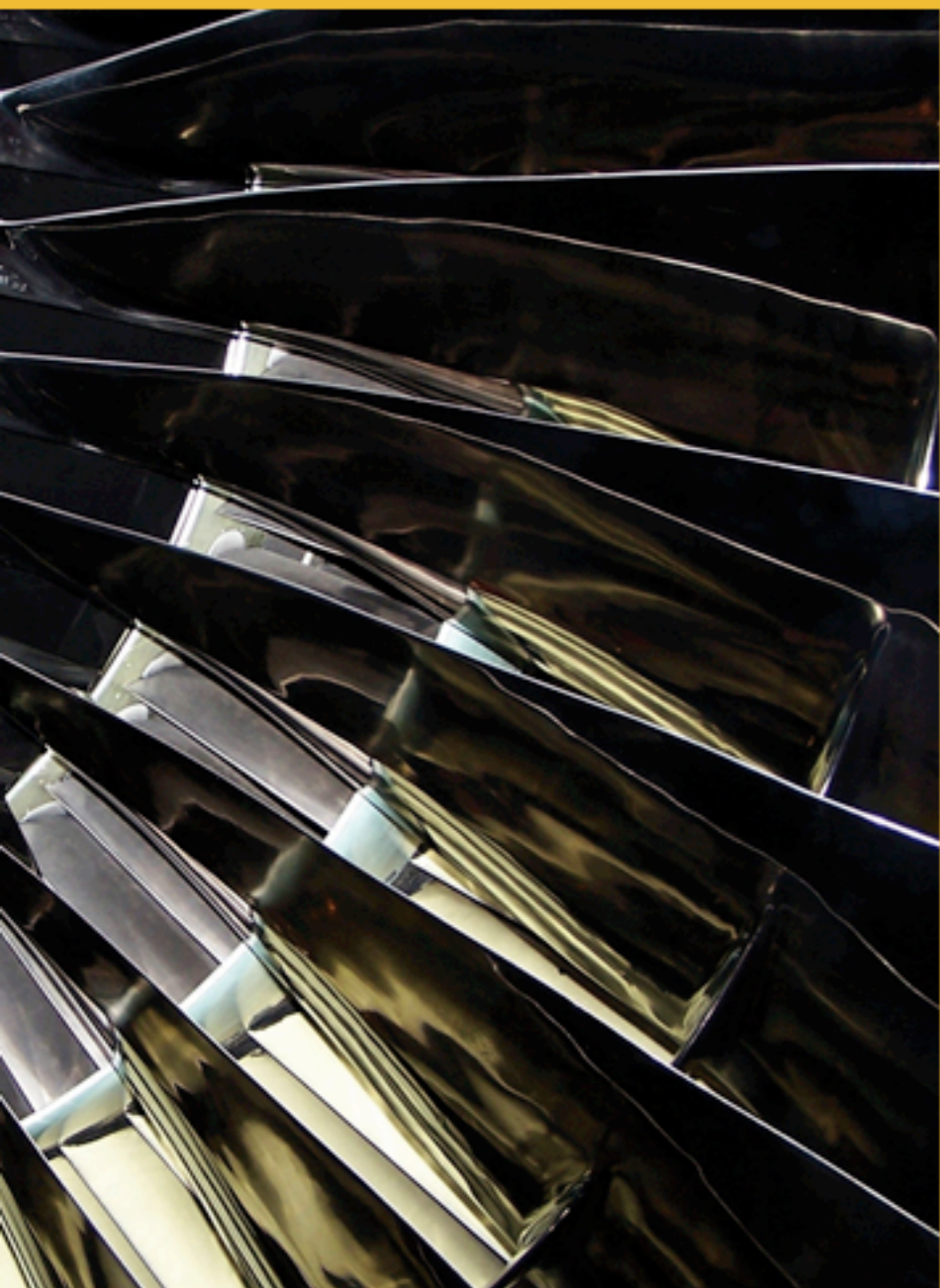


Velocity

Web Performance and
Operations Conference



Improving Netflix Performance

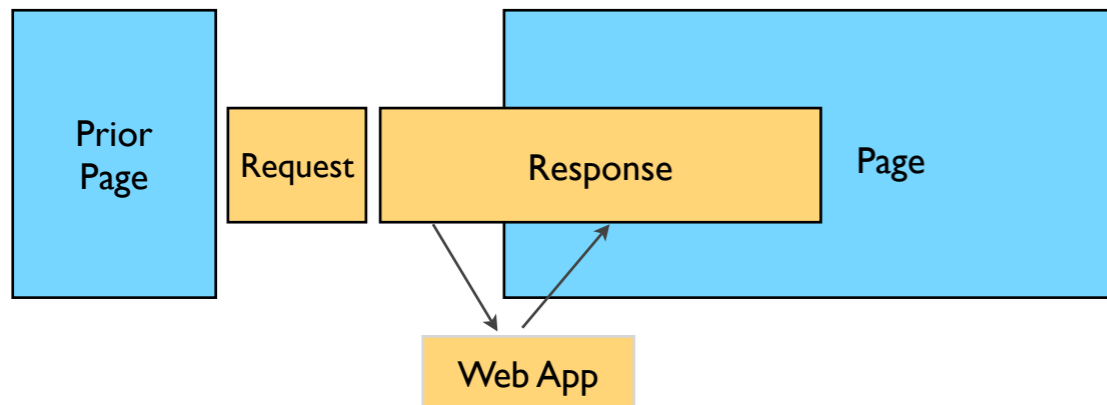
Bill Scott

Director, UI Engineering
Netflix

June 23, 2008

The Plan

- Accurately measure the full user experience performance



- Incrementally improve site performance

Exceptional Performance : Best Practices for Speeding Up Your Web Site

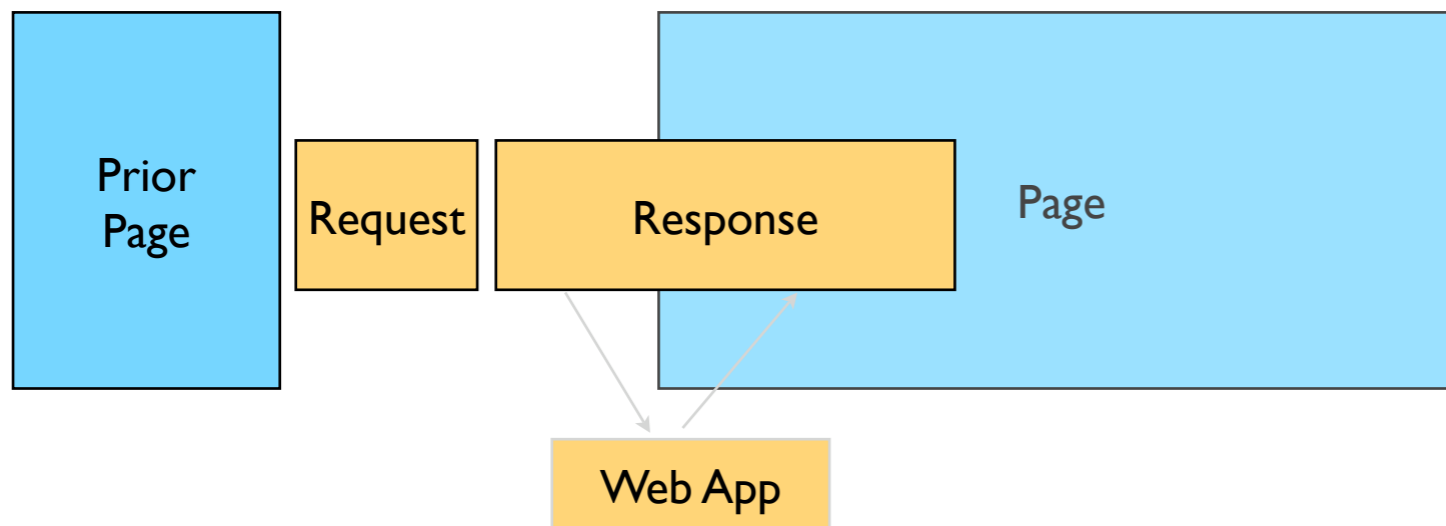
The Exceptional Performance team has identified a number of best practices for making web pages fast. The list includes 34 best practices divided into 7 categories.

