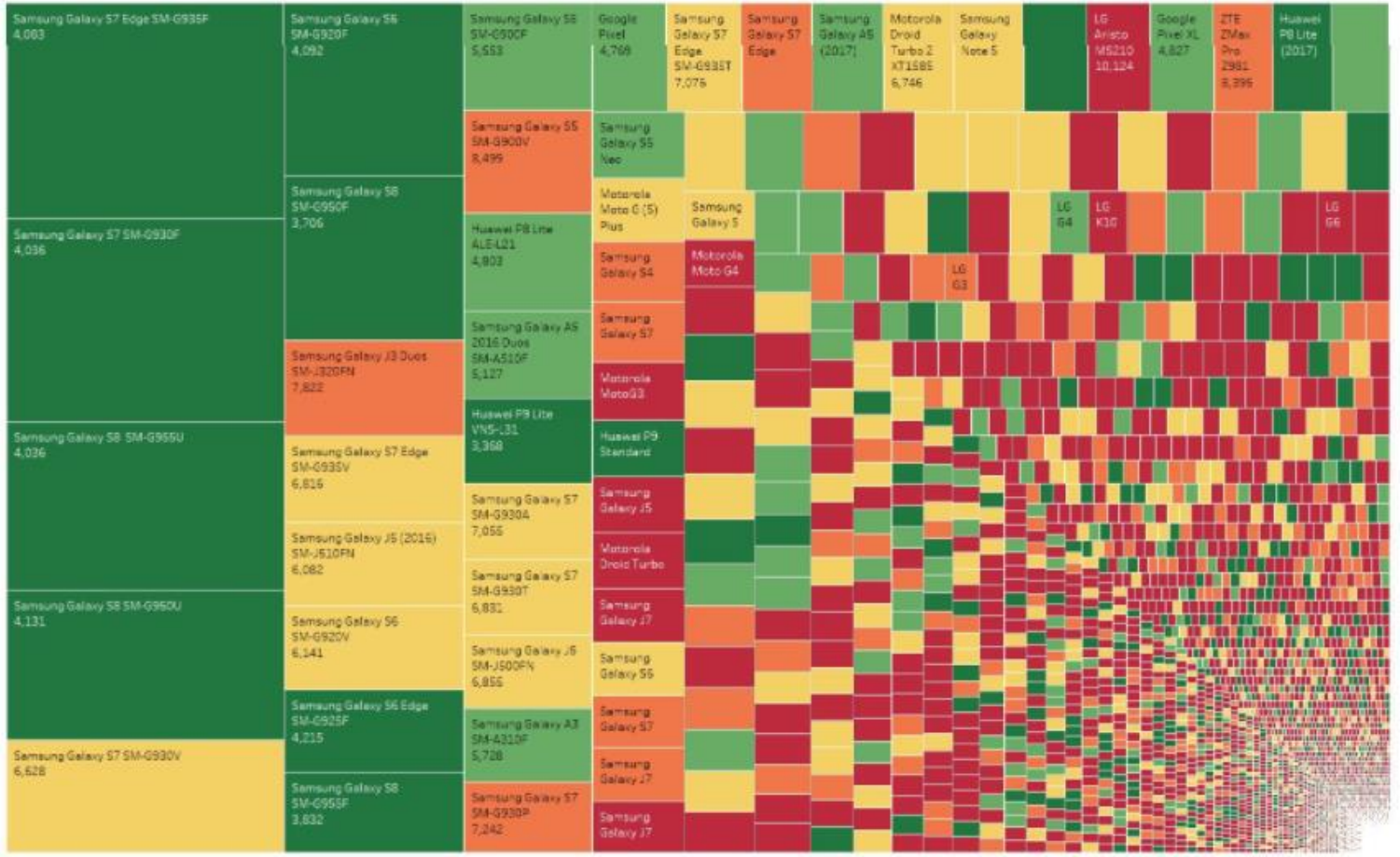
12,460,000 pixels

Image Processing



	Download (s)	Image Decode (ms)
Desktop	14	78
Moto G4	14.2	218
Alcatel 1X	14.2	820

Image Sizing



https://twitter.com/paulcalvano/status/928751141843808256

Image Sizing

Responsive Images:

