WhyR? 2019 Conference
28.09.2019

Google PageSpeed with R

(or how to automate your web performance audits)

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About me

Data analyst in
Monetization Team of Video
Department

Former SEO specialist

Working in digital marketing
agencies since 2014

Most important tools:

- R
- SQL
- Google Analytics
- SEO tools & knowledge

ringier
axel springer

Top publisher in Poland

Owner of Onet, Newsweek,
Forbes, Fakt, VOD.pl

Responsibilites:

- Analysing website traffic
- Analysing monetization data
- Improving traffic & website health
- Improving internal data flow

SEO = Search Engine Optimization

Objective:

- increasing domain's visibility in Search Engine Results Pages

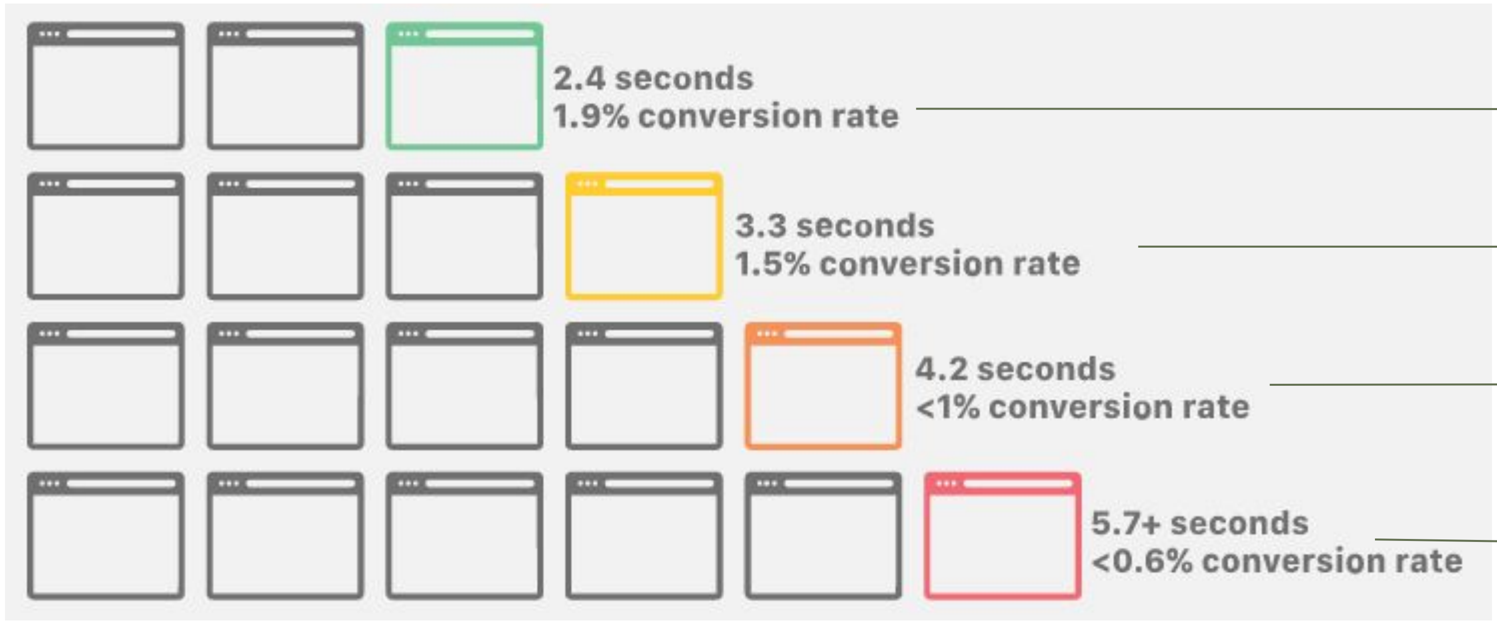
Most important activities:

- technical optimisation (i.e. **improving loading performance**)
- content creation & optimization
- optimization & acquisition of external backlinks

Why should we even care about improving page's loading time?

1. Better user experience
2. More sales
3. Lesser costs

Imagine that 1 000 users come to the shopping page...



→ 19 users will buy

→ 15 users will buy

→ less than 10 users will buy

→ less than 6 users will buy

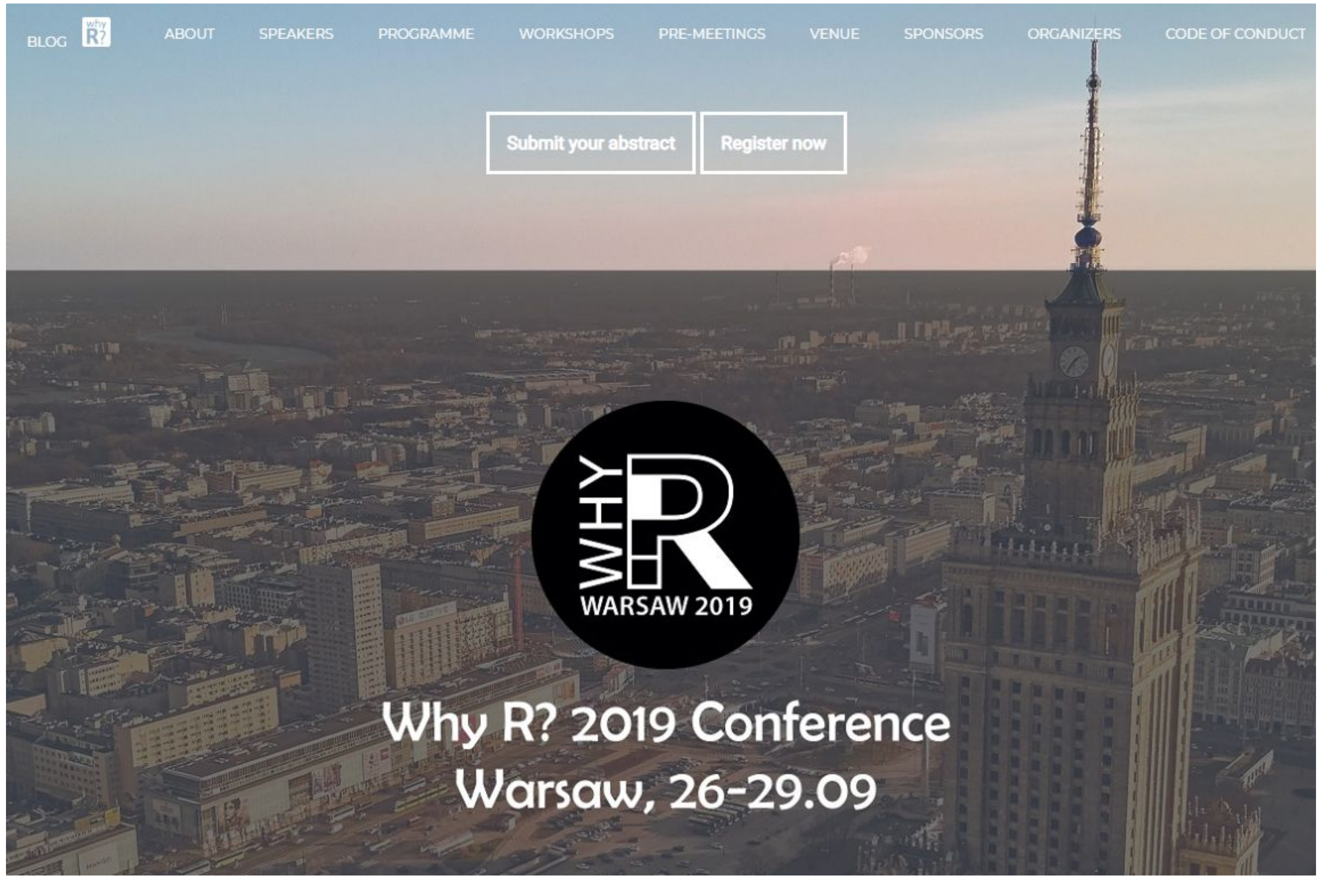
Source: https://www.cloudflare.com/learning/performance/more/website-performance-conversion-rates/

