

interactive slides:
bit.ly/faster-rails

Making the Web Fast(er)

*one **Rails** page at a time*

+[Ilya Grigorik](#), @[igrigorik](#)

RailsConf 2012



“Browsing should be
as simple and fast as
turning a page in a
magazine”

—Larry Page

actually, it should be even faster...



“Goal: make the entire web faster”

- Kernel, Networking, Mobile, Chrome, Infrastructure, ...
- Research & drive performance web standards (W3C, etc)
- Build open source tools, contribute to existing projects
- Optimize Google, optimize the web...

Make The Web Fast (MTWF)

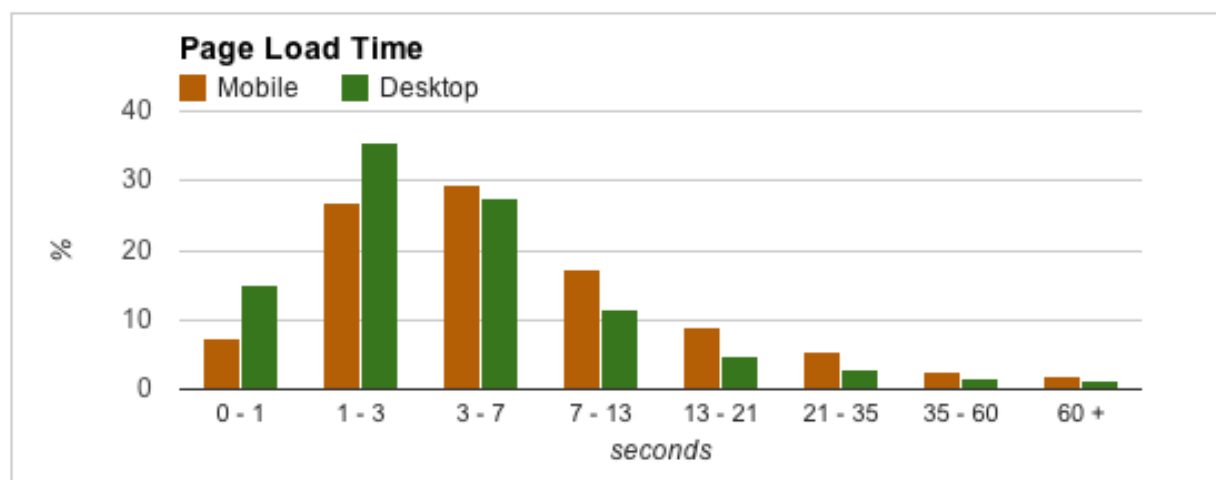
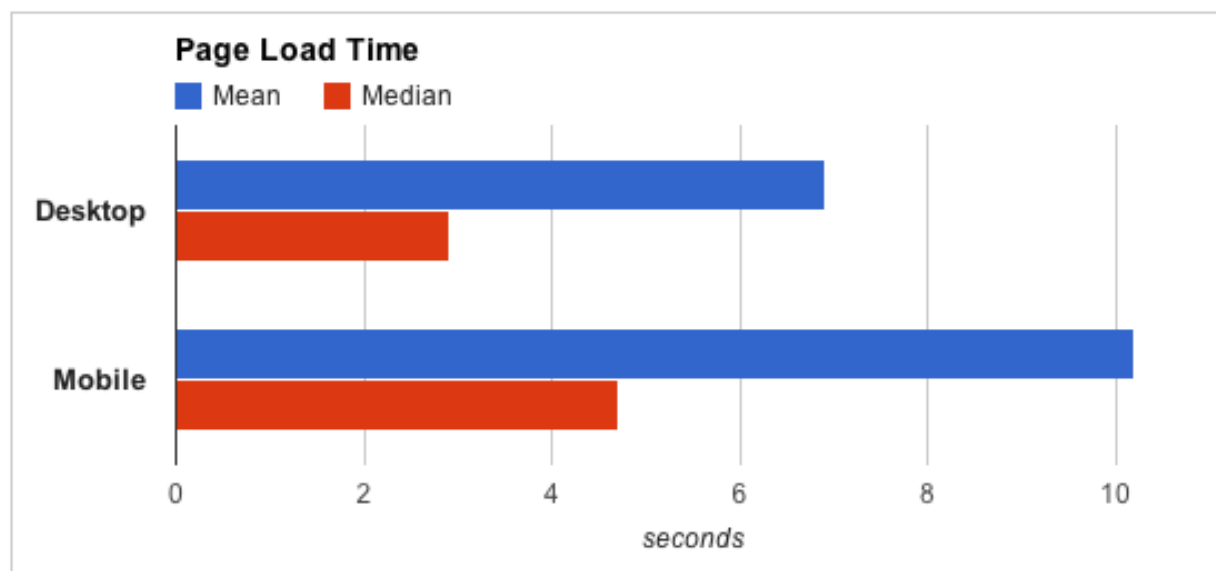
<http://developers.google.com/speed>



Delay	User reaction
0-100ms	Instant
0-300ms	Feels sluggish
100-1000ms	Machine is working...
1s+	Mental context switch
10s+	I'll come back later...

Usability Engineering 101





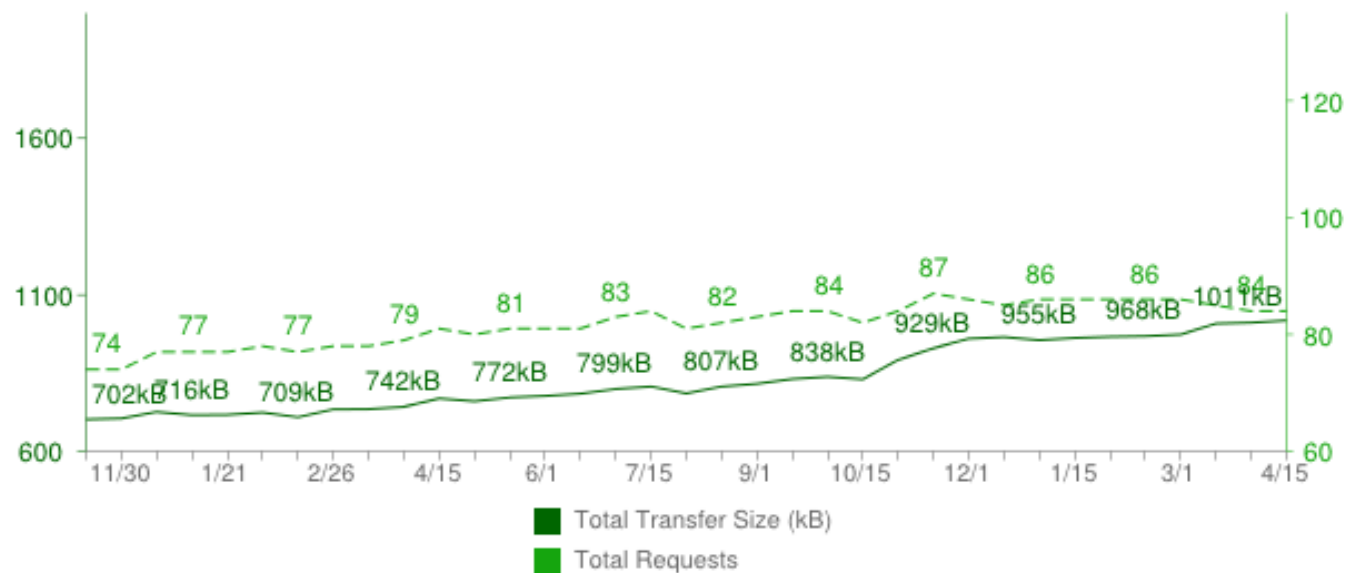
Delay	User reaction
0-100ms	Instant
0-300ms	Feels sluggish
300-1000ms	Machine is working...
1s+	Mental context switch
» we're here! « on average...	
10s+	I'll come back later...

Code **RED!**

To add insult to injury: mobile experience is [1.5x slower](#) on average.



Total Transfer Size & Total Requests



Content Type	Avg # of Requests	Avg size
HTML	8	44kB
Images	53	635kB
Javascript	14	189kB
CSS	5	35kB

(short) life of a web request...

1. Unload the DOM
2. DNS resolution
3. Connection & TCP handshake
4. Send request, wait for response
5. Parse response
6. Request sub-resources (see step 1) ***
7. Execute scripts, apply CSS rules
8. ...

