

# Load Time

Time it takes full web page to render in the browser. Measured in seconds.



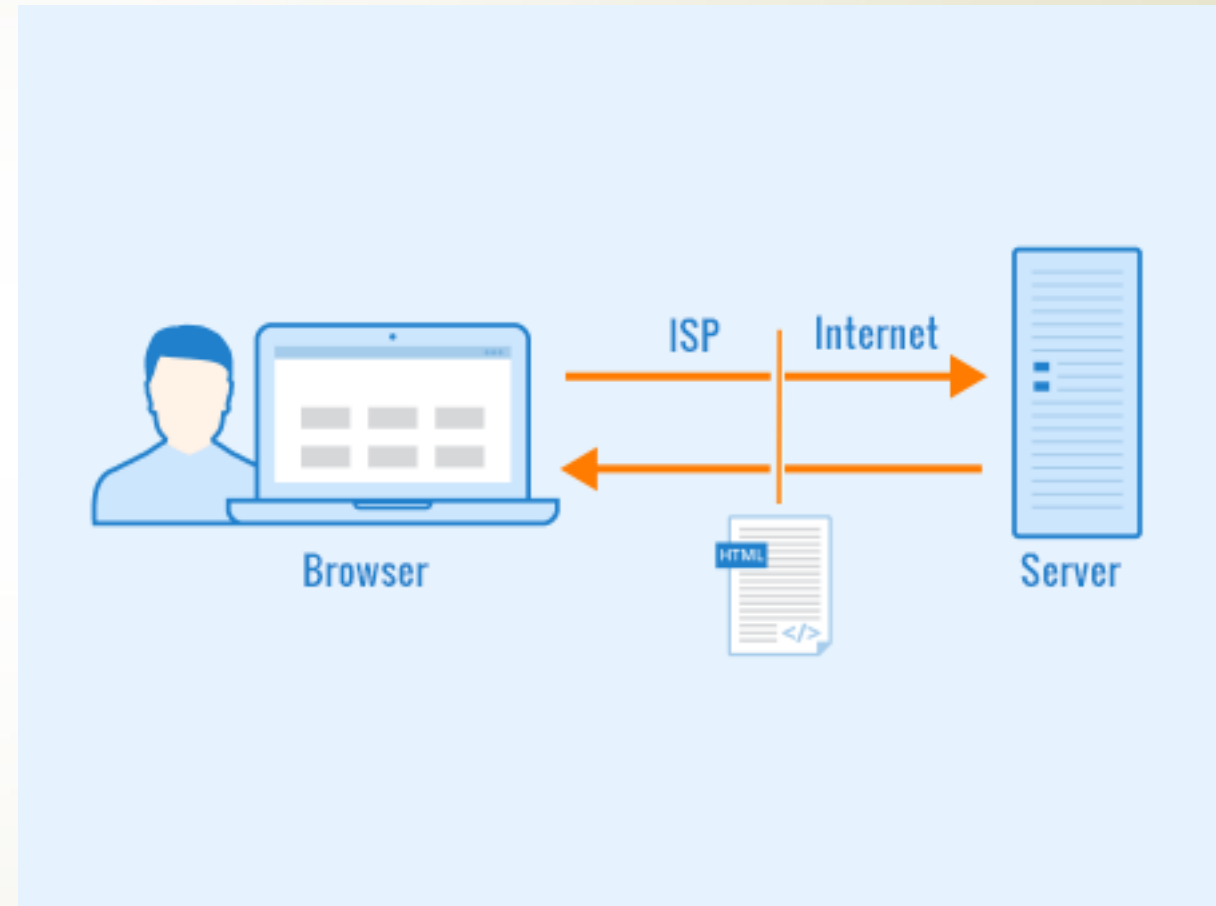
# Web Server/Client (Browser)

Client (browser) requests a resource

- Web page
- Image
- CSS
- etc.

