

High Performance Web Sites

14 rules for faster pages

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Time Spent on the Frontend

	Empty Cache	Full Cache
amazon.com	82%	86%
aol.com	94%	86%
cnn.com	81%	92%
ebay.com	98%	92%
google.com	86%	64%
msn.com	97%	95%
myspace.com	96%	86%
wikipedia.org	80%	88%
yahoo.com	95%	88%
youtube.com	97%	95%

The Performance Golden Rule

80-90% of the end-user response time is spent on the front-end. Start there.

- Greater potential for improvement
- Simpler
- Proven to work

14 Rules

14 Rules

1. Make fewer HTTP requests
2. Use a CDN
3. Add an Expires header
4. Gzip components
5. Put stylesheets at the top
6. Move scripts to the bottom
7. Avoid CSS expressions
8. Make JS and CSS external
9. Reduce DNS lookups
10. Minify JS
11. Avoid redirects
12. Remove duplicate scripts
13. Configure ETags
14. Make AJAX cacheable

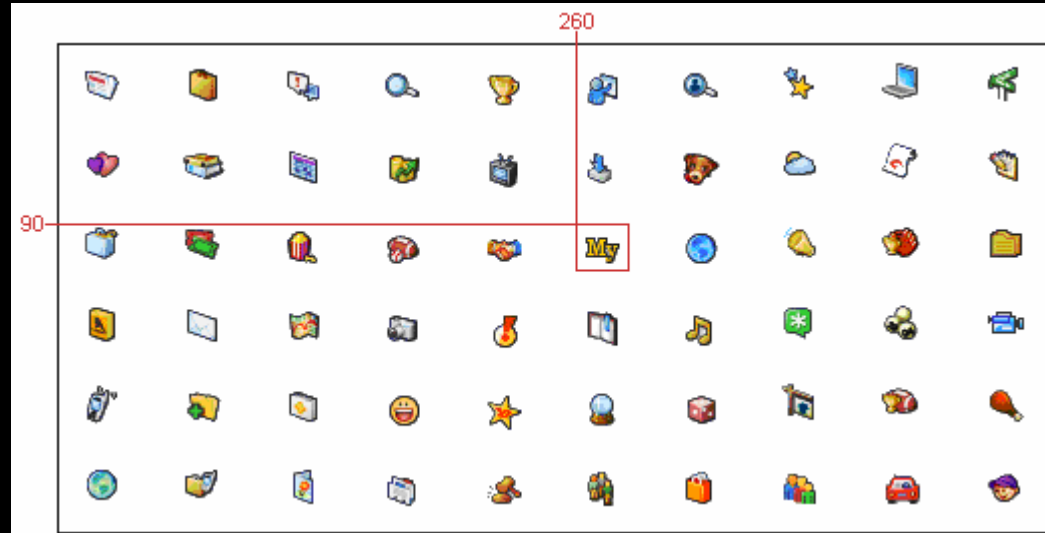
Rule 1: Make fewer HTTP requests

CSS sprites

combined scripts, combined stylesheets

Image maps

CSS Sprites



```
<span style="
  background-image: url('sprites.gif');
  background-position: -260px -90px;">
</span>
```

size of combined image is less

Rule 2: Use a CDN

amazon.com	Akamai
aol.com	Akamai
cnn.com	
ebay.com	Akamai, Mirror Image
google.com	
msn.com	SAVVIS
myspace.com	Akamai, Limelight
wikipedia.org	
yahoo.com	Akamai
youtube.com	

distributed your static content before
distributing your dynamic content

Rule 3: Add an Expires header

not just for images

	Images	Stylesheets	Scripts	%	Median Age
amazon.com	0/62	0/1	0/3	0%	114 days
aol.com	23/43	1/1	6/18	48%	217 days
cnn.com	0/138	0/2	2/11	1%	227 days
ebay.com	16/20	0/2	0/7	55%	140 days
froogle.google.com	1/23	0/1	0/1	4%	454 days
msn.com	32/35	1/1	3/9	80%	34 days
myspace.com	0/18	0/2	0/2	0%	1 day
wikipedia.org	6/8	1/1	2/3	75%	1 day
yahoo.com	23/23	1/1	4/4	100%	n/a
youtube.com	0/32	0/3	0/7	0%	26 days