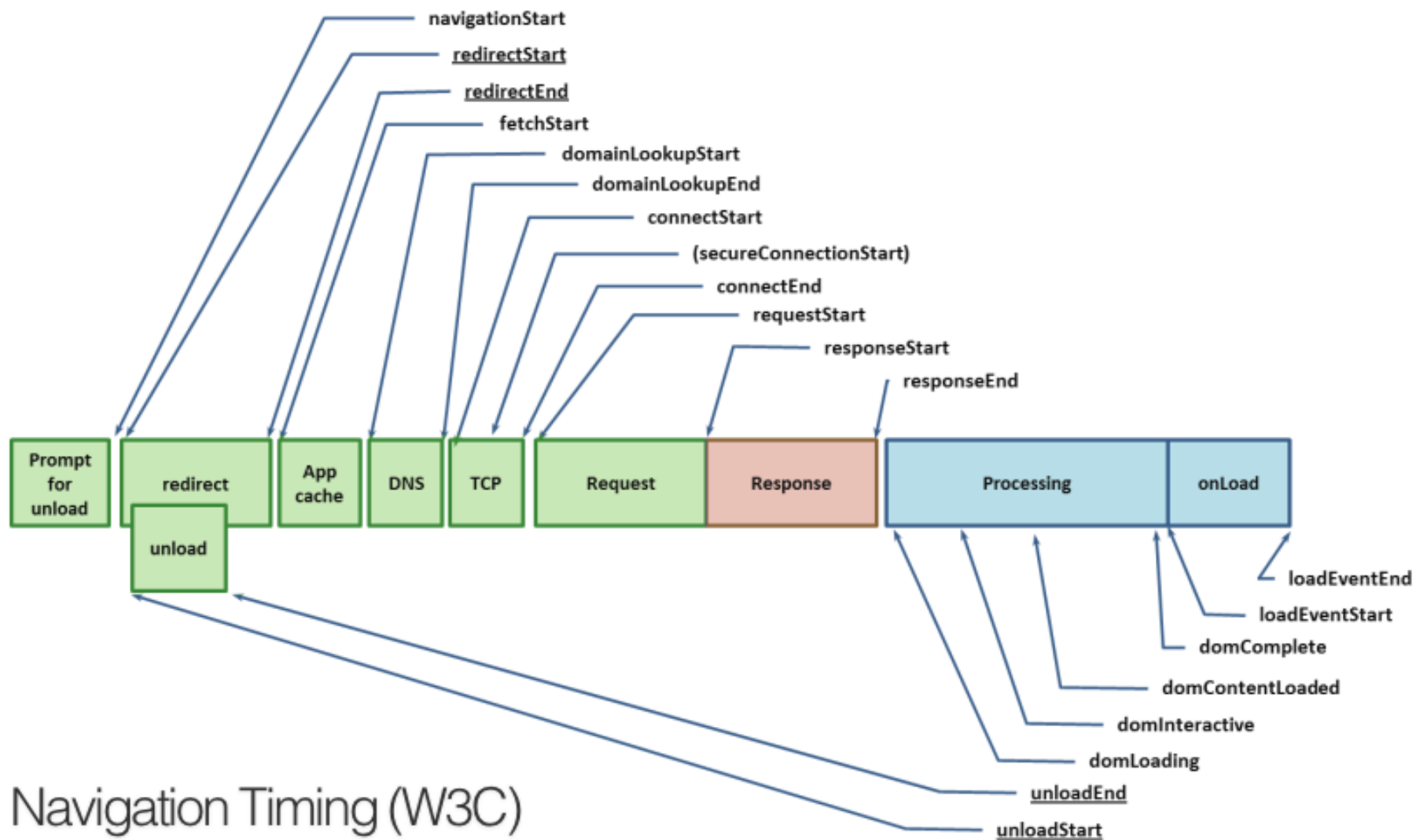
Where is your bottleneck?

MEASURE



memegenerator.net





Navigation Timing (W3C)

When can I use Navigation Timing API?

[View in interactive mode](#)

Compatibility table for support of Navigation Timing API in desktop and mobile browsers.

= Supported = Not supported = Partially supported = Support unknown

Navigation Timing API - Candidate Recommendation

Global user stats*:

Support: 58.56%

API for accessing timing information related to navigation and elements.

Resources: [MDN article](#) [HTML5 Rocks tutorial](#)

	IE	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Opera Mobile	Android Browser
14 versions back			4.0						
13 versions back			5.0						
12 versions back		2.0	6.0 webkit						
11 versions back		3.0	7.0 webkit						
10 versions back		3.5	8.0 webkit						
9 versions back		3.6	9.0 webkit						
8 versions back		4.0	10.0 webkit		9.0				
7 versions back		5.0	11.0 webkit		9.5-9.6				
6 versions back		6.0	12.0 webkit		10.0-10.1				
5 versions back		7.0	13.0		10.5				
4 versions back	5.5	8.0	14.0	3.1	10.6			10.0	
3 versions back	6.0	9.0	15.0	3.2	11.0	3.2		11.0	2.1
2 versions back	7.0	10.0	16.0	4.0	11.1	4.0-4.1		11.1	2.2
Previous version	8.0	11.0	17.0	5.0	11.5	4.2-4.3		11.5	2.3 3.0
Current	9.0	12.0	18.0	5.1	11.6	5.0	5.0-6.0	12.0	4.0
Near future	10.0	13.0	19.0	5.2	12.0				
Farther future		14.0	20.0						

W3C Navigation Timing

If we want to see the end-user perspective, then we need to instrument the browser to give us this information. Thankfully, the [W3C Web Performance Working Group](#) is ahead of us: [Navigation Timing](#). The spec is still a draft, but Chrome, Firefox and IE have already implemented the proposal.

The screenshot shows a web browser's developer tools interface. The 'Elements' panel is active, displaying the HTML document structure. The 'Timeline' panel is also visible. The 'performance.timing' object is expanded, showing various timing metrics for the page load. A red rectangular stamp with the text 'bit.ly/HgjvhM' is overlaid on the right side of the image.

Elements Resources Network Scripts Timeline Search Elements

<!DOCTYPE html>
<!--[if lt IE 7]> <html class="no-js ie6 oldie" lang="en"> <![endif]>
<html class="no-js ie6 oldie" lang="en">

html body

> performance.timing

▼ PerformanceTiming

- connectEnd: 1334966059713
- connectStart: 1334966059713
- domComplete: 1334966061325
- domContentLoadedEventEnd: 1334966059816
- domContentLoadedEventStart: 1334966059816
- domInteractive: 1334966059816
- domLoading: 1334966059729
- domainLookupEnd: 1334966059713
- domainLookupStart: 1334966059713
- fetchStart: 1334966059713
- loadEventEnd: 1334966061337
- loadEventStart: 1334966061325
- navigationStart: 1334966059713
- redirectEnd: 0
- redirectStart: 0
- requestStart: 1334966059721
- responseEnd: 1334966059723
- responseStart: 1334966059721
- secureConnectionStart: 0
- unloadEventEnd: 1334966059724
- unloadEventStart: 1334966059724

bit.ly/HgjvhM

<top frame> All Errors Warnings Logs

Good news, Google Analytics collects this data for us...

```
<script>
  _gaq.push(['_setAccount', 'UA-XXXX-X']);
  _gaq.push(['_setSiteSpeedSampleRate', 100]); // #protip
  _gaq.push(['_trackPageview']);
</script>
```

- Defaults to 5% sampling rate
- Max sample is 10k visits/day
- GA advanced segments FTW!

Google Analytics > Content > [Site Speed](#)



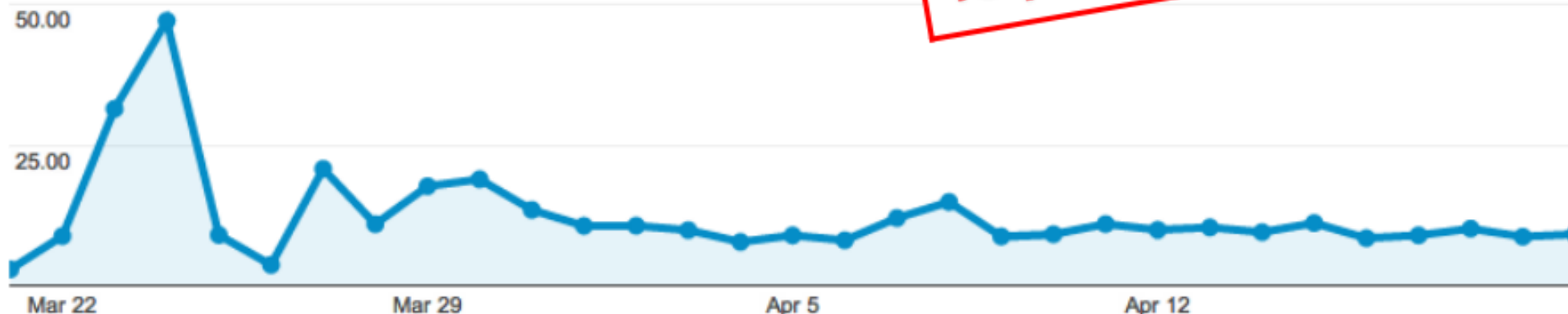
100.00% of total pageviews

Explorer Performance Map Overlay

Site Usage Technical

Avg. Page Load Time (sec) vs. Select a metric

Avg. Page Load Time (sec)



No instrumentation required

| Pageviews | Avg. Page Load Time (sec) | Avg. Redirection Time (sec) | Avg. Domain Lookup Time (sec) | Avg. Server Connection Time (sec) | Avg. Server Response Time (sec) | Avg. Page Download Time (sec) |
|------------------------------|---------------------------|-----------------------------|-------------------------------|-----------------------------------|---------------------------------|-------------------------------|
| 59,778 | 9.70 | 0.36 | 0.18 | 0.12 | 0.30 | 0.17 |
| % of Total: 100.00% (59,778) | Site Avg: 9.70 (0.00%) | Site Avg: 0.36 (0.00%) | Site Avg: 0.18 (0.00%) | Site Avg: 0.12 (0.00%) | Site Avg: 0.30 (0.00%) | Site Avg: 0.17 (0.00%) |

Primary Dimension: Page Page Title Other

Secondary dimension Sort Type: Default

advanced

Avg. Page Avg. Avg. Domain Avg. Server Avg. Server Avg. Page

Asia 17.18% of total pageviews

Europe 34.47% of total pageviews

Explorer

Performance

Map Overlay

Site Usage

Technical

Segment by:
geo, browser, UA, ...