Generate a set of images
25 KB difference in size

-

Responsive Images

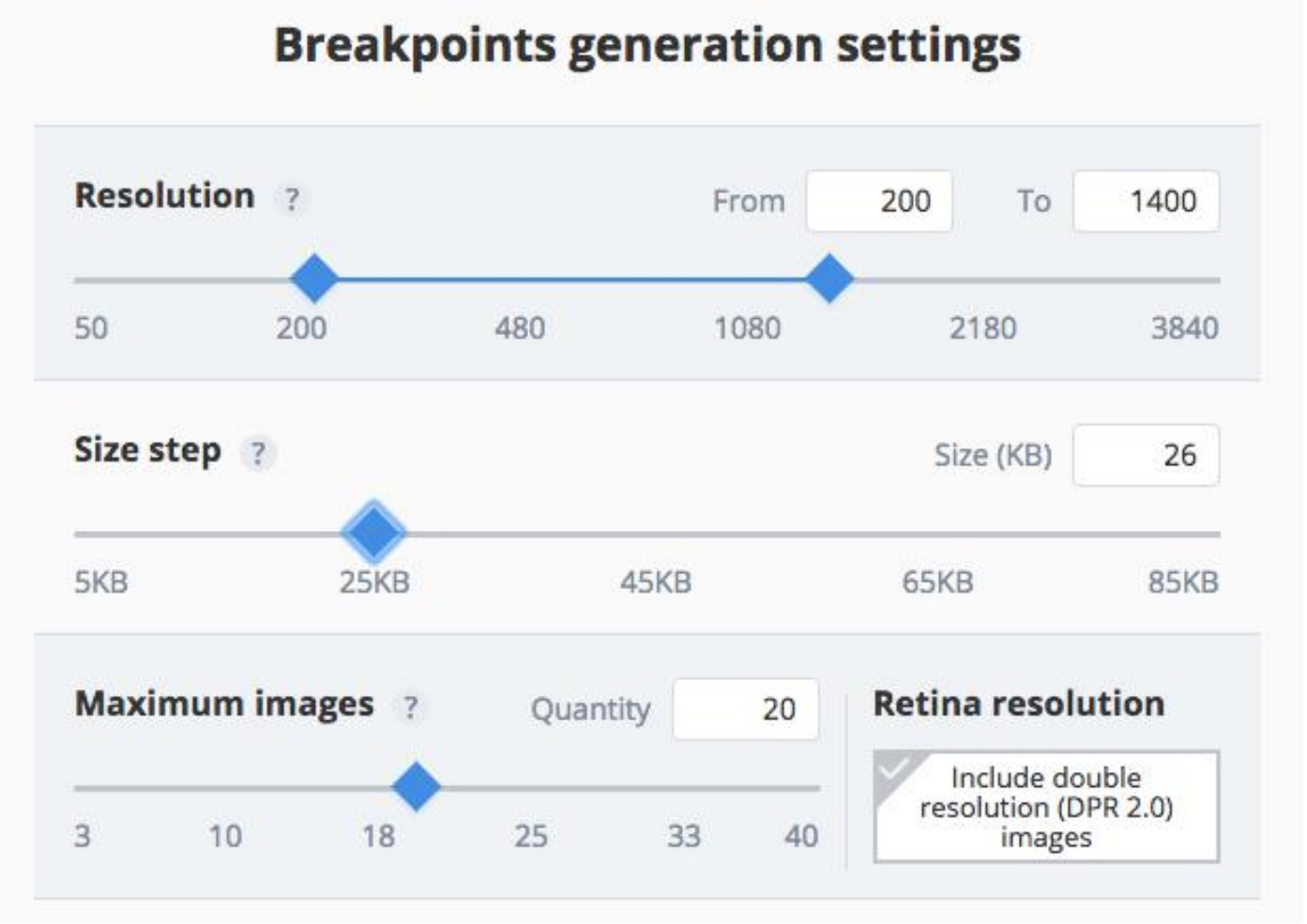
625,000 pixels

- 519,000 pixels

106,000 pixels

Responsive Breakpoint Generation

https://github.com/cloudinary/responsive_breakpoints_generator
http://www.responsivebreakpoints.com/



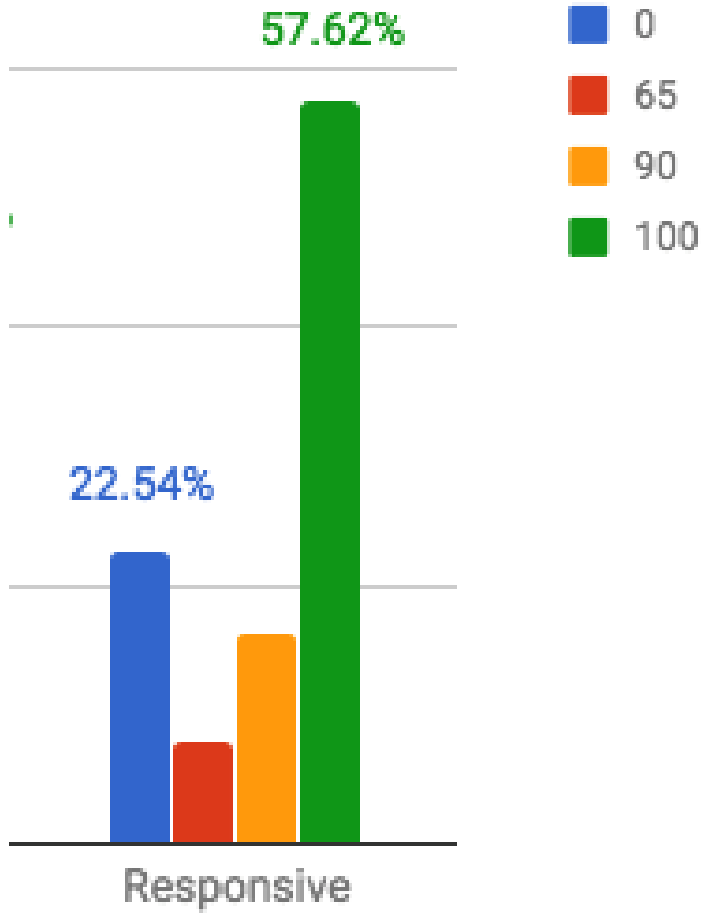
Responsive Images

	Load Time (ms)	TotalBytes
Full	21786	3761729
85%	11830	1967615
SSIM	9457	1538613
WebP	7031	1014535
Responsive	2186	120918

Responsive Images Use “In The Wild”

