

Website Performance

Frontend Masters II

Webapp Performance

Frontend Masters II

Web Performance

Frontend Masters II

Kyle Simpson
@getify
<http://getify.me>



- LABjs
- grips
- h5ive
- We Puzzle It!

O'Reilly Discount Code: "**AUTHD**"

Kyle Simpson @getify <http://getify.me>



<http://speakerdeck.com/getify>

Why web
performance?

performance

caveat lector

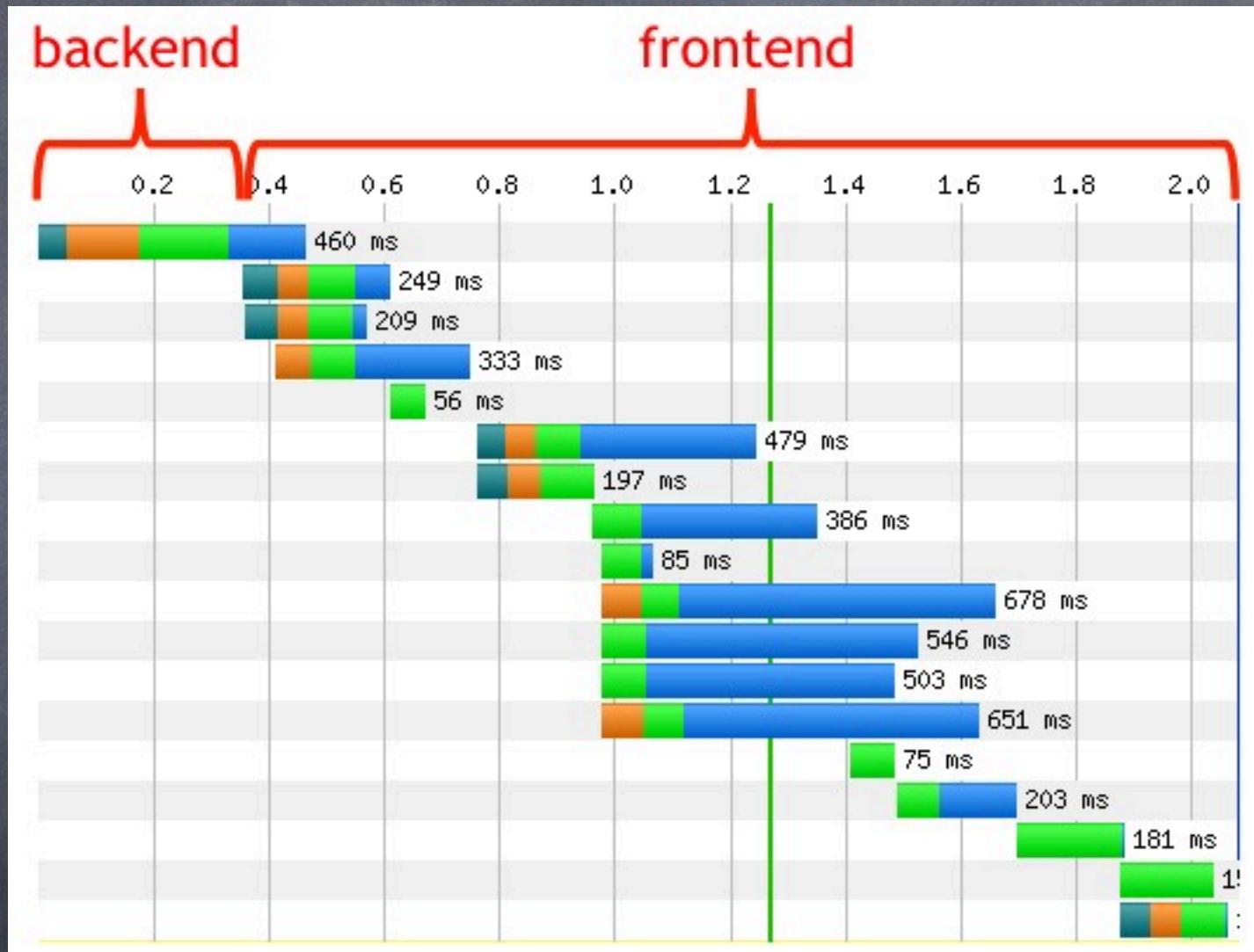
caveat utilitor

Why web
performance?

Performance Golden Rule

“**80-90%** of the end-user response time is spent on the frontend. Start there.”