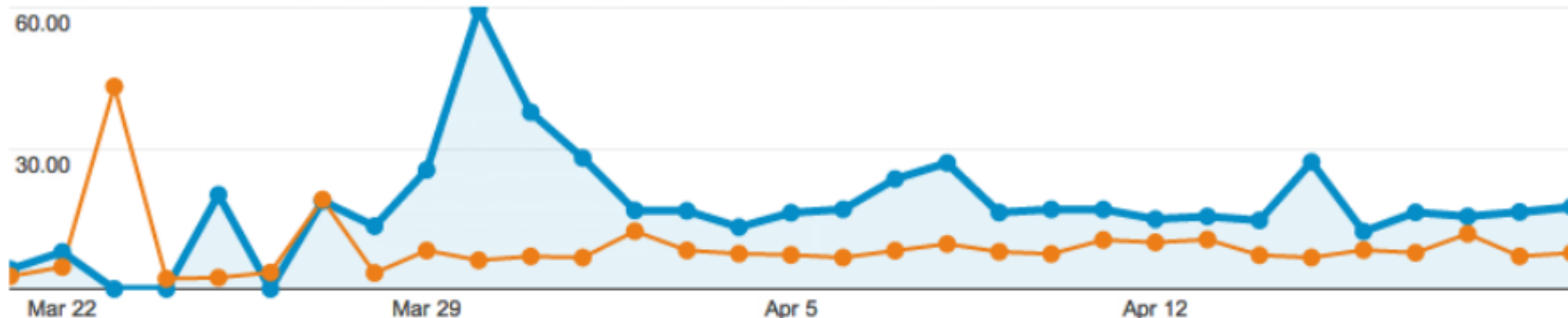
Avg. Page Load Time (sec) vs. Select a metric

Day

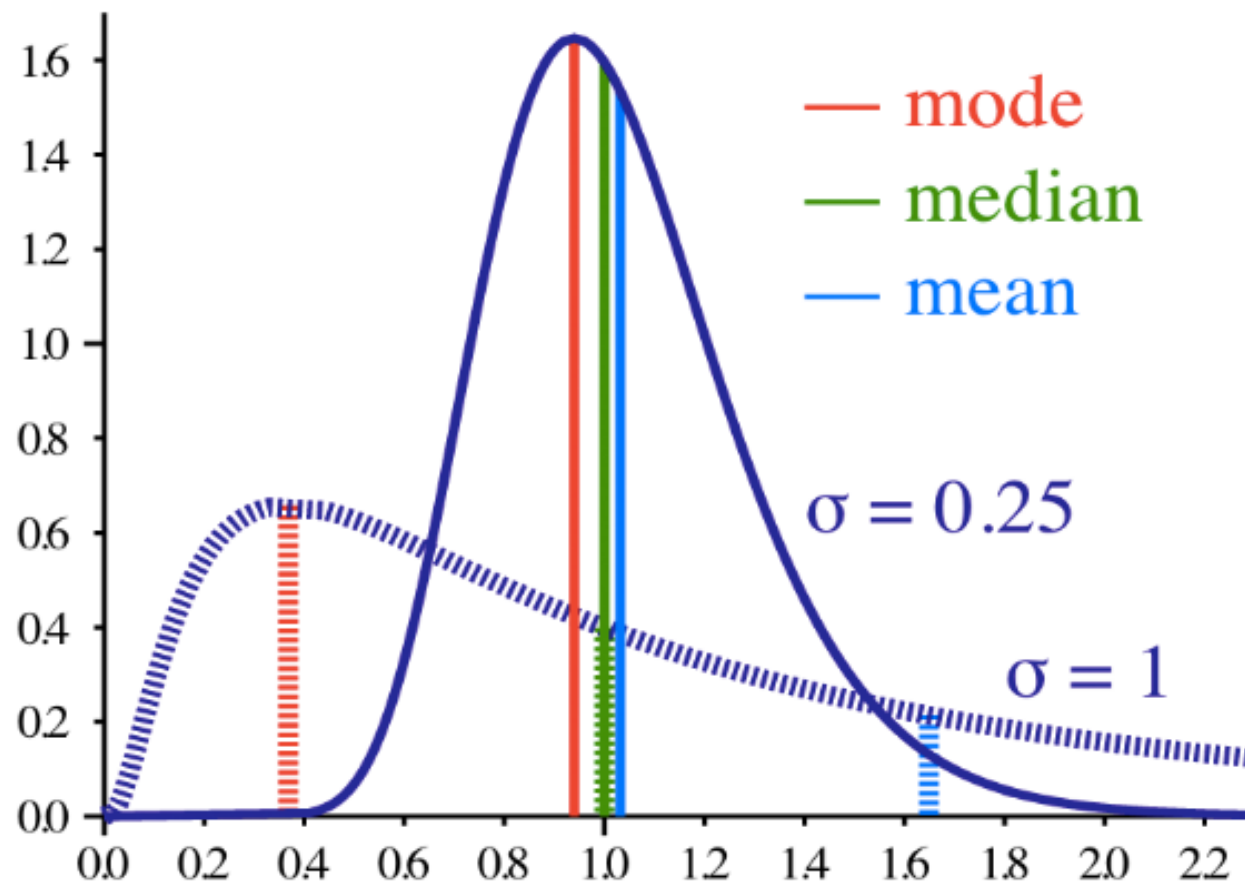
Week

Month

Avg. Page Load Time (sec) (Asia) Avg. Page Load Time (sec) (Europe)