Filter rules by category: **content** server cookie css javascript images mobile all

1. [Make Fewer HTTP Requests](#)
2. [Reduce DNS Lookups](#)
3. [Avoid Redirects](#)
4. [Make Ajax Cacheable](#)
5. [Post-load Components](#)
6. [Preload Components](#)
7. [Reduce the Number of DOM Elements](#)
8. [Split Components Across Domains](#)
9. [Minimize the Number of iframes](#)
10. [No 404s](#)

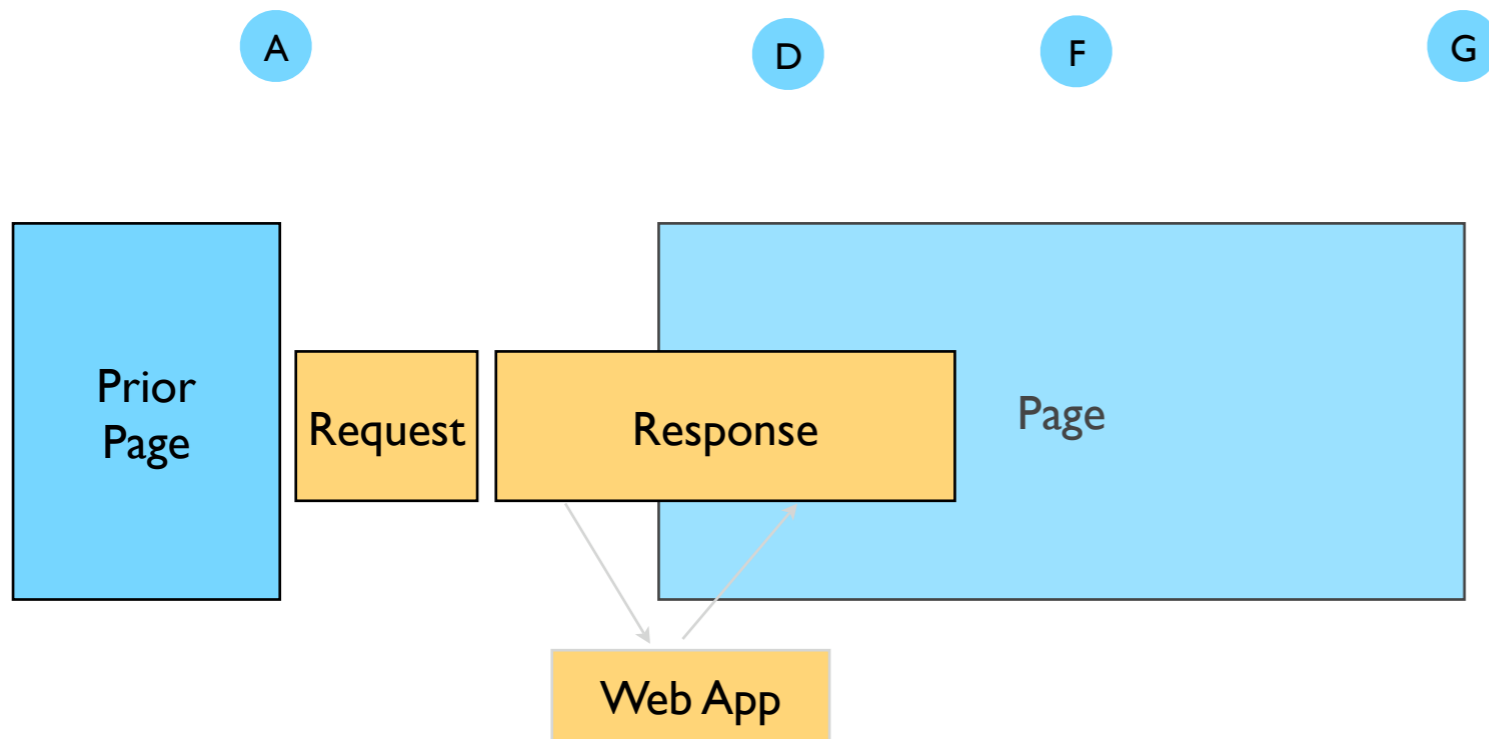


Measuring: User Experience Performance Tracing



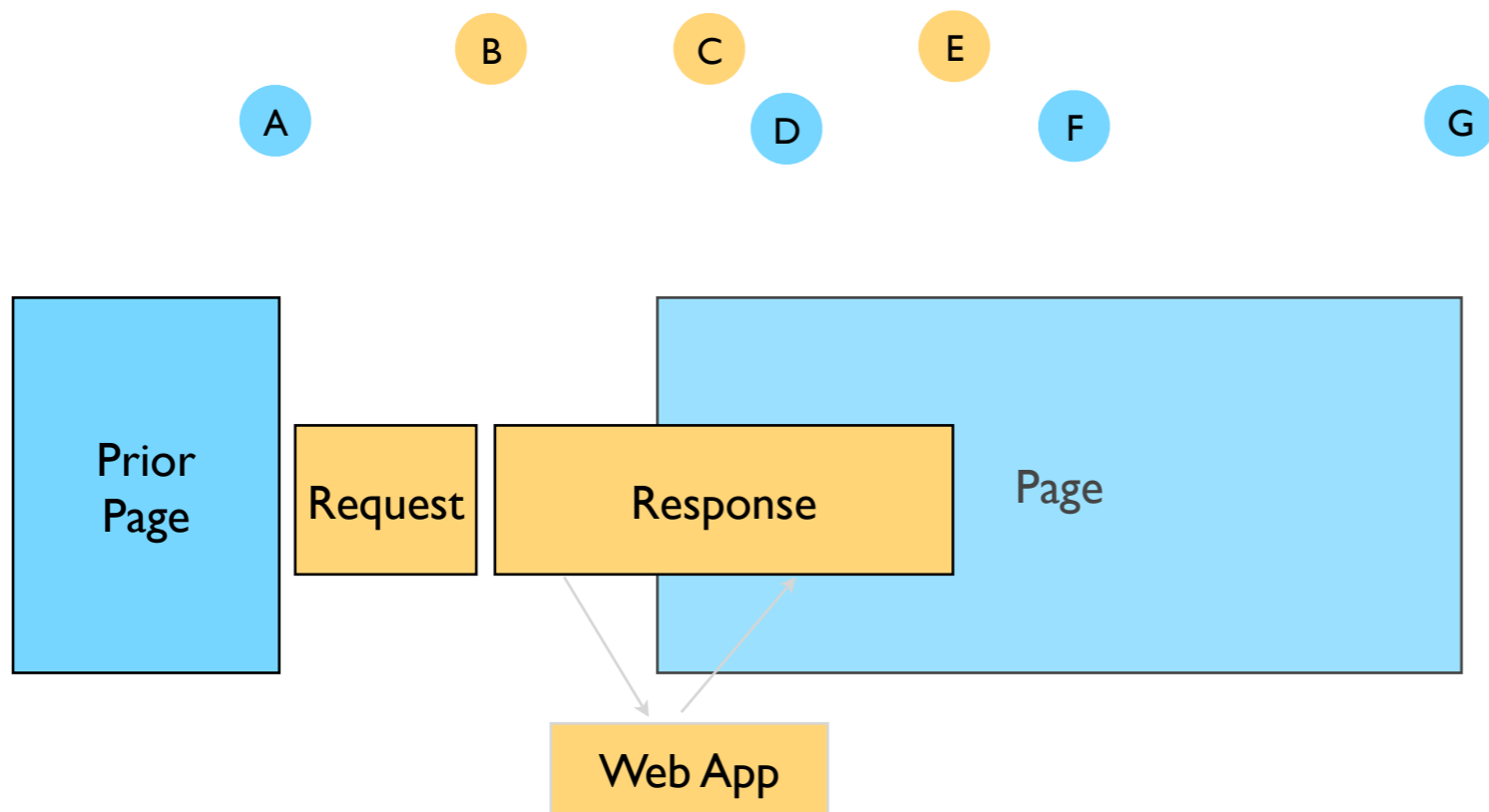