http archive

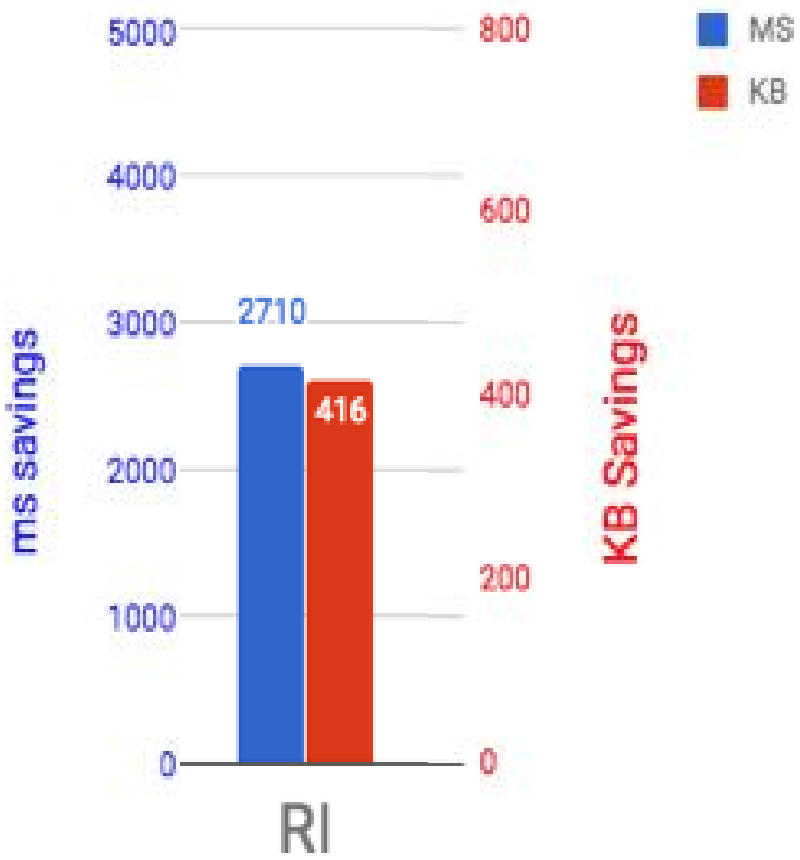
500,000 mobile sites
Analyzed 3/15/18



Responsive Images Use “In The Wild”

http archive

442,000 mobile sites
Analyzed 3/15/18



4 Simple Image Optimizations

1. Quality
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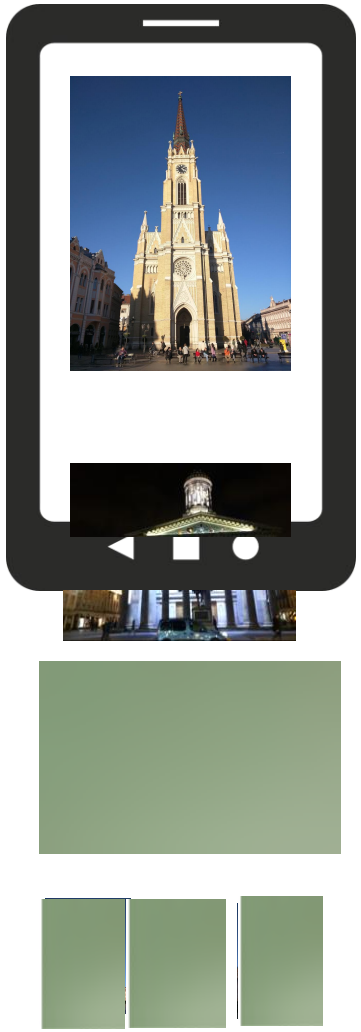
Lazy Load

https://calendar.perfplanet.com/2017/progressive-image-loading-using-intersection-observer-and-sqip/

Lazy Load

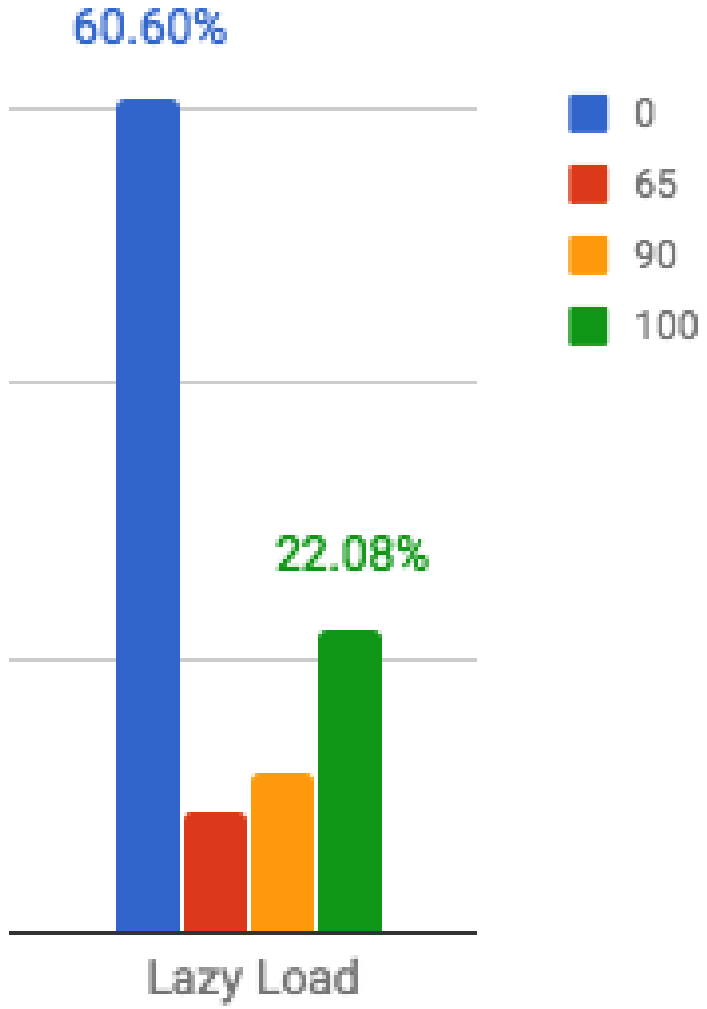


https://calendar.perfplanet.com/2017/progressive-image-loading-using-intersection-observer-and-sqip/

Lazy Loading Use “In The Wild”