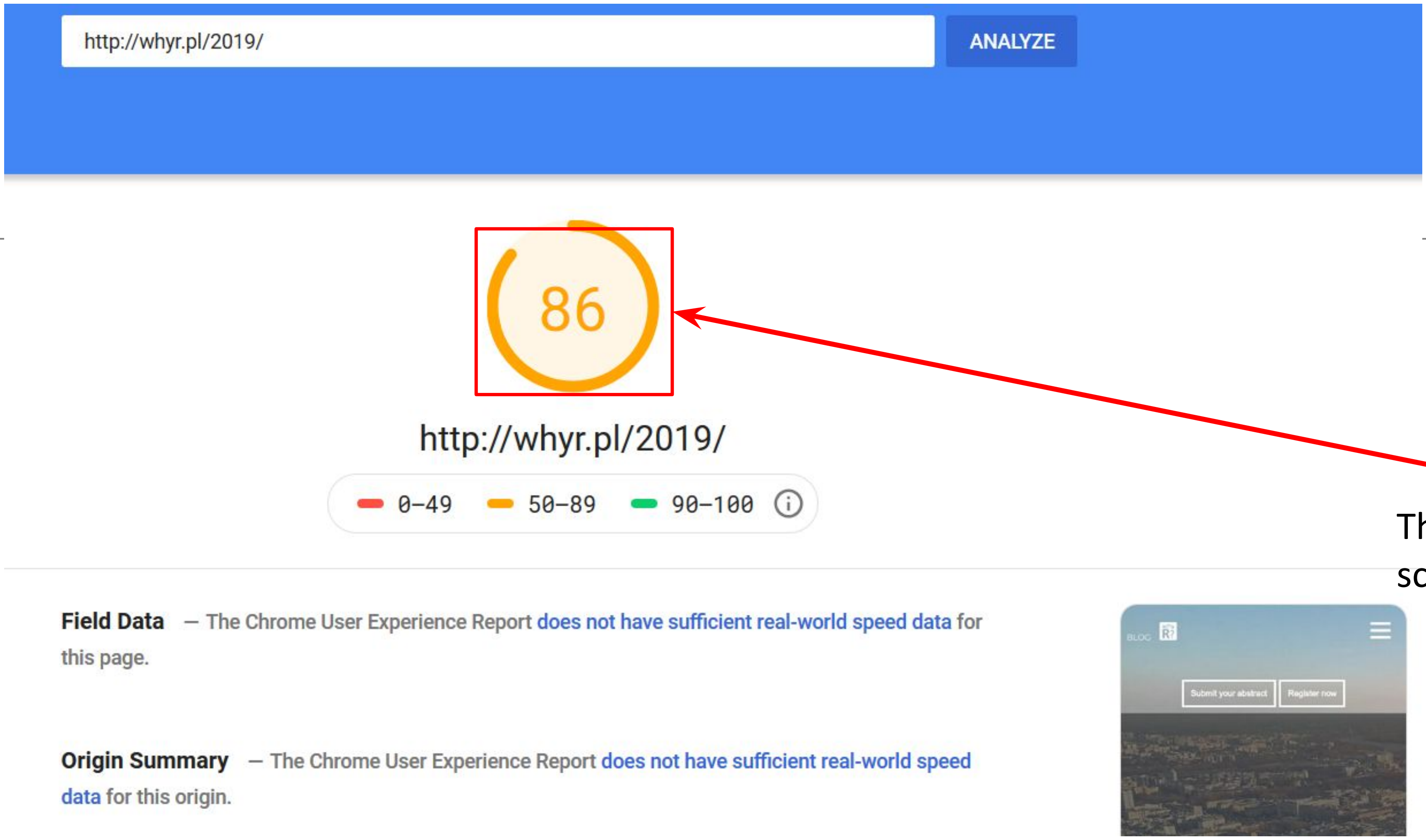
Working in optimization: Google tools

External tools for checking URL’s performance & load time:

- **Google PageSpeed Insights**
- Google Test My Site
- Google Lighthouse
- Google CrUx
- GTmetrix (not Google!)
- other

Let’s take a closer look for a report’s example:





http://whyr.pl/2019/

ANALYZE

86

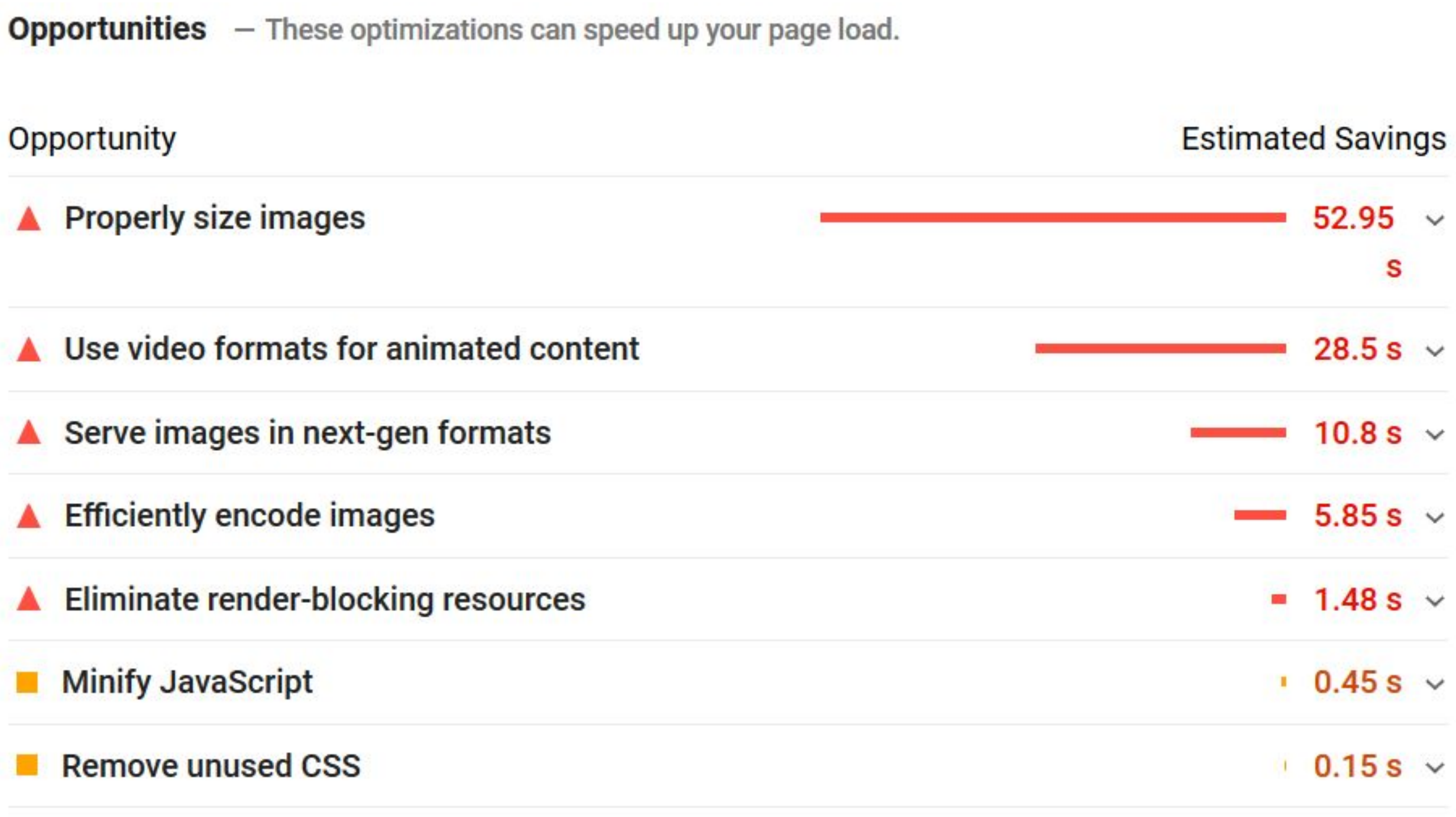
http://whyr.pl/2019/

🟥 0–49 🟧 50–89 🟩 90–100

Field Data — The Chrome User Experience Report does not have sufficient real-world speed data for this page.