Server returns resource

Both directions - ISP (Internet Service Provider) and Internet



# Simple Download Time

Depends on connection speed and file sizes

Page is made up of multiple files

Page size is total of all files

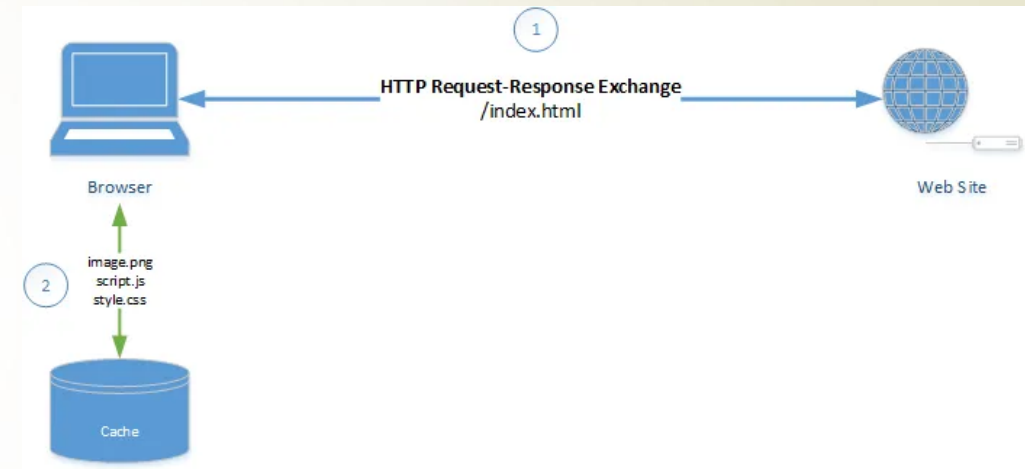
Add by hand, or see WebPageTest tool

[www.webpagetest.org](http://www.webpagetest.org)



# Browser Cache

- Browser cache—stores recently downloaded files
- Default size 50M - configurable
- Max cache size 1024M (1G)
- Deletes older files when full
- Disk cache (view in Firefox - about:cache)



# Nielsen Guidelines

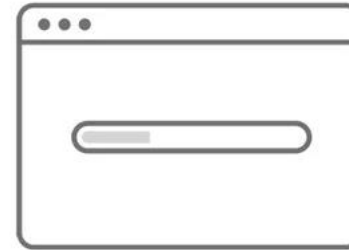
- < 0.1 sec – Instantaneous
- <1.0 sec – User Thought uninterrupted
- 10 sec – Limit for keeping user's attention

[www.nngroup.com/articles/response-times-3-important-limits/](http://www.nngroup.com/articles/response-times-3-important-limits/)



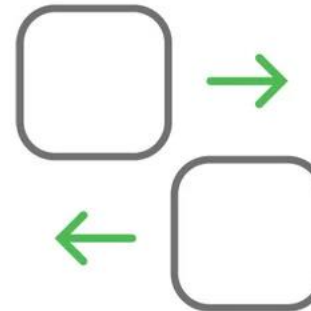
# Google Guidelines

- Slow sites have a negative impact on revenue
- 40% of shoppers will wait no more than three seconds before abandoning a retail or travel site
- Slow site/app - 29% of smartphone users will immediately switch to another site/app



40%

of shoppers will wait no more than three seconds before abandoning a retail or travel site.



29%

of smartphone users will immediately switch to another site or app if it doesn't satisfy their needs (e.g. they can't find information or it's too slow)

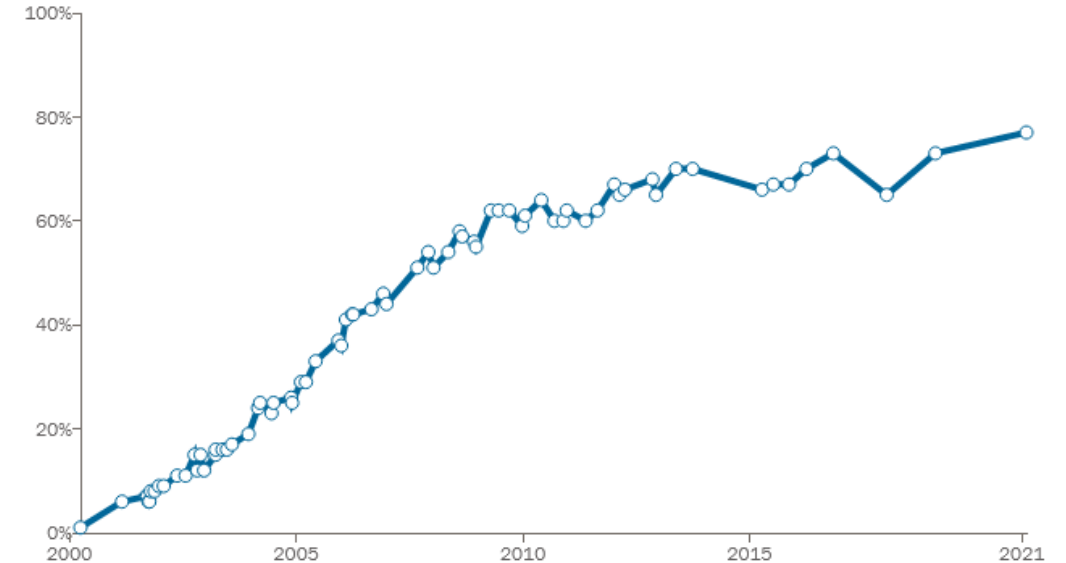


# Home Broadband

- 95% of US adults use internet
- ~77% of adults have home broadband

## Home broadband use

% of U.S. adults who say they have a broadband connection at home



Note: Respondents who did not give an answer are not shown. The Center has used several different question wordings to identify broadband users in recent years, which may account for some variance in broadband adoption figures between 2015 and 2018. Our survey conducted in July 2015 used a directly comparable question wording to the one conducted in January 2018.