http archive

442,000 mobile sites
Analyzed 3/15/18



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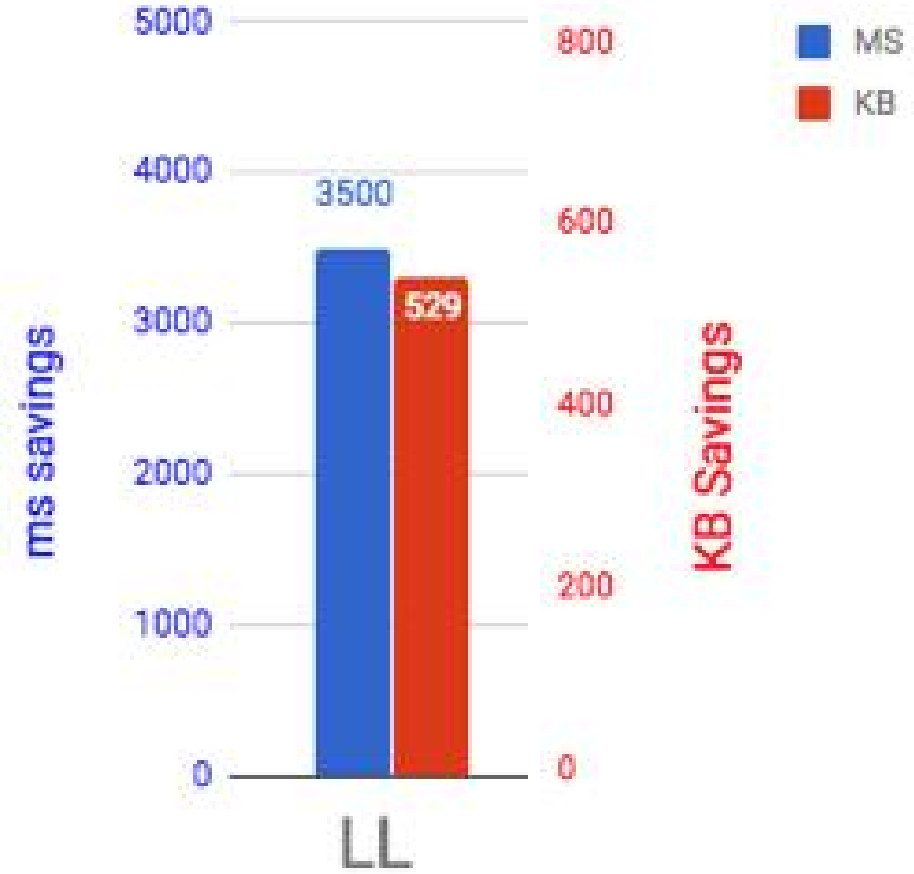
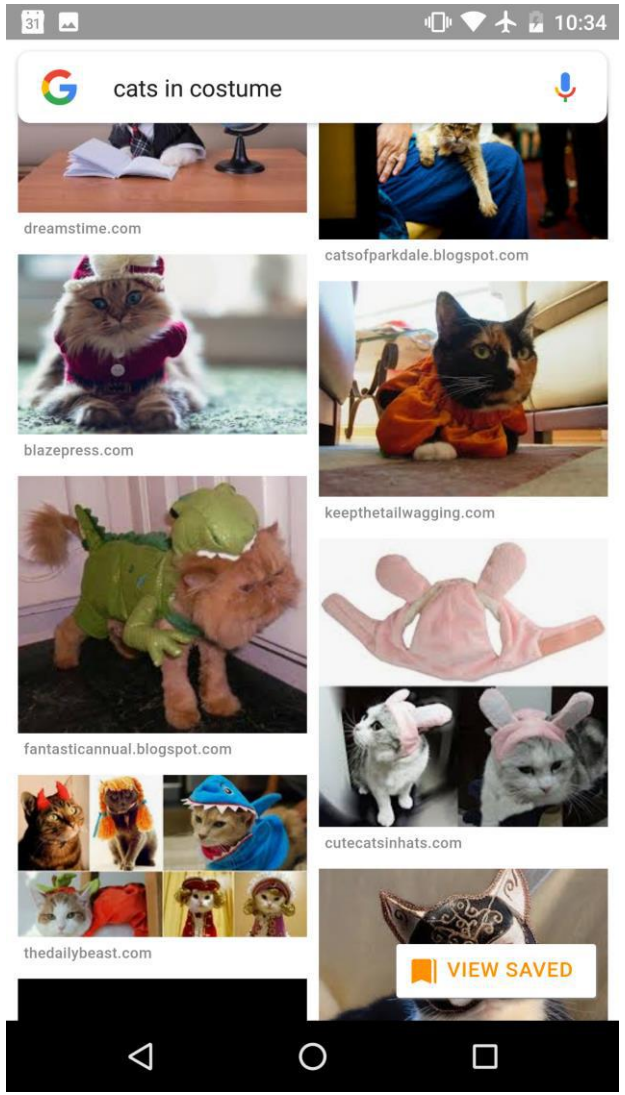