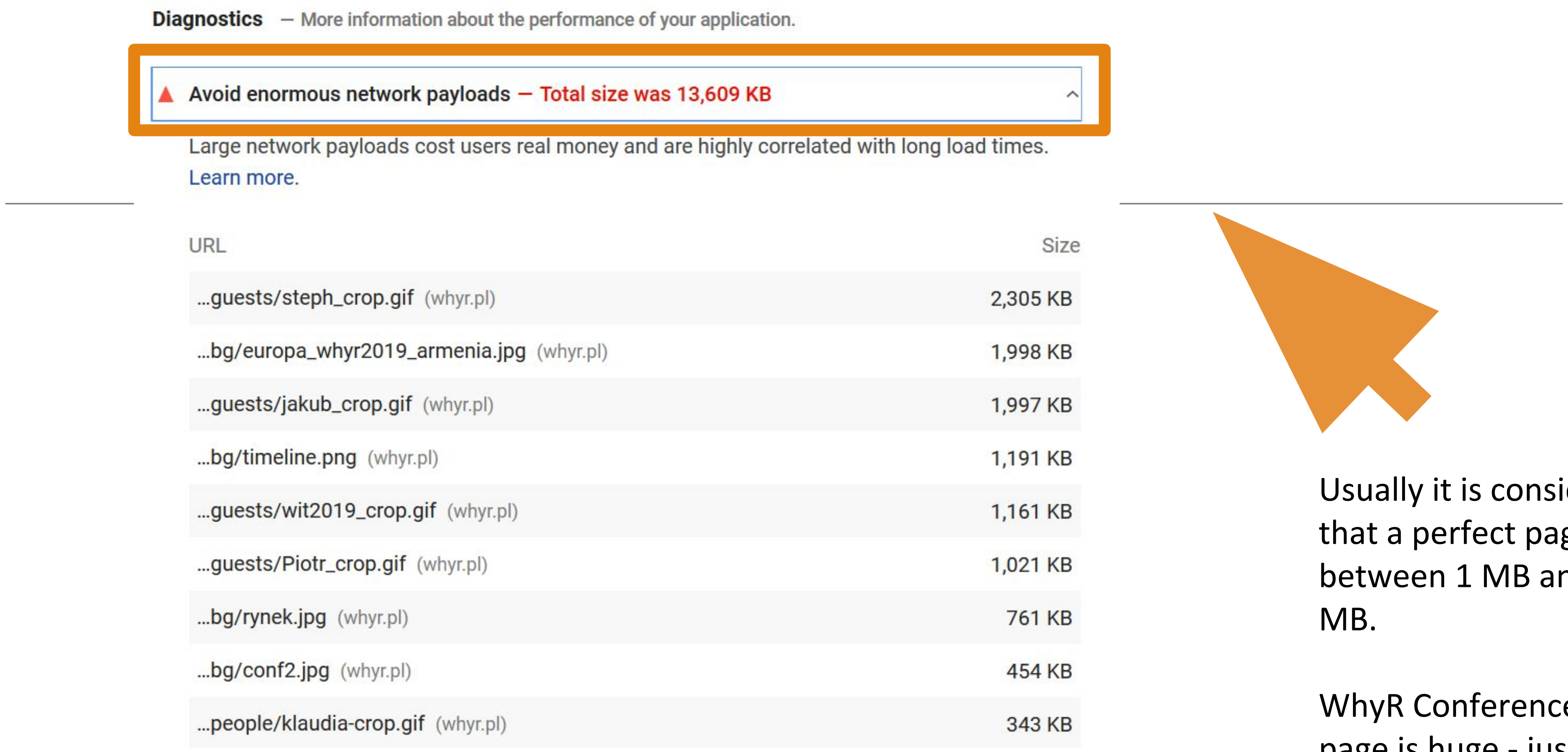
Origin Summary — The Chrome User Experience Report does not have sufficient real-world speed data for this origin.

That's a good score!


Opportunities — These optimizations can speed up your page load.

Opportunity	Estimated Savings
▲ Properly size images	52.95 s
▲ Use video formats for animated content	28.5 s
▲ Serve images in next-gen formats	10.8 s
▲ Efficiently encode images	5.85 s
▲ Eliminate render-blocking resources	1.48 s
■ Minify JavaScript	0.45 s
■ Remove unused CSS	0.15 s

… but the loading time of images is terribly long and may decrease user experience (especially on mobile)


Diagnostics — More information about the performance of your application.

▲ Avoid enormous network payloads — Total size was 13,609 KB

Large network payloads cost users real money and are highly correlated with long load times. Learn more.

URL	Size
...guests/steph_crop.gif (whyr.pl)	2,305 KB
...bg/europa_whyr2019_armenia.jpg (whyr.pl)	1,998 KB
...guests/jakub_crop.gif (whyr.pl)	1,997 KB
...bg/timeline.png (whyr.pl)	1,191 KB
...guests/wit2019_crop.gif (whyr.pl)	1,161 KB
...guests/Piotr_crop.gif (whyr.pl)	1,021 KB
...bg/rynek.jpg (whyr.pl)	761 KB
...bg/conf2.jpg (whyr.pl)	454 KB
...people/klaudia-crop.gif (whyr.pl)	343 KB

Usually it is considered that a perfect page is between 1 MB and 2 MB.

WhyR Conference home page is huge - just the images are ~13 MB (!)

Problem: How can we increase efficiency of web performance testing?

- Problems with traditional use of PageSpeed Insights (paste the URL, wait for the output, collect the report):
  - slow
  - impossible to automate this process for a non-technical specialist

- Solutions
  - slow -> we can’t really speed it up, so let’s at least schedule regular tests earlier
  - impossible to automate this process for a non-technical specialist -> let’s request the reports throught the **API***

* “Web APIs are the **defined interfaces** through which interactions happen between an enterprise and applications that use its assets, which also is a Service Level Agreement (SLA) to specify the functional provider and expose the service path or URL for its API users.” *"API-fication" (PDF). www.hcltech.com. 08.2014.*

There are some existing solutions in R...

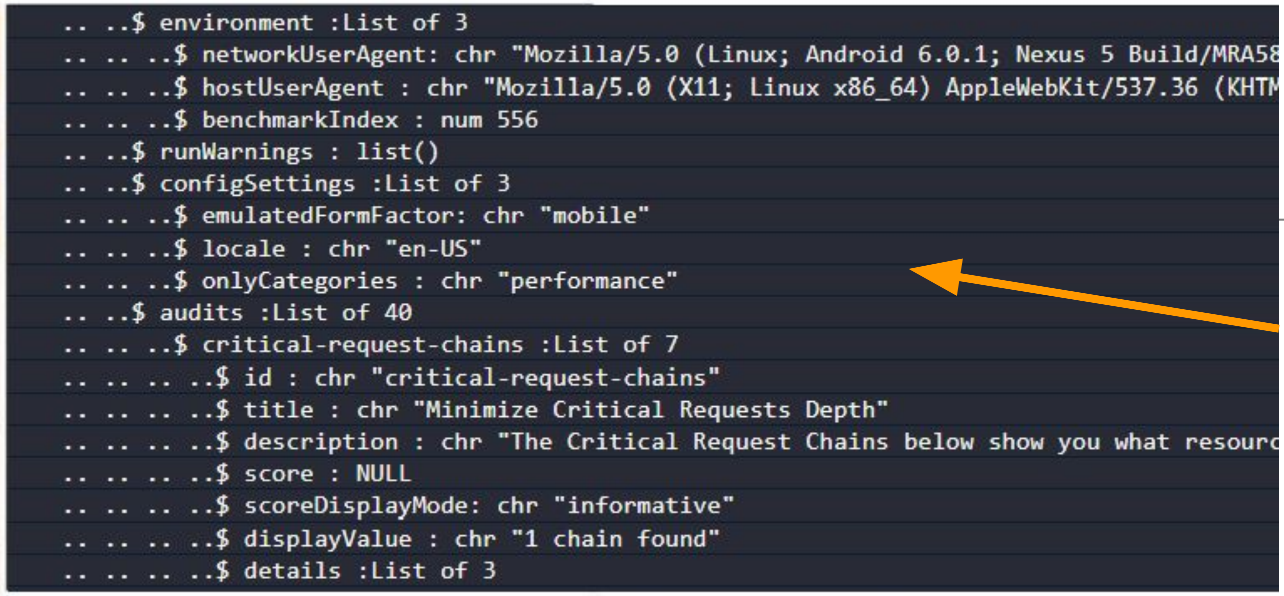
- “googlePageSpeedR” - https://github.com/Phippsy/googlePageSpeedR
- “gpagespeed” - https://github.com/simitpatel/gpagespeed
- “pagespeed” - https://github.com/mhairi/pagespeed