Measuring: User Experience Performance Tracing



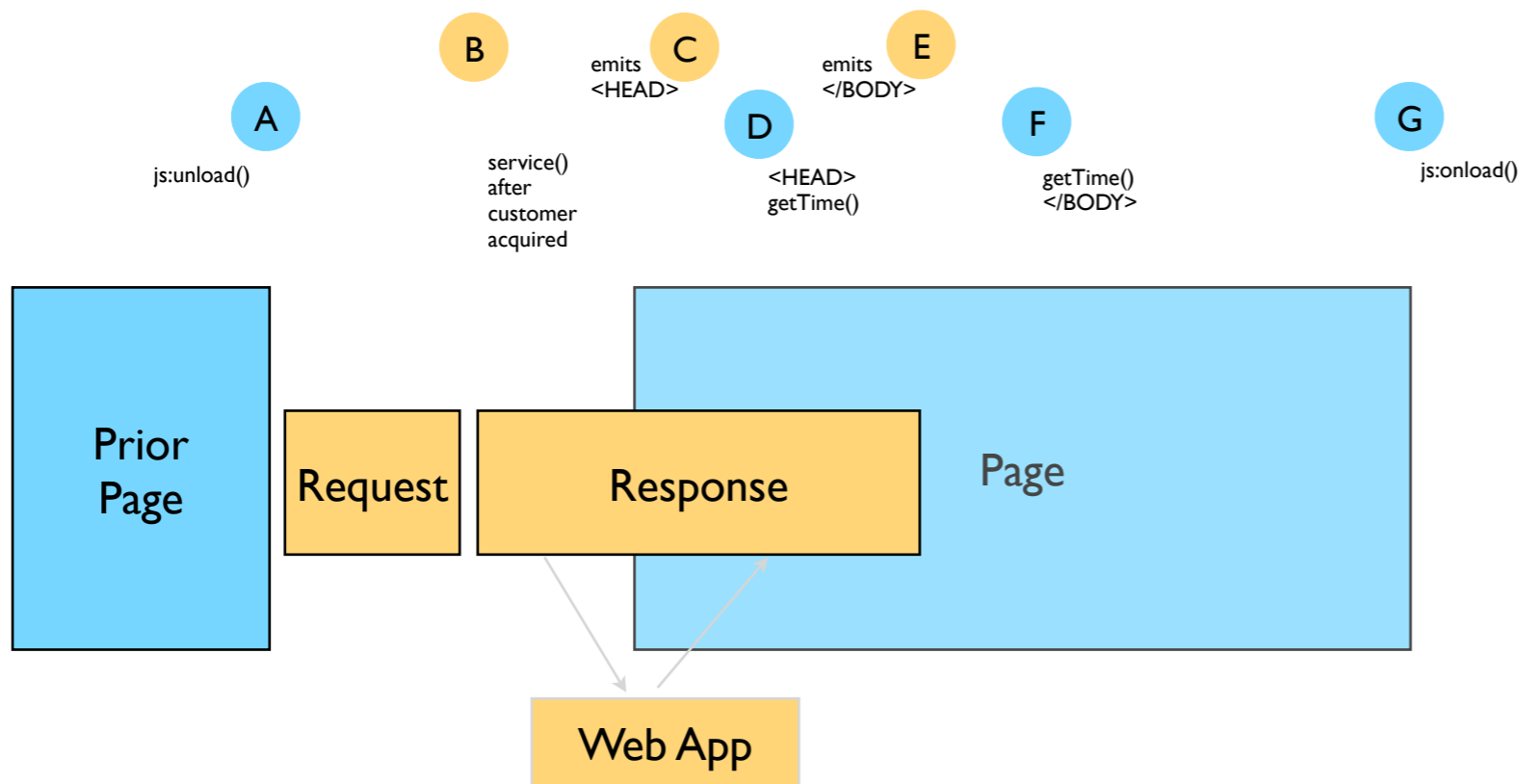


Measuring: User Experience Performance Tracing

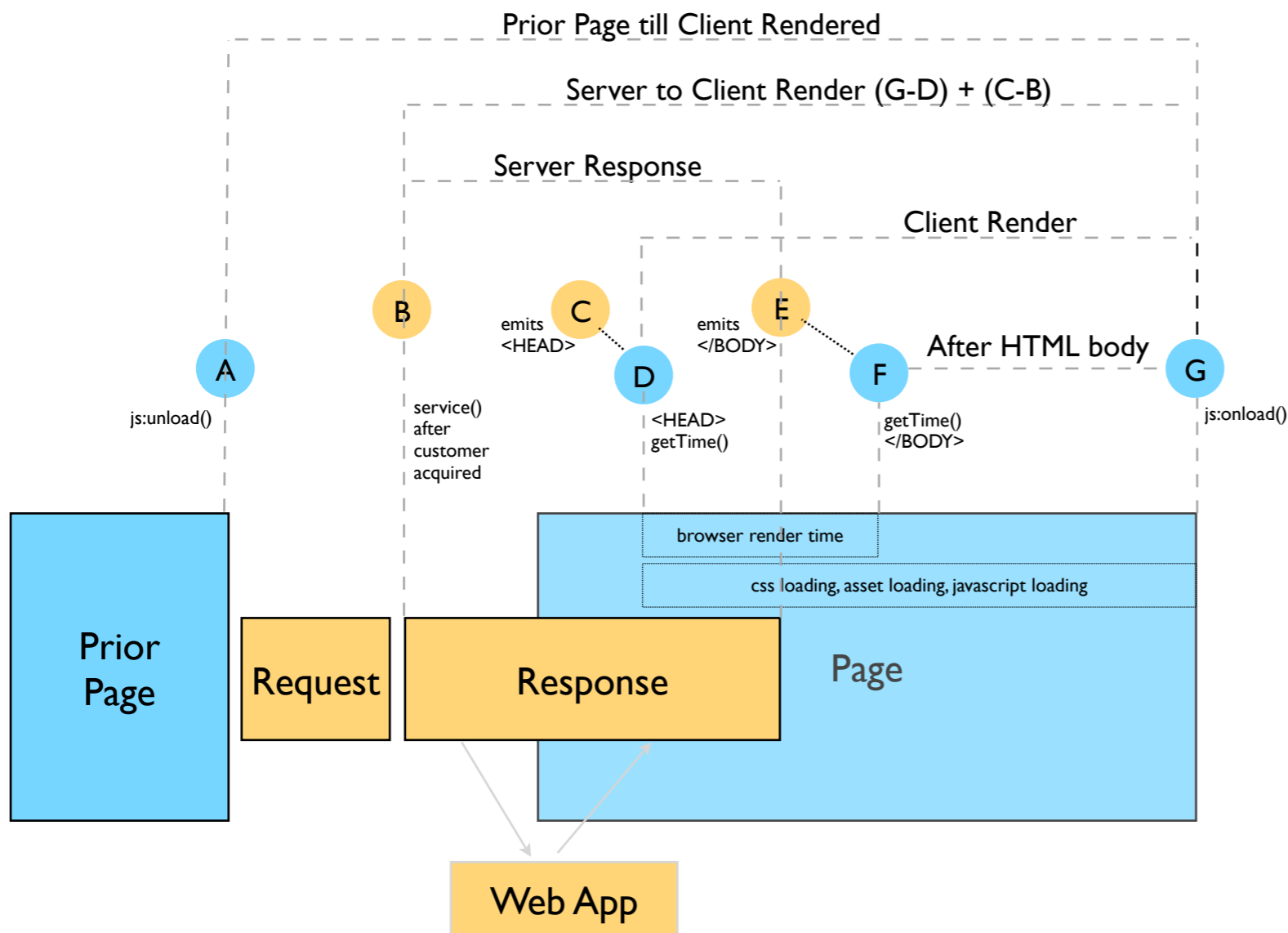




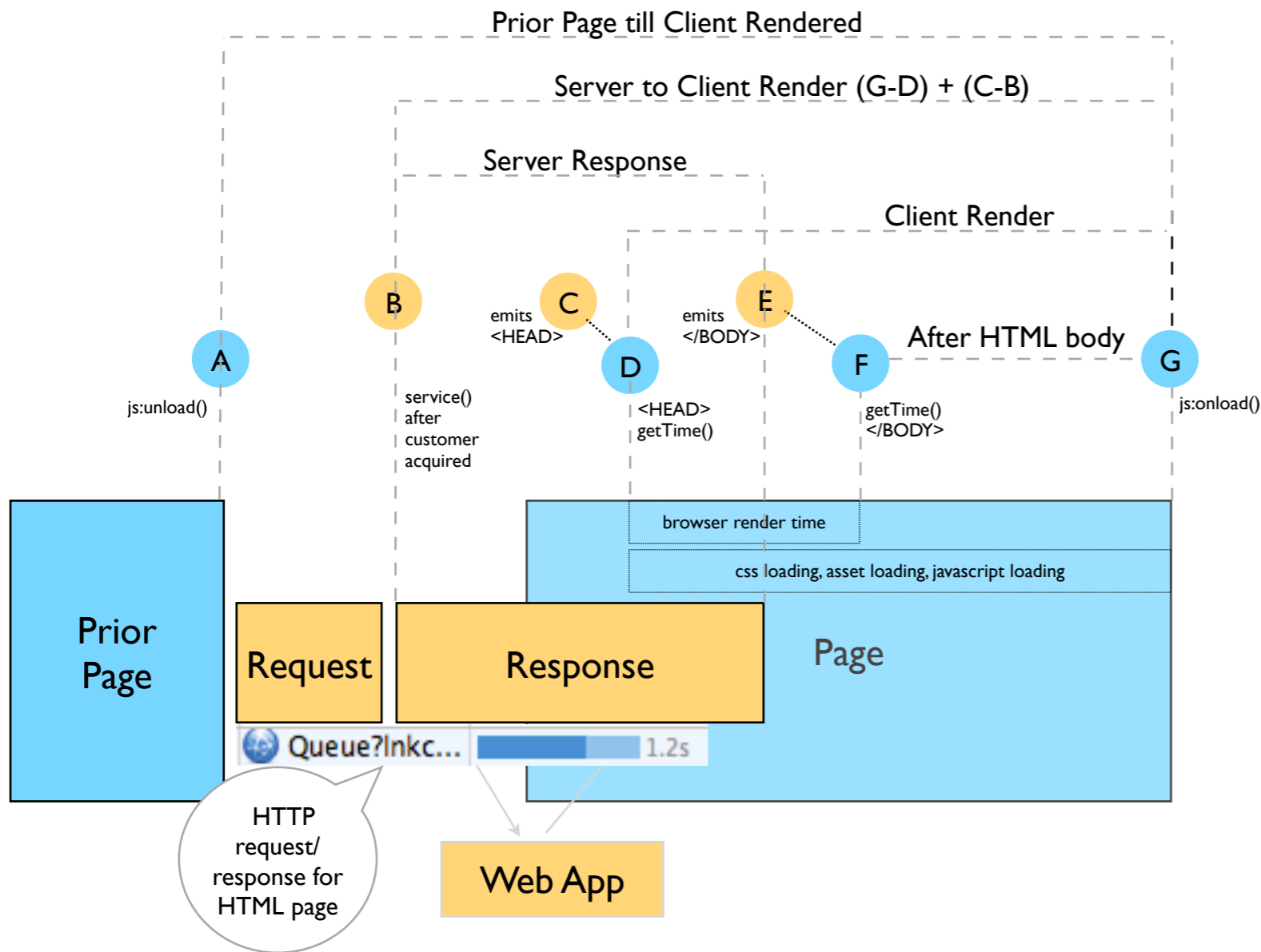
Measuring: User Experience Performance Tracing