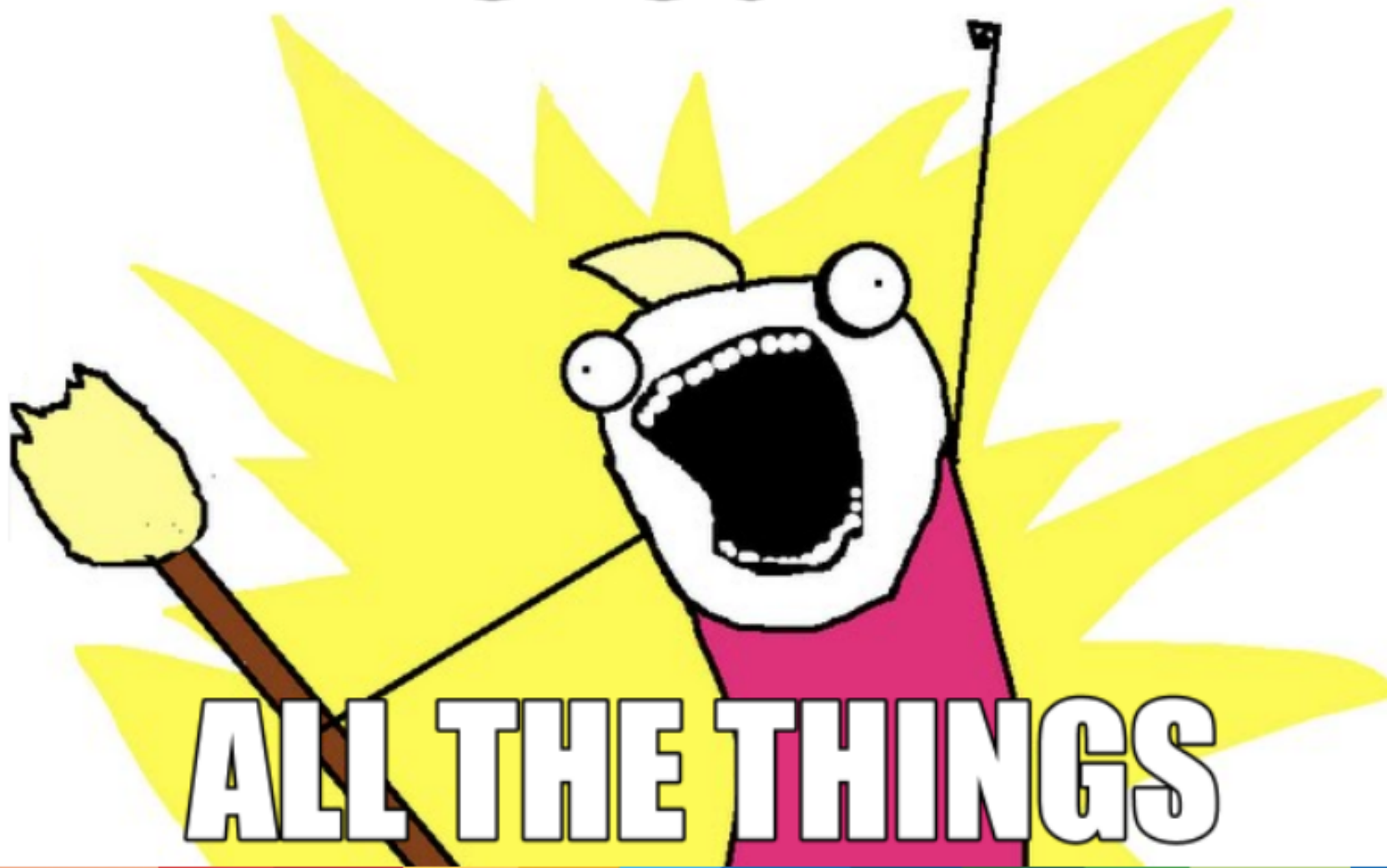


| | Pageviews | Avg. Page Load Time (sec) | Avg. Redirection Time (sec) | Avg. Domain Lookup Time (sec) | Avg. Server Connection Time (sec) | Avg. Server Response Time (sec) | Avg. Page Download Time (sec) |
|--------|--|-------------------------------------|-------------------------------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Asia | 10,269
% of Total: 17.18%
(59,778) | 17.86
Site Avg: 9.70
(84.17%) | 0.27
Site Avg: 0.36
(-26.60%) | 0.35
Site Avg: 0.18
(91.99%) | 0.16
Site Avg: 0.12
(34.35%) | 0.52
Site Avg: 0.30
(76.34%) | 0.28
Site Avg: 0.17
(60.58%) |
| Europe | 20,603
% of Total: 34.47%
(59,778) | 8.47
Site Avg: 9.70
(-12.61%) | 0.49
Site Avg: 0.36
(35.69%) | 0.14
Site Avg: 0.18
(-20.02%) | 0.16
Site Avg: 0.12
(30.06%) | 0.31
Site Avg: 0.30
(3.28%) | 0.17
Site Avg: 0.17
(-2.71%) |



Averages (often) lie!

HISTOGRAM



Case Study: igvita.com Page Load Time

Dec 1, 2011 - Dec 31, 2011 ▾

| Page Load Time Bucket (sec) | Page Load Sample | Percentage of total |
|-----------------------------|------------------|---|
| 0 - 1 | 22 | 5.35%  |
| 1 - 3 | 116 | 28.22%  |
| 3 - 7 | 148 | 36.01%  |
| 7 - 13 | 66 | 16.06%  |
| 13 - 21 | 22 | 5.35%  |
| 21 - 35 | 14 | 3.41%  |
| 35 - 60 | 10 | 2.43%  |
| 60+ | 13 | 3.16%  |

Jan 1, 2012 - Jan 31, 2012 ▾

| Page Load Time Bucket (sec) | Page Load Sample | Percentage of total |
|-----------------------------|------------------|--|
| 0 - 1 | 83 | 13.61%  |
| 1 - 3 | 256 | 41.97%  |
| 3 - 7 | 158 | 25.90%  |
| 7 - 13 | 58 | 9.51%  |
| 13 - 21 | 14 | 2.30%  |
| 21 - 35 | 9 | 1.48%  |
| 35 - 60 | 6 | 0.98%  |
| 60+ | 26 | 4.26%  |

Content > Site Speed > Page Timings > Performance

Migrated site to new host, server stack, web layout, and using static generation.
Result: noticeable shift in the user page load time distribution.



Case Study: igvita.com Server Response Time

Dec 1, 2011 - Dec 31, 2011 ▾

| Server Response Time Bucket (sec) | Response Sample | Percentage of total |
|-----------------------------------|-----------------|---|
| 0 - 0.01 | 18 | 4.40%  |
| 0.01 - 0.10 | 33 | 8.07%  |
| 0.10 - 0.50 | 168 | 41.08%  |
| 0.50 - 1 | 22 | 5.38%  |
| 1 - 2 | 124 | 30.32%  |
| 2 - 5 | 38 | 9.29%  |
| 5+ | 6 | 1.47%  |

Jan 1, 2012 - Jan 31, 2012 ▾

| Server Response Time Bucket (sec) | Response Sample | Percentage of total |
|-----------------------------------|-----------------|--|
| 0 - 0.01 | 188 | 31.92%  |
| 0.01 - 0.10 | 120 | 20.37%  |
| 0.10 - 0.50 | 249 | 42.28%  |
| 0.50 - 1 | 23 | 3.90%  |
| 1 - 2 | 3 | 0.51%  |
| 2 - 5 | 5 | 0.85%  |
| 5+ | 1 | 0.17%  |

Content > Site Speed > Page Timings > Performance

Bimodal response time distribution?

Theory: user cache vs. database cache vs. full recompute



1. Measure user perceived latency
2. Use Navigation Timing data
3. Use GA's advanced segments!
4. Setup {daily,weekly, ...} reports

Measure, analyze, optimize, repeat...

Chrome Developer Tools

- Level 1: Network waterfall
- Level 2: Timeline profiler
- Level 3: CSS/JS profiler
- Level 4: <chrome://tracing>