--Steve Souders



<http://www.stevesouders.com/blog/2012/02/10/the-performance-golden-rule/>

User Experience

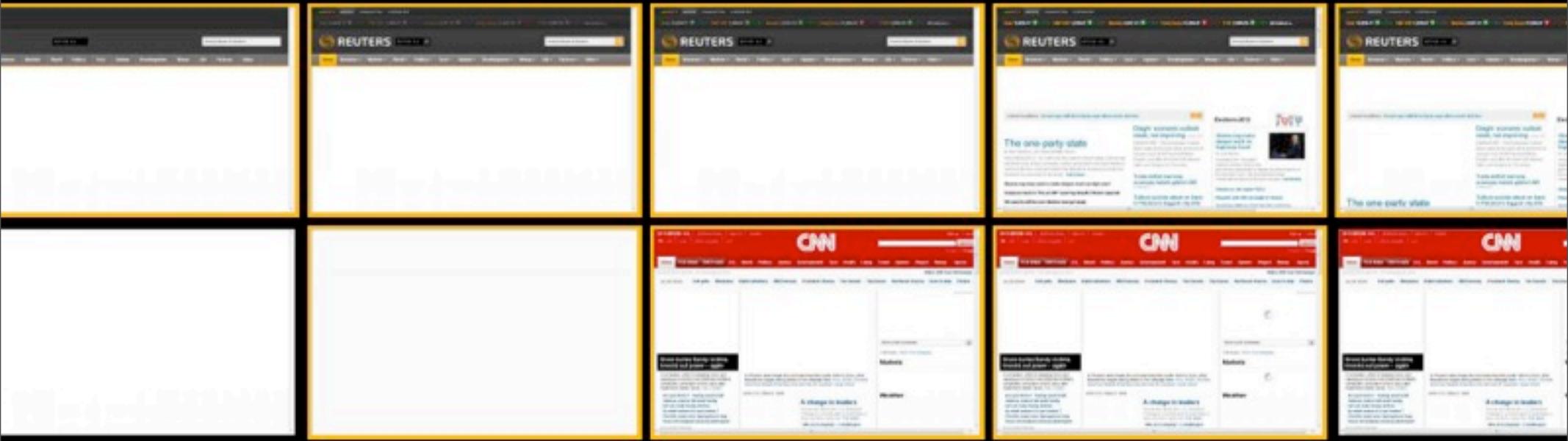
2.0s

2.5s

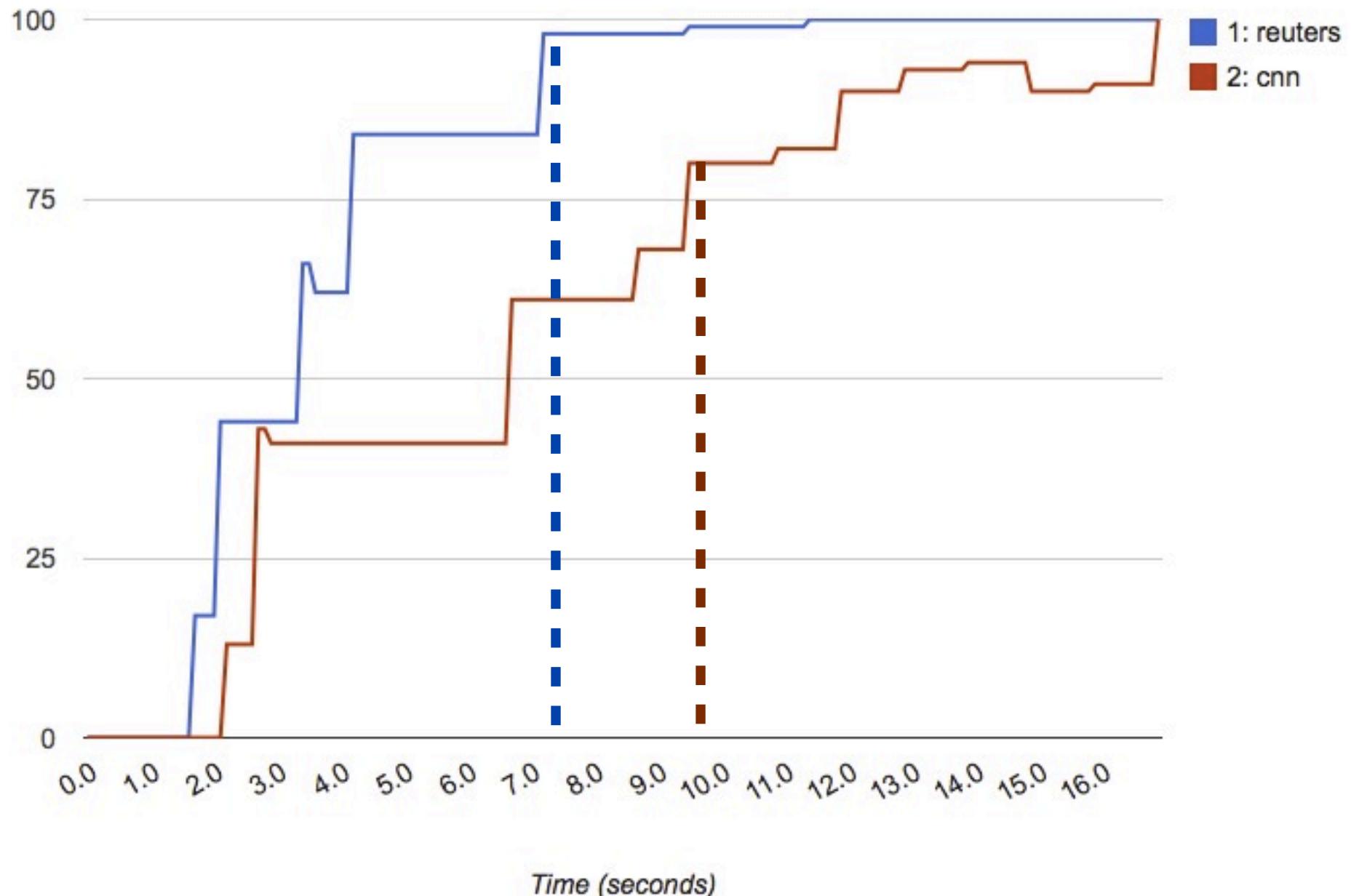
3.0s

3.5s

4.0s



Visual Progress (%)



http://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Dapparel

<http://www.shopzilla.com/shoes/search>

→ GO



Join Prime

Kyle's Amazon.com | Today's Deals | Gift Cards | Help

Shop by Department ▾

Search All ▾ shoes

Gateway Gift Certificates/Cards International Hot New Releases Best Sellers Today's Deals

Department

Shoes

Women's Pumps

Women's Flats

Men's Classic & Fashion Sneakers

Men's Running Shoes

Men's Skateboarding Shoes

Sports & Outdoors

Running Footwear

+ See All 35 Departments

Shipping Option (What's this?)