… but

- they all use old API version (4) instead of the newest (5)
  - the 4th version is “classic” PageSpeed, but 5th contains more data from the Lighthouse!
- they offer little data and no errors descriptions/examples
- … and the loading time is long
  - in fact we download ALL the data but we can access only small portion of it
- they are not resistant for 404 errors in input
  - if your input has 10k URLs and your output has 3k URLs, you don’t know which URLs failed
- not really „vectorized” - if you want it in a loop, you must do it yourself
- the only one package that is “vectorized” loses errors
- no documentation

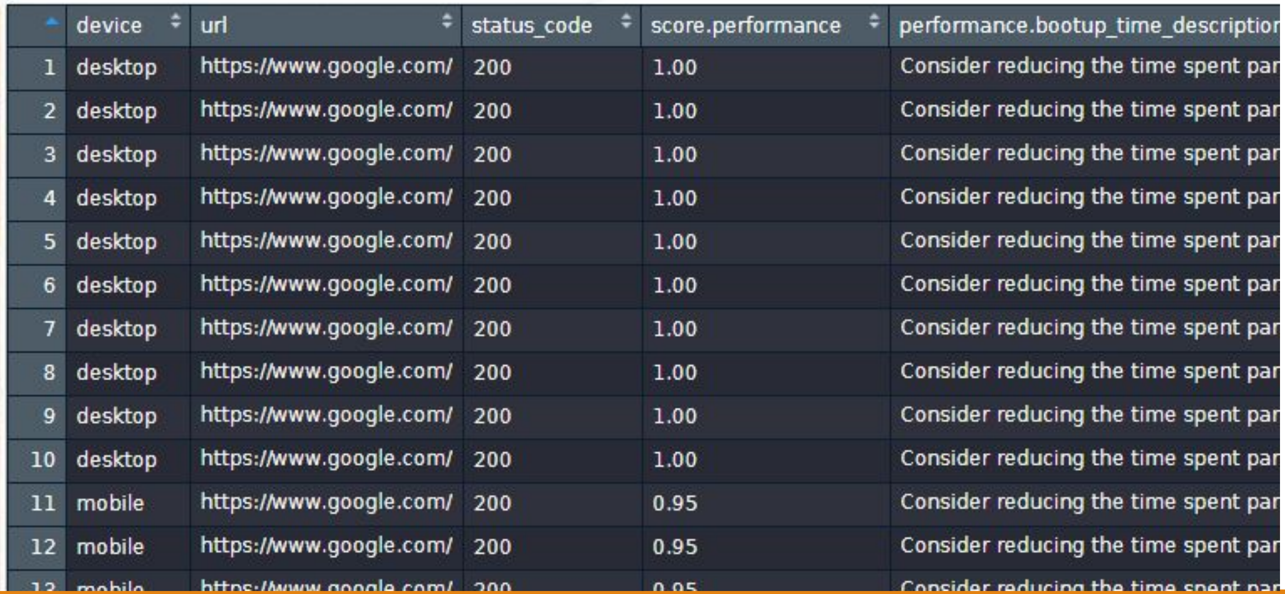
And this is not really their creators fault!

What is the reason for all those issues?



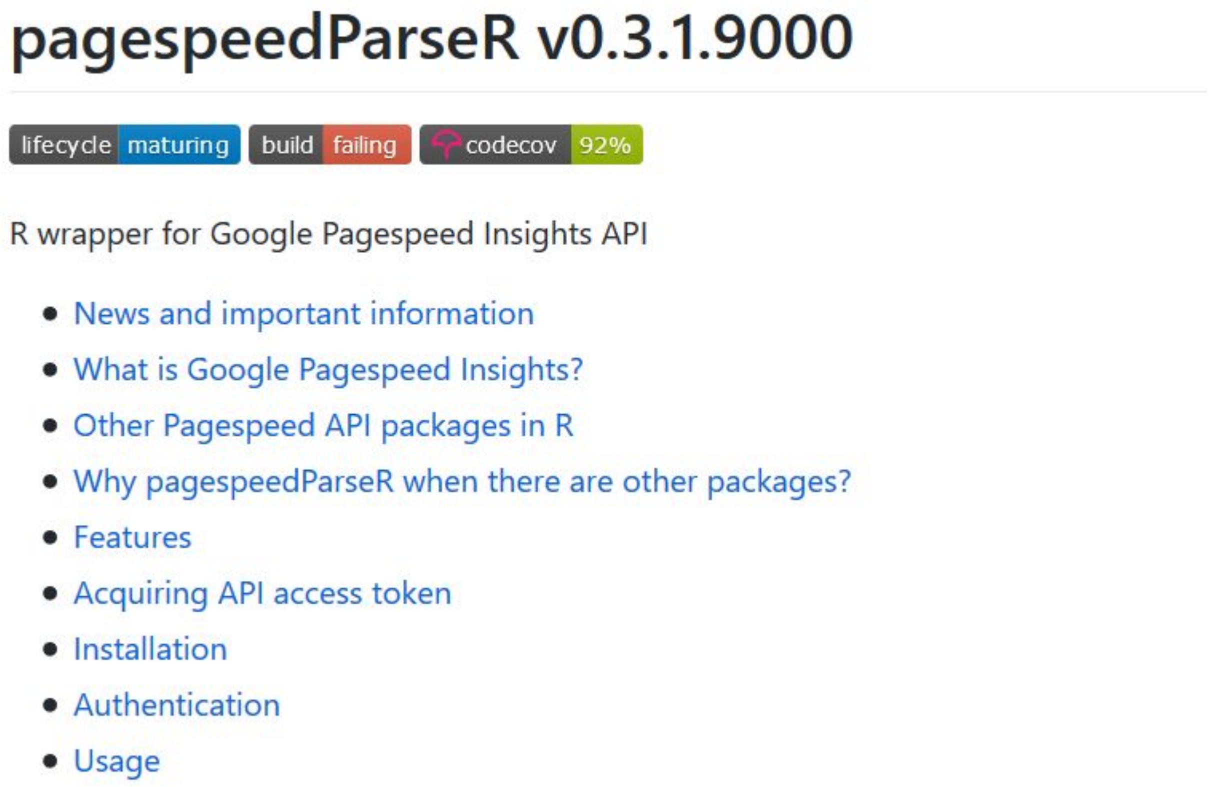
```
.. ..$ environment :List of 3
.. .. ..$ networkUserAgent: chr "Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/MRA58
.. .. ..$ hostUserAgent : chr "Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTM
.. .. ..$ benchmarkIndex : num 556
.. ..$ runWarnings : list()
.. ..$ configSettings :List of 3
.. .. ..$ emulatedFormFactor: chr "mobile"
.. .. ..$ locale : chr "en-US"
.. .. ..$ onlyCategories : chr "performance"
.. ..$ audits :List of 40
.. .. ..$ critical-request-chains :List of 7
.. .. .. ..$ id : chr "critical-request-chains"
.. .. .. ..$ title : chr "Minimize Critical Requests Depth"
.. .. .. ..$ description : chr "The Critical Request Chains below show you what resourc
.. .. .. ..$ score : NULL
.. .. .. ..$ scoreDisplayMode: chr "informative"
.. .. .. ..$ displayValue : chr "1 chain found"
.. .. .. ..$ details :List of 3
```

API returns nested lists...



	device	url	status_code	score.performance	performance.bootup_time_descriptior
1	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
2	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
3	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
4	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
5	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
6	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
7	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
8	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
9	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
10	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent par
11	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent par
12	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent par
13	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent par

Solution: well, do it yourself. So I did!