Preview Images



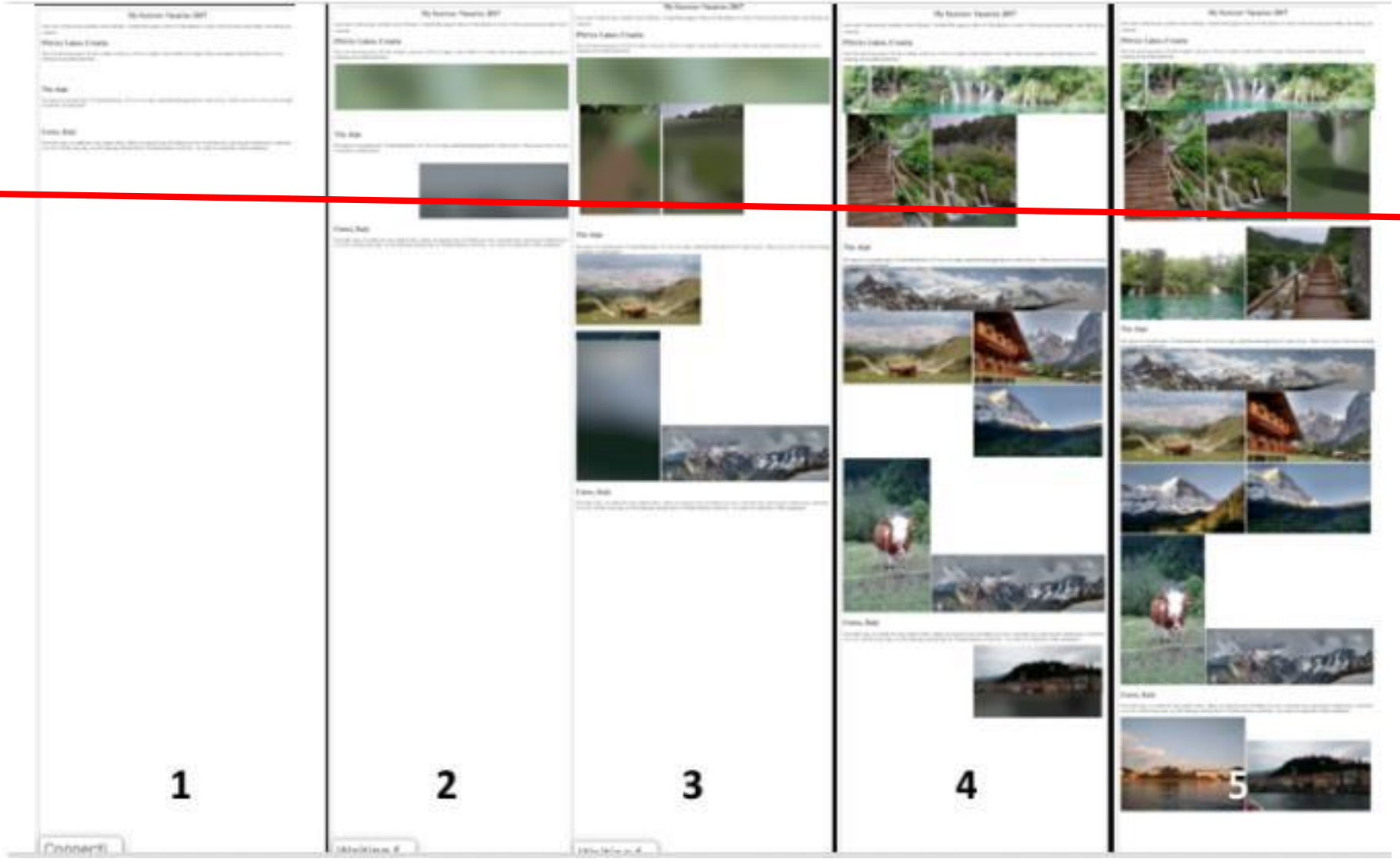
Optimizing Content Delivery

Preview Images

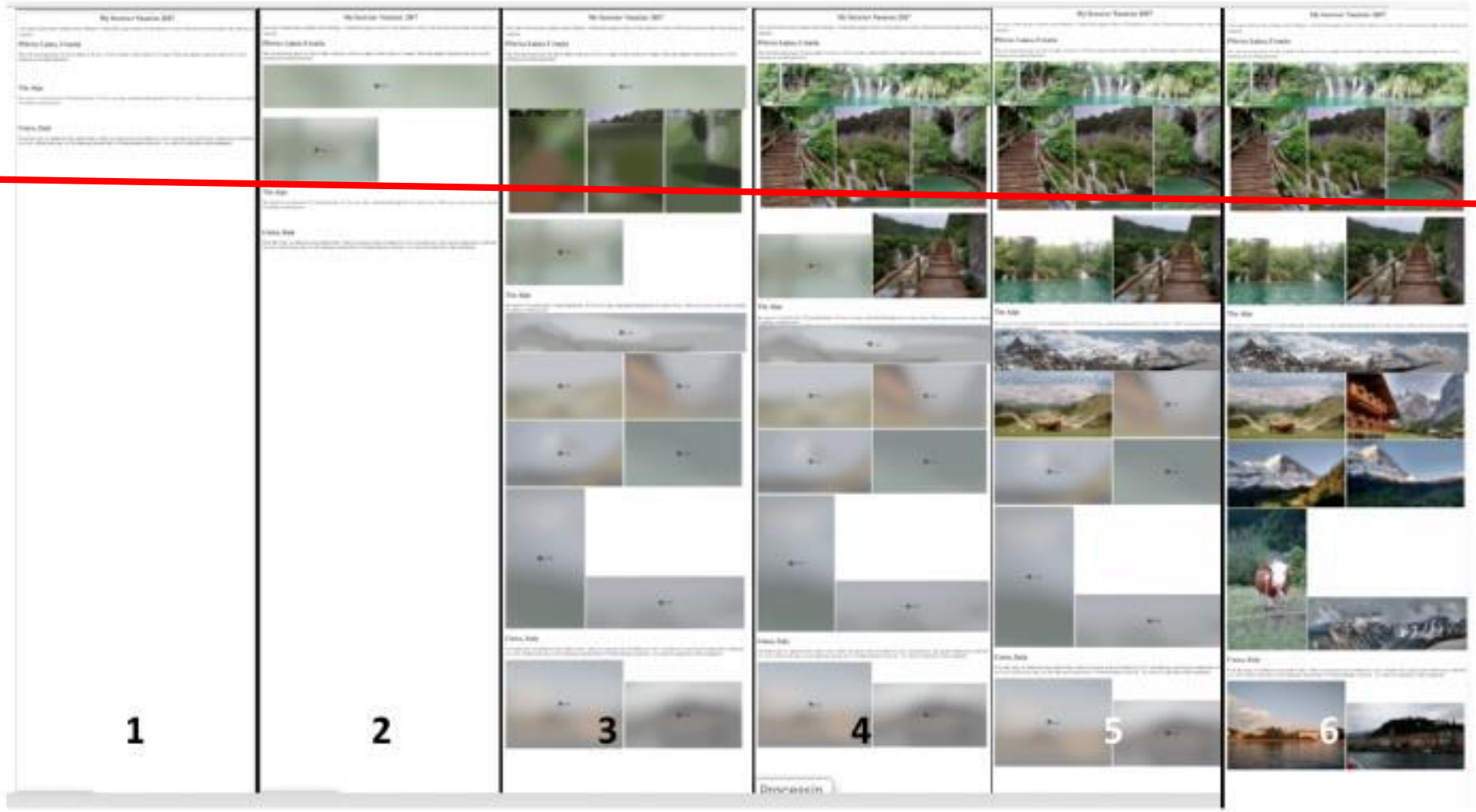
https://github.com/technopagan/sqip

Lazy Loading: Experiments

Lazy Loading: Chrome Experiments



Lazy Loading: Chrome Experiments