Rule 4: Gzip components

you can affect users'

download times

90%+ of browsers support

compression

Gzip: not just for HTML

	HTML	Scripts	Stylesheets
amazon.com	x		
aol.com	x	some	some
cnn.com			
ebay.com	x		
froogle.google.com	x	x	x
msn.com	x	deflate	deflate
myspace.com	x	x	x
wikipedia.org	x	x	x
yahoo.com	x	x	x
youtube.com	x	some	some

gzip scripts, stylesheets, XML, JSON (not images, PDF)

Rule 5: Put stylesheets at the top

stylesheets block rendering in IE

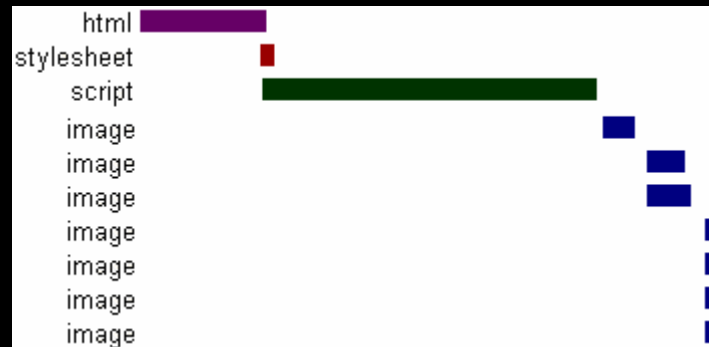
solution: put stylesheets in HEAD (per spec)

avoids Flash of Unstyled Content

use LINK (not @import)

Rule 6: Move scripts to the bottom

scripts block parallel downloads across all hostnames



scripts block rendering of everything below them in the page

`script defer` attribute is not a solution

- blocks rendering and downloads in FF
- slight blocking in IE

Rule 7: Avoid CSS expressions

used to set CSS properties dynamically in IE

```
width: expression(  
    document.body.clientWidth < 600 ?  
    "600px" : "auto" );
```

problem: expressions execute many times

- mouse move, key press, resize, scroll, etc.

alternatives:

- one-time expressions
- event handlers

Rule 8: Make JS and CSS external

inline: HTML document is bigger

external: more HTTP requests, but cached

variables

- page views per user (per session)
- empty vs. primed cache stats
- component re-use

external is typically better

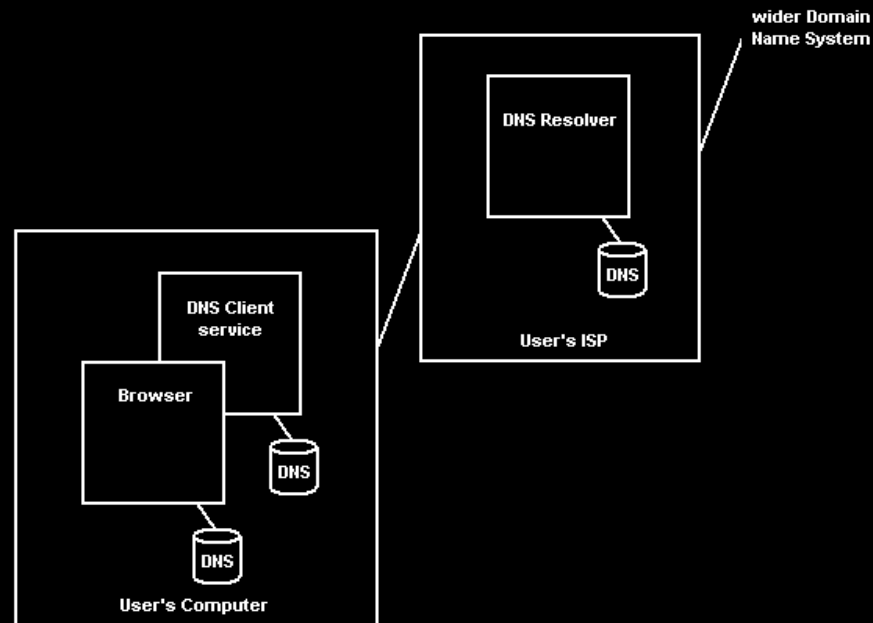
extra credit: post-onload download,
dynamic inlining