Source: Surveys of U.S. adults conducted 2000-2021.

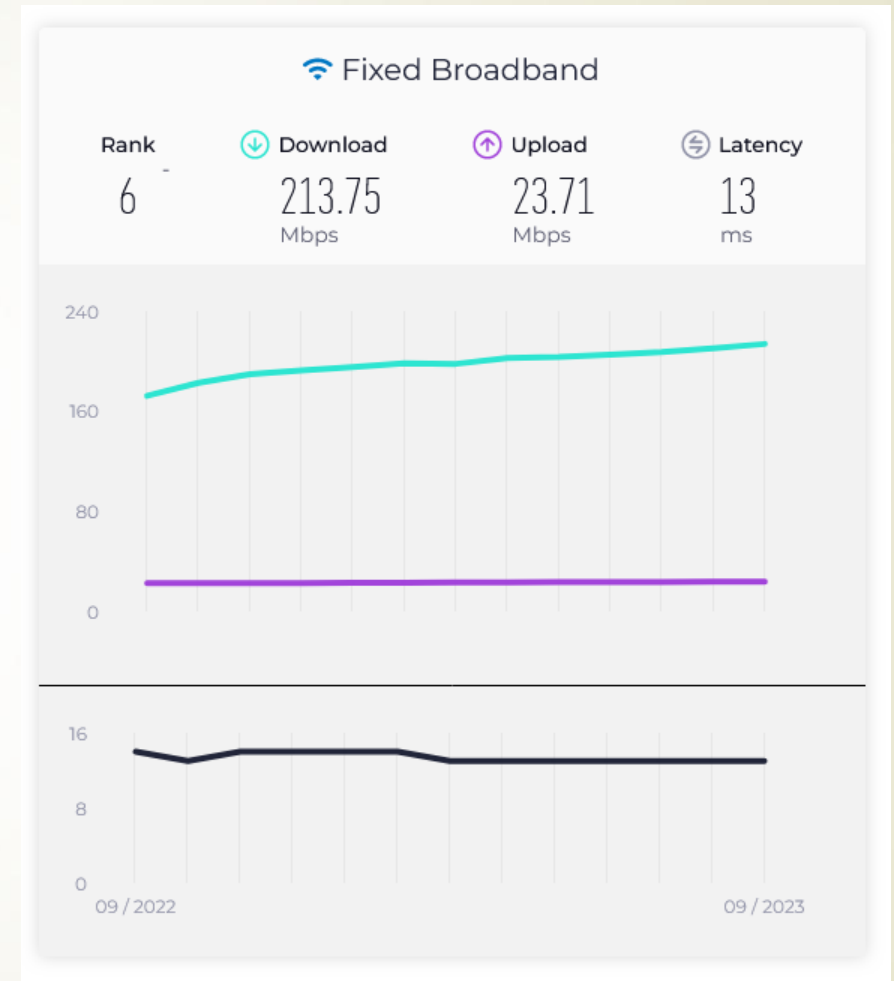
PEW RESEARCH CENTER

[Chart](#) [Data](#) [Share](#)