pagespeedParseR v0.3.1.9000

R wrapper for Google Pagespeed Insights API

- News and important information
- What is Google Pagespeed Insights?
- Other Pagespeed API packages in R
- Why pagespeedParseR when there are other packages?
- Features
- Acquiring API access token
- Installation
- Authentication
- Usage

“pagespeedParseR” package

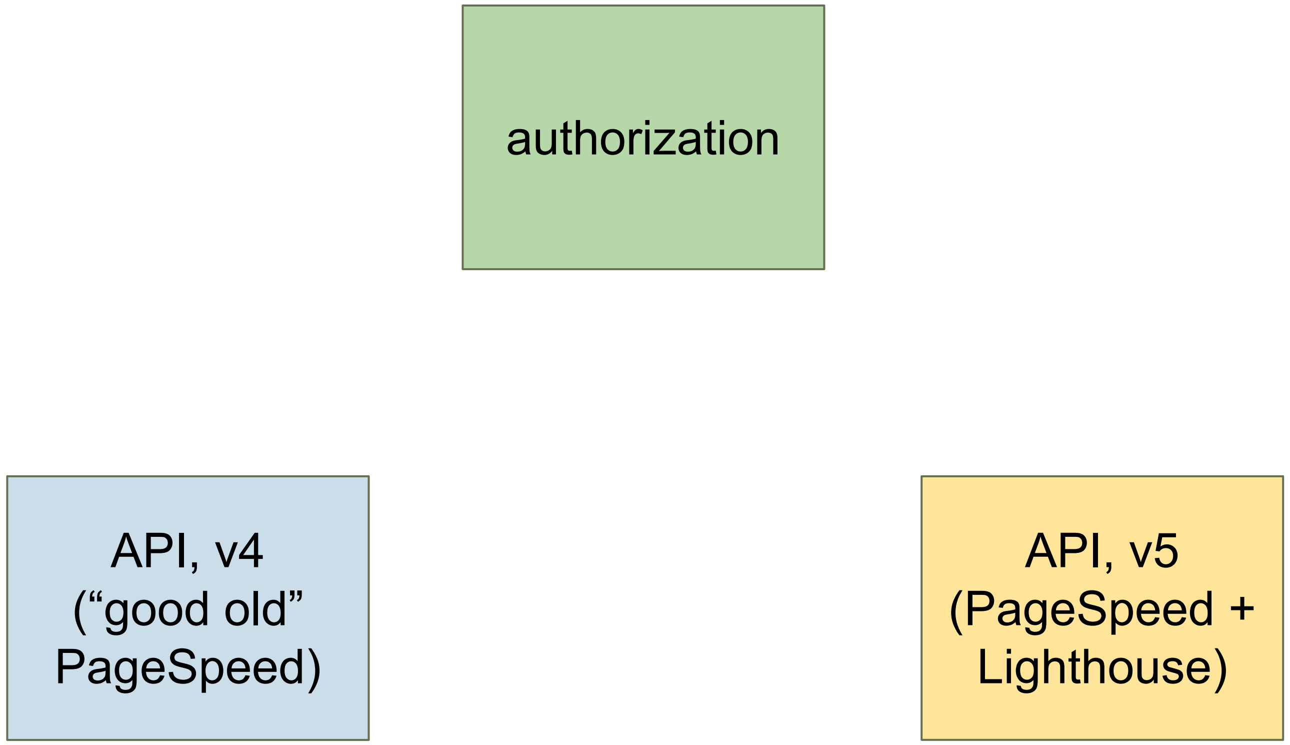
Underlying assumptions:

- I wanted it to let me download everything as a nested list or to download most of the data as a data frame (parsing to data frame on-the-fly)
- I wanted it to let me choose API version (4th or 5th)
- I wanted it to have built-in loops (because I’m lazy)
- I wanted it to keep the information which URL returned an error (non 200 HTTP status) and which error was that
- I wanted it to let me check desktop and mobile in a single call (yes, I know I’m lazy)
- I wanted it to have a simple mechanism that I can use to enforce waiting some time between the calls to keep the API request limits happy ;) (requests/minute)
- I wanted it to have at least acceptable documentation that helps the user

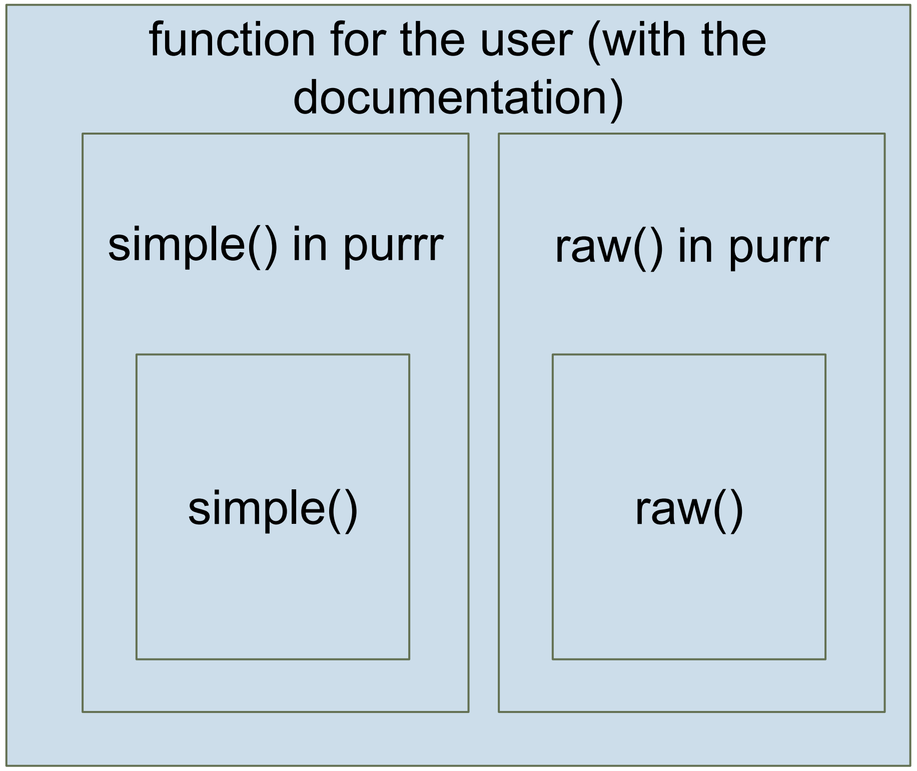
Some problems with PageSpeed output nested lists:

- not stable – no performance error found creates other nested lists that some errors found
- often doesn’t have stable length (number of subelements) – for example redirection errors audit can have up to 20 subelements or more
- some audits generate empty lists when passed, other don’t
- scores mean different things - “score = 1” may mean 100% (perfect grade) in some audits and 1% in the other ones (bad) - the scale is changing and depend on the type of the audit
- Google loves its toys and continually adds more audits or changes exisiting ones