Rule 9: Reduce DNS lookups

typically 20-120 ms

block parallel downloads

OS and browser both have DNS caches



Rule 10: Minify JavaScript

	Minify External?	Minify Inline?
www.amazon.com	no	no
www.aol.com	no	no
www.cnn.com	no	no
www.ebay.com	yes	no
froogle.google.com	yes	yes
www.msn.com	yes	yes
www.myspace.com	no	no
www.wikipedia.org	no	no
www.yahoo.com	yes	yes
www.youtube.com	no	no

minify inline scripts, too

Minify vs. Obfuscate

	Original	JSMIn Savings	Dojo Savings
www.amazon.com	204K	31K (15%)	48K (24%)
www.aol.com	44K	4K (10%)	4K (10%)
www.cnn.com	98K	19K (20%)	24K (25%)
www.myspace.com	88K	23K (27%)	24K (28%)
www.wikipedia.org	42K	14K (34%)	16K (38%)
www.youtube.com	34K	8K (22%)	10K (29%)
Average	85K	17K (21%)	21K (25%)

minify - it's safer

not much difference



Rule 11: Avoid redirects

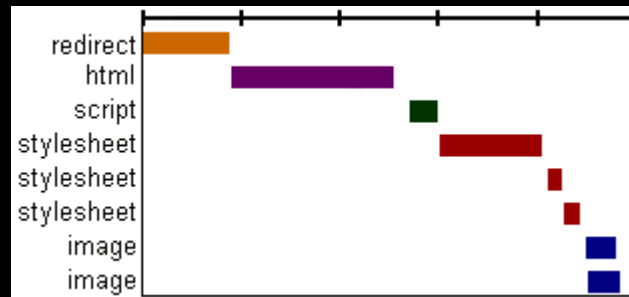
3xx status codes – mostly 301 and 302

HTTP/1.1 301 Moved Permanently

Location: <http://stevesouders.com/newuri>

add Expires headers to cache redirects

worst form of blocking



Rule 12: Remove duplicate scripts

hurts performance

- extra HTTP requests (IE only)
- extra executions

atypical?

- 2 of 10 top sites contain duplicate scripts

team size, # of scripts

Rule 13: Configure ETags

unique identifier returned in response

```
ETag: "c8897e-ae-4165acf0"
```

```
Last-Modified: Thu, 07 Oct 2004 20:54:08 GMT
```

used in conditional GET requests

```
If-None-Match: "c8897e-ae-4165acf0"
```

```
If-Modified-Since: Thu, 07 Oct 2004 20:54:08 GMT
```

if ETag doesn't match, can't send 304

ETag format

- Apache: inode-size-timestamp
- IIS: Filetimestamp: ChangeNumber

Use `em or lose `em

- Apache: FileETag none
- IIS: <http://support.microsoft.com/kb/922703/>

Rule 14: Make AJAX cacheable and small

XHR, JSON, iframe, dynamic scripts can still be cached (and minified, and gzipped)

a personalized response should still be cacheable by that person

YSlow

<http://developer.yahoo.com/yslow>


performance lint tool

grades web pages for each rule

Firefox add-on integrated with Firebug

open source license

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Apr 14, 2007



Disturbing thoughts

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Users review the new thriller 'Disturbia'



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B	1. Minimize HTTP requests ▾ <i>This page has 4 external JavaScript files.</i>
A	2. Use edge computing
A	3. Add an Expires header
B	4. Gzip components ▾ <i>These components are not gzipped:</i> <i>(1.9K) http://l.yimg.com/us.js.yimg.com/lib/bc/bc_2.0.3.js</i>
B	5. Move CSS to the top ▾

Takeaways

focus on the front-end

harvest the low-hanging fruit

you do control user response times

Small investment up front keeps on giving

LOFNO - be an advocate for your users

Links

book: <http://www.oreilly.com/catalog/9780596514211/>

examples: <http://stevesouders.com/examples/>

image maps: <http://www.w3.org/TR/html401/struct/objects.html#h-13.6>

CSS sprites: <http://alistapart.com/articles/sprites>

inline images: <http://tools.ietf.org/html/rfc2397>

jsmin: <http://crockford.com/javascript/jsmin>

dojo compressor: <http://dojotoolkit.org/docs/shrinksafe>

HTTP status codes: <http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html>

IBM Page Detailer: <http://alphaworks.ibm.com/tech/pagedetailer>

Fasterfox: <http://fasterfox.mozdev.org/>

LiveHTTPHeaders: <http://livehttpheaders.mozdev.org/>

Firebug: <http://getfirebug.com/>

YUIBlog: <http://yuiblog.com/blog/2006/11/28/performance-research-part-1/>

<http://yuiblog.com/blog/2007/01/04/performance-research-part-2/>

<http://yuiblog.com/blog/2007/03/01/performance-research-part-3/>

<http://yuiblog.com/blog/2007/04/11/performance-research-part-4/>

YDN: http://developer.yahoo.net/blog/archives/2007/03/high_performanc.html

http://developer.yahoo.net/blog/archives/2007/04/rule_1_make_few.html