Free Super Saver Shipping

Listmania!



Create a Listmania! list

"shoes"

Related Searches: [shoes for men](#), [shoes for women](#), [shoes men](#), [shoes women](#)

Showing 1 - 16 of 582,039 Results

← Madd 60%
\$29.70 - \$39.95

2135 ms / 3415 ms



Skechers Men's M

\$74.95 - \$85.00



shoes

Home > Shoes

Shoes? How about these?

See matches in:

- [Men's Shoes](#)
- [Women's Shoes](#)
- [Motorcycle Parts](#)

Sort: [Most Popular](#)

Display: [20](#)



[Dora Snowboard Dora Shoes ...](#)

She will look adorable in her warm Snowbo...



[Men's Shoes Boardroom Shoe ...](#)

Free Shipping on all orders \$195 or m...

Jos. A Bank Exclusive. This timeless classic...



[New Balance 706 BL Postal: Ne...](#)

New Balance 706 BL Postal : Stability. A co...

Compare prices at other stores



[Alfani Women's Shoes, Jessa V...](#)

Alfani Women's Shoes, Jessa Wide Calf Ta...

Compare prices at other stores

\$\$

Quality

How web
performance?

Web

Measurement

Perception

Efficiency

Speed

Memory

Performance

Benchmark

Optimize

“premature optimization is
the root of all evil”

--Donald Knuth

“Programmers waste enormous amounts of time...worrying about the speed of **noncritical** parts of their programs...We should forget about small efficiencies, say about 97% of the time...Yet we should not pass up our opportunities in that **critical 3%**.”

--Donald Knuth

Optimization

noncritical

critical

“noncritical path optimization
is the root of all evil”

--Donald Knuth

“**immature** optimization is
the root of all evil”

--getify

Mature Optimization

<http://msdn.microsoft.com/en-us/magazine/gg622887.aspx>

100ms
↔
1000ms

<http://www.useit.com/papers/responsetime.html>

“Death by a
thousand papercuts”

Inefficiency is
systemic

The myth of the
refactor

TCO

Performant by
Default

Dirty Little Secret:

Most of “front-end”
optimization actually
happens in the
“middle-end”

Middle-end

Templating, URL Routing,
Headers, Caching, Ajax, etc.

<http://middleEnd.com>

Agenda

Middle-end

- YSlow
- Resources (CSS, JS, images)
- Architecture
- Communication

Front-end

- Resource Loading
- Abstractions
- JS-to-CSS
- UI Thread & GC
- jsPerf

Agenda

Middle-end

- **YSlow**
- Resources (CSS, JS, images)
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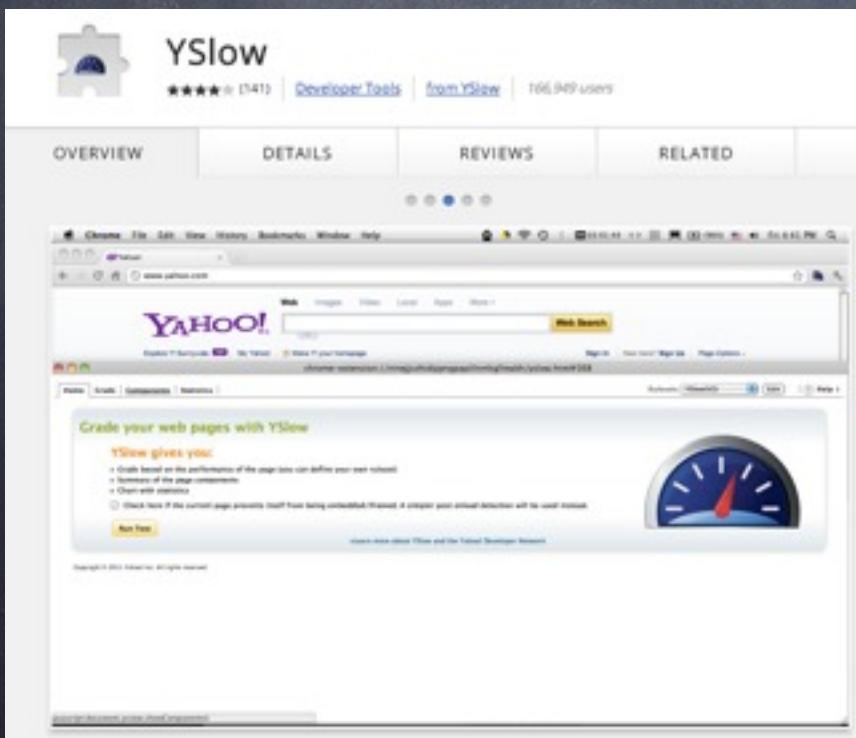
Front-end

- Resource Loading
- Abstractions
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The screenshot shows the Mozilla Add-ons website. At the top, there's a search bar with the placeholder "search for". Below it, a navigation menu includes "EXTENSIONS", "PERSONAS", "THEMES", "COLLECTIONS", and "MORE...". The main content area is titled "Extensions > YSlow". It features a thumbnail of the YSlow icon (a speedometer), the name "YSlow 3.1.4", and the developer "YSlow". A brief description states: "YSlow analyzes web pages and why they're slow based on Yahoo!'s rules for high performance web sites. Visit YSlow official website for more info: <http://yslow.org>". Below this are two buttons: a green "Add to Firefox" button and a blue "Privacy Policy" link.