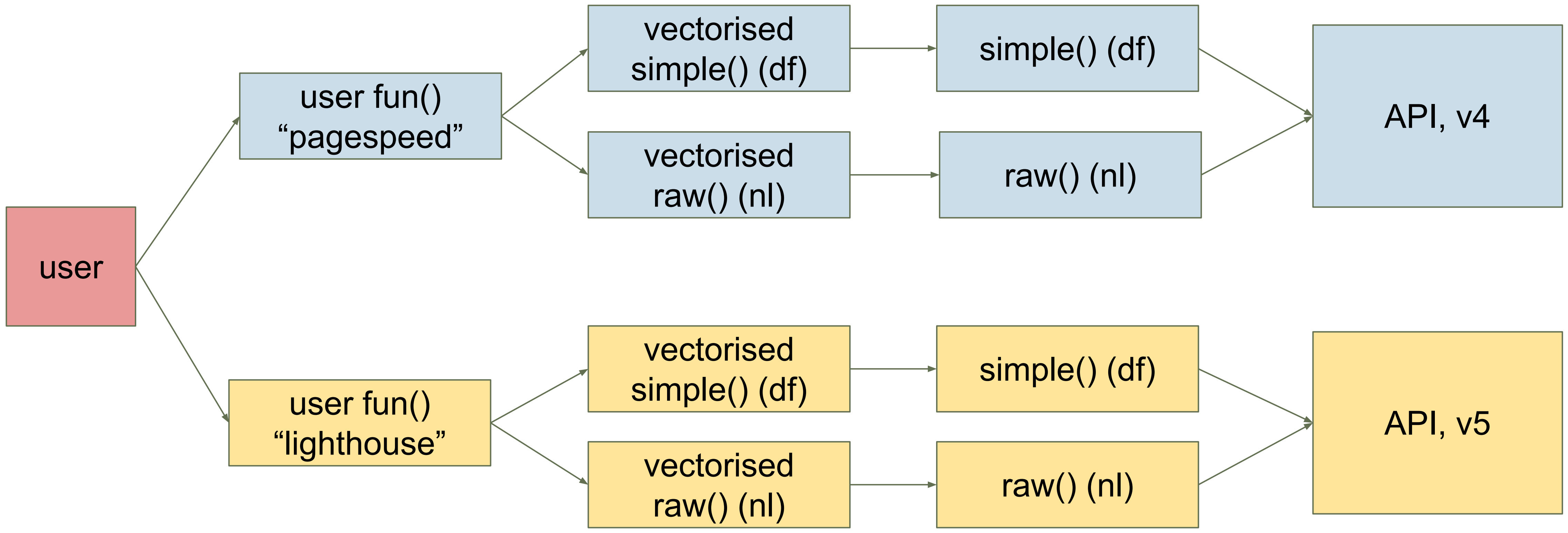
Package architecture: 3 pillars



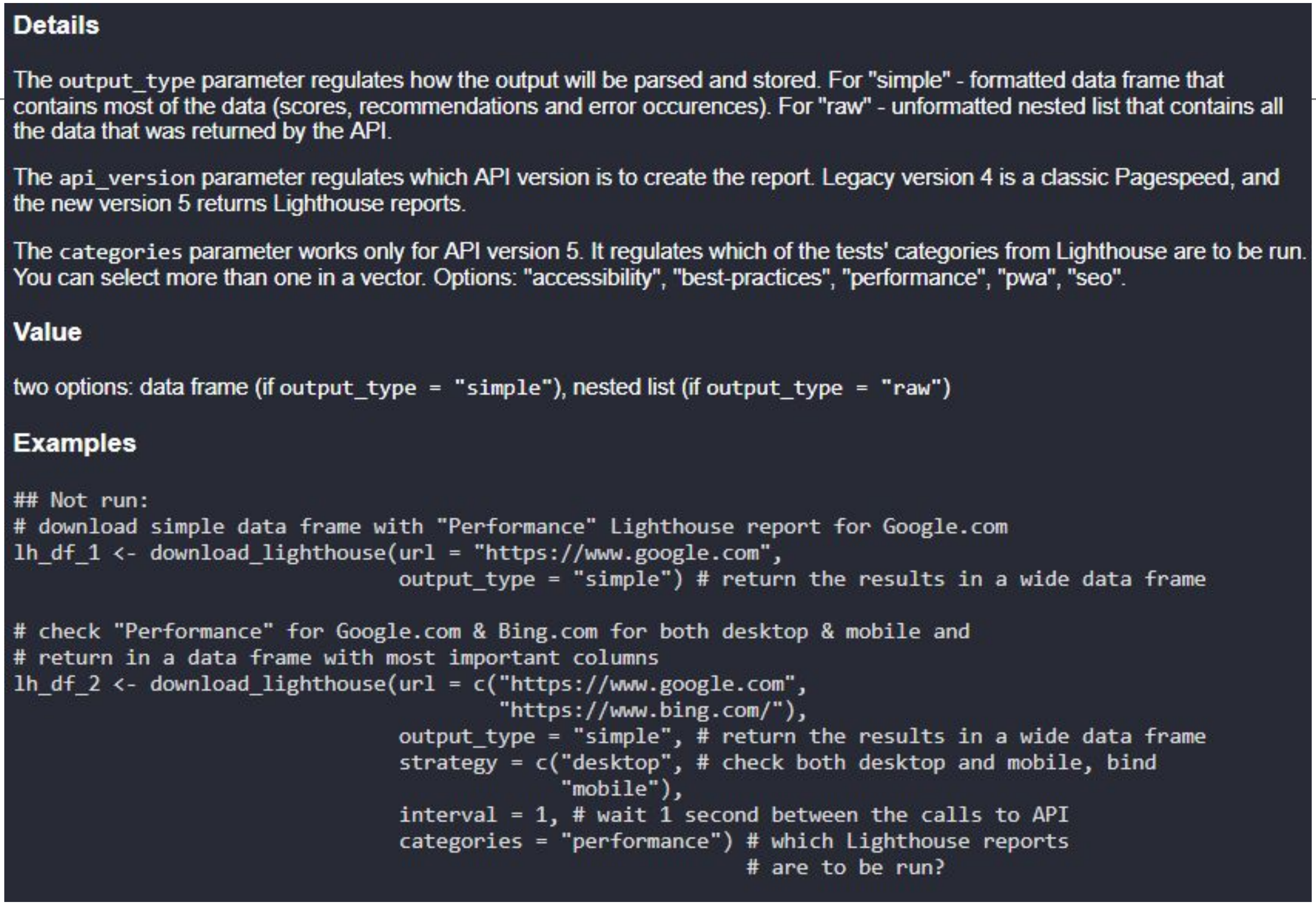
Package architecture: internal functions



Package architecture: communication



Top level functions: documentation ;)



Details

The `output_type` parameter regulates how the output will be parsed and stored. For "simple" - formatted data frame that contains most of the data (scores, recommendations and error occurences). For "raw" - unformatted nested list that contains all the data that was returned by the API.

The `api_version` parameter regulates which API version is to create the report. Legacy version 4 is a classic Pagespeed, and the new version 5 returns Lighthouse reports.

The `categories` parameter works only for API version 5. It regulates which of the tests' categories from Lighthouse are to be run. You can select more than one in a vector. Options: "accessibility", "best-practices", "performance", "pwa", "seo".

Value

two options: data frame (if `output_type = "simple"`), nested list (if `output_type = "raw"`)