# Home Broadband Speed

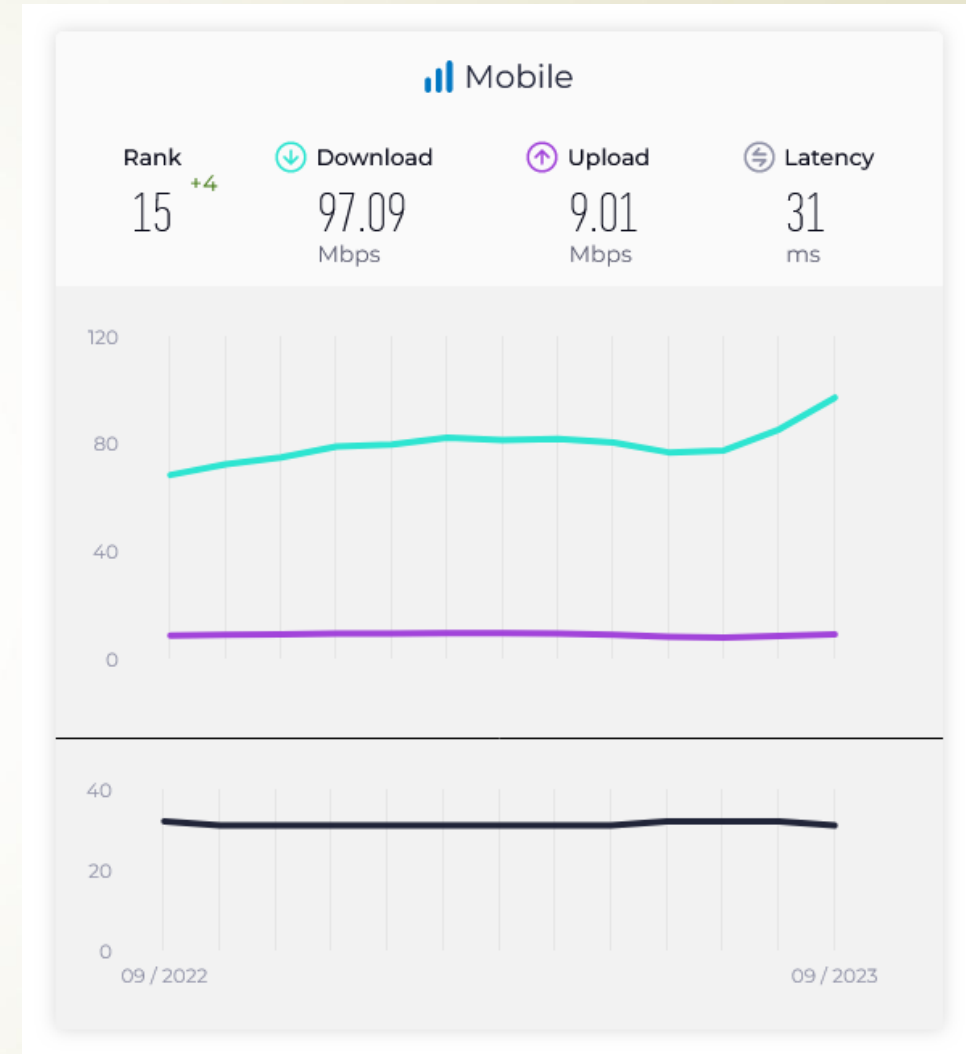
- Average fixed broadband speed U.S. 214 Mbps
- <https://www.speedtest.net/global-index/united-states>
- 486 Mbps in my house this morning - Fiber Optic
- Google "Speed Test"





# Mobile Broadband Speed

- ~15% of adults smartphone internet only
- Mobile internet penetration ~75%
- Average mobile broadband speed 97M U.S
- Real world speeds often much lower - examples: motel connections, mobile connections outside urban areas