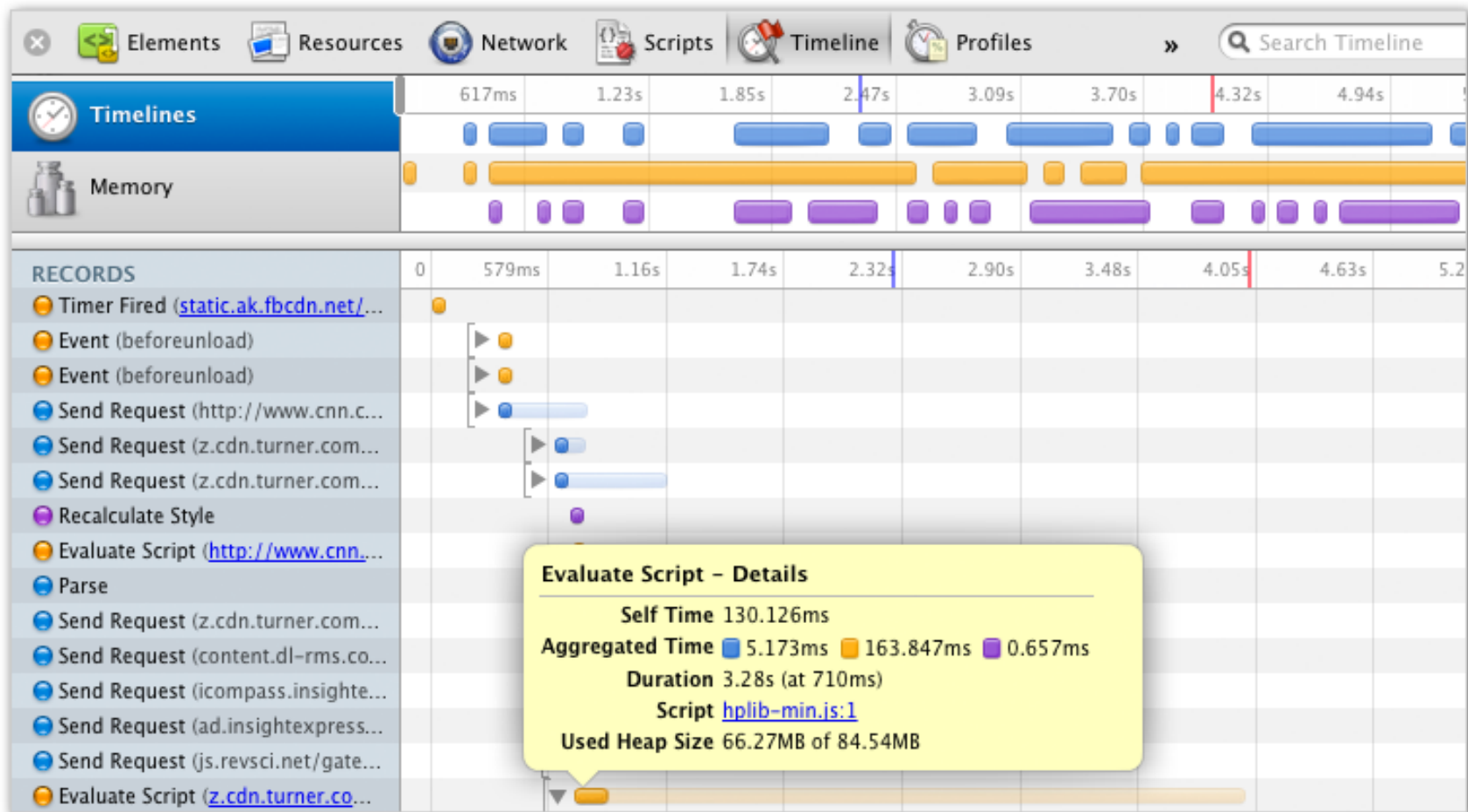
Hands-on: Analyzing Performance



| <div><div><div>✕</div><div>Elements</div><div>Resources</div><div>Network</div><div>Scripts</div><div>Timeline</div><div>Profiles</div><div>»</div><div>Search Network</div></div></div> | | | | | | | | | |
|--|---------|----------|----------|----------------------|---------|-------|---|-------|-------|
| Name | Meth... | Status | Type | Initiator | Size | Time | Timeline | 2.46s | 3.69s |
|  http://www.cnn.com/ | GET | 200 | text/... | Other | 25.1... | 304ms |  | | |
|  hplib-min.js | GET | 200 | appli... | http://www.cnn.co... | (fro... | 73ms |  | | |
|  hplib-min.css | GET | 304 | text/... | http://www.cnn.co... | 293B | 28ms |  | | |
|  hdr-main.gif | GET | 304 | imag... | http://www.cnn.co... | 210B | 219ms |  | | |
|  120417065926-popp... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 199ms |  | | |
|  120417022810-oldes... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 201ms |  | | |
|  120420093245-docu... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 201ms |  | | |
|  110824062821-eiffel... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 200ms |  | | |
|  120421121120-jack-... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 200ms |  | | |
|  120421125859-pkg-... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 201ms |  | | |
|  120421011222-blueb... | GET | 200 | imag... | http://www.cnn.co... | (fro... | 202ms |  | | |
|  advertisement.gif | GET | (failed) | Pend... | http://www.cnn.co... | 13B | 196ms |  | | |
|  globallib-min.js | GET | 200 | appli... | http://www.cnn.co... | (fro... | 207ms |  | | |
|  nodetag.js | GET | (failed) | Pend... | http://www.cnn.co... | 13B | 208ms |  | | |
|  97.js | GET | (failed) | Pend... | http://www.cnn.co... | 13B | 208ms |  | | |
|  adServer.aspx | GET | (failed) | Pend... | http://www.cnn.co... | 13B | 208ms |  | | |
|  gw.js | GET | (failed) | Pend... | http://www.cnn.co... | 13B | 208ms |  | | |

cnn.com waterfall: blocking JS requests, missing assets, missing cache headers on images and JS. Plenty of room for improvement.





cnn.com timeline: evaluate every request, track JS execution time, style reflows, etc.



<meta>

- No magic, pure HTML fun
- Remote debugging.. via Chrome!

</meta>

Chrome DevTools is a web app!

Remote Debugging + Performance Analysis

```
$> Google Chrome --remote-debugging-port=9222
$> curl localhost:9222/json
[ {
  "devtoolsFrontendUrl": "/devtools/devtools.html?host=localhost:9222",
  "faviconUrl": "",
  "thumbnailUrl": "/thumb/chrome://newtab/",
  "title": "New Tab",
  "url": "chrome://newtab/",
  "websocketDebuggerUrl": "ws://localhost:9222/devtools/page/1"
} ]
```

- Each open tab is a process
- Each process has a ws:// debug URL



Remote DOM + Debugging FTW!

igvita.com

about

Ilya Grigorik

- h2 325px x 37px - Analytics at Google
- Founder & CTO of PostRank (Google)
- Open-source evangelist
- Web engineer
- Photographer

Ilya Grigorik is a web engineer, an open-source and Ruby evangelist, a data geek, and a proverbial early adopter of all things digital. He is currently helping lead the social analytics efforts at Google. Earlier, Ilya was the founder and CTO of PostRank, a social analytics company, which was acquired by Google.

Make the web x google analytic x google analytic x Car

localhost:9222/devtools/devtools.html?ws=localhost:9222

Elements Resources Network Scripts Timeline Profiles Audits Console

```
<!DOCTYPE html>
<!--[if lt IE 7]> <html class="no-js ie6 oldie" lang="en"> <![endif]-->
<!--[if IE 7]> <html class="no-js ie7 oldie" lang="en"> <![endif]-->
<!--[if IE 8]> <html class="no-js ie8 oldie" lang="en"> <![endif]-->
<!--[if gt IE 8]><!-->
<html class="js flexbox canvas canvastext webgl no-touch geolocation
indexeddb hashchange history draganddrop websockets rgba hsla multiple
borderimage borderradius boxshadow textshadow opacity cssanimations cs
cssreflections csstransforms csstransforms3d csstransitions fontface g
localstorage sessionstorage webworkers applicationcache svg inlinesvg
<!--<![endif]-->
<head>...</head>
<body>
  <div id="container">
    <header>...</header>
    <div id="meta">
      <div class="group">
        <div id="ilya" itemscope itemtype="http://data-vocabulary.org/Person">
          <h2 itemprop="name">Ilya Grigorik</h2>
          <ul>...</ul>
          <p id="icons">...</p>
        </div>
      </div>
    </div>
    <div id="main" role="main">...</div>
    <footer>...</footer>
  </div>
  <!--! end of #container -->
  <script>...</script>
  <!-- Reinvigorate -->
  <script type="text/javascript" src="http://include.reinvigorate.net">
  <script type="text/javascript">try { reinvigorate_track("1k7e7-i0")
```

Driving Chrome from CLI

```
ws = Faye::WebSocket::Client.new(resp.first['websocketDebuggerUrl'])
ws.onopen = lambda do |event|
  ws.send JSON.dump({id: 1, method: 'Network.enable'})

  ws.send JSON.dump({
    id: 2,
    method: 'Page.navigate',
    params: {url: 'http://twitter.com/#!/search/chrome?q=railsconf&'}
  })
end

ws.onmessage = lambda do |event|
  p [:new_message, JSON.parse(event.data)]
end
```



responseReceived event

```
"method": "Network.responseReceived",  
"params": {  
  "type": "XHR",  
  "response": {  
    "url": "http://api.twitter.com/1/trends/available.json?lang=en",  
    "status": 200,  
    "statusText": "OK",  
    "mimeType": "application/json",  
    "connectionReused": false,  
    "fromDiskCache": false,  
    "timing": {  
      "requestTime": 1333830921.9814498,  
      "connectStart": 1,  
      "receiveHeadersEnd": 234  
    }  
  }  
}
```



- [Chrome for Android](#): same tools + all the same stats!
- In-browser stats: network, DOM, JS, GPU, memory
- Remote instrumentation: debugging, perf analysis, DOM manipulation, ...

TL;DR: You have no excuse.. all the tools are there!

Instrument all the things!



“Wonder how my page load time
looks in IE {8,9,10} for a visitor
from Singapore...”

—You after this talk...



WebPagetest.org

- Developed at AOL, open-sourced in 2008
- Actively developed and maintained
- Test sites across the globe

Test with various browsers, connection speeds, geo locations. Support for video capture, waterfall analysis, page speed optimization checks, and much more -- all, for free.



Web Page Performance Test for www.cnn.com/

From: Singapore - IE8 - DSL
Sun Apr 22 2012 10:41:10 GMT-0700 (PDT)

Page Speed 1.12 Score: 81/100

[Need help improving?](#)

F	A	A	C	F	✓
First Byte Time	Keep-alive Enabled	Compress Text	Compress Images	Cache static content	CDN detected

Summary Details Performance Review Page Speed Content Breakdown Domains Screen Shot

[Re-run the test](#)

[Raw page data](#) - [Raw object data](#)
[Export HTTP Archive \(.har\)](#)

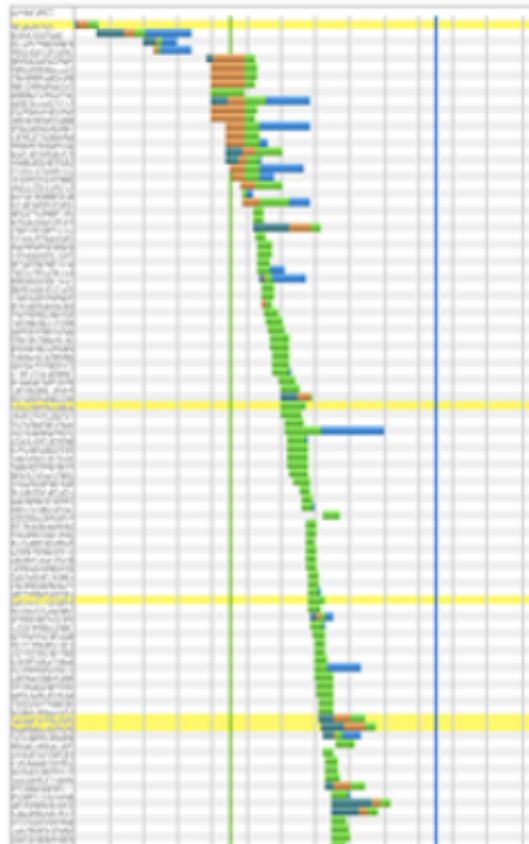
	Load Time	First Byte	Start Render	Speed Index	DOM Elements	Document Complete			Fully Loaded		
						Time	Requests	Bytes In	Time	Requests	Bytes In
First View	10.476s	2.015s	4.503s	7158	1682	10.476s	117	788 KB	13.355s	141	892 KB
Repeat View	4.531s	0.697s	2.686s	2898	1658	4.531s	16	108 KB	6.833s	26	140 KB

