Page speed optimization

Squeezing milliseconds for better rankings from the server level up to the application layer

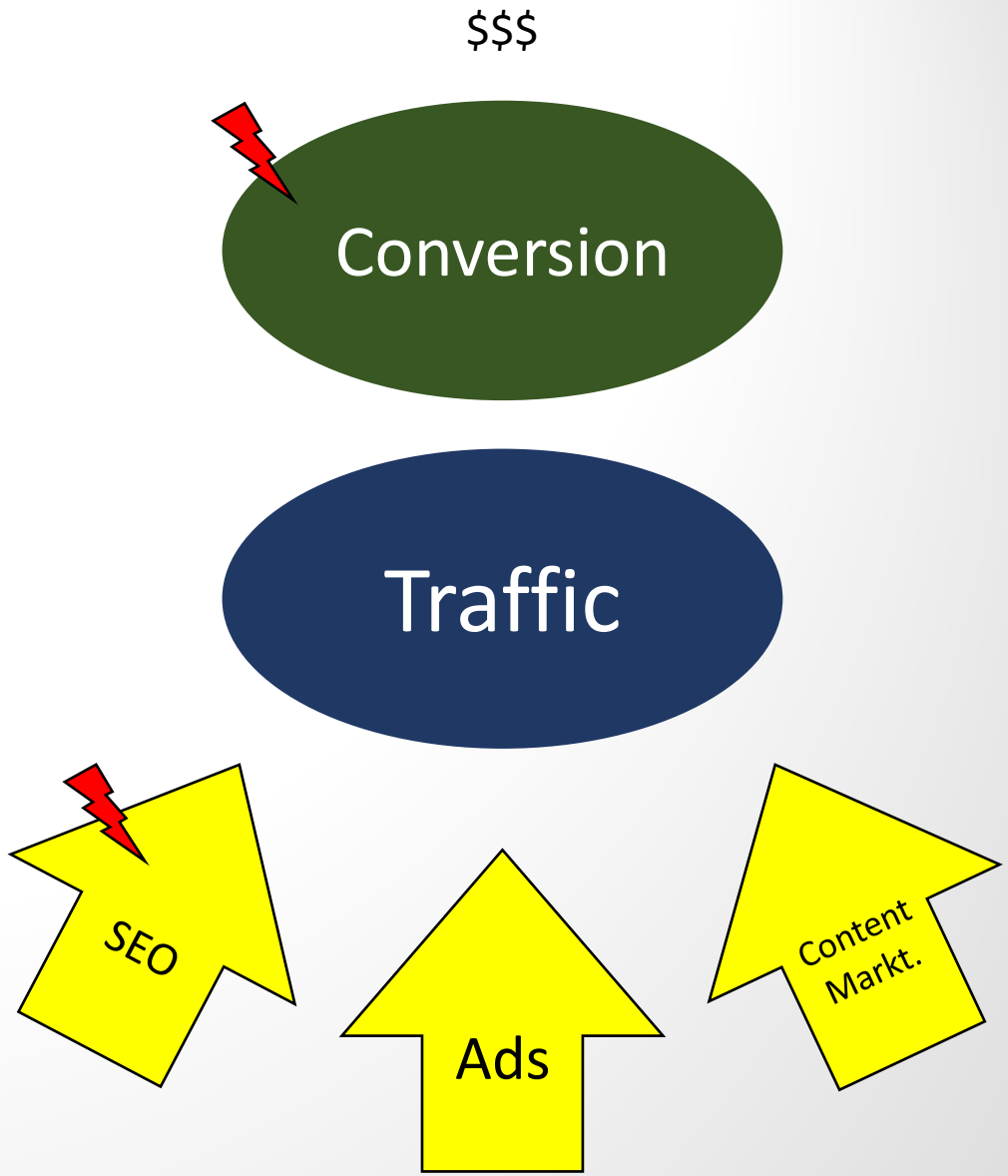
by Ralf Schwoebel (**@orgaralf**)

Why the fixation on speed?

Google, naturally and ...

Why the fixation on speed?

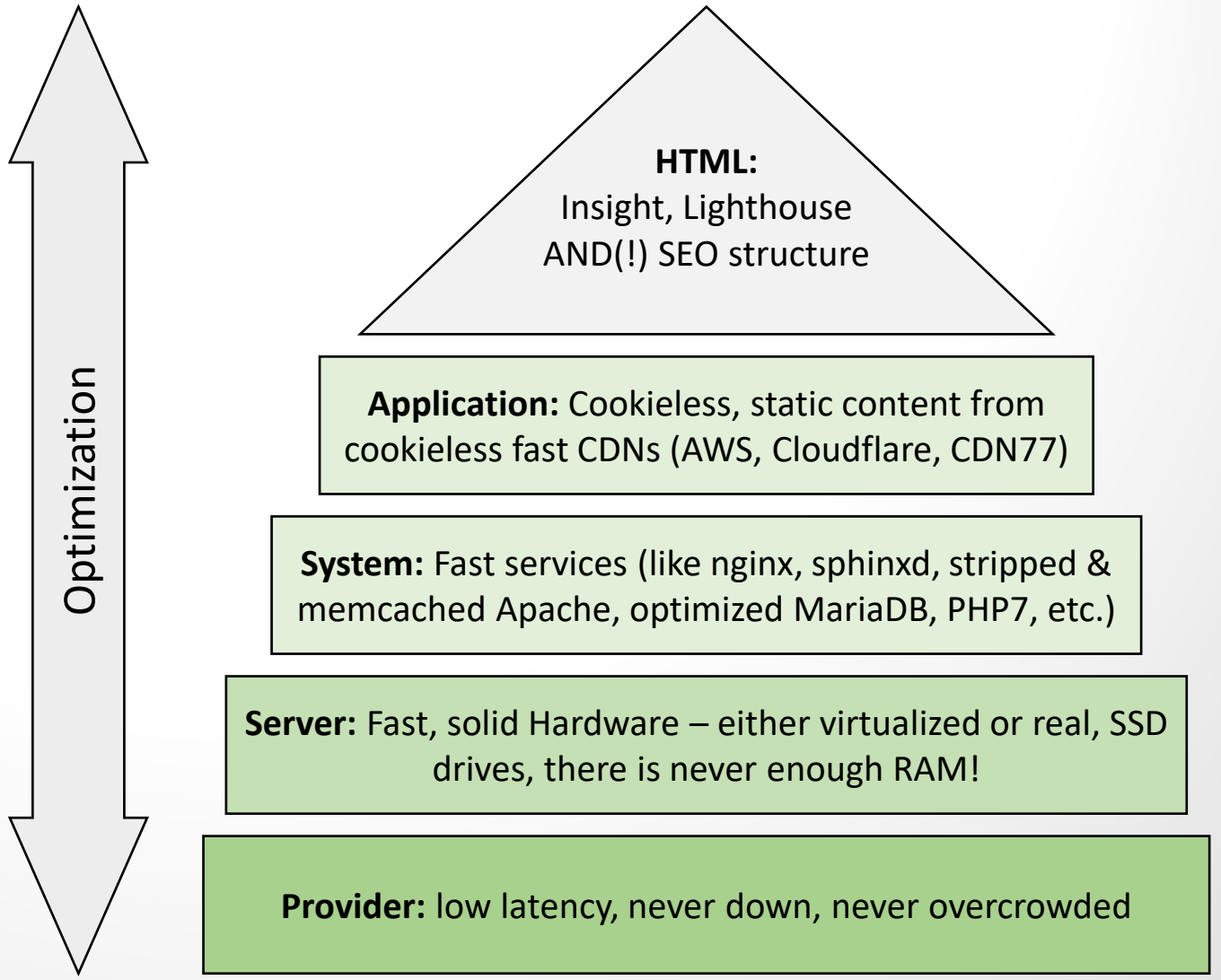
... ultimately money!



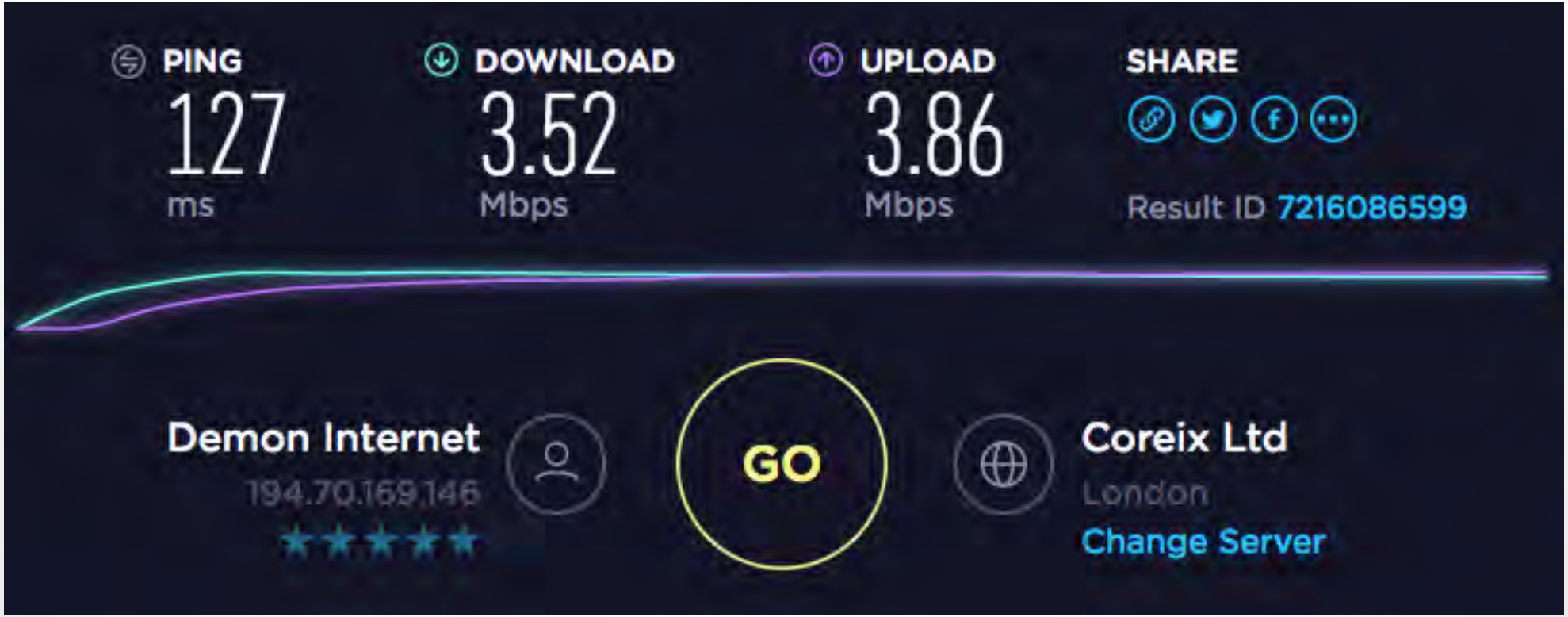
Online Marketing
Findability
Usability
SEO, Social,
Ads, Content
Speed, Mobile,
Clarity, Layout
Works and
works as expected
Functionality
Customer Retention

How to approach it?

Using only Pagespeed Insights is not **enough**!



But why, we have broadband now...



How do we test speed?