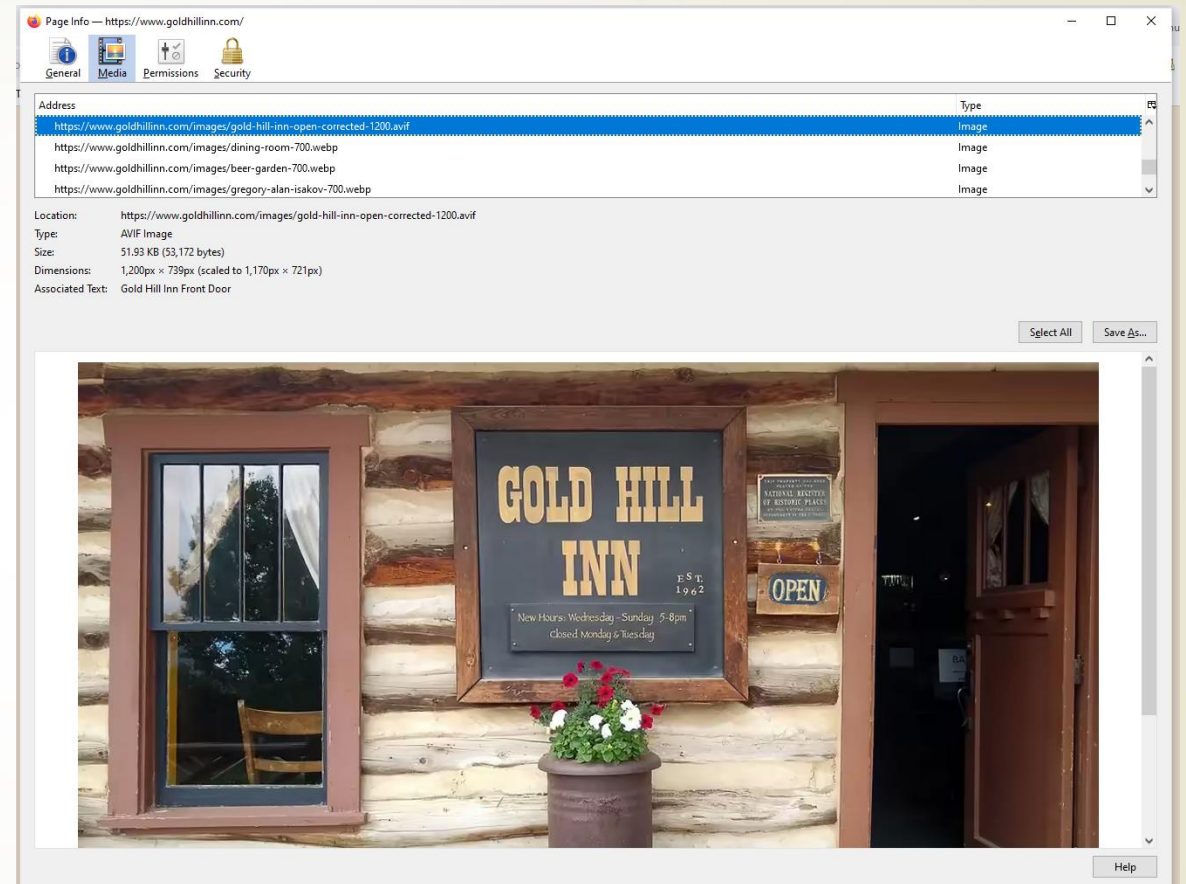
# Image size vs. file size

- JPG @ 75 Quality
  - 753K (2400 x 2400 px)
  - 220K (1200 x 1200 px)
  - 57K (600 x 600 px)
- File size roughly proportional to the number of pixels



# View File Size

- Firefox
- Ctrl-I
- Media



# Simple Strategies

- Less complicated, graphical layouts
- Fewer, smaller images
- Size images correctly
- Optimal image formats
  - **JPG** – Photos, images with many colors (*Lossy*)
  - **PNG-8** – Graphics, <256 colors (*Lossless*)
  - **PNG-24** – Alpha Transparency (*Lossless*)



# Optimize w/Online Tools

- Squoosh
- Compress-or-die
- Tinypng
  - Analyzer
  - Web files
- Examples



# Next Gen Formats

- WebP
- SVG
- AVIF

webp

SVG



# Can I Use Webp?

- [caniuse.com/webp](https://caniuse.com/webp)
- Safari since 2022
- See video!

## WebP image format - OTHER





**Baseline** Widely available across major browsers  

Image format (based on the VP8 video format) that supports lossy and lossless compression, as well as animation and alpha transparency. WebP generally has better compression than JPEG, PNG and GIF and is designed to supersede them. [AVIF](#) and [JPEG XL](#) are designed to supersede WebP.

Current aligned

Usage relative

Date relative

Filtered

All



Chrome	Edge <sup>*</sup>	Safari	Firefox	Opera	IE	Chrome for Android	Safari on iOS <sup>*</sup>
4-8				10.1			
<sup>1</sup> 9-22		3.1-13.1		<sup>1</sup> 11.5			
<sup>2</sup> 23-31	12-17	<sup>3</sup> 14-15.6	2-64	<sup>2</sup> 12.1-18			3.2-13.7
32-134	18-133	16.0-18.3	65-136	19-116	6-10		14-18.3
135	134	18.4	137	117	11	134	18.4
136-138		18.5-TP	138-140				18.5





# Can I Use AVIF?

- [caniuse.com/?search=avif](https://caniuse.com/?search=avif)
- Firefox, Safari since 2023

## AVIF image format - OTHER



**Baseline 2024**

Newly available across major browsers



A modern image format based on the [AV1 video format](#). AVIF generally has better compression than [WebP](#), JPEG, PNG and GIF and is designed to supersede them. AVIF competes with [JPEG XL](#) which has similar compression quality and is generally seen as more feature-rich than AVIF.