Waterfall

Screen Shot

Video

First View
(10.476s)



view



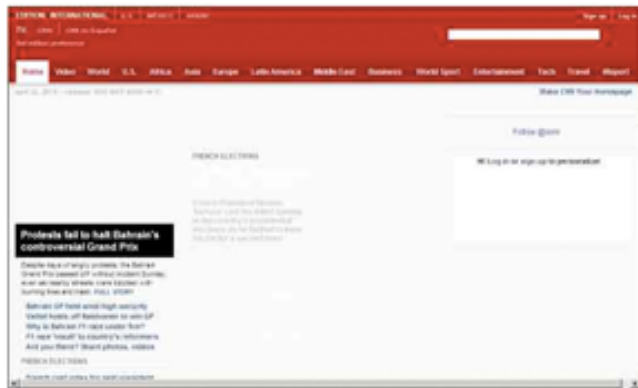
[Filmstrip View](#)
-
[Watch Video](#)
-
[Compare to](#)

How did the user see it?



On-demand video + filmstrip view, tcpdump stats, HAR downloads, and more.

Start Render (4.503 sec)



Document Complete (10.476 sec)



Measuring "visual completeness"?

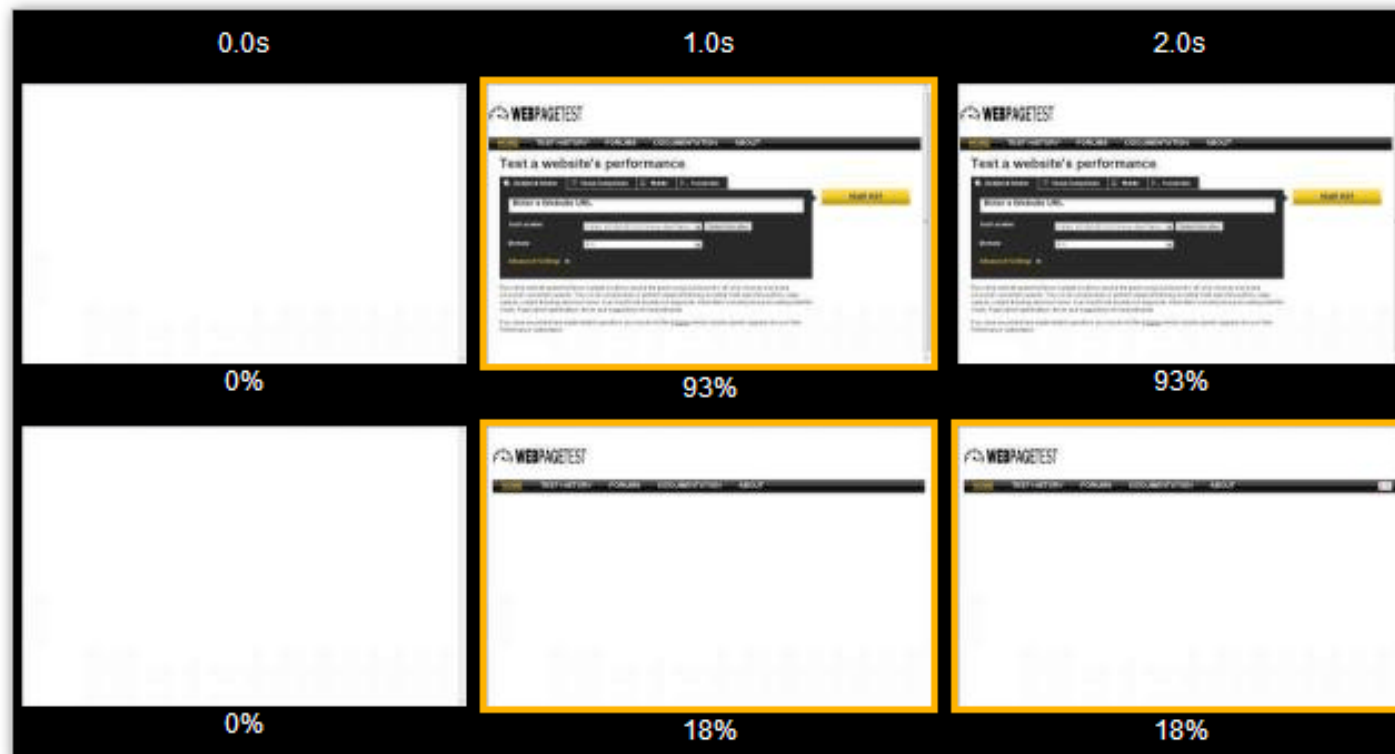


“measures how quickly the page contents are visually populated”

Introducing "Speed Index"