- Google Webmaster Console
- Google PageSpeed Insights
- tools.pingdom.com
- Lighthouse Audit
- Firefox/Chrome Dev Tools (network)
- Online Tools (for different locations) for „traceroute“ or „ping“

Provider

Bottom-up approach: Provider

- If money (=amount of traffic & scalability) **is not an issue**:

  AWS instances or Google Cloud (Compute Engine)

- If you want specific setups (dedicated machines):

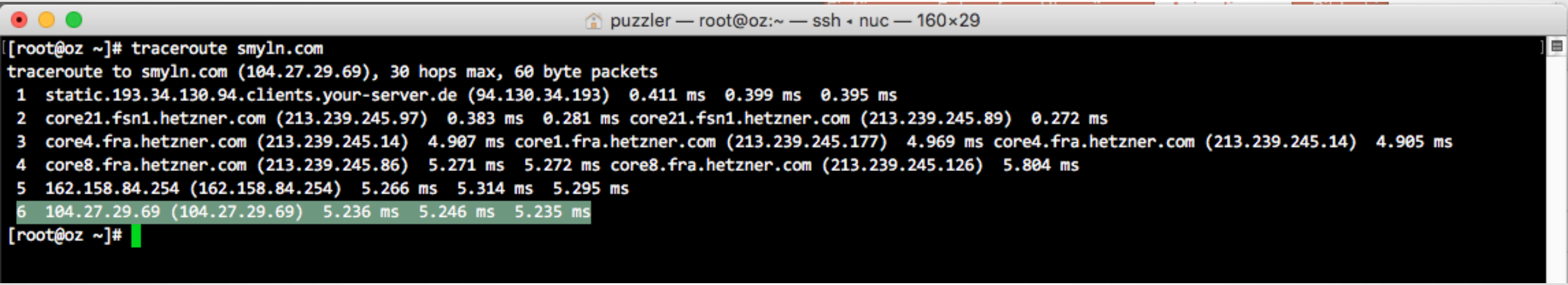
  Local provider with CDN combination

```
[root@oz ~]# ping www.agentor.de
PING www.agentor.de (104.27.167.203) 56(84) bytes of data.
64 bytes from 104.27.167.203 (104.27.167.203): icmp_seq=1 ttl=59 time=5.22 ms
64 bytes from 104.27.167.203 (104.27.167.203): icmp_seq=2 ttl=59 time=5.23 ms
64 bytes from 104.27.167.203 (104.27.167.203): icmp_seq=3 ttl=59 time=5.22 ms
64 bytes from 104.27.167.203 (104.27.167.203): icmp_seq=4 ttl=59 time=5.28 ms
64 bytes from 104.27.167.203 (104.27.167.203): icmp_seq=5 ttl=59 time=5.22 ms
```

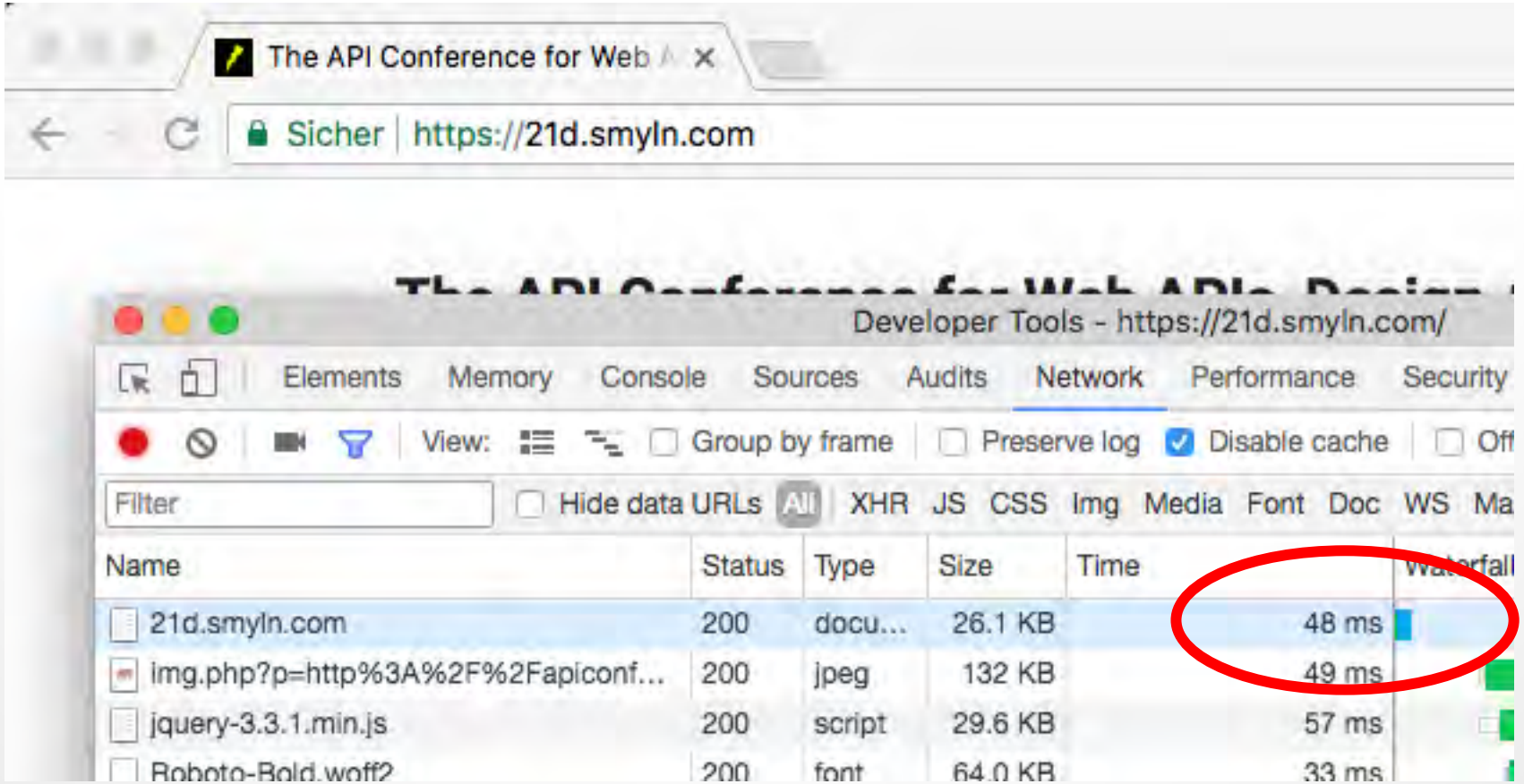
Provider choice:

Basic check:

Google rankings & network tools to find your flavour!



Why start at that level?



Google

Search Console

https://www.gmk-markenberatung.de/ Help

Try the new Search Console

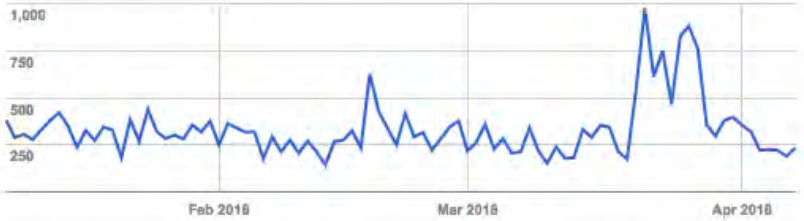
- Dashboard
- Messages
- Search Appearance
- Search Traffic
- Google Index
- Crawl
  - Crawl Errors
  - Crawl Stats
  - Fetch as Google
  - robots.txt Tester
  - Sitemaps
  - URL Parameters
- Security Issues
- Web Tools

Crawl Stats

Googlebot activity in the last 90 days

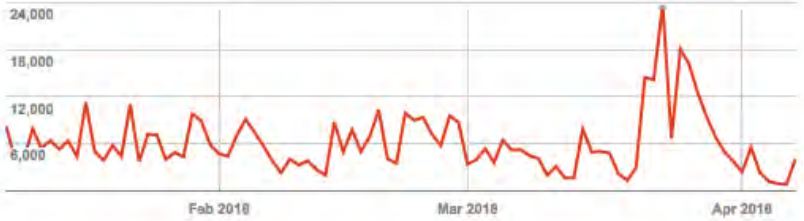
Pages crawled per day

High	Average	Low
976	332	143



Kilobytes downloaded per day

High	Average	Low
23,738	6,111	830



Time spent downloading a page (in milliseconds)

High	Average	Low
437	249	55

Provider choice: the traffic snob approach

List of Internet exchange points by size

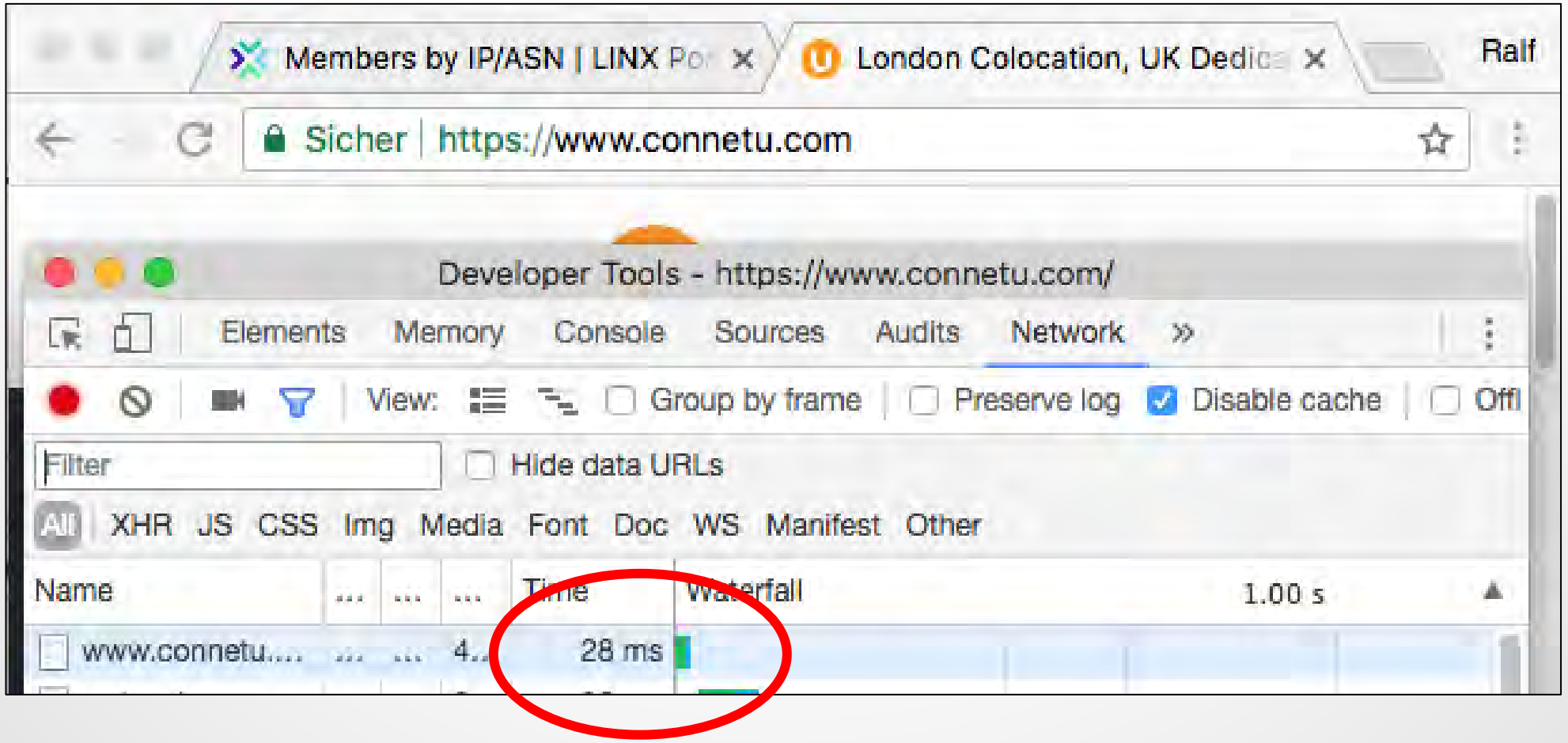
From Wikipedia, the free encyclopedia

See also: List of Internet exchange points

Short name	Name	City	Country	Established	Members	Maximum throughput (Gb/s)
DE-CIX	Deutsche Commercial Internet Exchange[1]	Frankfurt, Hamburg, Munich, Düsseldorf, New York City, Dubai (as UAE-IX), Palermo, Marseille, Istanbul, Dallas, Madrid, Mumbai (as Mumbai IX)	Germany, USA, UAE, Italy, France, Turkey, Spain, India	1995	735[2]	6,408[3]
AMS-IX	Amsterdam Internet Exchange[4]	Amsterdam[5], Haarlem[5], Schiphol-Rijk[5], Willemstad[6], Hong Kong[7], New York City[8], Chicago[9], San Francisco Bay Area[10], Mumbai[11]	Netherlands, Curaçao, China, USA, India	1997[12]	818[13]	5,513[14]
IX.br	Brazil Internet Exchange[15]	Belém, Belo Horizonte, Brasília, Campina Grande, Campinas, Caxias do Sul, Cuiabá, Curitiba, Florianópolis, Fortaleza, Goiânia, Lajeado, Londrina, Manaus, Maringá, Natal, Porto Alegre, Recife, Rio de Janeiro, Salvador, São Carlos, São José dos Campos, São José do Rio Preto, São Paulo, Vitória	Brazil	2004	1,350[16]	4,020[17]
LINX	London Internet Exchange[18]	London, Manchester, Edinburgh, Cardiff, Northern Virginia[19]	United Kingdom, USA	1994	789[20]	3,860[21]