Current aligned

Usage relative

Date relative

Filtered

All



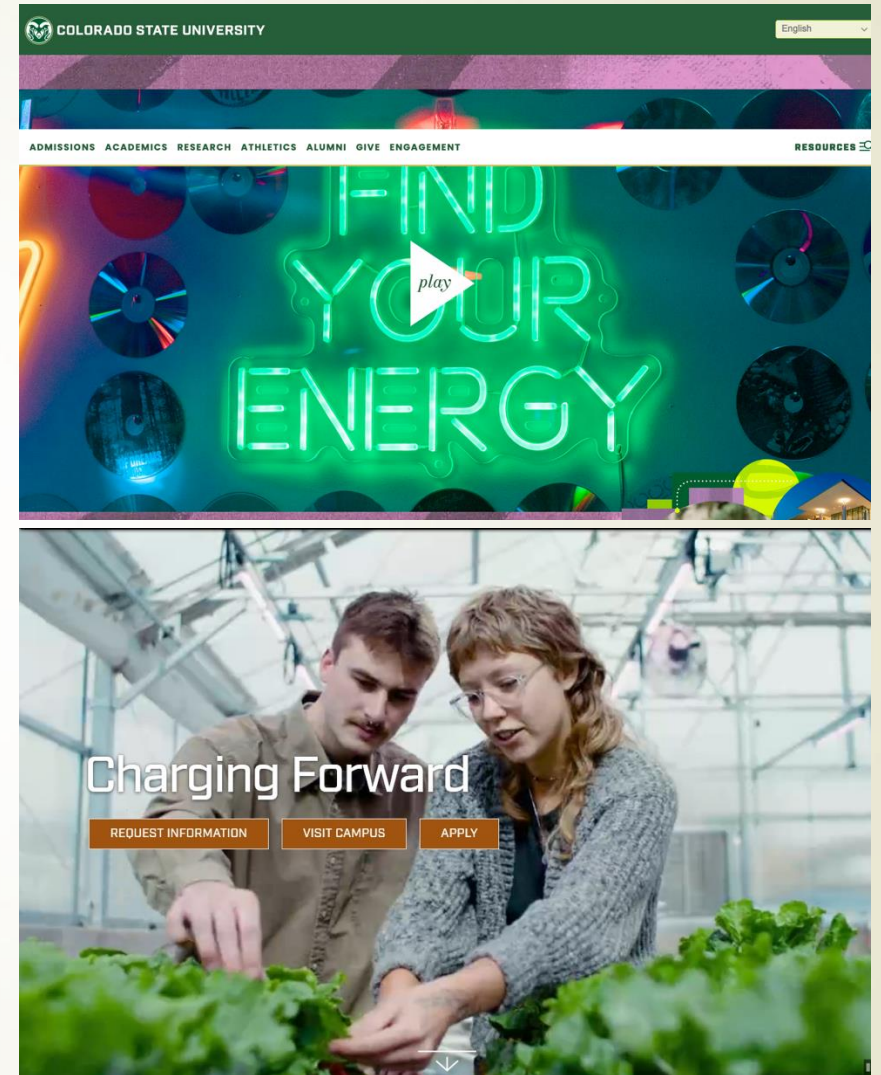
Chrome	Edge *	Safari	Firefox	Opera	IE	Chrome for Android	Safari on iOS *
			2-76				
	12-113		1 77-92				
	6 114-117		2 93-110				3.2-15.8
		3.1-16.0	5 111-112				2 4 16.0-16.3
4-84	118-120	2 3 4 16.1-16.3		10-70			
85-134	121-133	16.4-18.3	113-136	71-116	6-10		16.4-18.3
135	134	18.4	137	117	11	134	18.4
136-138		18.5-TP	138-140				18.5





# Video

- Landing pages solution (e.g., home, etc.)
- Look at CSU home page – Got rid of background video
- [www.colostate.edu](http://www.colostate.edu)
- Now has play button



# More Techniques

- Optimize web fonts - see article - example [goldhillinn.com](http://goldhillinn.com)
- **Use current version of Google Fonts!**
- Solid colors/small tiling images as part of design – Exercise #4
- No or little text as images
- Reuse images - browser cache
- Linked CSS (and javascript)
- Minify code - example [fontawesome.css](#)
- Examples...