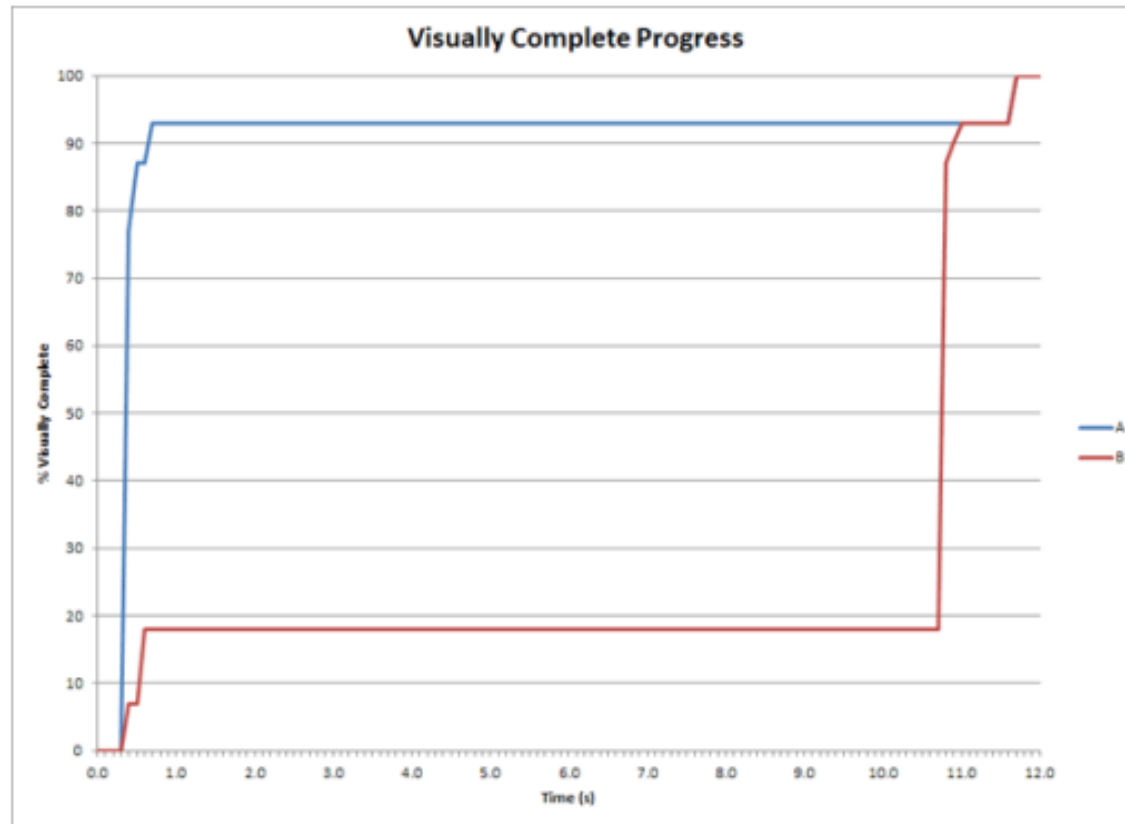


Speed Index: Step 1



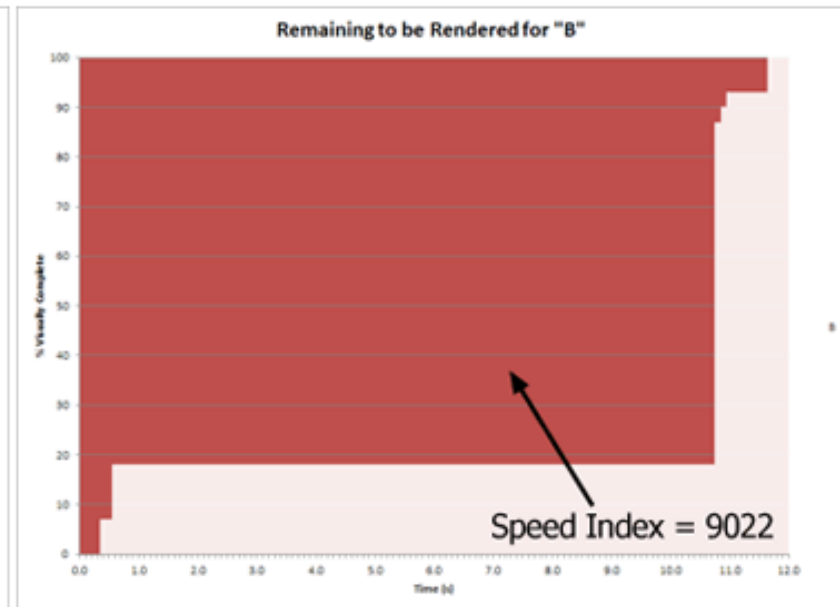
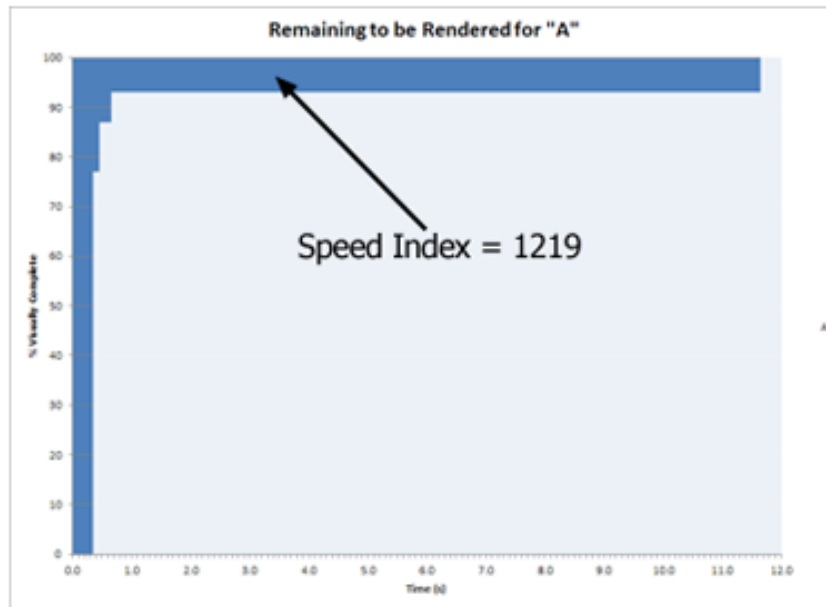
1. Render filmstrip of optimized page
2. Render filmstrip of original page

Speed Index: Step 2



Plot "visual completeness" vs. time

Speed Index: Step 3



- Use "area above the graph" to calculate unrendered portion of the page
- Color histogram: not perfect, but good tradeoff so far
- Lower score means faster visual rendering

Web Page Performance Test for www.cnn.com/

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Page Speed 1.12 Score: 81/100

[Need help improving?](#)

F	A	A	C	F	✓
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[Raw page data](#) - [Raw object data](#)

[Export HTTP Archive \(.har\)](#)

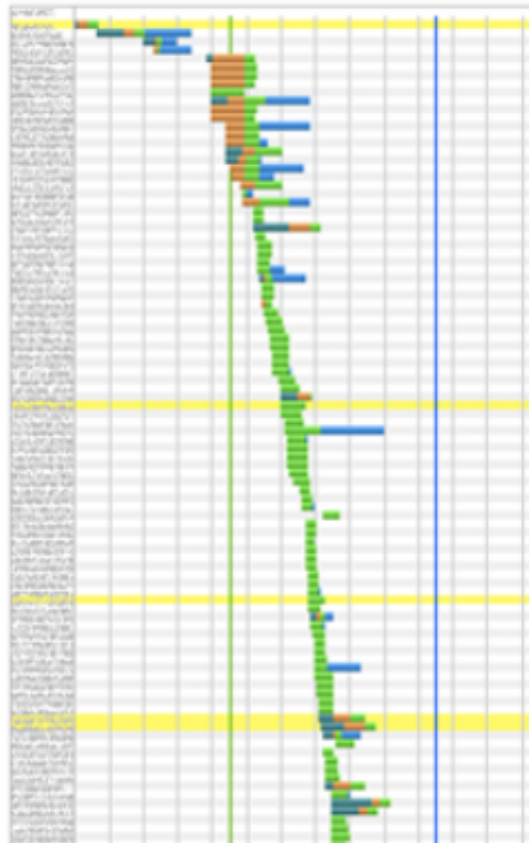
	Load Time	First Byte	Start Render	Speed Index	DOM Elements	Document Complete			Fully Loaded		
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First View	10.476s	2.015s	4.503s	7158	1682	10.476s	117	788 KB	13.355s	141	892 KB
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Waterfall

Screen Shot

Video

First View
(10.476s)



[Filmstrip View](#)

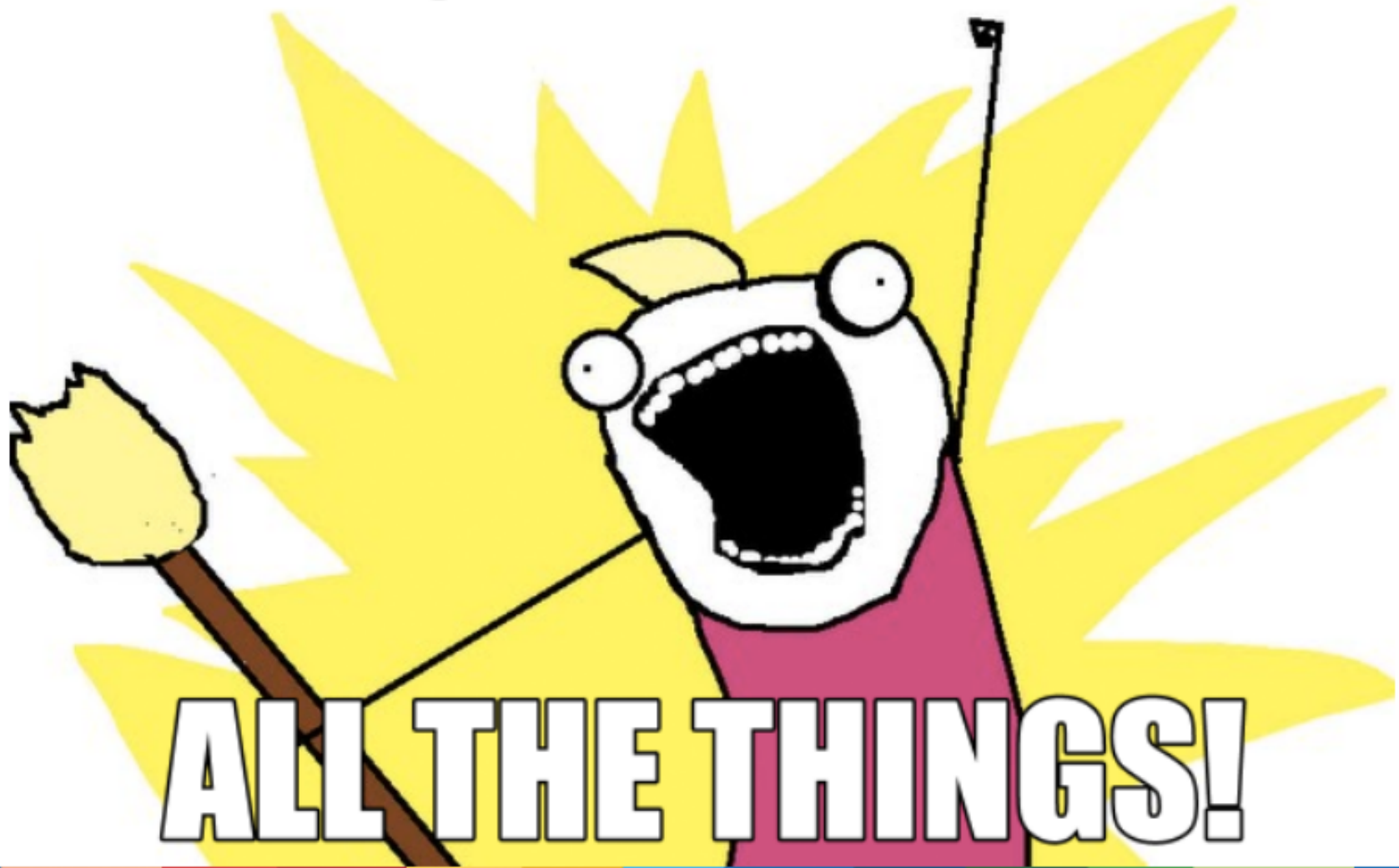
[Watch Video](#)

[Compare to](#)

1. Web Timing API for user latency
2. Google Analytics + Site Speed
3. Chrome Dev Tools: Network, Profiler, ...
4. Remote profiling: Mobile, CLI, ...
5. WebPageTest.org: Geo + Browser testing
6. Speed Index: Visual completeness

Measure three times before you...