Provider choice: the traffic snob approach

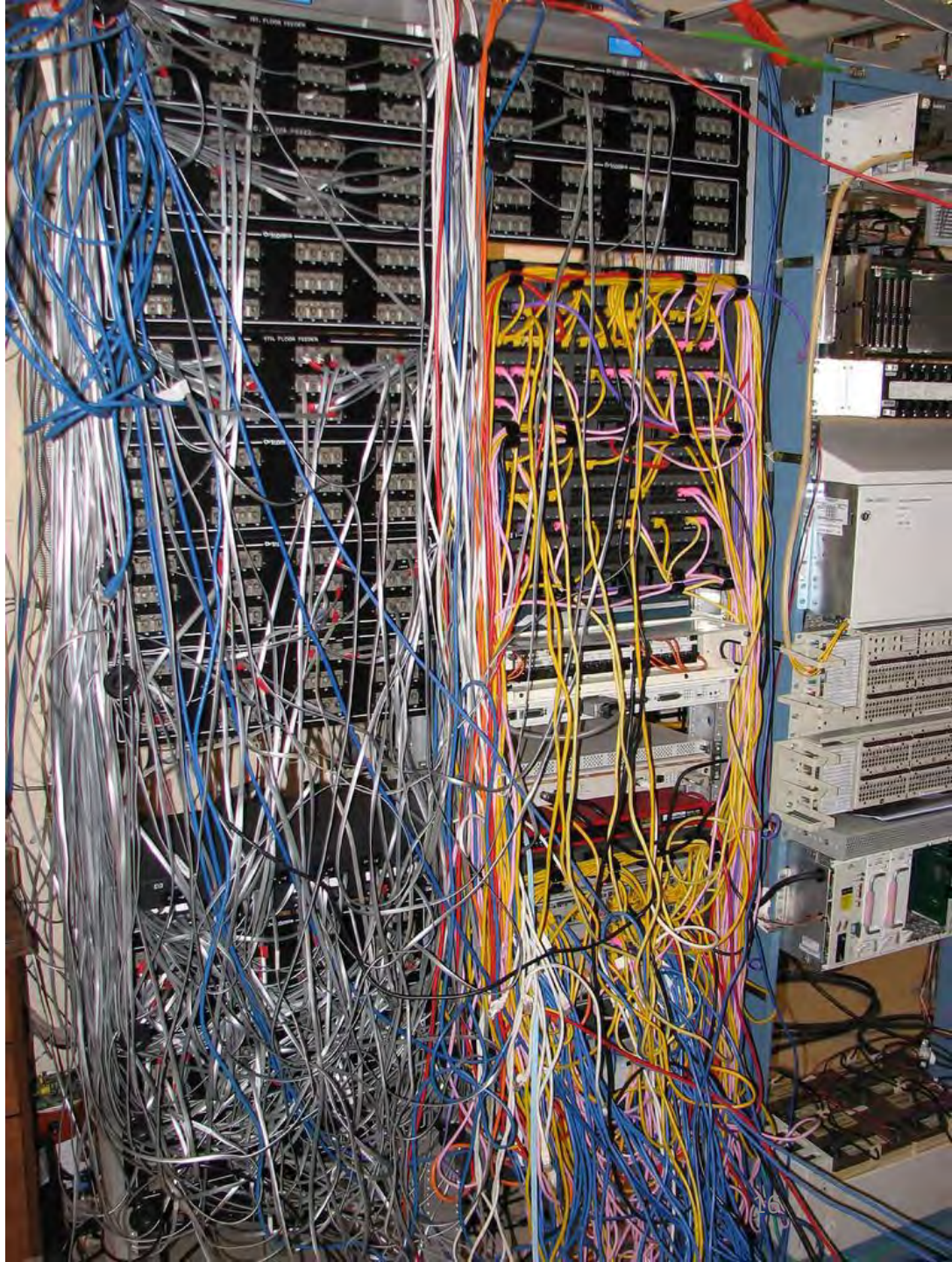
https://portal.linx.net/members/list-ip-asn => looked for random entry



The cloud „problem“...

Summary Provider

- **There is no** „cloud is better than dedicated“
- It all depends **on your individual site**/offer
- The **servers must respond quickly**, the rest is happening in the app layer above
- **Cloud** scales better, **dedicated** servers are easier to control (they are yours)

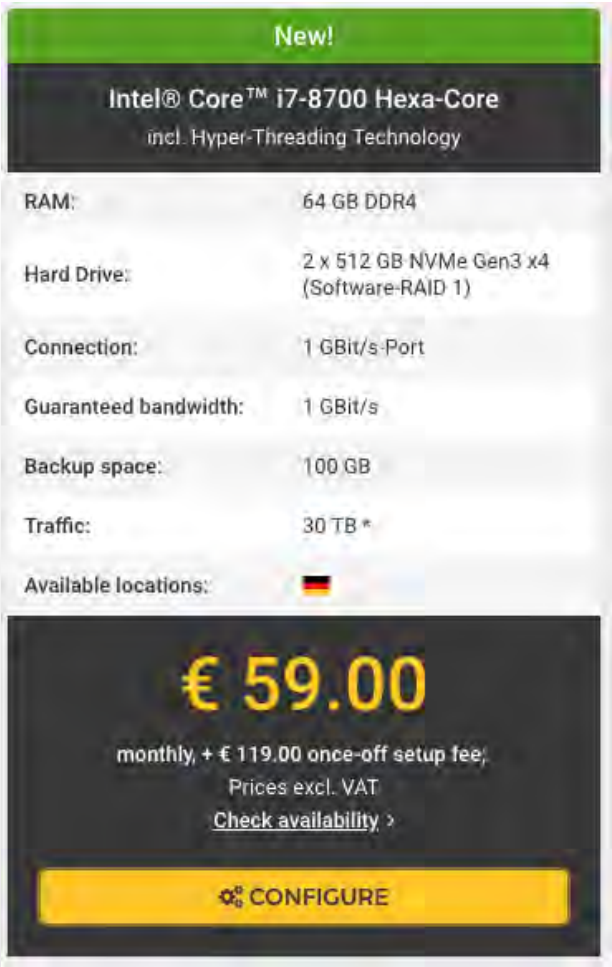


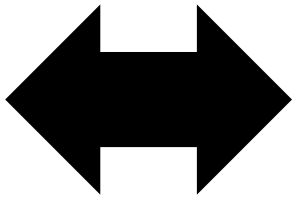
Hardware (if dedicated)

Picking hardware...

- There is **never** enough RAM
- SSD + RAM + CPU + OS => a choice of money and task

The cloud vs. dedicated servers





MEMORY	vCPUs	SSD DISK	TRANSFER	PRICE
1 GB	1 vCPU	25 GB	1 TB	$5/mo $0.007/hr
2 GB	1 vCPU	50 GB	2 TB	$10/mo $0.015/hr
4 GB	2 vCPUs	80 GB	4 TB	$20/mo $0.030/hr
8 GB	4 vCPUs	160 GB	5 TB	$40/mo $0.060/hr
16 GB	6 vCPUs	320 GB	6 TB	$80/mo $0.119/hr
32 GB	8 vCPUs	640 GB	7 TB	$160/mo $0.238/hr
48 GB	12 vCPUs	960 GB	8 TB	$240/mo $0.357/hr

Summary Hardware

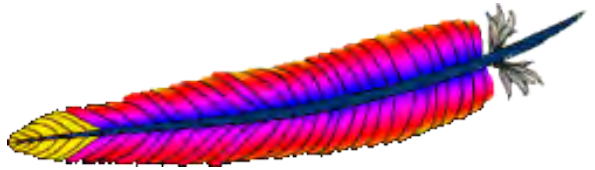
- Choose along your „knowledge pool“ and budget + provider choice, but it has to be a decent machine or cloud offer...

System Layer

System Layer

- OS (Linux or Windows – I think, but I am a Linux guy)
- Services
  - Webserver (Apache)
  - Reverse Proxy / Cache (nginx, varnishd, squid, memcached)
  - Database (MariaDB, SphinxSearch, ElasticSearch)
  - Filesystem (from NFS to Hadoop)

System Layer



For example: **persistent connections** make a huge difference!

Advantages of KeepAlive

- **Improves website speed**: It reduces latency associated with HTTP transfers and delivers a better user experience.
- **Reduces CPU usage**: On the server side enabling KeepAlive reduces CPU usage. Consider that a typical web page has dozens of different files such as images, stylesheets, javascript files etc. If KeepAlive is disabled a separate connection must be made for each of those files. Creating and closing connections has an overhead and doing it for every single file wastes CPU time.

Disadvantages of Keepalive

- **Increases memory usage**: Enabling KeepAlive increases memory usage on the server. Apache processes have to keep connections open waiting for new requests from established connections. While they are waiting they are occupying RAM that could be used to service other clients. If you turn off KeepAlive fewer apache processes will remain active. This will lower memory usage and allow Apache to serve more users.

System Layer

For example: **persistent connections** make a huge difference!

System Layer: the lazy approach

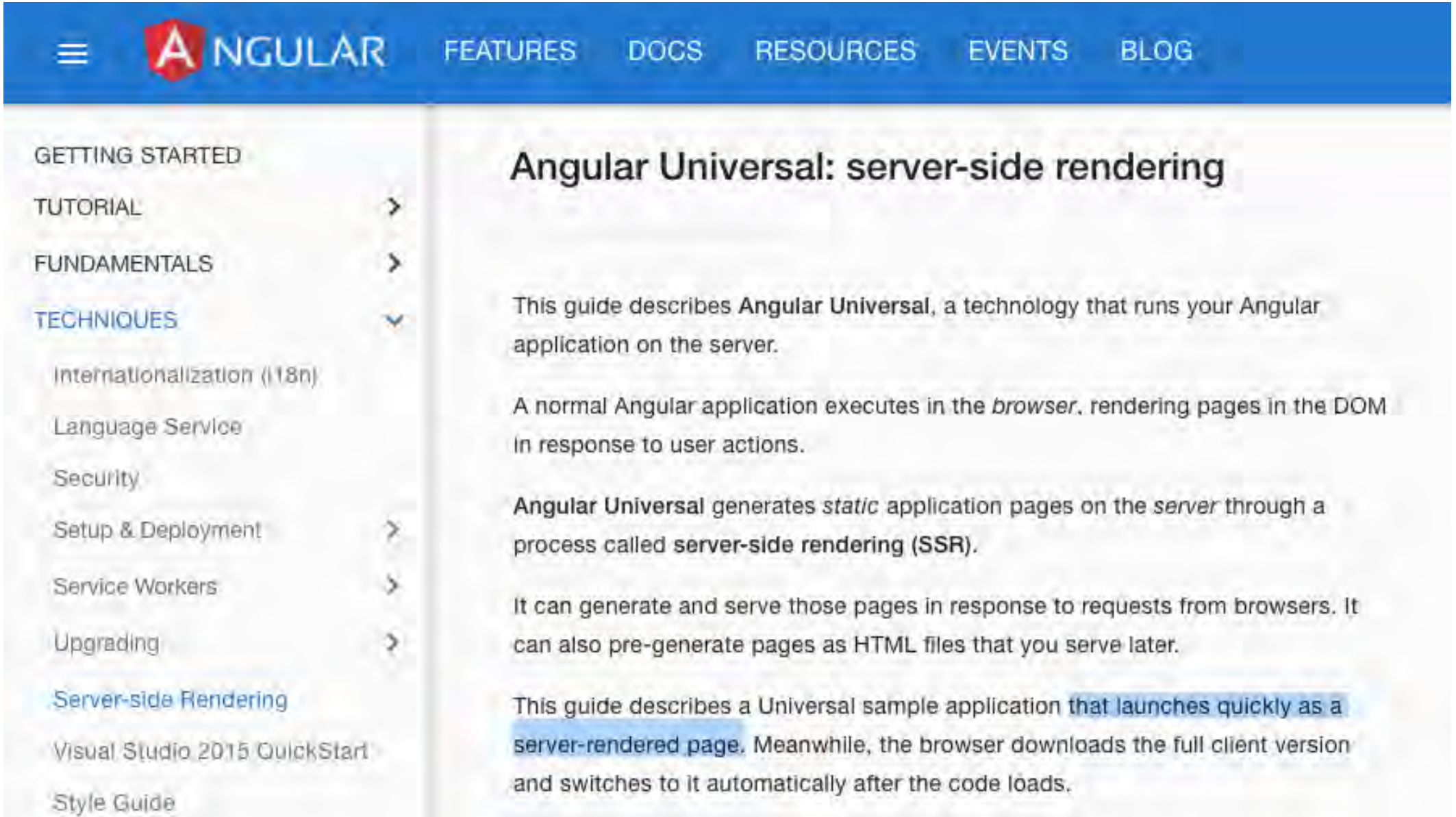
https://developers.google.com/speed/pagespeed/module/