<https://addons.mozilla.org/en-US/firefox/addon/yslow/>

<https://chrome.google.com/webstore/detail/yslow/ninejjcohidippngpapiilnmkgllmakh>



YSlow

The Big 14

<http://stevesouders.com/hpws/rules.php>

YSlow

1. Fewer HTTP Requests
2. Use a CDN
3. Expires/Cache-Control Header
4. Gzip
5. Stylesheets at Top
6. Scripts at Bottom
7. ~~CSS Expressions~~
8. External JS/CSS
9. Fewer DNS Lookups
10. Minify JS/CSS
11. ~~Redirects~~
12. ~~Duplicate Scripts~~
13. ETags
14. Cacheable Ajax

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13. ETags
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Image Sprites



YSlow: Fewer HTTP Requests

Concat JS/CSS

```
1 var $j=$;function getDeviceType(){var d="",c=/\b(Ar
2 a.setAttribute("name",d);a.setAttribute("value",c);b.ap
3 this.settings=Object.extend(this.defaults,this.config);t
4 }temp_s+="></div>";d+='div id="cnn_bnbrgt2" style="opac
6 var a;a=new Element("div",{"class":"cnn_gallery_test"}).
7 this.title.update(p["title"]);this.caption.update(p["cap
8 if(overrideID){internalDomId=overrideID;}var domList=new
9 if(c){var b=this.eventTypes[c];b(c,e);}}};this.startPoll
10 for(j=0;j&lt;=localStorage.length-1;j++){var key=localStorage
11 queryString+=queueItem.url;if(queueItem.params.len&gt;0){qu
12 $("cnnConnectFormScreenname").screenname.addClassNames("r
13 d.addParam("action","resendEmailConfirmation");d.addPara
14 $("cnnConnectLoginErrors").show();break;}};function cnnCo
15 b[1]="&lt;h1&gt;Thank you for confirming your email address.&lt;/
16 Event.stopPropagation());});});Ajax.JSONRequest=Class.create(Aja
17 CNN_setCookie("CNN_memberID",Object.toJSON(CNN_FBF_user),</pre
```

YSlow: Fewer HTTP Requests

mod_deflate (Apache)

```
1 <IfModule mod_deflate.c>
2   # these are known to be safe with MSIE 6
3   AddOutputFilterByType DEFLATE text/html text/plain text/xml
4
5   # everything else may cause problems with MSIE 6
6   AddOutputFilterByType DEFLATE text/css
7   AddOutputFilterByType DEFLATE text/javascript application/x-javascript
8   application/javascript application/ecmascript application/json
9   AddOutputFilterByType DEFLATE application/rss+xml
10 </IfModule>
```

Zip Test

A simple online web page compression / deflate / gzip test tool

Web Page URL:

Results for: <http://blog.getify.com>

Web page compressed?	Yes
Compression type?	gzip
Size, Markup (bytes)	25,601
Size, Compressed (bytes)	6,945
Compression %	72.9

Response Headers

status	HTTP/1.0 200 OK
	Mon, 06 Nov 2012

Page Source

```
<!DOCTYPE html>
<html dir="ltr" lang="en-US" xmlns:fb="http://www.facebook.com/2008/fb">
```

<http://www.gidnetwork.com/tools/gzip-test.php>

YSlow: GZip

Expires/Cache-Control/ETag

URL: http://www.w3.org/Protocols/rfc2616/rfc2616-sec14.html						
Request Headers	Request Body	Response Headers	Response Body	Cookies	Initiator	Timings
Key	Value					
Response		HTTP/1.1 304 Not Modified				
ETag		"1edec-3e3073913b100"				
Content-Length		126444				
P3P		policyref="http://www.w3.org/2001/05/P3P/p3p.xml"				
Content-Type		text/html; charset=iso-8859-1				
Expires		Sun, 05 Dec 2010 07:32:38 GMT				
Last-Modified		Wed, 01 Sep 2004 13:24:52 GMT				

<http://calendar.perfplanet.com/2010/bloated-request-response-headers/>

YSlow: Conditional Requests

Beyond the Big 14

<http://developer.yahoo.com/performance/rules.html>

More YSlow

Reduce Cookie Size

URL: http://blog.getify.com/	
Request Headers Request Body Response Headers Response Body Cookies Initiator Timings	
Key	Value
Request	GET / HTTP/1.1
Accept	text/html, application/xhtml+xml, */*
Accept-Lan...	en-US
User-Agent	Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; WOW64; Trident/5.0)
Accept-Enc...	gzip, deflate
Host	blog.getify.com
Connection	Keep-Alive
Cookie	__utma=1.1385743383.1270314436.1291268336.1291507720.267; __utmz=1.1289853656.261.43.utmcsr=twitter.com utmccn=(referral) utmcmd=referral

More YSlow: Cookies



Cookie-free Domains

More YSlow: Cookies

Optimize Sprites



More YSlow: Images



```
<img src="">
```

More YSlow: Images

Inspect

Console HTML CSS Script DOM Net YSlow Options +

Grade Components Statistics Tools Rulesets YSlow(V2) Edit Printable View Help

Grade A Overall performance score 99 Ruleset applied: YSlow(V2) URL: http://search.yahoo.com/web?...