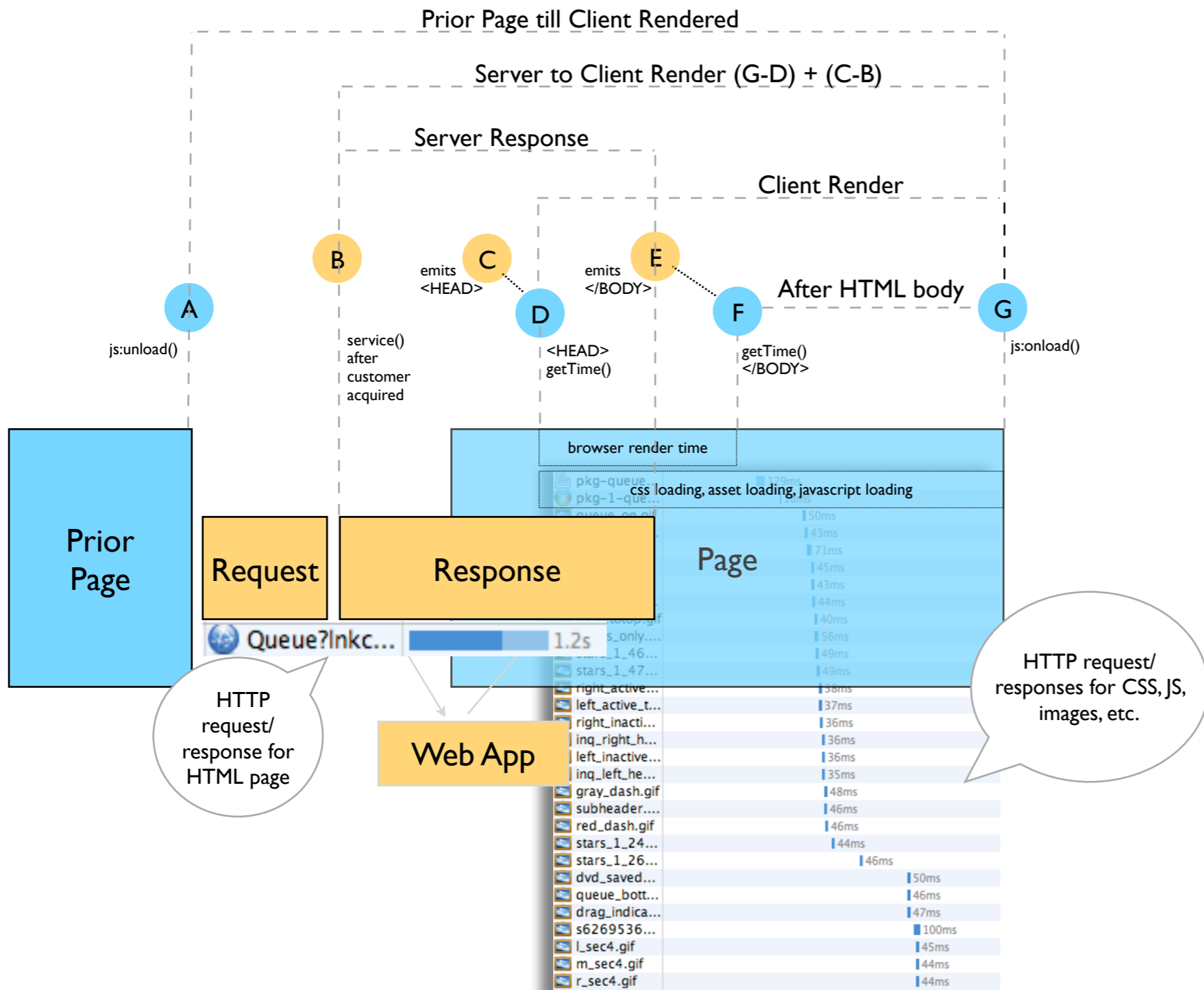
Measuring: User Experience Performance Tracing



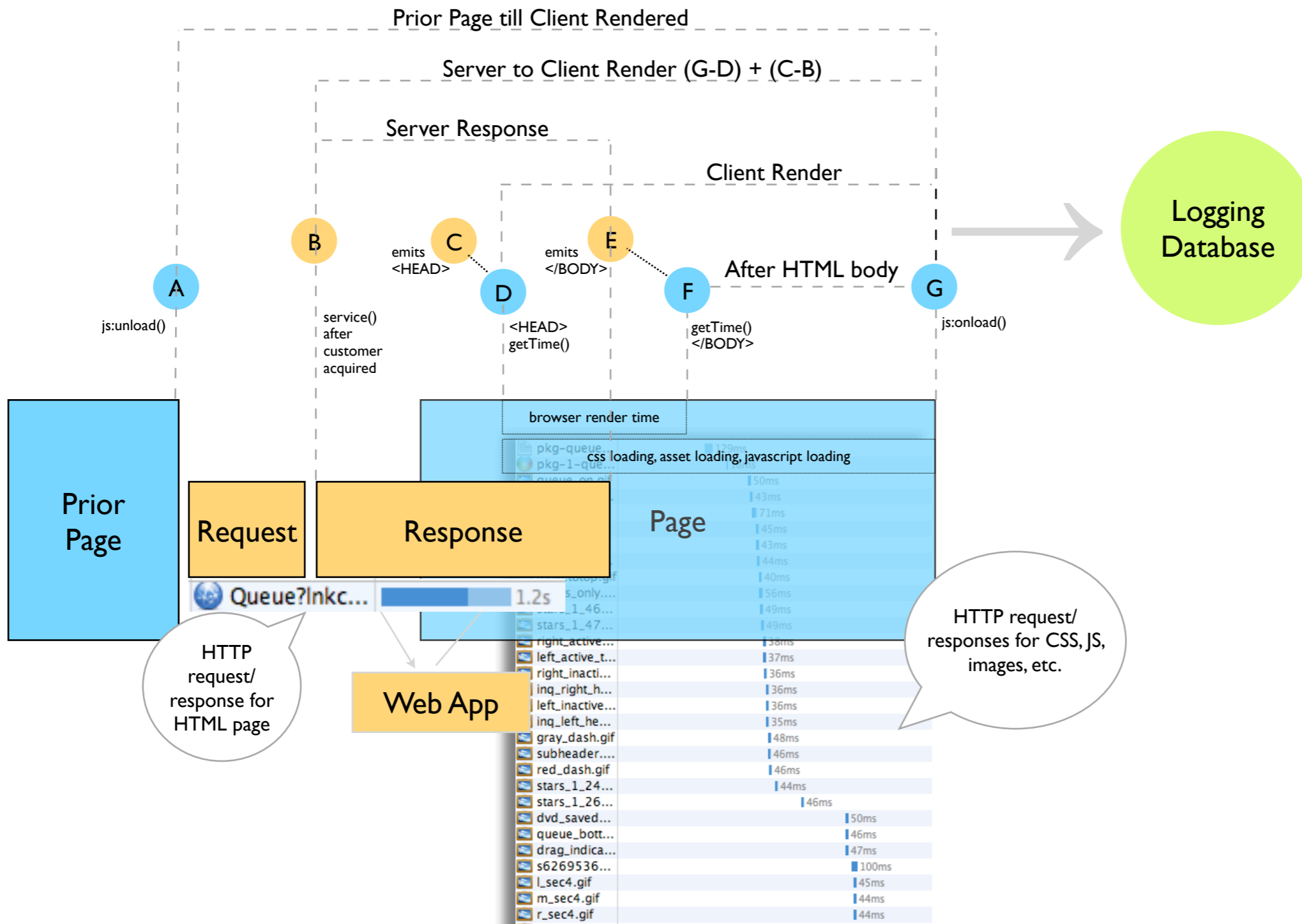
Measuring: User Experience Performance Tracing