Install on your webserver

System: rules of thumb

- Cache in RAM, whatever possible
- Limit requests per second to system by splitting static content
- Writing is **more expensive** than reading
- The Open Source community has you covered, but you need to know, what you are doing!

System: dynamic pages with JS



Summary System

- If it shall scale, the choices are limited!
- Progressive web apps with **1+ Mio. daily users** and a lot of files are probably best kept in a cloud environment (coz: add instances per task)
- Solid WP blogs (we have customers with 120k visits / day) can be done on a single server system with a CDN

Application Level

Application Layer

Out of the box systems are never 100% optimized!

WordPress.org

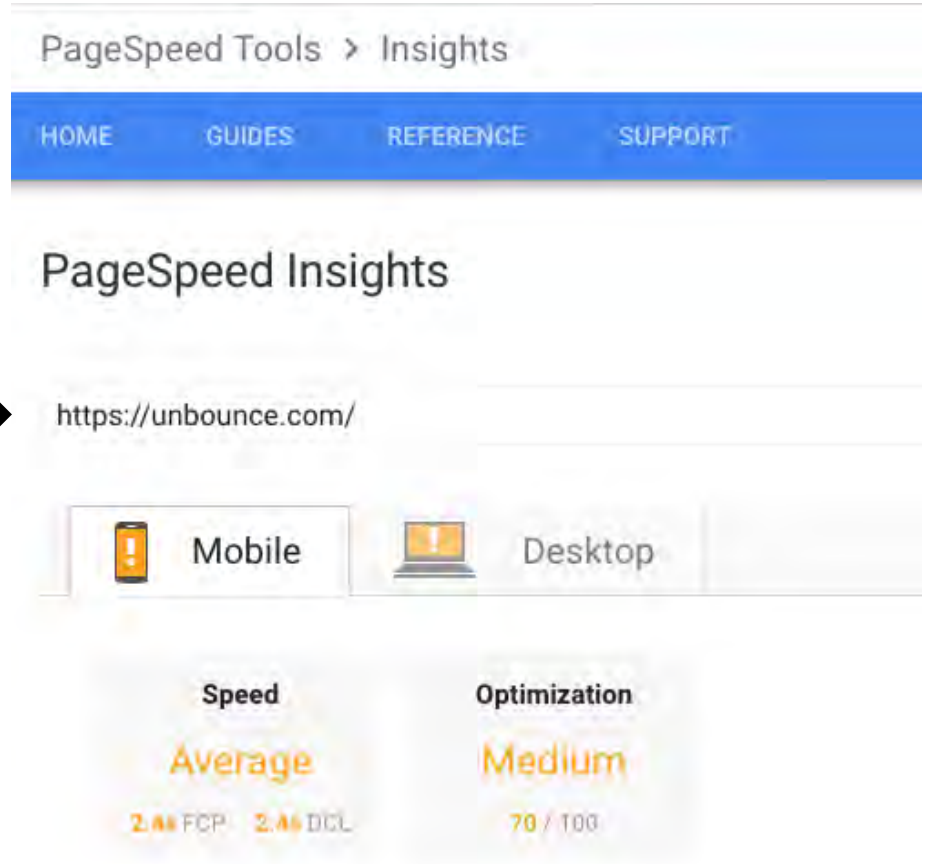
Contao

Joomla!

Drupal

unbounce

totally normal



Application Layer

But most of them can be tweaked right!

- add a CDN
- avoid Cookies, if possible
- Combine JS, CSS and minify
- Manage images automatically (resizing)
- Nested Loops, *if(file_exists())*, tables without index, etc. = evil!

Application Layer

index.php base.php

```php
<?
$doSession=false;
include("inc/base.php");
```

```php
if(!isset($doSession) OR isset($_COOKIE['PHPSESSID'])) {
    $doSession=true;
}
if($doSession) {
    session_start();
    // logged in or not?
    if(!isset($_SESSION["USERID"])) {
        $_SESSION["USERID"]=0;
    }
} else {
    $myHours = 1;
    header( string: 'Expires: ' . gmdate( format: 'D, d M Y H:i:s \G\M\T',  timestamp: time() + (60 * 60 * $myHours)));
    header( string: "Pragma: cache");
    header( string: "Cache-Control: max-age=" . (60 * 60 * $myHours));
    header( string: "User-Cache-Control: max-age=" . (60 * 60 * $myHours));
}
```

Application Layer: CDN

A CDN-URL for your assets has **2 advantages**!

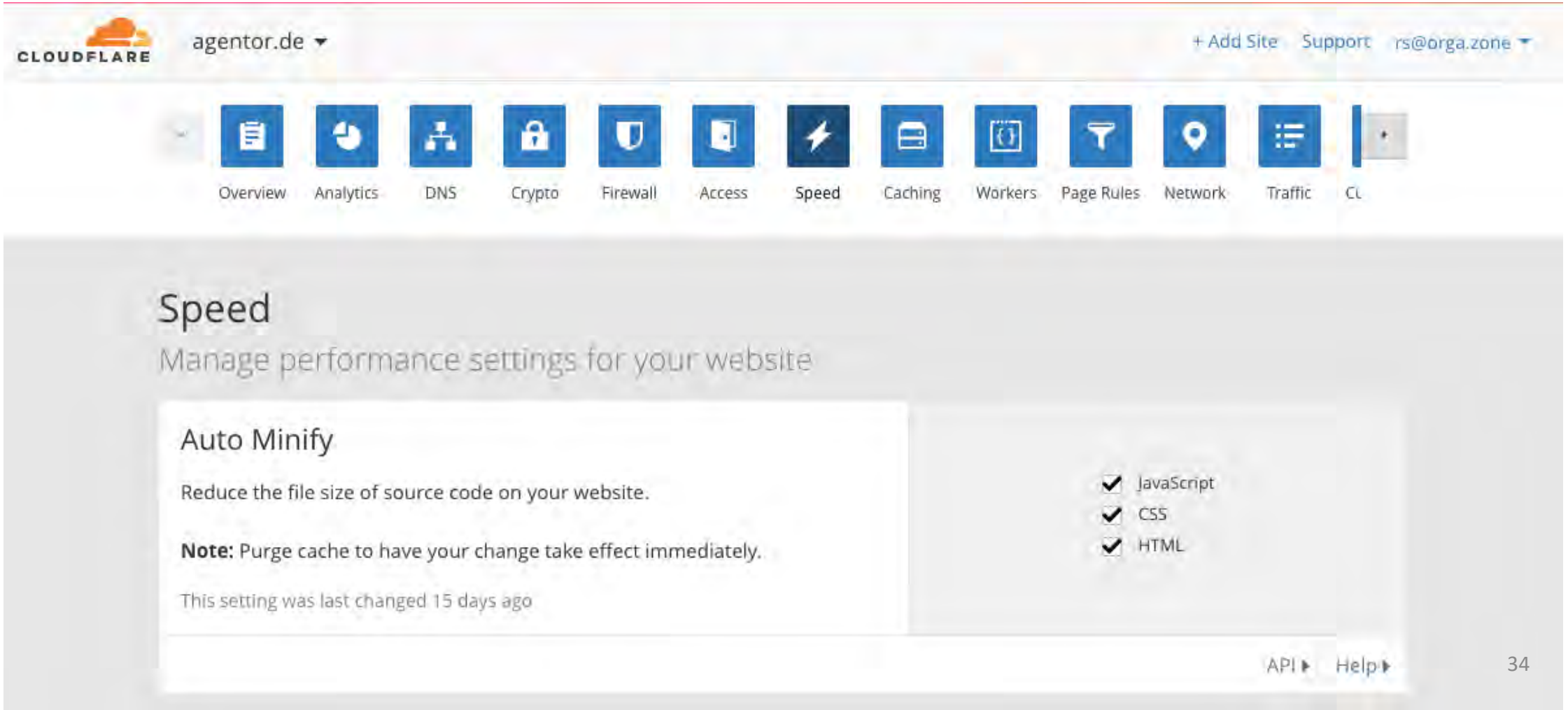
1. Global caching
2. More simultaneous connections per user

TABLE 1. MAXIMUM SUPPORTED CONNECTIONS

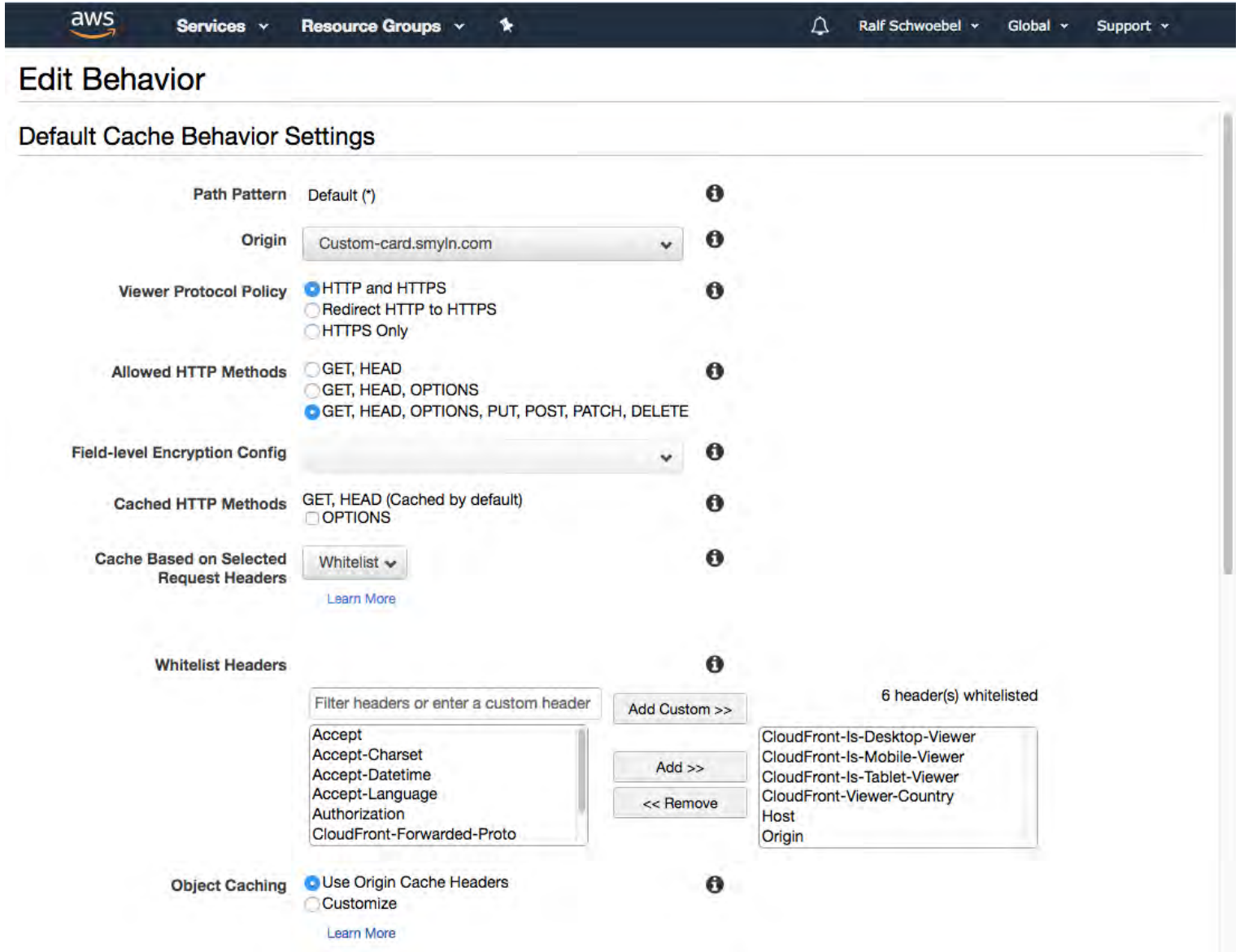
Version	Maximum connections
Internet Explorer® 7.0	2
Internet Explorer 8.0 and 9.0	6
Internet Explorer 10.0	8
Internet Explorer 11.0	13
Firefox®	6
Chrome™	6
Safari®	6
Opera®	6
iOS®	6
Android™	6