ALL (22) FILTER BY: CONTENT (6) | COOKIE (2) | CSS (6) | IMAGES (2) | JAVASCRIPT (4) | SERVER (5)

A Make fewer HTTP requests

A Use a Content Delivery Network (CDN)

A Add Expires headers

A Compress components with gzip

A Put CSS at top

A Put JavaScript at bottom

A Avoid CSS expressions

N/A Make JavaScript and CSS external

A Reduce DNS lookups

A Minify JavaScript and CSS

A Avoid URL redirects

A Remove duplicate JavaScript and CSS

A Configure entity tags (ETags)

A Make AJAX cacheable

A Use GET for AJAX requests

A Reduce the number of DOM elements

A Avoid HTTP 404 (Not Found) error

B Reduce cookie size

A Use cookie-free domains

A Avoid AlphaImageLoader filter

A Do not scale images in HTML

A Make favicon small and cacheable

Grade A on Make fewer HTTP requests

Decreasing the number of components on a page reduces the number of HTTP requests required to render the page, resulting in faster page loads. Some ways to reduce the number of components include: combine files, combine multiple scripts into one script, combine multiple CSS files into one style sheet, and use CSS Sprites and image maps.

[Read More](#)

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YSlow Plugin

ex.1
(5 min)

YSlow

Agenda

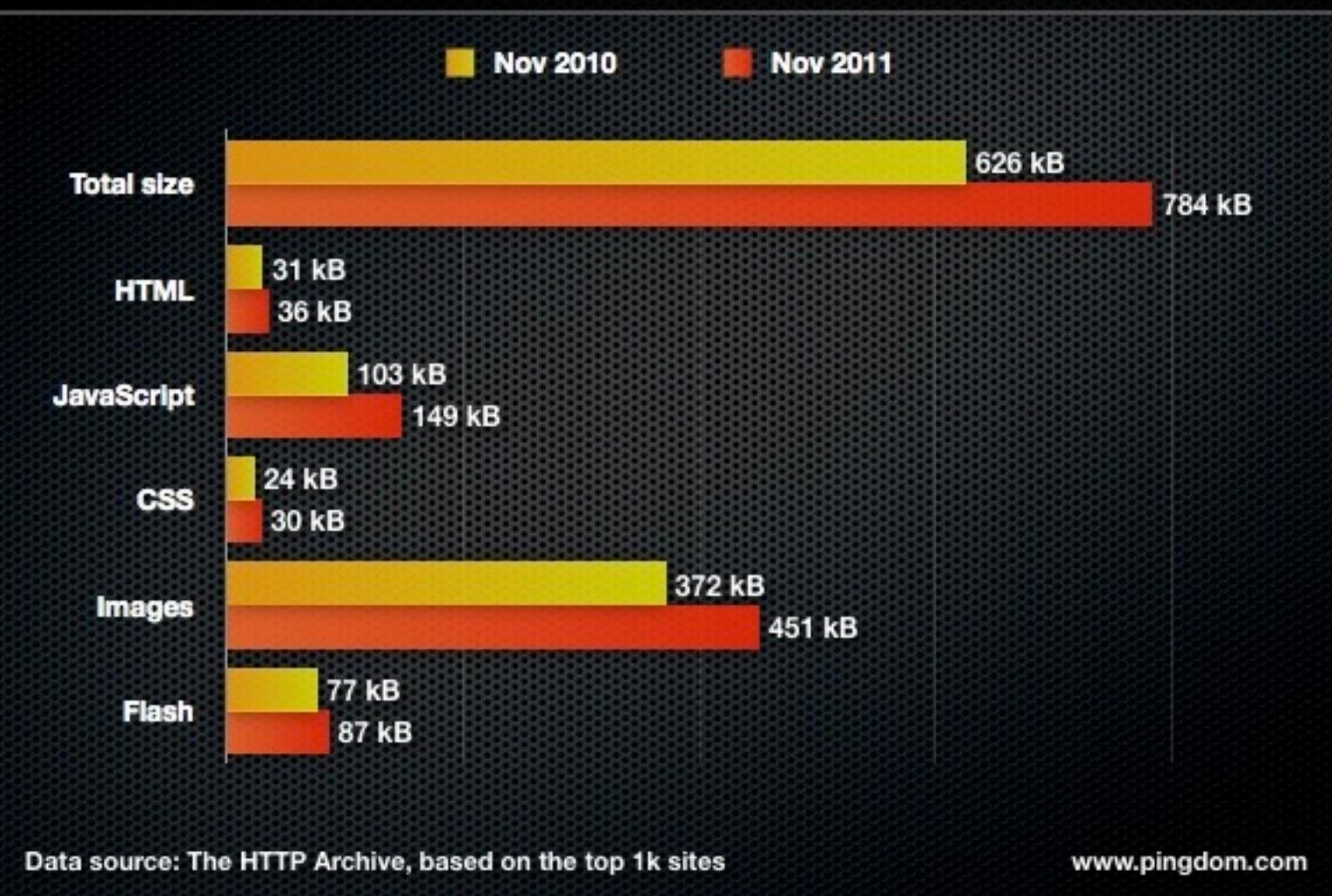
Middle-end

- YSlow
- **Resources (CSS, JS, images)**
- Architecture
- Communication

Front-end

- Resource Loading
- Abstractions
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- UI Thread & GC
- jsPerf

Average web page size, Nov 2010 vs. Nov 2011



Resources

Image Leanificationizing™



102kb



20kb

<http://www.smushit.com/ysmush.it/>

<http://imageoptimizer.net/>

<http://pmt.sourceforge.net/pngcrush/>

Resources: Images

Image Sprites



<http://spriteeme.org/>

<http://spritegen.website-performance.org/>

<http://www.floweringmind.com/sprite-creator/>

Resources: Images

Inline Images

```
1
2 #foo {
3     background: url(data:image/png;base64,iVBORw0KGgoAAAANSUhEUgA
4 }
5
```