Animated GIFs

Original MP4
1.4 MB

Animated GIFs

Animated GIFs

Animated GIF
3.8 MB
270% larger

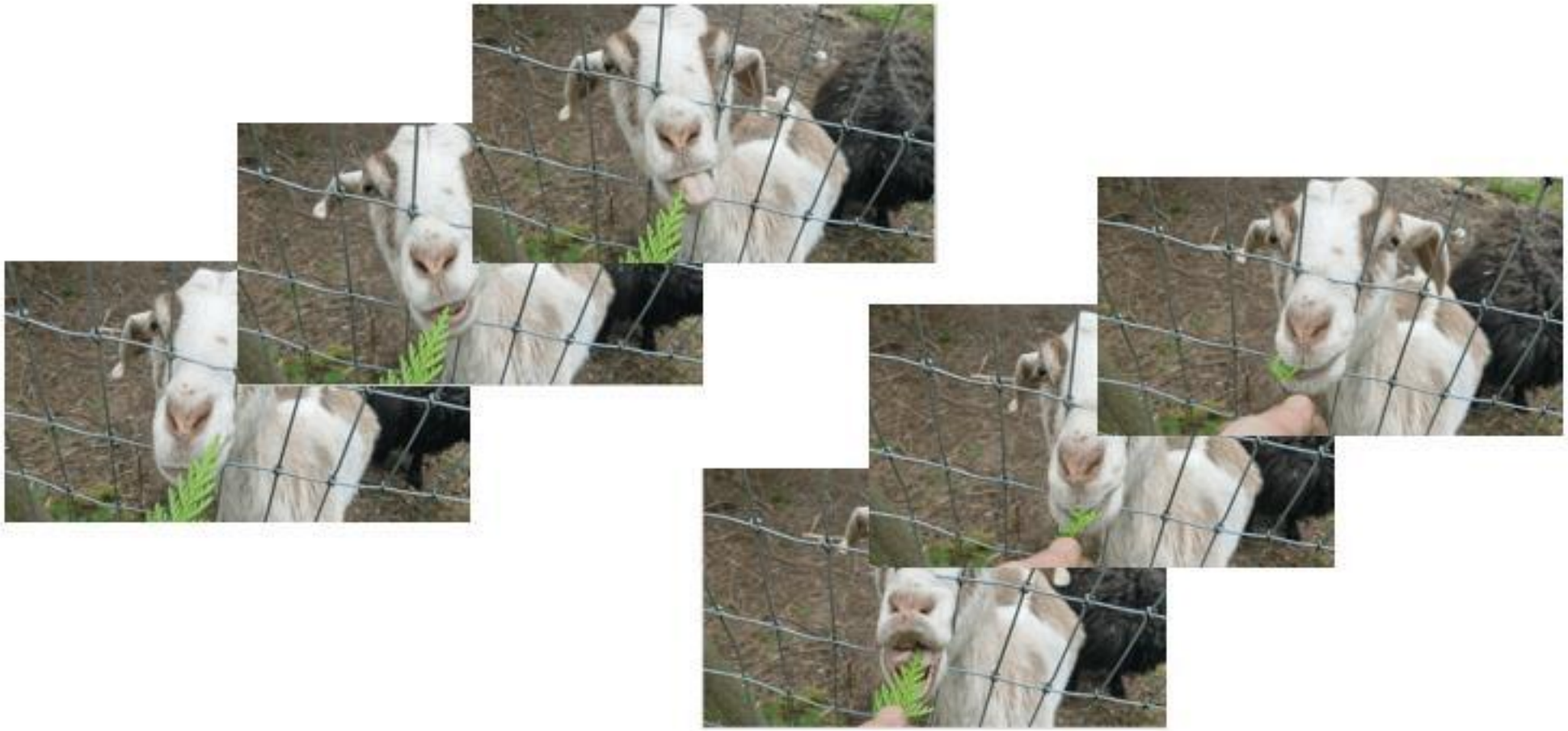
Animated GIFs

“The Graphics Interchange Format is not intended as a platform for animation, even though it can be done in a limited way.”