OPTIMIZE



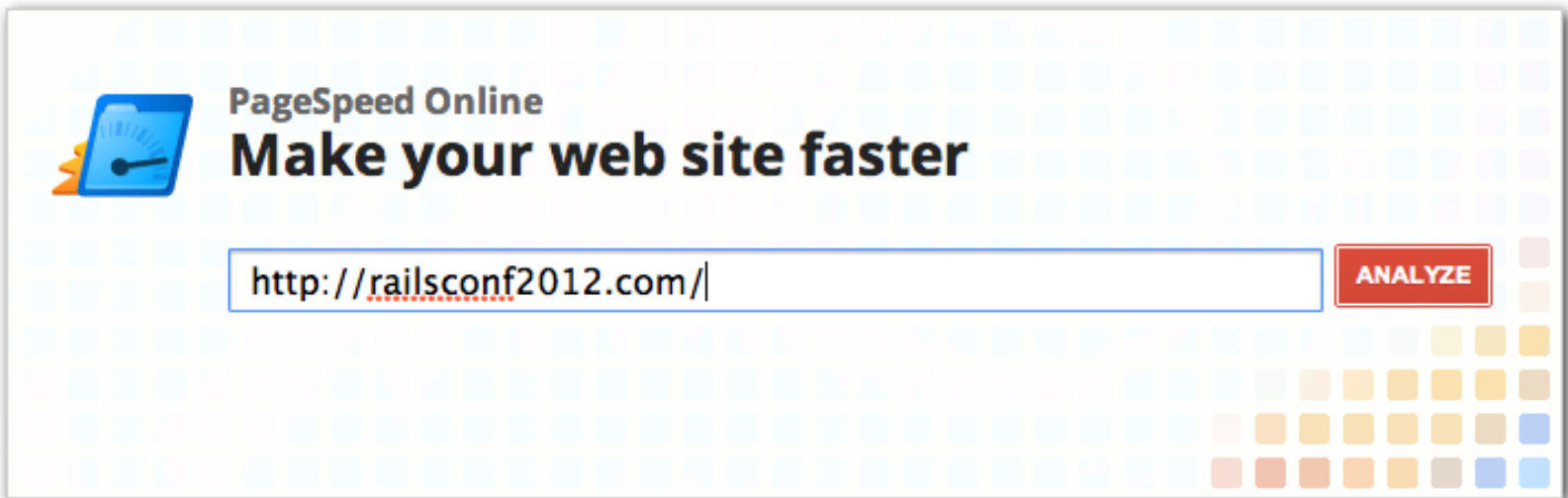
- PageSpeed Online
- PageSpeed SDK
- mod_pagespeed
- PageSpeed Service



Google PageSpeed



PageSpeed Online



- 0-100 score (the higher, the better)
- Desktop + Mobile optimized analysis & recommendations
- 31+ [optimization rules](#) (and growing)
- Demo: railsconf2012.com



PageSpeed Online API

```
require 'net/https'
require 'json'

uri = URI.parse('https://www.googleapis.com/pagespeedonline/v1/runPagespeed')
http = Net::HTTP.new(uri.host, uri.port)
http.use_ssl = true

params = { :key => 'API KEY', :url => 'http://railsconf2012.com/',
           :strategy => 'desktop', :rules => '...' }

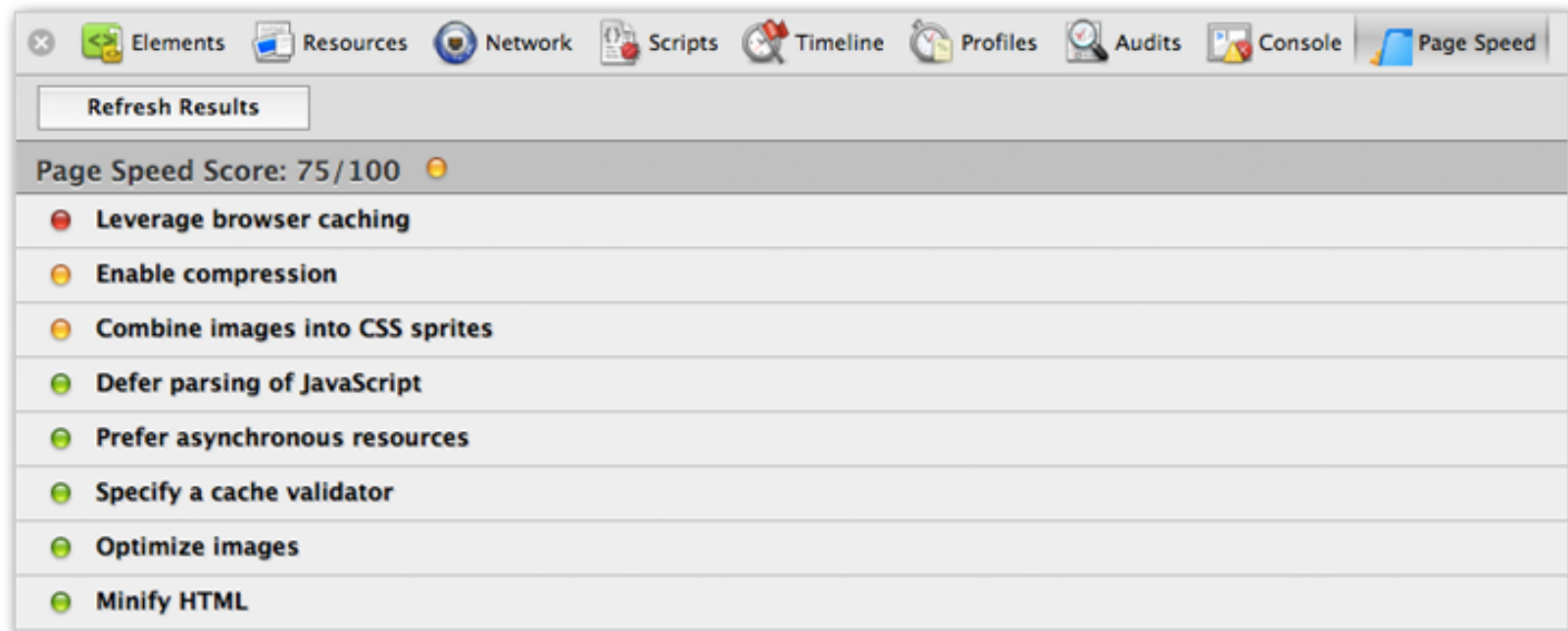
uri.query = URI.encode_www_form(params)
req = Net::HTTP::Get.new(uri.request_uri)
res = http.request(req)

jj JSON.parse(res.body)
```

[API Documentation](#), widget examples, etc.



PageSpeed SDK



- Open-source [SDK](#) for embedding (same rules, same code)
- Browser integration for [Chrome & Firefox](#)
- Active [pagespeed community](#)



AUTOMATE



mod_pagespeed

Open-source Apache module that automatically optimizes web pages and associated resources.

```
ModPagespeedCssInlineMaxBytes          2048
ModPagespeedImageInlineMaxBytes         2048
ModPagespeedCssImageInlineMaxBytes      2048
ModPagespeedJsInlineMaxBytes            2048
ModPagespeedCssOutlineMinBytes          3000
ModPagespeedJsOutlineMinBytes           3000
ModPagespeedRetainComments              "[WILDCARD PATTERN]"
ModPagespeedJpegRecompressionQuality    -1
ModPagespeedImageLimitOptimizedPercent  100
ModPagespeedImageLimitResizeAreaPercent 100
ModPagespeedMaxInlinedPreviewImagesIndex 5
ModPagespeedMinImageSizeLowResolutionBytes 10240
// ...
```

mod_pagespeed + Passenger = fast(er) Rails

```
<VirtualHost *:80>
  ServerName www.awesome-rails-app.com
  DocumentRoot /apps/foo/public

  PassengerEnabled on
  ModPagespeed on

  /* ... */
</VirtualHost>
```

- Dozen's of [filters](#) (and growing)
- Like asset pipeline, but much more...
- Inlining, optimization, resizing, headers, UA patterns, etc.



PageSpeed Service fetches content from your servers, rewrites the pages by applying web performance best practices and serves them to end users via Google's servers across the globe.

Setup:

1. Alias DNS CNAME entry to ghs.google.com.
2. Sit back and enjoy

Stay tuned for more...

PageSpeed Service (beta)



- Mobile optimizations
- Javascript & CSS optimizations
- Image compression & WebP
- TCP, SSL & kernel optimizations
- SPDY
- ...

Wait, there is more (but no time)...

1. Half the battle is knowing what to measure
2. Measure user perceived latency
3. Optimize from user's perspective
4. Mobile web is 1.5x slower on average!
5. No excuses, the tools are there *
6. Plenty of better tools to be built still

Food for thought...

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Blog @ www.igvita.com

Slides: bit.ly/faster-rails

Fin. Questions?