<http://dopiaza.org/tools/datauri/>

<http://dataurl.net/#dataurlmaker>

<http://dataurl.net/#cssoptimizer>

Resources: Images

Minification

```
1 ;Object.keys|| (Object.keys=function(t){var n,r=[];for(n in t  
2 ;(function(e){function t(e,t){return e-t}var n=e.defineParti.  
3
```

```
1 body{height:100%;margin:0;}h1{position:absolute;left:20px  
2 #content{margin-top:15px;padding:0 10px;}nav{text-align:r  
3 font-weight:700;}#pleasewait{display:none;position:absolu  
4
```

<http://compressorrater.thruhere.net/>

<http://marijnhaverbeke.nl/uglifyjs>

<http://www.minifycss.com/css-compressor/>

<http://jsbeautifier.org/> <http://cssbeautify.com/>

Resources: CSS & JavaScript

Concatenation

Resources: CSS & JavaScript

http://zBugs.com

zBugs beta

[Share +1](#) 115 [Tweet](#) 445 [Like](#) 216 [Sign In](#) [Join Now it's FREE](#)

http://blog.getify.com [Speed up](#)

Help us to improve our service! [Make a suggestion.](#)

You can save: 71% in file size and 3 HTTP requests

We are still in beta version, [sign up](#) to stay informed on new features.

Original	Compressed	Compressed & Gzipped
7 Kb Original DOWNLOAD JS (3 Kb) DOWNLOAD CSS (4 Kb)	5 Kb Compressed DOWNLOAD JS (2 Kb) DOWNLOAD CSS (3 Kb)	2 Kb Compressed & Gzipped DOWNLOAD JS (1 Kb) DOWNLOAD CSS (1 Kb)

Resources: CSS & JavaScript

Tools

<http://robertnyman.com/2010/01/19/tools-for-concatenating-and-minifying-css-and-javascript-files-in-different-development-environments/>

Resources: CSS & JavaScript

ex.2
(20 min)

Resources

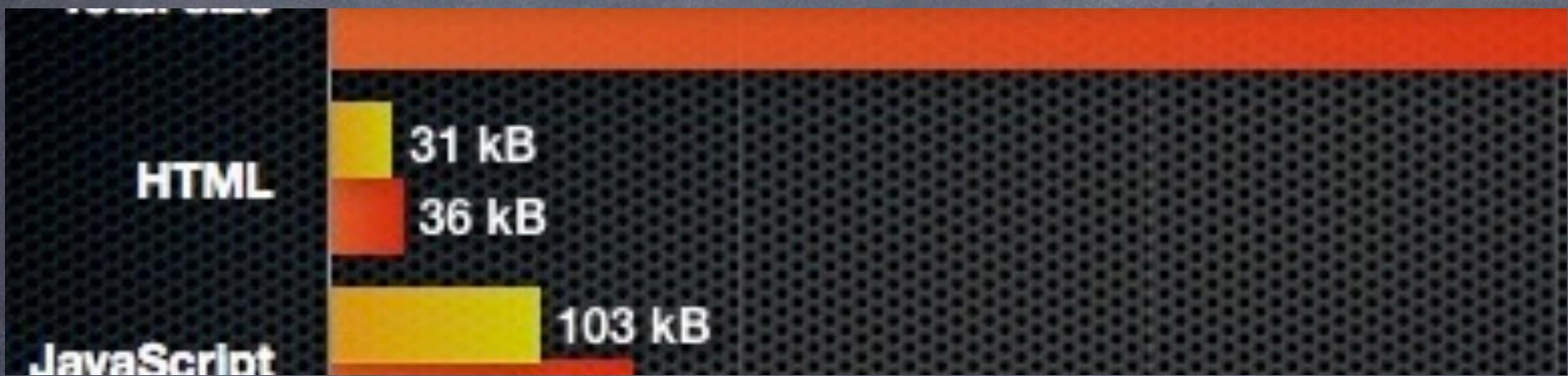
Agenda

Middle-end

- YSlow
- Resources (CSS, JS, images)
- **Architecture**
- Communication

Front-end

- Resource Loading
- Abstractions
- JS-to-CSS
- UI Thread & GC
- jsPerf



Architecture

Single-page Apps

Architecture

Data Validation

(try it!)

Architecture

Templating

<http://getify.github.com/grips>

Architecture

shortie.me

Architecture

Agenda

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JSON

<http://michaoux.ca/articles/json-db-a-compressed-json-format>

Communication

Ajax vs. Web Sockets

Communication

Agenda

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Preloading

Resource Loading

```
1 <link rel="prefetch" href="something.jpg">
2
3 <script>
4 var img = new Image();
5 img.src = "something.jpg";
6 </script>
7
8
```

Resource Loading

Lazy Loading On-demand Loading Postloading

Resource Loading

```
1 function scriptLoaded() {  
2     // yay!  
3 }  
4  
5 var scr = document.createElement("script");  
6 scr.src = "foobar.js";  
7 document.head.appendChild(scr);  
8  
9 scr.onload = scriptLoaded;  
10 scr.onreadystatechange = function() {  
11     if (scr.readyState === "loaded" || scr.readyState === "complete") {  
12         scriptLoaded();  
13     }  
14 }  
15
```