Application Layer: CDN

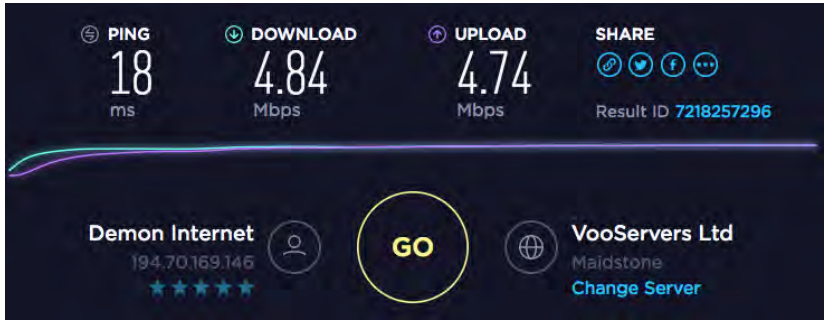
There are some and a lot are good!

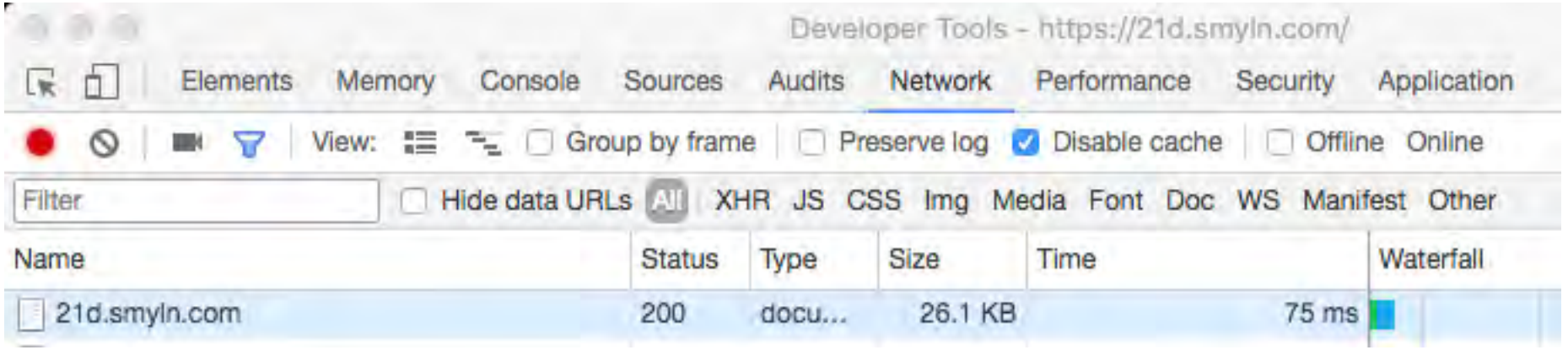


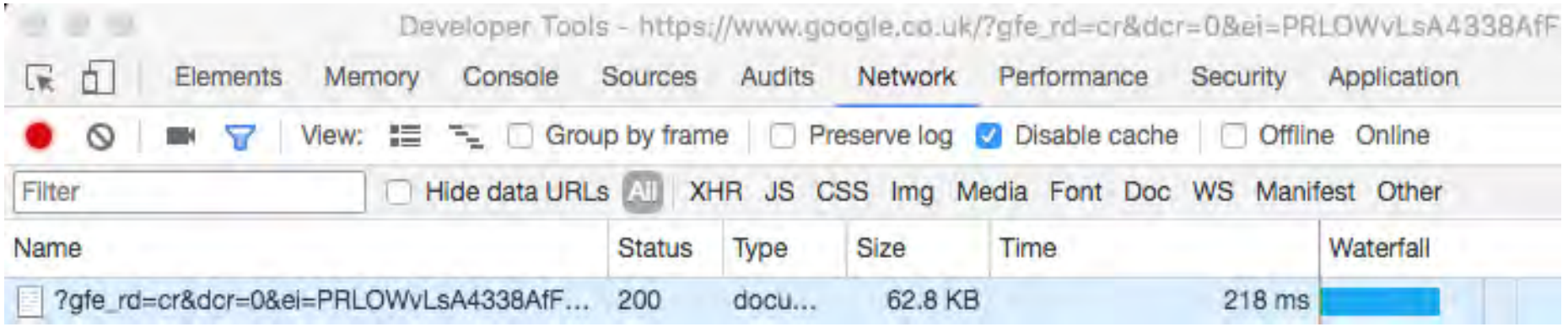
Application Layer: CDN



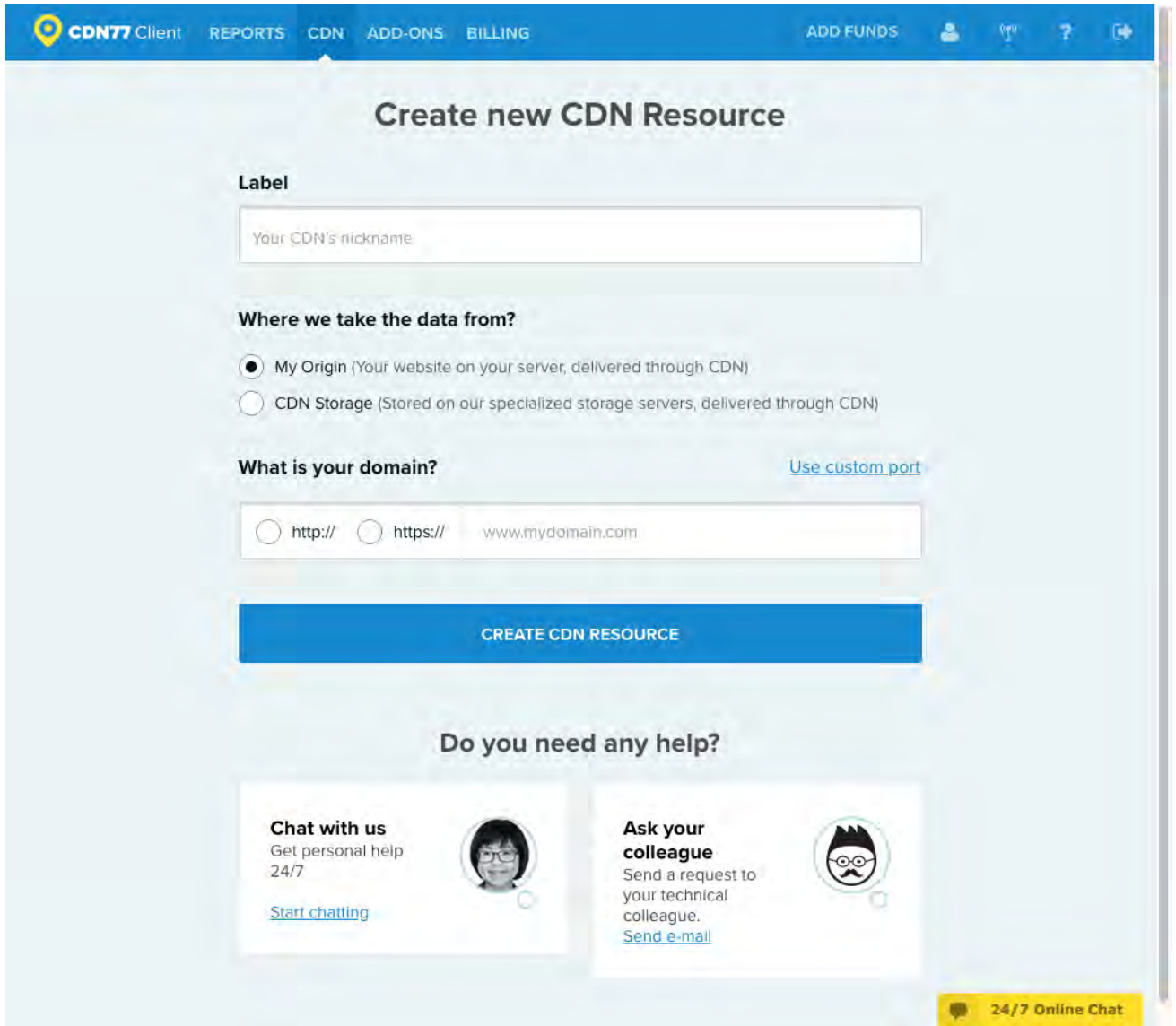
Amazon Cloudfront at its best @5Mbit/s





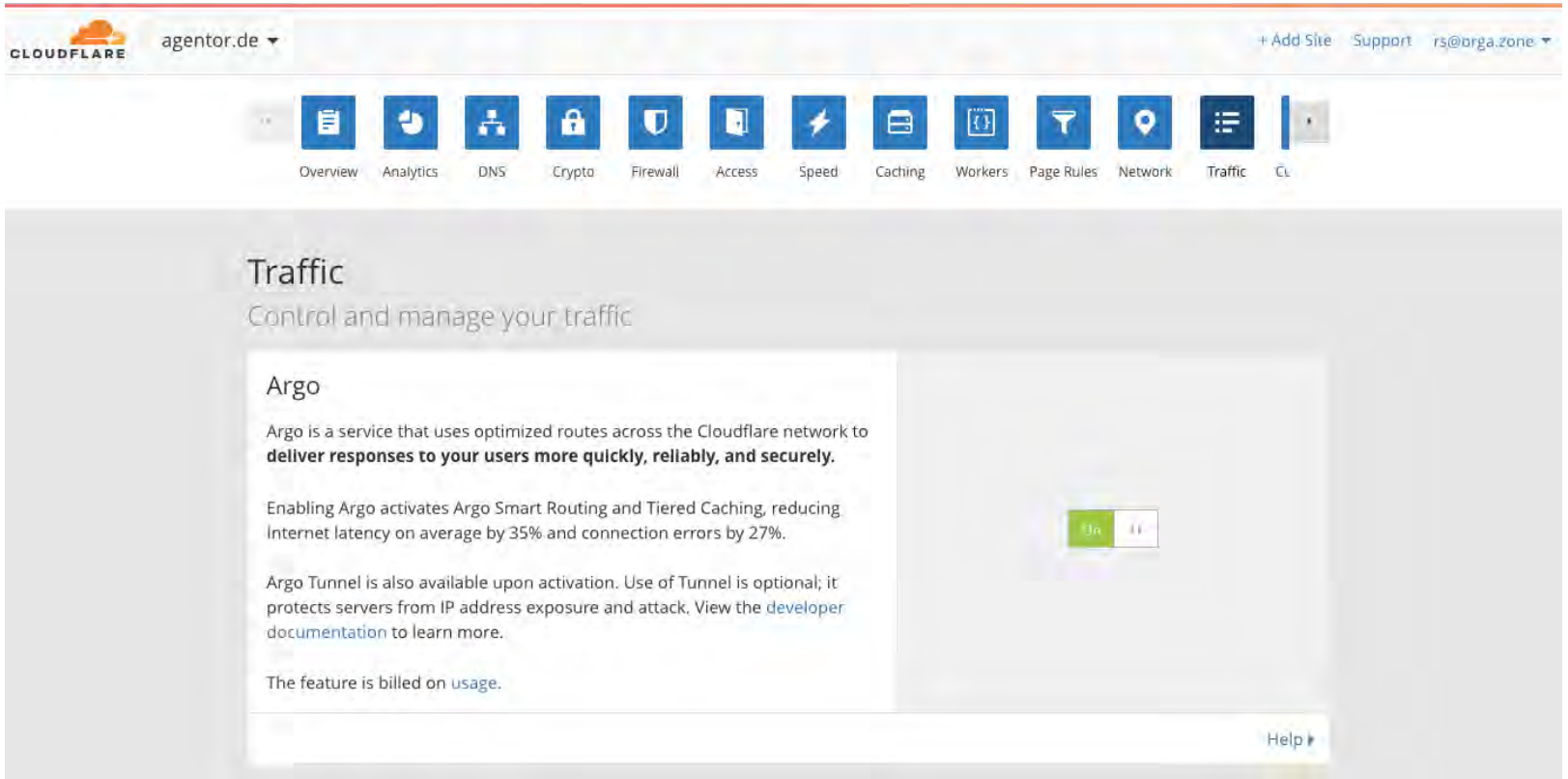