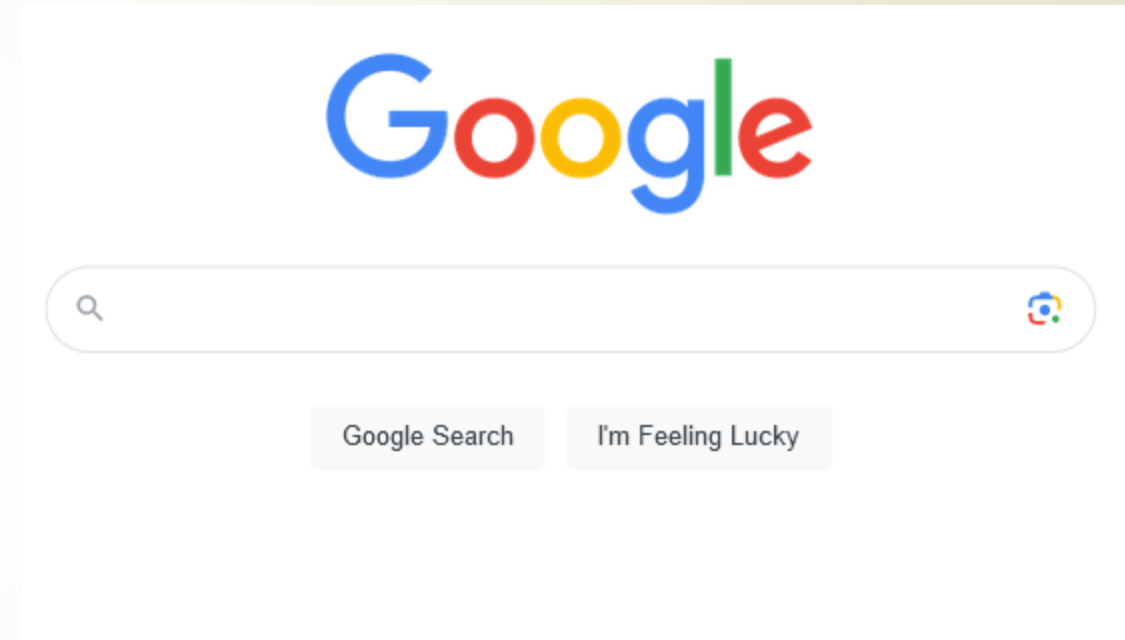
# More Complex Strategies

- Case by case basis
- Lots of server-side stuff
- See me in lab is this is something that interests you