Resource Loading

Parallel Loading

preserve execution order

Resource Loading

```
1 function allScriptsLoaded() {  
2     // yay!  
3 }  
4  
5 function loadScript(source,done) {  
6     var scr = document.createElement("script");  
7     scr.src = source;  
8     scr.async = false; // ----- LOOKEY LOOKEY!!  
9     document.head.appendChild(scr);  
10  
11    if (done) {  
12        scr.onload = done;  
13        scr.onreadystatechange = function() {  
14            if (scr.readyState === "loaded" || scr.readyState === "complete") {  
15                done();  
16            }  
17        }  
18    }  
19 }  
20  
21 loadScript("jquery.js");  
22 loadScript("foobar.js");  
23 loadScript("baz.js",allScriptsLoaded);  
24
```

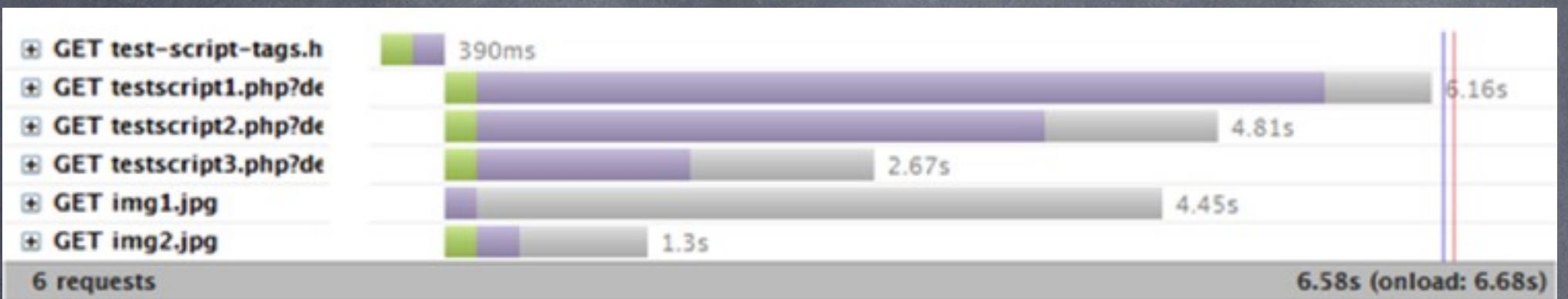
Resource Loading

<http://LABjs.com/>

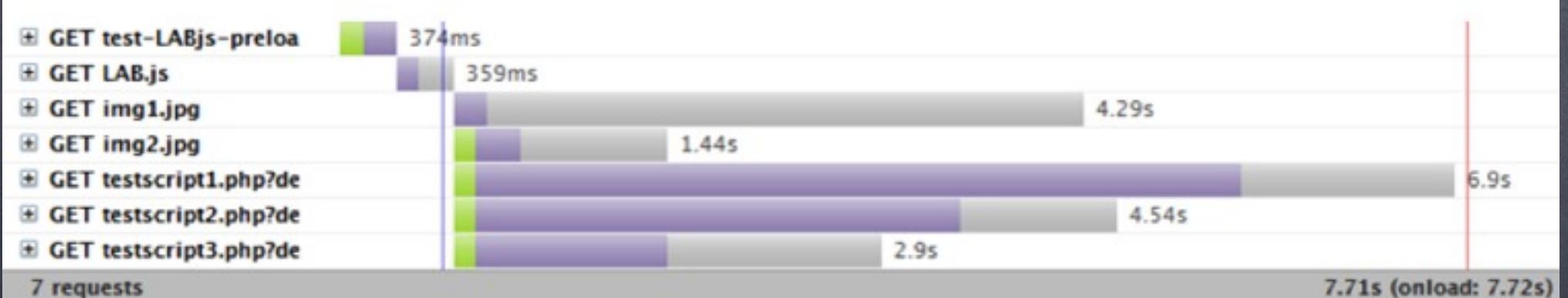
Resource Loading

Why Dynamic?

Resource Loading



<script>



dynamic loading

Resource Loading

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- **Abstractions**
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OO is Slow(er)

Remove Abstractions

Batch Operations

Remove Abstractions

ex.4
(30 min)

Remove Abstractions

Agenda

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JS Animation

Animations: JS vs. CSS

```
1 function updateElement() {
2     $elem.css({
3         left: x + "px",
4         top: y + "px"
5     });
6 }
7
8 var x, y;
9
10 function doAnimation() {
11     // calculate new x,y
12     updateElement();
13     setTimeout(doAnimation, 1000/60);
14 }
15
```

Animations: JS vs. CSS

requestAnimationFrame

Animations: JS vs. CSS

```
1 function updateElement() {
2     $elem.css({
3         left: x + "px",
4         top: y + "px"
5     });
6 }
7
8 var x, y;
9
10 function doAnimation() {
11     // calculate new x,y
12     updateElement();
13     requestAnimationFrame(doAnimation);
14 }
15
16 requestAnimationFrame(doAnimation);
17
```

Animations: JS vs. CSS

CSS: Transition vs. Animation

Animations: JS vs. CSS

```
1 function updateElement() {  
2     $elem.css({  
3         left: x + "px",  
4         top: y + "px"  
5     });  
6 }  
7  
8 var x, y;  
9  
10 // calculate new x,y  
11 updateElement();  
12
```

Animations: JS vs. CSS

```
1 #foo {  
2     transition: left 0.5s, top 0.5s;  
3 }  
4
```

Animations: JS vs. CSS

ex.5
(10 min)

Animations: JS vs. CSS

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- **UI Thread & GC**
- jsPerf