Measuring: User Experience Performance Tracing



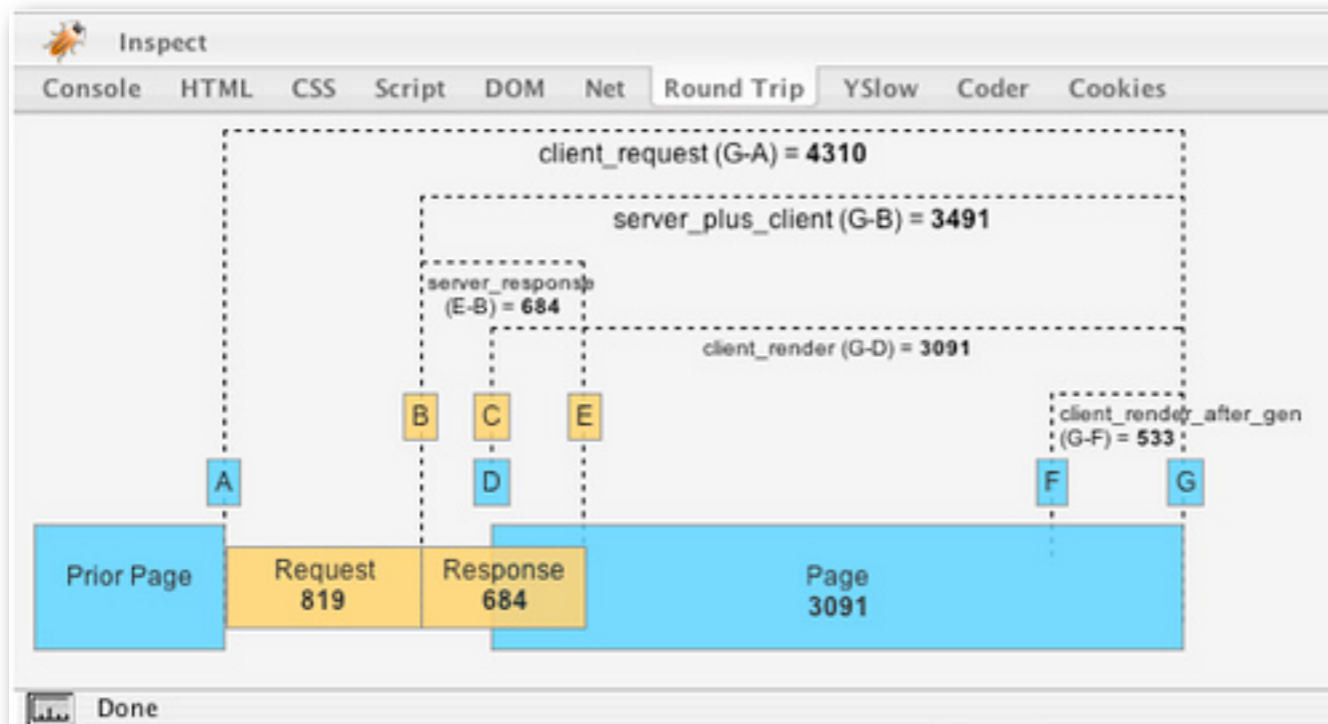
Measuring: User Experience Performance Tracing





Measuring: Firebug Panel

- Created a firebug extension that shows real time values for a given page being measured





Improve Performance

- Apache configuration
 - gzip, far future expires, etag configuration
- Images
 - far future expires, sprites
 - move to CSS based buttons, navigation, vignettes, star bars
- Javascript/CSS
 - Switch to YUI minifier
 - Refactor, migrate to jQuery
 - Correctly position CSS & Javascript



Improve Performance: Analysis of Queue

Where did the time go (180 item Q)

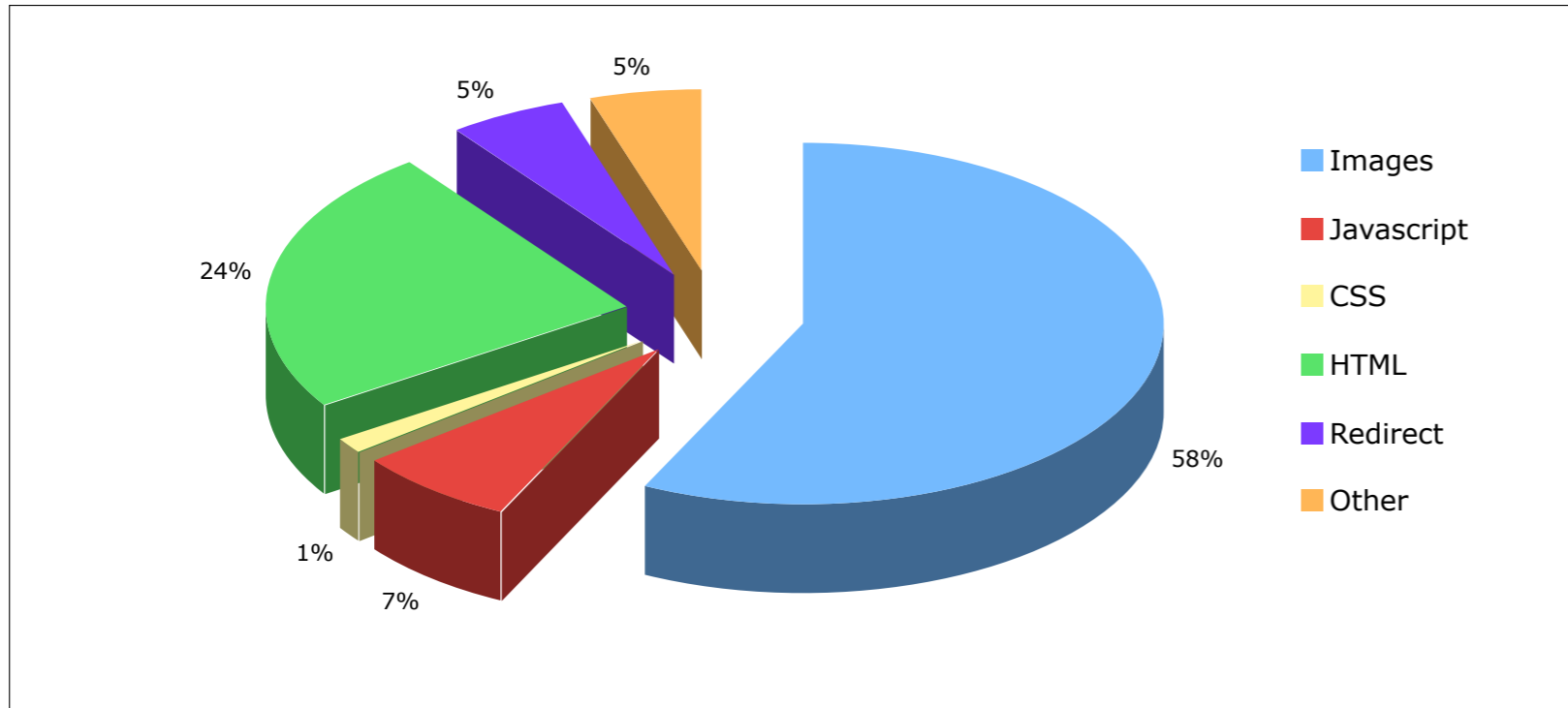
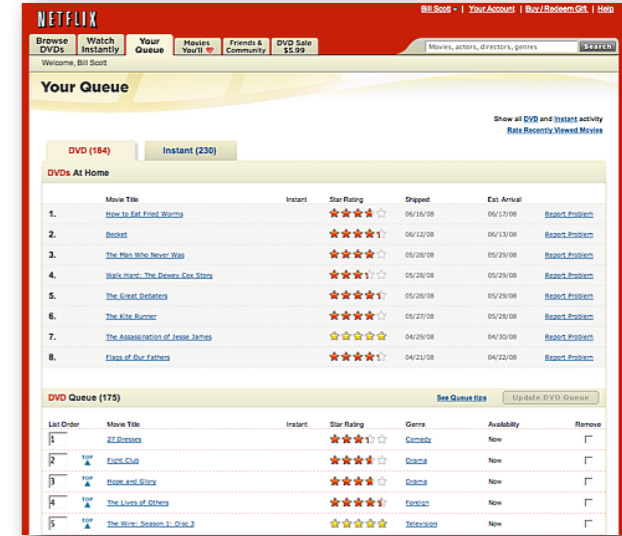
Images	57.1%
Javascript	7.3%
CSS	1.3%
HTML	23.9%
Redirect	5.2%
Other	5.1%