-GIF89a Specification

https://www.w3.org/Graphics/GIF/spec-gif89a.txt

Animated GIFs



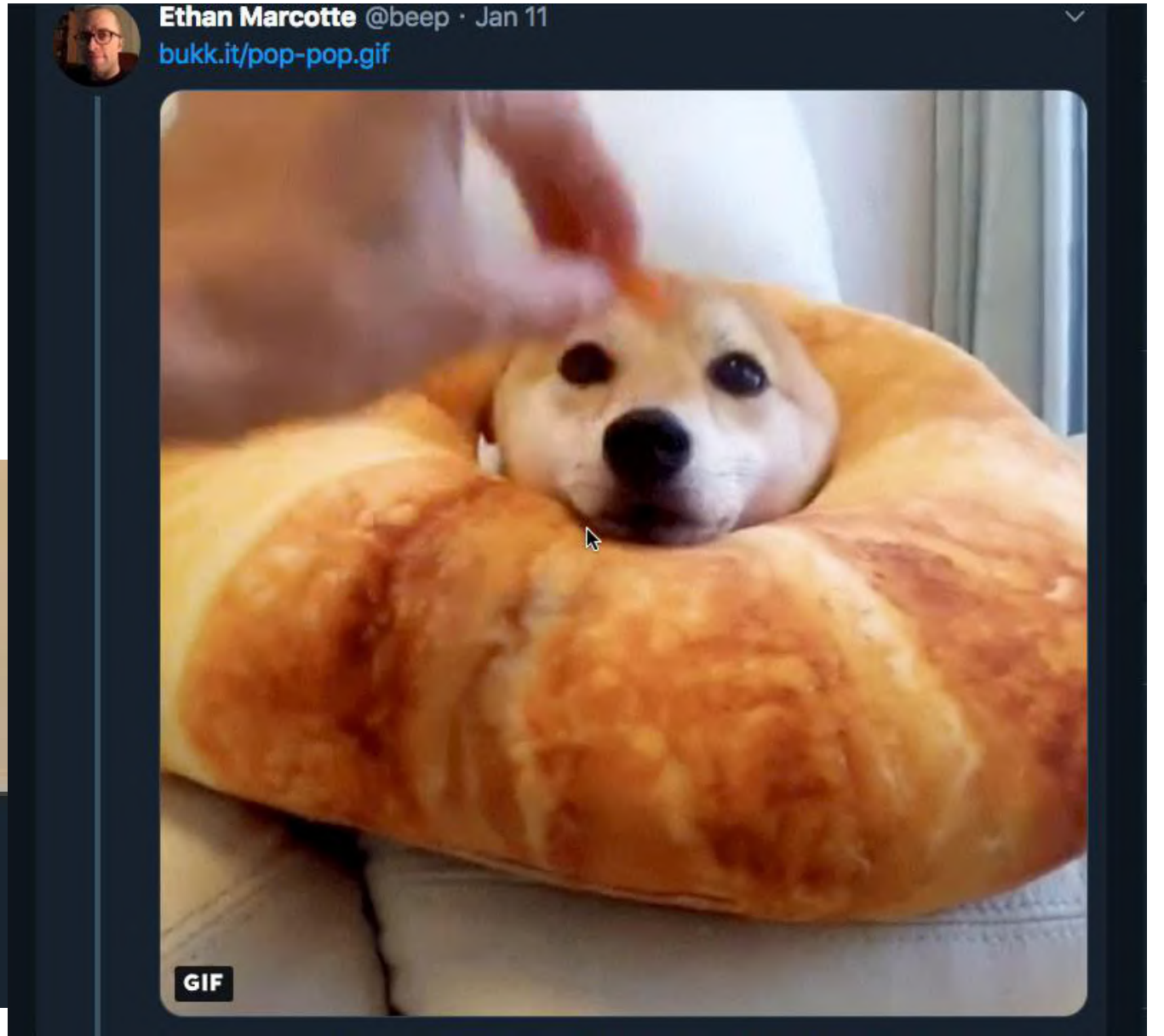
Animated GIFs

MP4: 256 colors

247KB

93% smaller

Animated GIFs: Social Media



Animated GIFs: Social Media

#FAKENEWS

Animated GIFs: Social Media

Name	Status	Type	Initiator	Size
				48
				Servic.
				984
DwpJ4pgWwAAGTLr.mp4	206	media	Other	396 K
				25
				2.1 K
				257
				629
				3.2 K
				ervic.
				25
				48
				115
				48
client_event.json	200	xhr	main.3ee8aa9b1f24...	(from Servic.

Animated GIFs: as Video!

Video Tags:

```
<video loop autoplay muted playsinline controls = "false” src="goats.mp4”/>
```

Img tags are fast!

```
<picture>
    <source type="video/mp4" srcset=”goats.mp4">
    <source type="image/webp" srcset=”goats.webp">
    <img src=”goats.gif">
</picture>
```

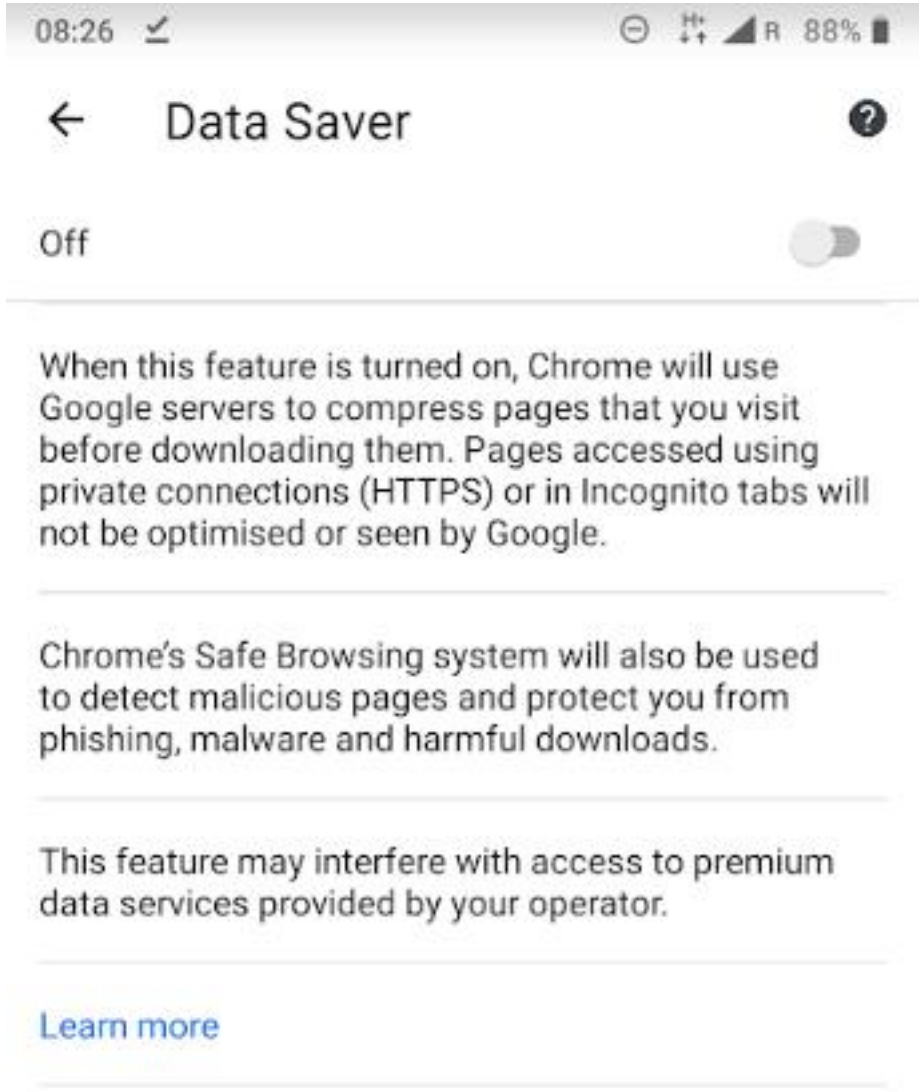
https://calendar.perfplanet.com/2017/animated-gif-without-the-gif/