Single Threaded

UI Thread

Async vs. Parallel

UI Thread

requestAnimationFrame

UI Thread

```
1 function updateElement() {
2     $elem.css({
3         left: x + "px",
4         top: y + "px"
5     });
6 }
7
8 var x, y;
9
10 function doAnimation() {
11     // calculate new x,y
12     updateElement();
13     requestAnimationFrame(doAnimation);
14 }
15
16 requestAnimationFrame(doAnimation);
17
```

UI Thread



UI Thread

“Threaded” JavaScript

Web Workers

UI Thread

```
1 var longThread = new Worker("long.js");
2
3 longThread.onmessage = function(evt) {
4     var answer = evt.data;
5     // do something with the answer
6 };
7
8 longThread.postMessage({
9     question: "..."
10 });
11
```

UI Thread

```
1 // long.js
2
3 function figureOutAnswer(question) {
4     // ...
5
6     return answer;
7 }
8
9 self.onmessage(function(evt){
10     var question = evt.data.question;
11
12     var answer = figureOutAnswer(question);
13
14     self.postMessage(answer);
15 });
16
```

Dynamic Memory Allocation

Garbage Collection

```
1 var obj = {  
2     // lots of data  
3 };  
4  
5 // later  
6  
7 obj = null;  
8  
9 // what now?  
10  
11
```

Garbage Collection



Garbage Collection

ex.6
(20 min)

UI Thread & Garbage Collection

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<http://msdn.microsoft.com/en-us/magazine/gg622887.aspx>

JavaScript Performance

Test runner

Handlebars × 8,536 (37 samples)

Stop running

Testing in Firefox 18.0 on Mac OS X 10.7

Test

Ops/sec

| | | |
|--|---------------------------|------------|
| Mustache 0.5.0 DEV
(compiled) | tpl.mustache(tpl.vars); | completed |
| Kendo UI | tpl.kendo(tpl.vars); | completed |
| Kendo UI (no "with"
block) | tpl.kendo2(tpl.vars); | completed |
| Handlebars | tpl.handlebars(tpl.vars) | pending... |
| Underscore | tpl.underscore(tpl.vars); | pending... |
| Resig Micro | tpl.resig(tpl.vars) | pending |

**grips (direct partial,
pre-compiled)**

```
// NOTE: this variation of the previous grips test is only present to get around this  
performance "bug" in FF, otherwise the "compiled" test for grips would have been sufficient.  
// http://jsperf.com/functions-created-globally-or-via-new-function  
  
tpl.grips2( tpl.vars );
```

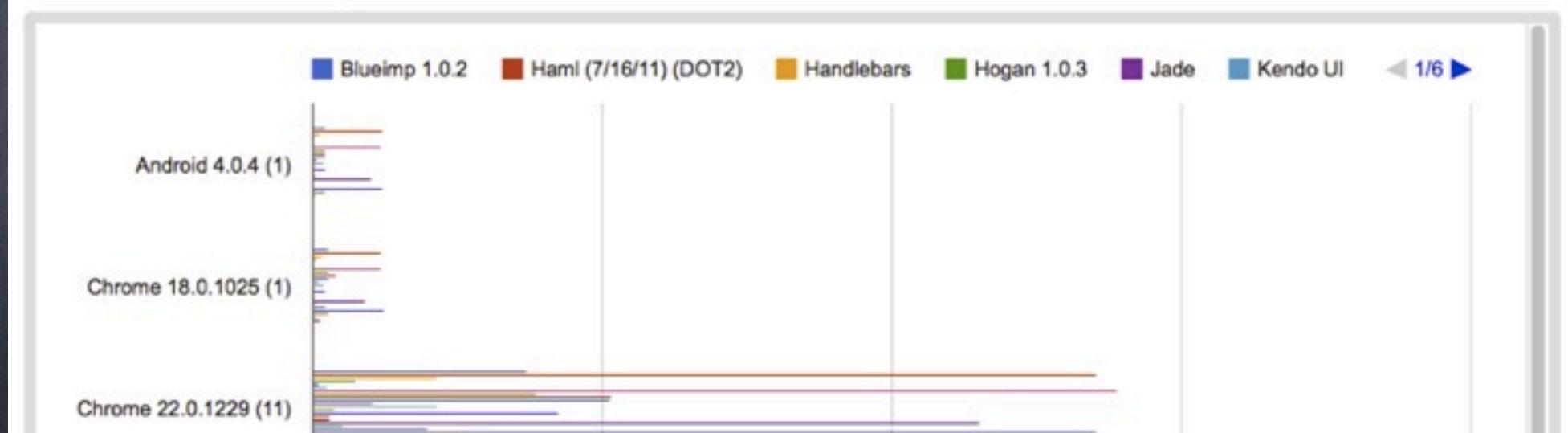
ready

Compare results of other browsers

Chart type: [bar](#), [column](#), [line](#), [pie](#), [table](#)

Filter: [popular](#), [all](#), [desktop](#), [family](#), [major](#), [minor](#), [mobile](#), [prerelease](#)

Browserscope



<http://jsperf.com>

jsPerf

JavaScript Performance Mythbusters

https://docs.google.com/present/view?id=dq52zrp_22f2rx5zjz&pli=1

ex.7
(15 min)

Review

Middle-end

- YSlow
- Resources (CSS, JS, images)
- Architecture
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Front-end

- Resource Loading
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- JS-to-CSS
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- jsPerf

take a deep breath

“**immature** optimization is
the root of all evil”

--getify

Kyle Simpson
@getify
<http://getify.me>

Thanks!

Questions?