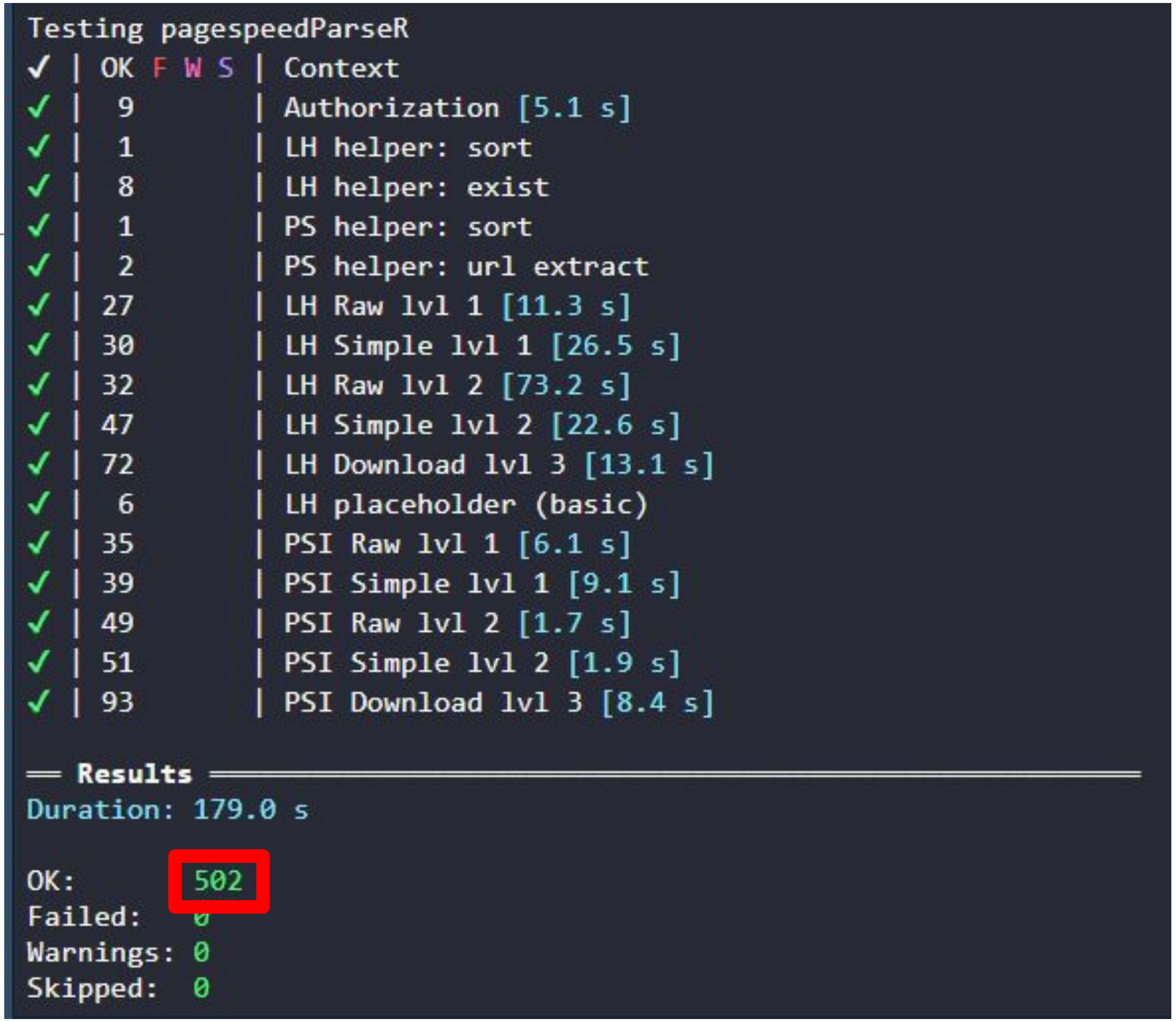
Examples

```
## Not run:
# download simple data frame with "Performance" Lighthouse report for Google.com
lh_df_1 <- download_lighthouse(url = "https://www.google.com",
                               output_type = "simple") # return the results in a wide data frame

# check "Performance" for Google.com & Bing.com for both desktop & mobile and
# return in a data frame with most important columns
lh_df_2 <- download_lighthouse(url = c("https://www.google.com",
                                       "https://www.bing.com/"),
                               output_type = "simple", # return the results in a wide data frame
                               strategy = c("desktop", # check both desktop and mobile, bind
                                            "mobile"),
                               interval = 1, # wait 1 second between the calls to API
                               categories = "performance") # which Lighthouse reports
                                                            # are to be run?
```

Unit tests

- boring…
- … you will hate them...
- … but they can save your life! ;)
- they let you find the bugs and/or changes in API much faster



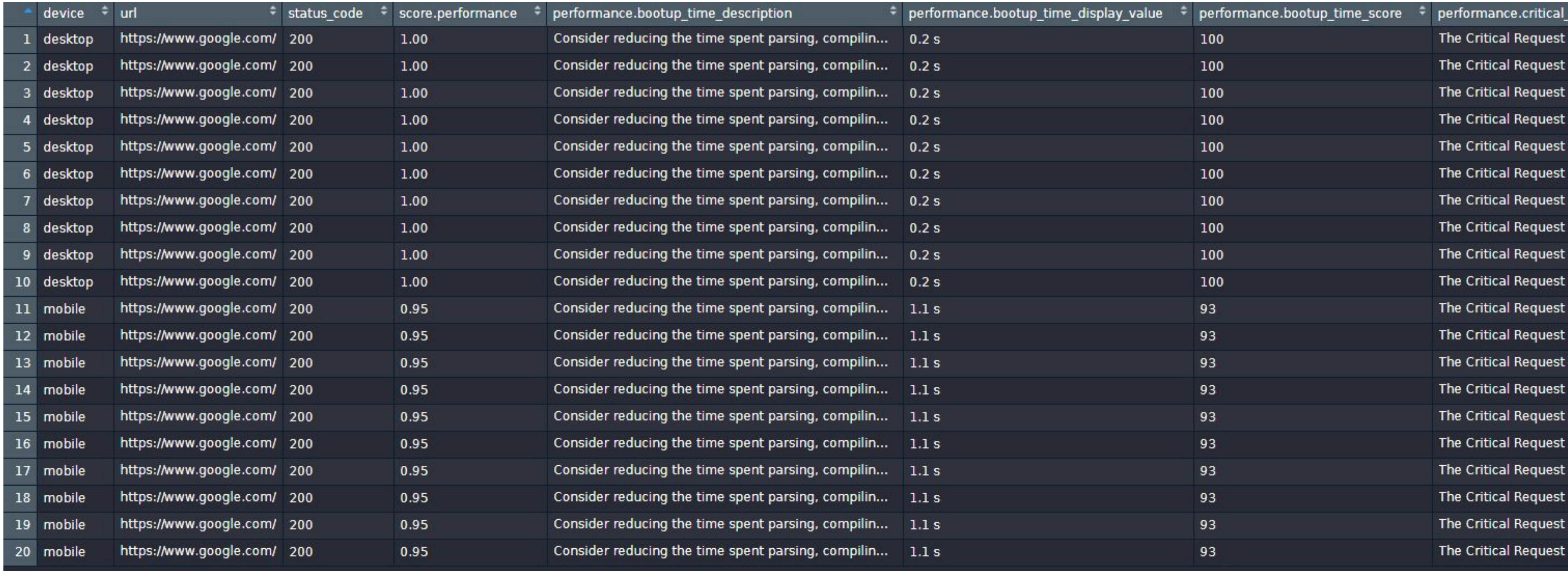
```
Testing pagespeedParseR
✓ | OK F W S | Context
✓ |  9       | Authorization [5.1 s]
✓ |  1       | LH helper: sort
✓ |  8       | LH helper: exist
✓ |  1       | PS helper: sort
✓ |  2       | PS helper: url extract
✓ | 27       | LH Raw lvl 1 [11.3 s]
✓ | 30       | LH Simple lvl 1 [26.5 s]
✓ | 32       | LH Raw lvl 2 [73.2 s]
✓ | 47       | LH Simple lvl 2 [22.6 s]
✓ | 72       | LH Download lvl 3 [13.1 s]
✓ |  6       | LH placeholder (basic)
✓ | 35       | PSI Raw lvl 1 [6.1 s]
✓ | 39       | PSI Simple lvl 1 [9.1 s]
✓ | 49       | PSI Raw lvl 2 [1.7 s]
✓ | 51       | PSI Simple lvl 2 [1.9 s]
✓ | 93       | PSI Download lvl 3 [8.4 s]

══ Results ═══════════════════════════════════════════════════════
Duration: 179.0 s

OK:       502
Failed:   0
Warnings: 0
Skipped:  0
```

Example (data frame)

- data frame can have 124 to 400 columns (Update: in newer version of the package it can be even 2k-7k columns. Pretty sure your Excel is now trembling in horror...)
- easy to compare the URLs
- you can possibly insert it into a database



	device	url	status_code	score.performance	performance.bootup_time_description	performance.bootup_time_display_value	performance.bootup_time_score	performance.critical_
1	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
2	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
3	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
4	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
5	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
6	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
7	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
8	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
9	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
10	desktop	https://www.google.com/	200	1.00	Consider reducing the time spent parsing, compilin...	0.2 s	100	The Critical Request
11	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
12	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
13	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
14	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
15	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
16	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
17	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
18	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
19	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request
20	mobile	https://www.google.com/	200	0.95	Consider reducing the time spent parsing, compilin...	1.1 s	93	The Critical Request

In development

- added support for “medium data” - reports saved as physical files that can support more 1k URLs checked at once (works for 5k-10k right now)
- changed the paradigm of working with the reports:
    - user will be able to download only nested lists and can work with them later on
    - parsing the data is done on the ready object (not on-the-fly as it slows down everything) and is done via separate functions
    - adding an option of leaving the data in JSON (nice to have for some databases’ users)
- increased the amount of data extracted into the data frame

Plans for the future:

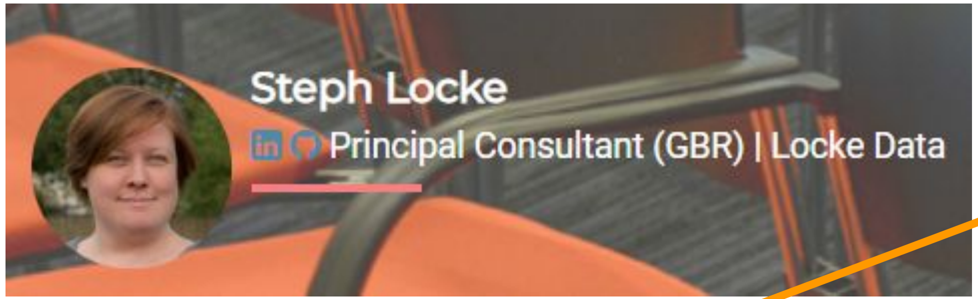
- improved stability
- speeding up the code:
  - lapply instead of for
  - less allocations
  - data.table
  - parallelisation (but it might be hard)
- CRAN release

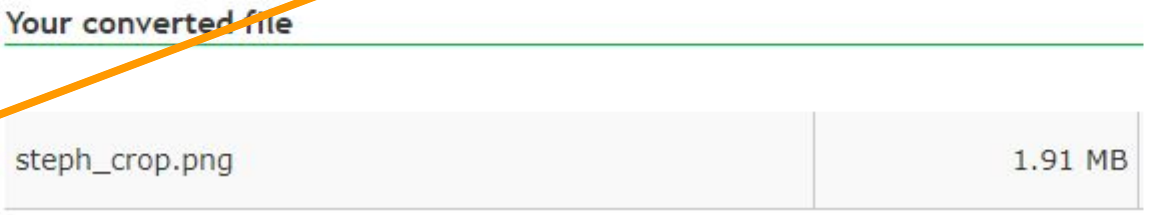
Example of use

We have found out that WhyR Conference page has too big images. Let’s improve them - faster page = more potential useRs!

.gif - 2.25 MB

.gif to .png - 1.91 MB

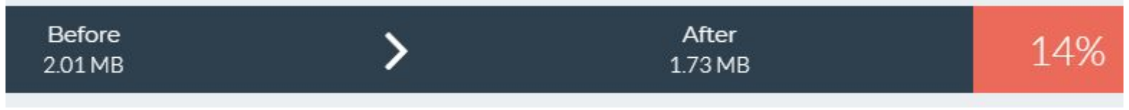



Your converted file

steph_crop.png 1.91 MB

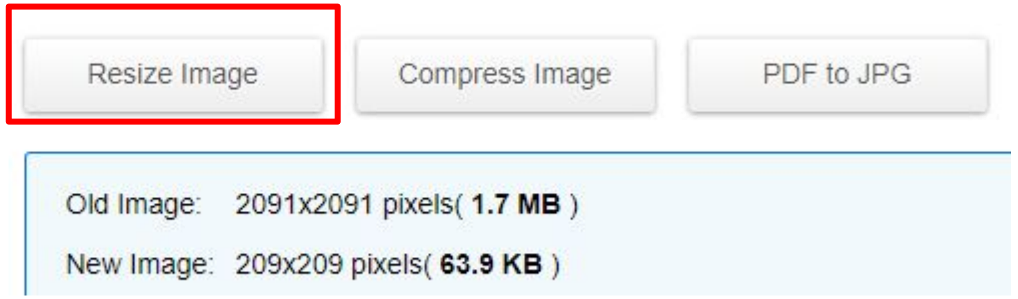
cropping .png - 64 KB

compressing .png - 1.73 MB


Before 2.01 MB

After 1.73 MB

14%



Old Image: 2091x2091 pixels(**1.7 MB**)

New Image: 209x209 pixels(**63.9 KB**)

Example of use

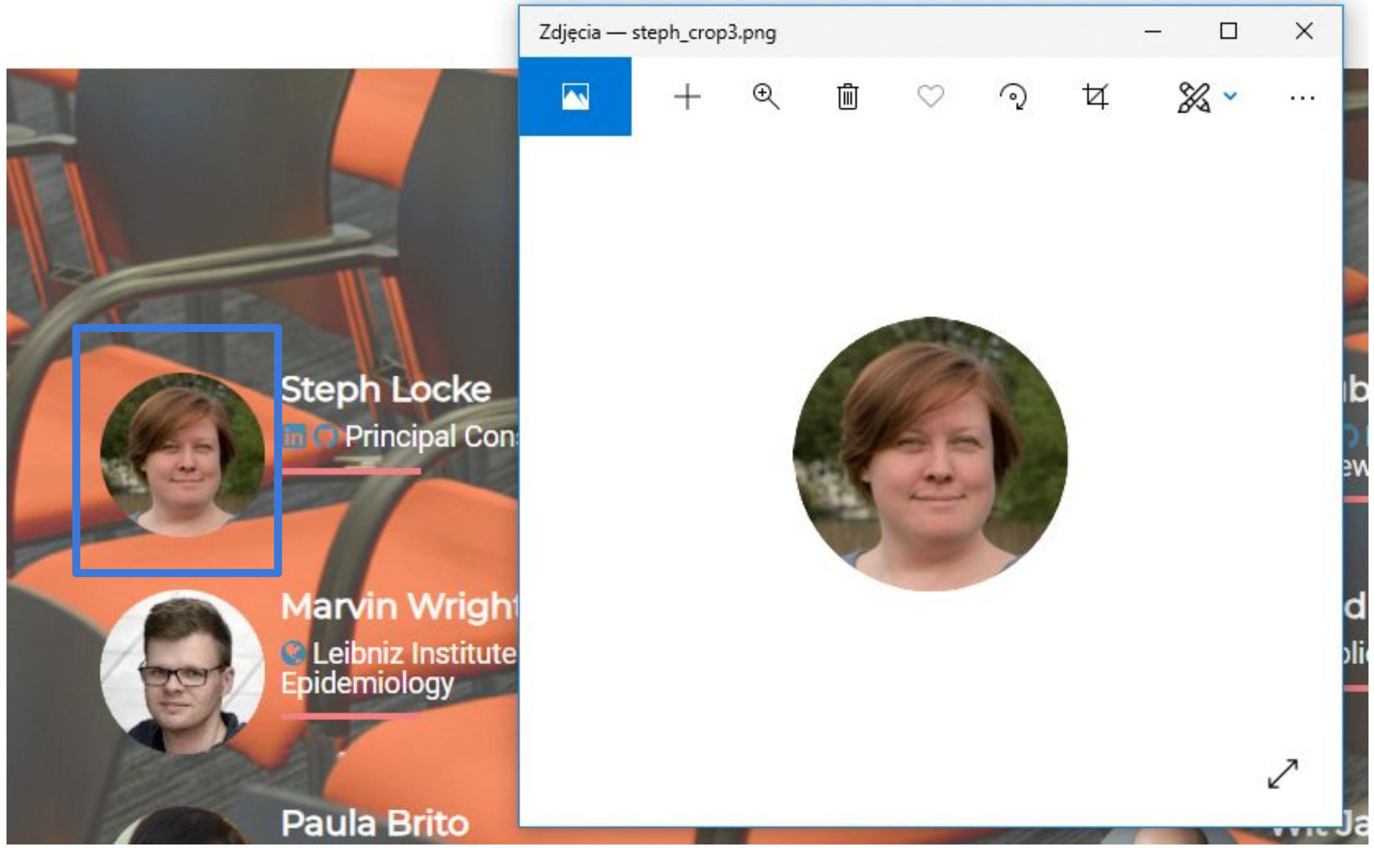
Image on the left: 2.25 MB

Image on the right: 63.9 KB

No visible difference

We have decreased the weight of the image by 97.2%

And maybe we can do it even further if we need to



Questions?

Thanks for your time! :)

Link to the package:

- https://github.com/Leszek-Sieminski/pagespeedParseR

My other R packages:

- https://github.com/Leszek-Sieminski/RAhrefs [CRAN]
- https://github.com/Leszek-Sieminski/screamingFrogR

Contact me:

- LinkedIn: https://pl.linkedin.com/in/leszek-sieminski