Animated GIFs

	Load Time (ms)	TotalBytes
Animated GIF	22424	3835301
Animated WebP	18757	3044910
Video	4536	250658

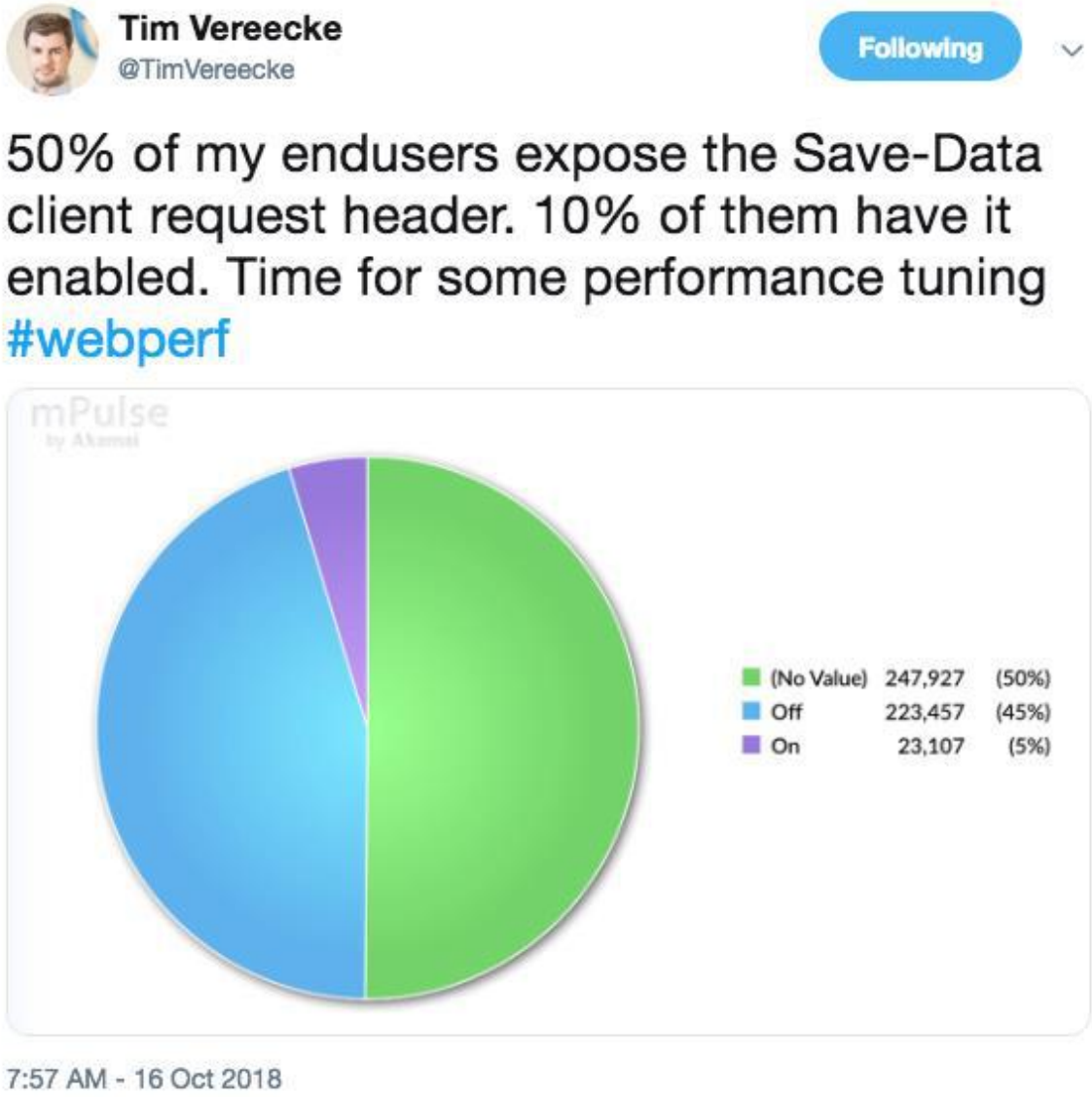
Addendum: What Are Your Customers Saying?

Addendum: Save-Data



Save-Data: on

Addendum: Save-Data



Addendum: Save-Data

q_auto -> q_auto:eco

180KB -> 135 KB

https://res.cloudinary.com/dougsillars/image/upload/w_1400,q_auto/v1540978150/IMG_20181028_153301_okeb2b.jpg

Addendum 2: Network Info

Addendum 2: Network Info

```
// Network type that browser uses
navigator.connection.type;

// Effective bandwidth estimate
navigator.connection.downlink

// Effective round-trip time estimate
navigator.connection.rtt

// Upper bound on the downlink speed of the first network hop
navigator.connection.downlinkMax
```

Addendum 2: Network Info

// Network type that browser uses
navigator.connection.type;

// Effective bandwidth estimate
navigator.connection.downlink

500 KBPS

// Effective round-trip time estimate
navigator.connection.rtt

// Upper bound on the downlink speed of the first network hop
navigator.connection.downlinkMax

Conclusion

Images

Optimize Image:

- Quality
- Format
- Sizing
- Lazy Load if Possible
- aGIFs to movies
- No Base64 Encoded Images
- Monitor Customer’s headers

Video

Optimize Image:

- device screen (DPR?)
- only download if displayed
- Bitrate
- Streaming is more efficient
- Video can be expensive

Summary

Tooling

Testing:

WebPageTest	https://www.webpagetest.org
HttpArchive	https://httparchive.org

Images:

ImageMagick	https://www.imagemagick.org
SSIM	https://github.com/technopagan/cjpeg-dssim
LazySizes	https://github.com/aFarkas/lazysizes
Responsive Breakpoints	http://www.responsivebreakpoints.com/
Cloudinary	https://www.cloudinary.com

Conclusion

Images CAN Be Beautiful AND Fast

Love Building with Video and Images?

Become a

Cloudinary

Media Developer Expert

mde-comm@cloudinary.com