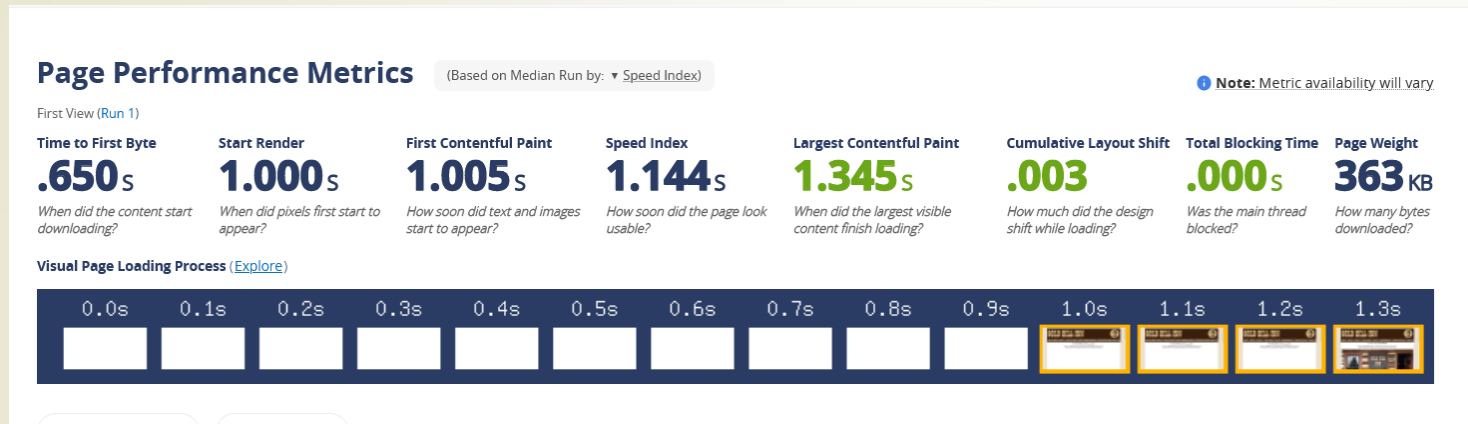


# Search Engine Signal

- Site speed can impact search engine results
- Full lecture coming



# Measurement - WebPageTest

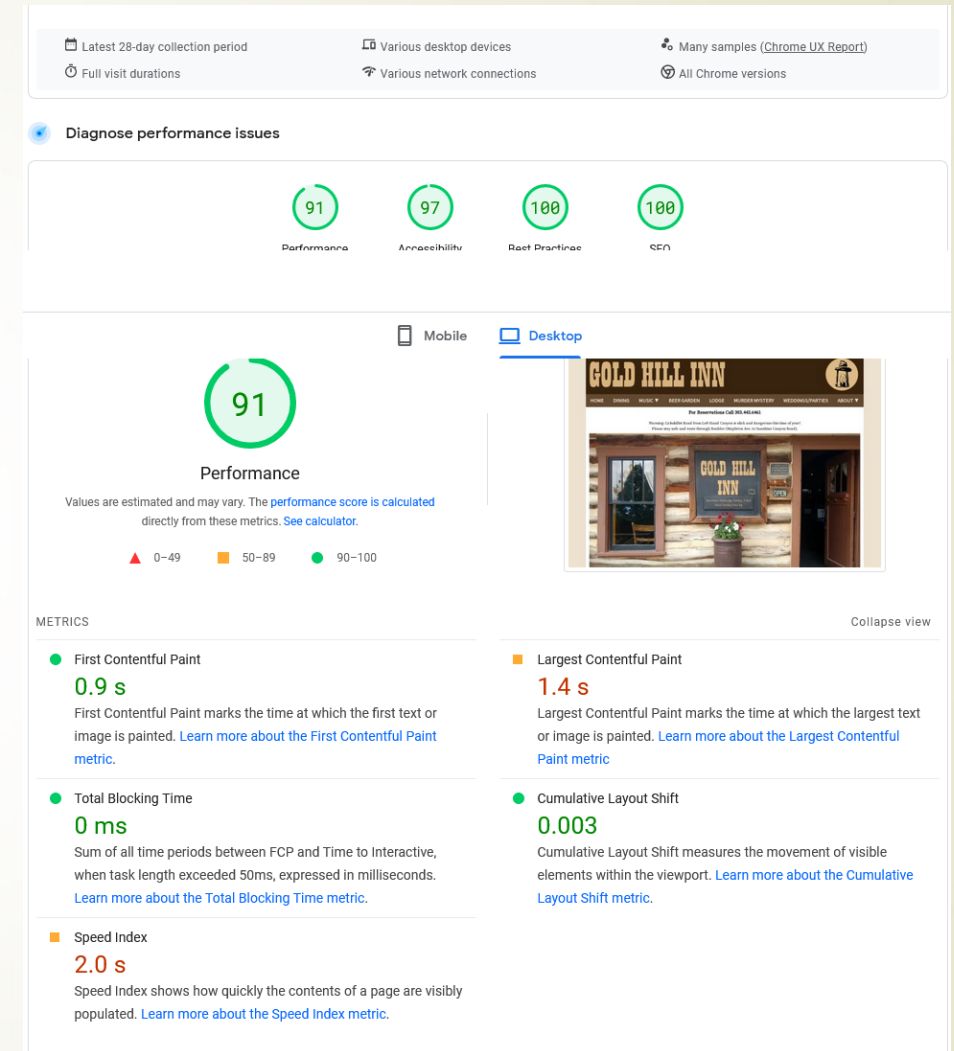


- [www.webpagetest.org](http://www.webpagetest.org)
- Have to create account
- **Speed Index** -
  - Measures how quickly the content is visually displayed
  - Lower is better



# Measurement

- Google PageSpeed Insights
- [developers.google.com/speed/pagespeed/insights/](https://developers.google.com/speed/pagespeed/insights/)
- Mobile - Simulated 4g connection – 1.6M
- Desktop - Cable connection 10M
- Might have to run a few times
- 0 - 3.4s is acceptable
- Field data



# Measurement

- Google PageSpeed Insights
- Field data
- Unrealistic simulation speeds?
  - Mobile - Simulated 4g connection – 1.6M
  - Desktop - Cable connection 10M

Report from Oct 30, 2023, 4:36:21 PM

<https://www.goldhillinn.com/>

Analyze

Mobile

Desktop



Discover what your real users are experiencing

This URL Origin



Core Web Vitals Assessment: **Passed**

Expand view

Largest Contentful Paint (LCP)

1 s

First Input Delay (FID)

9 ms

Cumulative Layout Shift (CLS)

0

OTHER NOTABLE METRICS

First Contentful Paint (FCP)

0.9 s

Interaction to Next Paint (INP)

77 ms

Time to First Byte (TTFB)

0.5 s

Latest 28-day collection period

Various mobile devices

Many samples (Chrome UX Report)

Full visit durations

Various network connections

All Chrome versions



# Google Mobile Guidelines

- Google now recommending 3 second Speed Index time/500k maximum page size
- [www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/mobile-page-speed-new-industry-benchmarks/](http://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/mobile-page-speed-new-industry-benchmarks/)

## Speed: Average Speed Index

How quickly the mobile page displays content to users (lower is better).

*Best Practice: Under 3 seconds*

## Weight: Average Page Weight Bytes

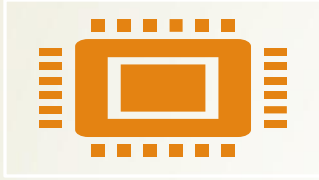
The total size of a mobile webpage, measured in bytes (lower is better).

*Best Practice: Less Than 500KB*





# For Project



**Page Speed Insights or WebPageTest**

Desktop/cable connection

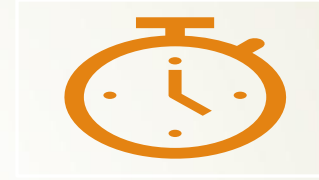
developers.google.com/speed/pagespeed/  
insights/

[www.webpagetest.org](http://www.webpagetest.org)

Images sized correctly, optimized –  
w/tinypng Analyzer, Firefox image size

Speed Index  $\leq$  3.4 seconds

Or less than 500k total page size



**For superior project : Mobile speed index  
 $\leq$  3.4 seconds on PageSpeed Insights  
(This is the recommendation)**