Application Layer: CDN



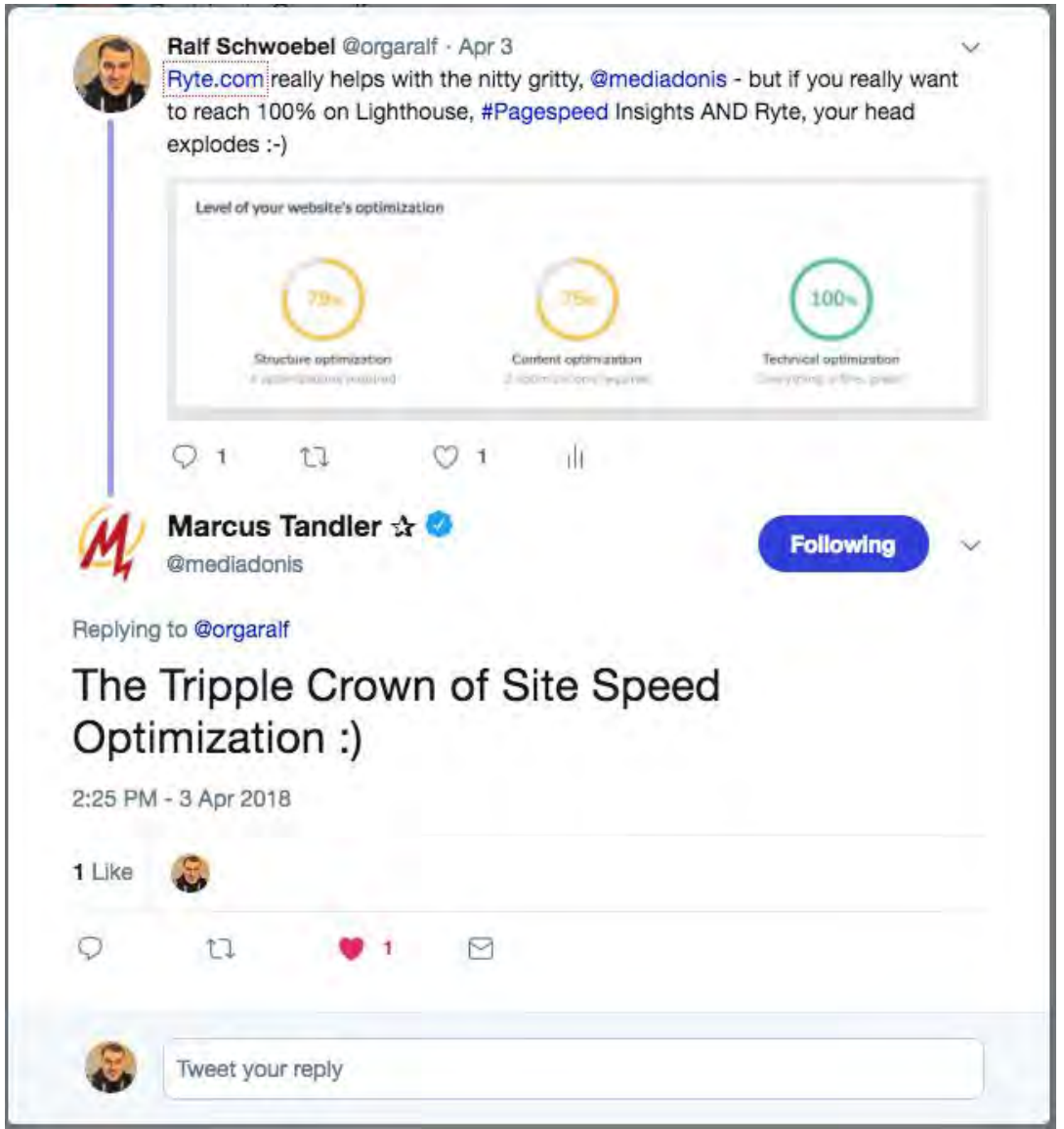
Summary: Application Layer

- This is the place for 70% of your optimization work
- The other 30% (provider, system) are **important to cover first**

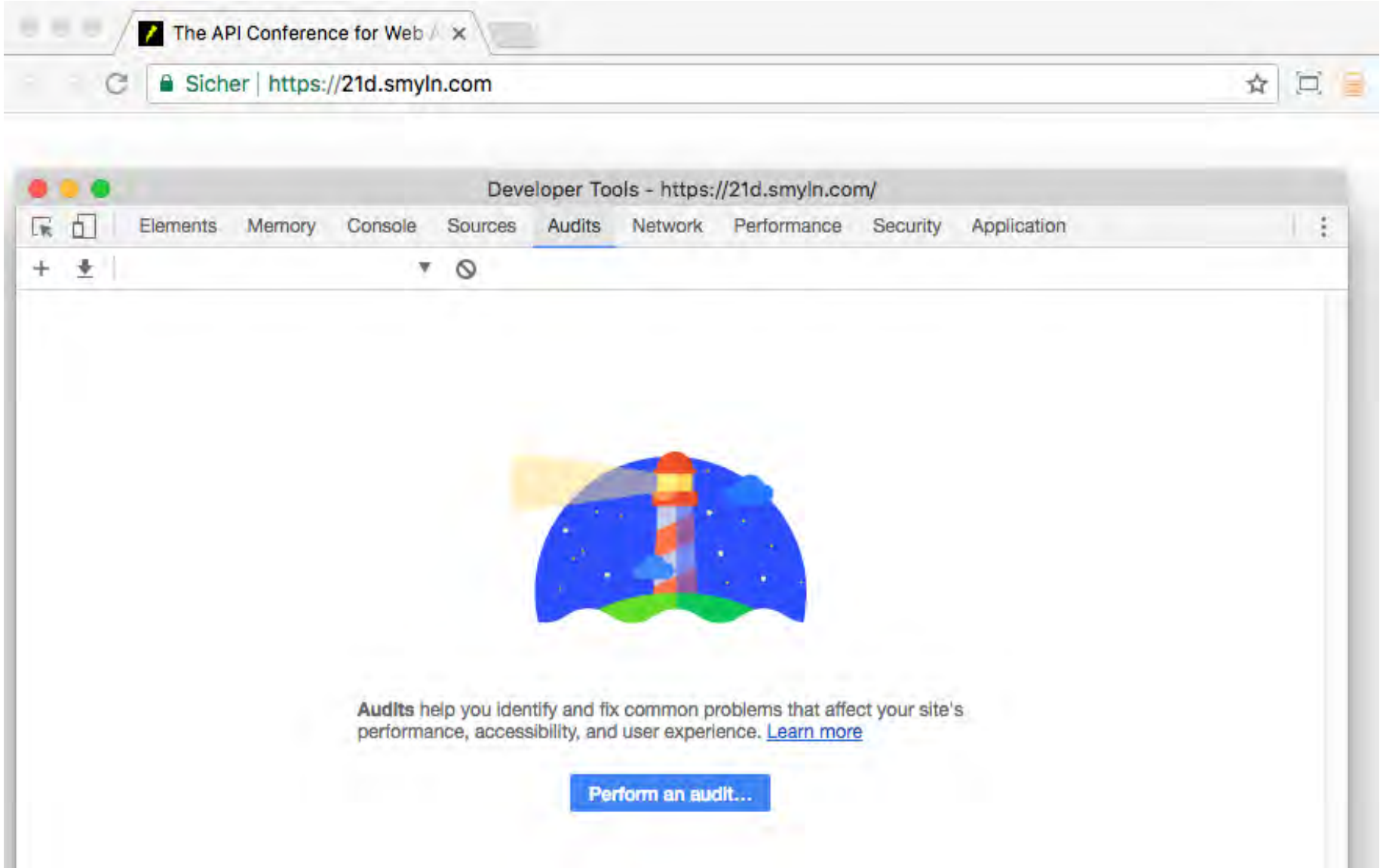


HTML = the result

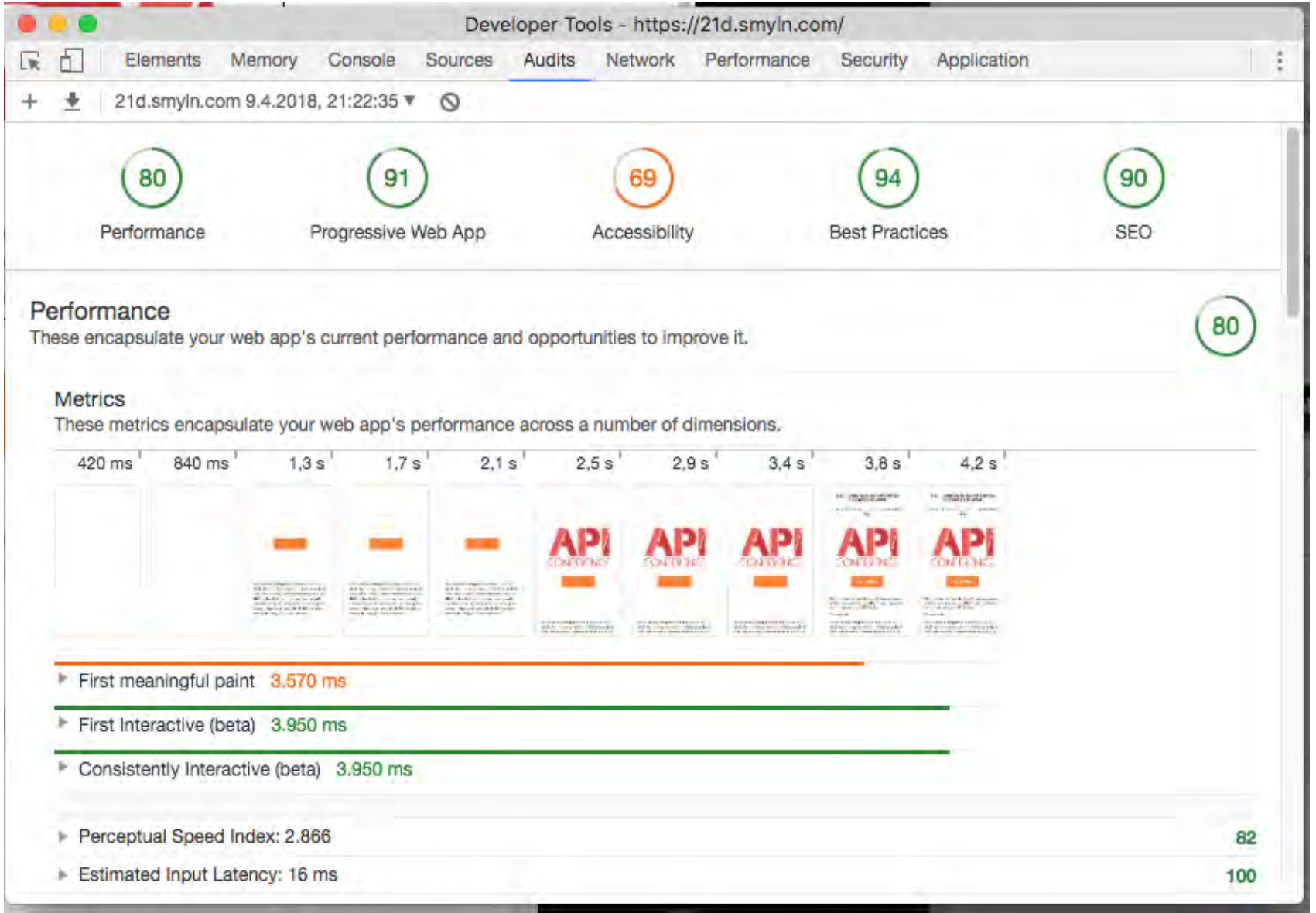
Now let us go “green“ in the tests!