Everthing Else	74.6%
Star bars	25.4%

Where did the time go (180 item Q)

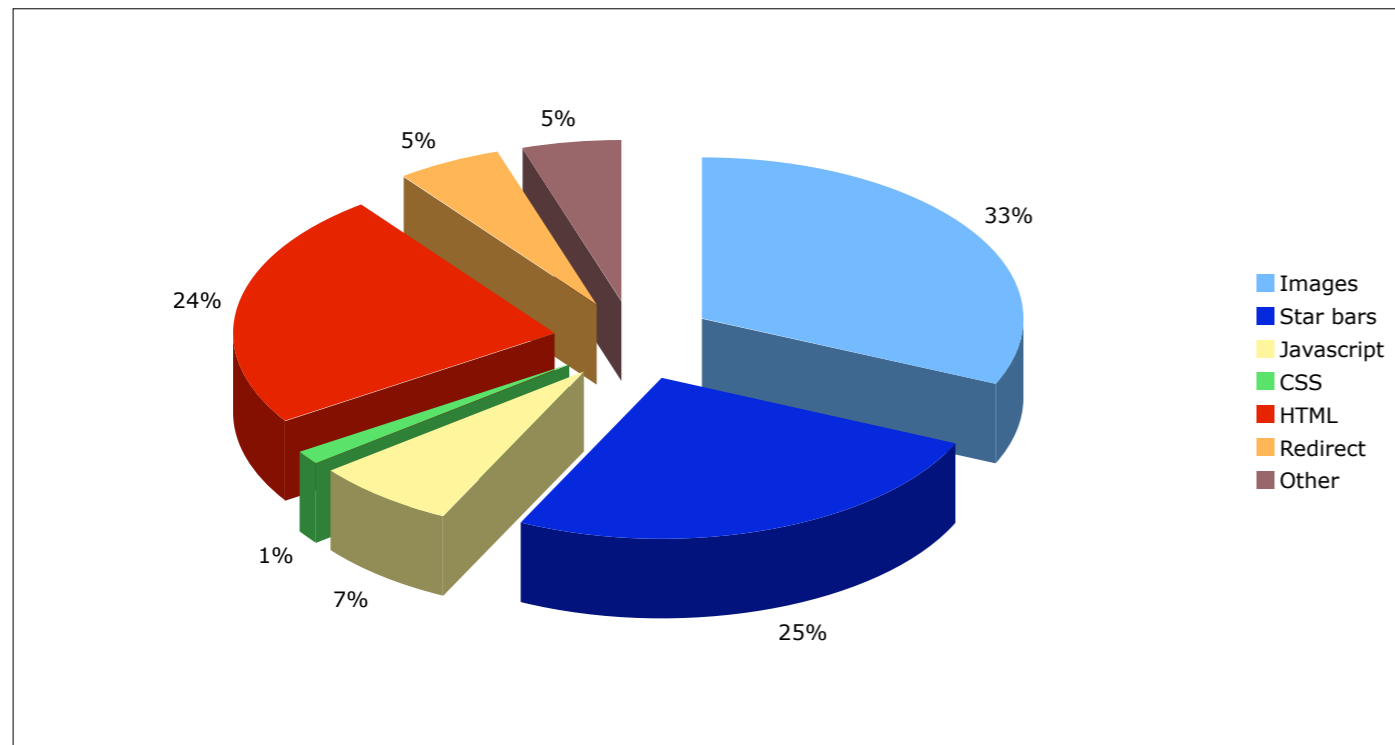
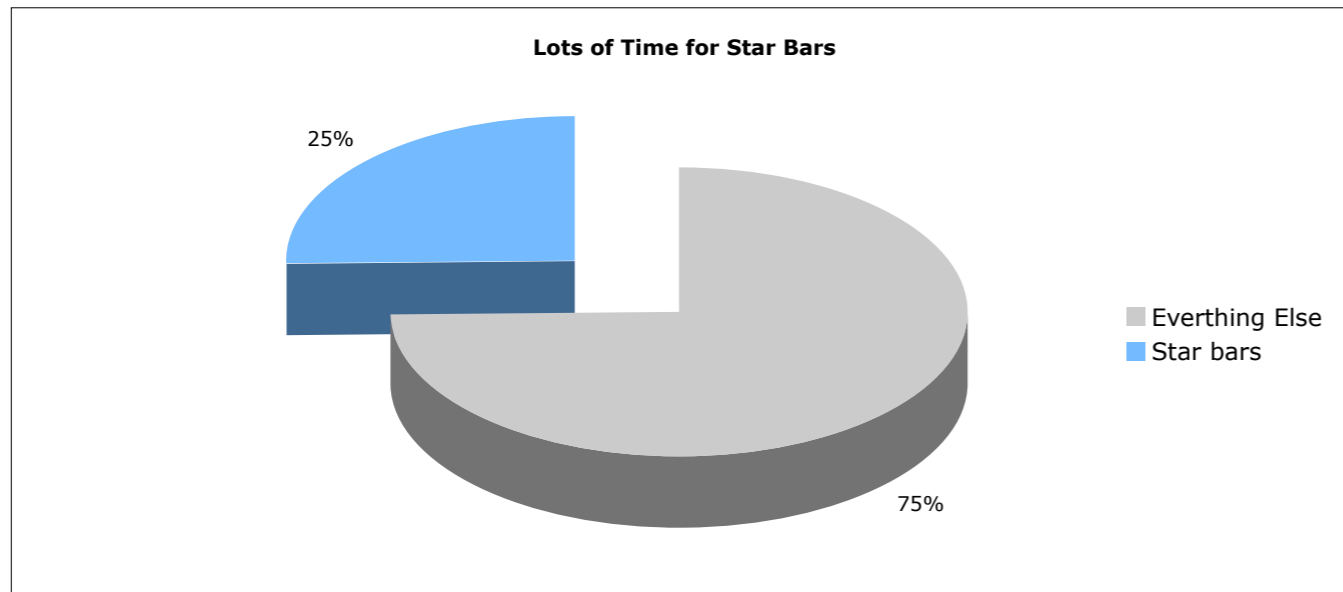
Images	31.7%
Star bars	25.4%
Javascript	7.3%
CSS	1.3%
HTML	23.9%
Redirect	5.2%
Other	5.1%