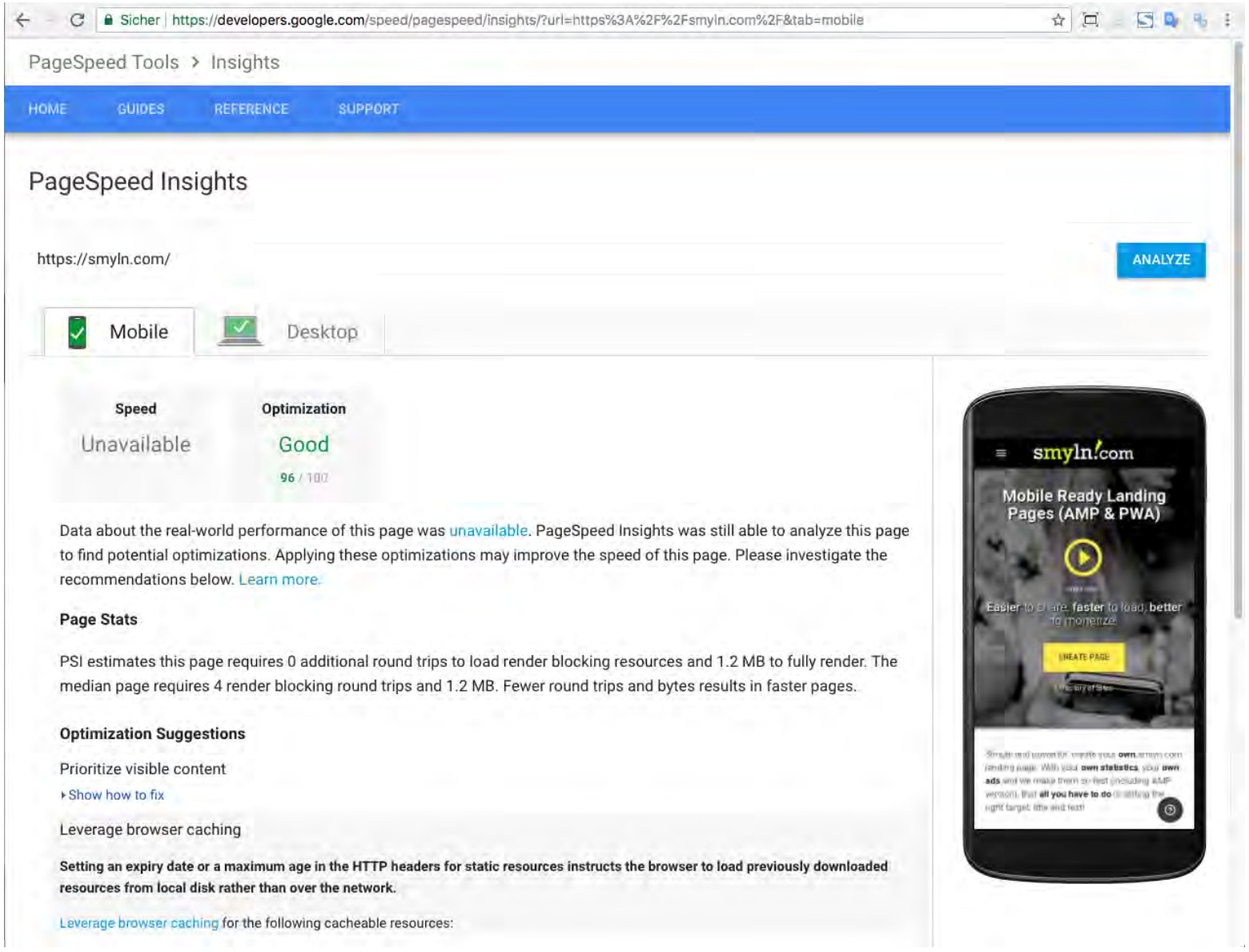
Lighthouse Audit



Lighthouse Audit

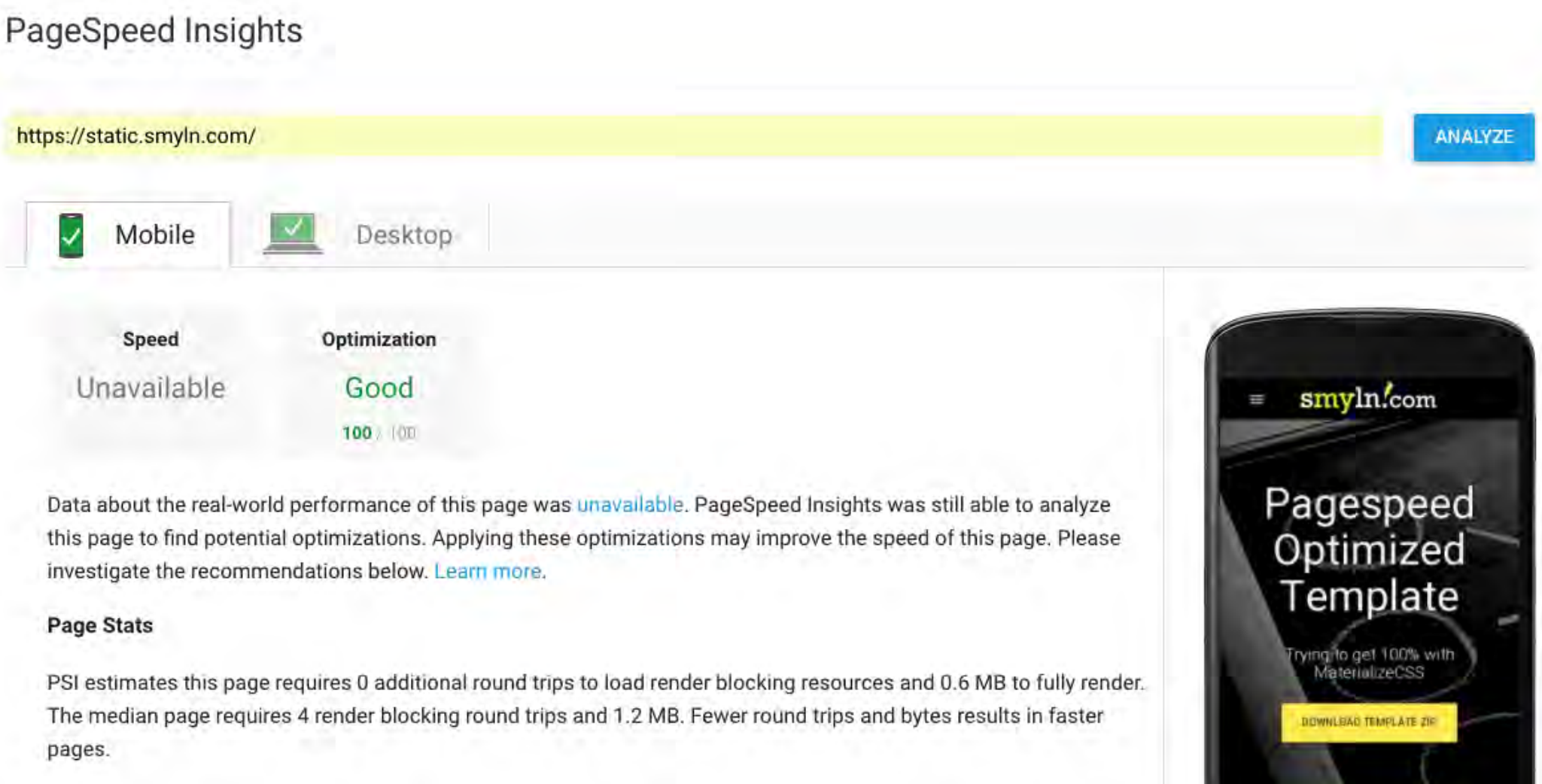


Pagespeed Insights



Pagespeed Insights: **Plain Vanilla MaterializeCSS**

Free download on https://static.smyln.com/



The cornerstones of „Insights“

- Server response time
- Caching time for static content >7days
- Render blocking removed (first paint)
- Images optimized
- CSS combined and minimized
- JS combined and minimized (and async‘ed)

The Javascript thing...

```
<script async onload="myInit()" src="<?=$cdnurl?>js/jquery-3.3.1.min.js"></script>
```

```
<script>
    //———
    function myInit() {
        $(document).ready(function() {
            $.ajaxSetup({ cache: true });
            $.getScript( "js/materialize.min.js", function( data, textStatus, jqxhr ) {
                (function($){
                    $(function(){
                        $('.button-collapse').sideNav();
                        $('select').material_select();
                        Materialize.updateTextFields();
                        $('.modal').modal();
                        $("#index-banner").css('background-image','url(<?=$cdnurl?>img/share-background.png)');
                    }); // end of document ready
                })(jQuery); // end of jQuery name space
            });
            $.getScript( "js/jssocials.min.js", function( data, textStatus, jqxhr ) {
                (function($){
                    $(function(){
                        $("#share").jsSocials({
                            shares: ["email", "twitter", "facebook", "googleplus", "linkedin", "pinterest", "stumbleupon", "whatsapp"],
                            showCount: false,
                            shareIn: "popup"
                        });
                    }); // end of document ready
                })(jQuery); // end of jQuery name space
            });
            $("#nav-mobile").append($("#myTopNav").html());
            $('head').append('<link rel="stylesheet" type="text/css" href="//maxcdn.bootstrapcdn.com/font-awesome/4.7.0/css/font-awesome.min.css">');
            $.ajaxSetup({ cache: false });
            /*<![CDATA[*/window.zE||(function(e,t,s){
                var n=window.zE=window.zEmbed=function(){
                    n._.push(arguments)}, a=n.s=e.createElement(t),r=e.getElementsByTagName(t)[0];
                n.set=function(e){
                    n.set._.push(e)},n._=[],n.set._=[],a.async=true,a.setAttribute("charset","utf-8"), a.src="https://static.zdassets.com/ekr/asset_co
            })(document,"script","e27a5f79-2671-4a5d-adb6-5a3d1ab3cd4a");/*]]>*/
        });
    }
</script>
```

The render blocking thing...

```
<style>
    <? include("css/materialize.min.css.php"); ?>
    body {
        display: flex;
        min-height: 100vh;
        flex-direction: column;
    }
    main {
        flex: 1 0 auto;
    }
</style>
```

The Wordpress thing

PageSpeed Insights

https://www.agentor.de/

ANALYZE

Mobile Desktop

Speed

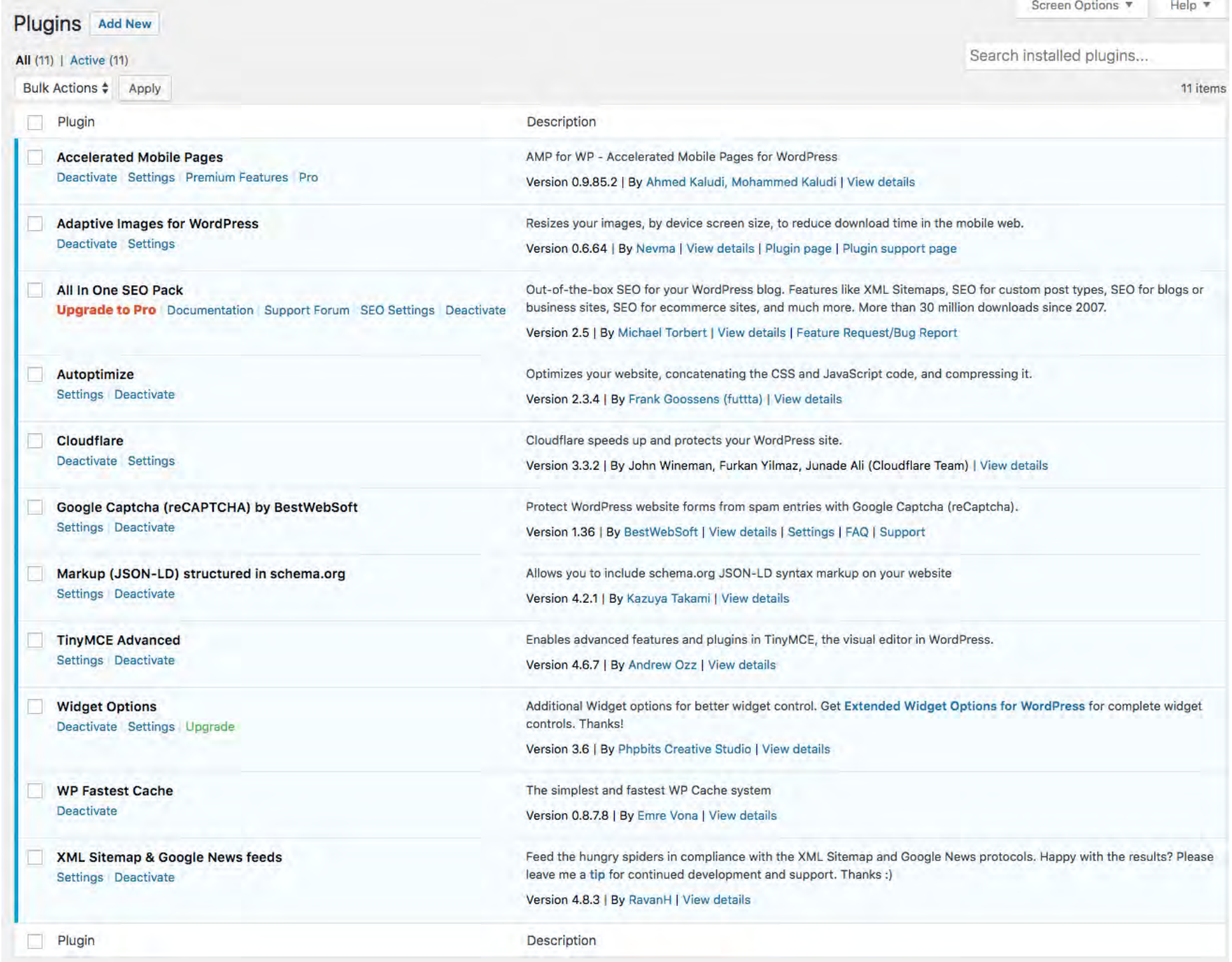
Unavailable

Optimization

Good

84 / 100

Data about the real-world performance of this page was unavailable. PageSpeed Insights was still able to analyze this page to find potential optimizations. Applying these optimizations may improve the


Plugins
Add New
Screen Options
Help
All (11) | Active (11)
Search installed plugins...
Bulk Actions
Apply
11 items
Plugin
Description
Accelerated Mobile Pages
Deactivate | Settings | Premium Features | Pro
AMP for WP - Accelerated Mobile Pages for WordPress
Version 0.9.85.2 | By Ahmed Kaludi, Mohammed Kaludi | View details
Adaptive Images for WordPress
Deactivate | Settings
Resizes your images, by device screen size, to reduce download time in the mobile web.
Version 0.6.64 | By Nevma | View details | Plugin page | Plugin support page
All In One SEO Pack
Upgrade to Pro | Documentation | Support Forum | SEO Settings | Deactivate
Out-of-the-box SEO for your WordPress blog. Features like XML Sitemaps, SEO for custom post types, SEO for blogs or business sites, SEO for ecommerce sites, and much more. More than 30 million downloads since 2007.
Version 2.5 | By Michael Torbert | View details | Feature Request/Bug Report
Autoptimize
Settings | Deactivate
Optimizes your website, concatenating the CSS and JavaScript code, and compressing it.
Version 2.3.4 | By Frank Goossens (futtta) | View details
Cloudflare
Deactivate | Settings
Cloudflare speeds up and protects your WordPress site.
Version 3.3.2 | By John Wineman, Furkan Yilmaz, Junade Ali (Cloudflare Team) | View details
Google Captcha (reCAPTCHA) by BestWebSoft
Settings | Deactivate
Protect WordPress website forms from spam entries with Google Captcha (reCaptcha).
Version 1.36 | By BestWebSoft | View details | Settings | FAQ | Support
Markup (JSON-LD) structured in schema.org
Settings | Deactivate
Allows you to include schema.org JSON-LD syntax markup on your website
Version 4.2.1 | By Kazuya Takami | View details
TinyMCE Advanced
Settings | Deactivate
Enables advanced features and plugins in TinyMCE, the visual editor in WordPress.
Version 4.6.7 | By Andrew Ozz | View details
Widget Options
Deactivate | Settings | Upgrade
Additional Widget options for better widget control. Get Extended Widget Options for WordPress for complete widget controls. Thanks!
Version 3.6 | By Phpbits Creative Studio | View details
WP Fastest Cache
Deactivate
The simplest and fastest WP Cache system
Version 0.8.7.8 | By Emre Vona | View details
XML Sitemap & Google News feeds
Settings | Deactivate
Feed the hungry spiders in compliance with the XML Sitemap and Google News protocols. Happy with the results? Please leave me a tip for continued development and support. Thanks :)
Version 4.8.3 | By RavanH | View details
Plugin
Description

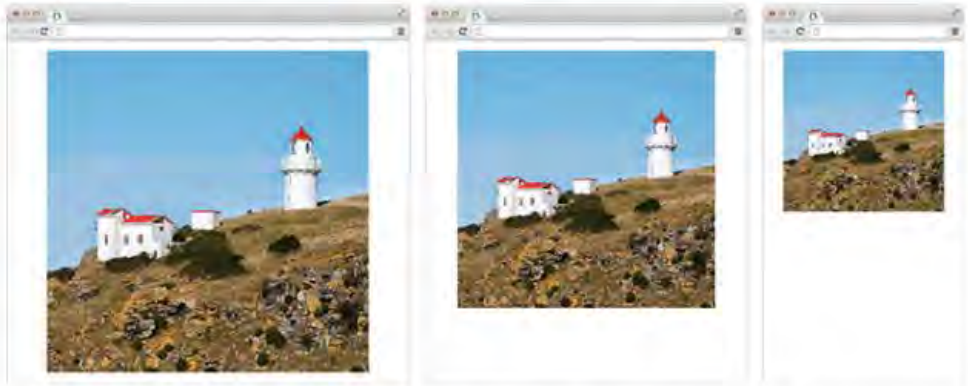
The Smartphone thing

Sicher | https://www.html5rocks.com/en/tutorials/responsive/picture-element/#t...

Here's an example of using the `sizes` attribute to set the proportion of an image to always fill 80% of the viewport. It is combined with the `srcset` attribute to supply four versions of the same lighthouse photo in widths of 160px, 320px, 640px, and 1280px wide:

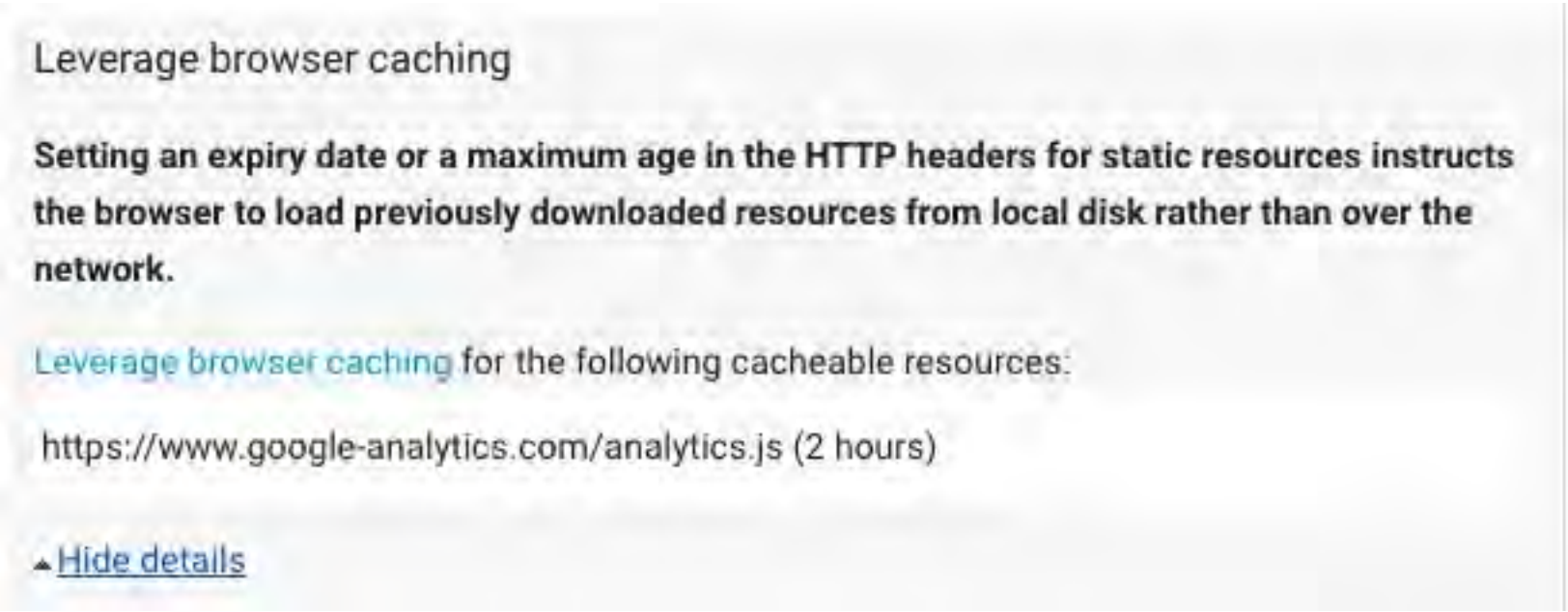
```
<img src="lighthouse-160.jpg" alt="lighthouse"
     sizes="80vw"
     srcset="lighthouse-160.jpg 160w,
             lighthouse-320.jpg 320w,
             lighthouse-640.jpg 640w,
             lighthouse-1280.jpg 1280w">
```

The browser will use these hints to choose the most appropriate image resource to serve up based on the viewport width and hardware display resolution:



For example, the viewport on the left is approx. 800px wide. The browser will load lighthouse-640.jpg unless the device pixel ratio is 2x —in which case, lighthouse-1280.jpg will be loaded instead.

The Google Analytics thing



Better, if you do not need everything - https://github.com/jehna/ga-lite

The ultimate SEO/quality checklist starts with speed

- The site responds <100ms on fa(s)t lines
- Pages are green on Insights + Lighthouse...
- ...also for mobile(!)
- Keyword is investigated
- On-Page SEO fits (ryte.com creates an extra ToDo list for you)
- Links are coming in (off-page SEO)
- Users stay (want to see more pages, do not use the back button)
- Visitors convert to customers

Thank you!

Thank you for your time and attention...

Have a great time in London!

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