Everthing Else	74.6%
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Improve Performance: Analysis of Queue



NETFLIX

Welcome, Bill Saut

[Browse DVDs](#) |
 [Watch Instantly](#) |
 [Your Queue](#) |
 [Movies You'll Like](#) |
 [Friends & Community](#) |
 [DVD Sale \\$5.99](#)

[Movies, actors, directors, genres](#)

Your Queue

Show all DVD and Instant activity
Rate Recently Viewed Movies

DVD (184) Instant (230)

DVDs At Home

Movie Title	Instant	Star Rating	Shipped	Est. Arrival	Report Problem
How to Eat Fried Worms		★ ★ ★ ★ ☆	05/15/08	06/17/08	Report Problem
Rocket		★ ★ ★ ★ ☆	05/12/08	06/13/08	Report Problem
The Man Who Knew Too Much		★ ★ ★ ★ ☆	05/20/08	05/29/08	Report Problem
Walk Hard: The Dewey Cox Story		★ ★ ★ ★ ☆	05/20/08	05/29/08	Report Problem
The Great Debaters		★ ★ ★ ★ ☆	05/20/08	05/29/08	Report Problem
The Kid Rapper		★ ★ ★ ★ ☆	05/27/08	05/28/08	Report Problem
The Assassination of Jesse James		★ ★ ★ ★ ☆	04/29/08	04/30/08	Report Problem
Eyes of Our Fathers		★ ★ ★ ★ ☆	04/21/08	04/22/08	Report Problem

DVD Queue (175) [Set Queue Size](#) [Update DVD Queue](#)

List Order	Movie Title	Instant	Star Rating	Genre	Availability	Remove
1	22 Roses		★ ★ ★ ★ ☆	Comedy	Now	Remove
2	Eyes Club		★ ★ ★ ★ ☆	Drama	Now	Remove
3	Hope and Glory		★ ★ ★ ★ ☆	Drama	Now	Remove
4	The Lives of Others		★ ★ ★ ★ ☆	Drama	Now	Remove
5	The Wire: Season 1, Disc 2		★ ★ ★ ★ ☆	Television	Now	Remove



Improve Performance: Incrementally

- Get tracing fully in place
- Push performance improvements opportunistically
 - This allows us to measure and verify
 - Star bar example
 - 50+ images originally
 - Changed to 2 images (sliding sprite)
 - Performance actually degraded
 - Request cut in half - GOOD
 - Extra HTML payload
 - Event Handlers on each star - BAD



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NETFLIX

Bill Scott - | Your Account | Buy/Redeem Gift

Browse DVDs | Watch Instantly | Your Queue | Movies You'll ♥ | Friends & Community | DVD Sale \$5.99

Welcome, Bill Scott

Your Queue

Show all DVD and Instant ac
Rate Recently Viewed M

DVD (184) | Instant (230)

DVDs At Home

	Movie Title	Instant	Star Rating	Shipped	Est. Arrival	
1.	How to Eat Fried Worms		★★★★☆	06/16/08	06/17/08	Report Problem
2.	Becket		★★★★☆	06/12/08	06/13/08	Report Problem
3.	The Man Who Never Was		★★★★☆	05/28/08	05/29/08	Report Problem
4.	Walk Hard: The Dewey Cox Story		★★★★☆	05/28/08	05/29/08	Report Problem
5.	The Great Debaters		★★★★☆	05/28/08	05/29/08	Report Problem
6.	The Kite Runner		★★★★☆	05/27/08	05/28/08	Report Problem
7.	The Assassination of Jesse James		★★★★★	04/29/08	04/30/08	Report Problem
8.	Flags of Our Fathers		★★★★☆	04/21/08	04/22/08	Report Problem

DVD Queue (175) [See Queue tips](#) [Update DVD Queue](#)

List Order	Movie Title	Instant	Star Rating	Genre	Availability	Ren
1	27 Dresses		★★★★☆	Comedy	Now	
2	Flight Club		★★★★☆	Drama	Now	
3	Hope and Glory		★★★★☆	Drama	Now	
4	The Lives of Others		★★★★☆	Foreign	Now	



Improving Performance: Gzip

- Payload reduced in some cases 15x (typically in half)
- User experience performance improvement 13% - 25%
- Network outbound traffic cut in half



Improving Performance: Gzip

- Payload reduced in some cases 15x (typically in half)

Empty Cache	Primed Cache
804.8K 1HTML/Text	804.8K 1HTML/Text
284.5K 3JavaScript Files	284.5K 3JavaScript Files
73.4K 2Stylesheet Files	73.4K 2Stylesheet Files
8.0K20CSS Images	0.0K20CSS Images
55.0K60Images	0.0K60Images
1225.8K Total size	1162.8K Total size
86 HTTP requests	86 HTTP requests

- User experience performance improvement 13% - 25%
- Network outbound traffic cut in half



Improving Performance: Gzip

- Payload reduced in some cases 15x (typically in half)

Empty Cache		Primed Cache		Empty Cache		Primed Cache	
804.8K	1HTML/Text	804.8K	1HTML/Text	51.6K	1HTML/Text	51.6K	1HTML/Text
284.5K	3JavaScript Files	284.5K	3JavaScript Files	0.0K	1XMLHttpRequest	0.0K	1XMLHttpRequest
73.4K	2Stylesheet Files	73.4K	2Stylesheet Files	63.9K	3JavaScript Files	0.0K	1XMLHttpRequest
8.0K	20CSS Images	0.0K	20CSS Images	15.4K	2Stylesheet Files	0.0K	1XMLHttpRequest
55.0K	60Images	0.0K	60Images	21.9K	23CSS Images	0.0K	23CSS Images
1225.8K	Total size	1162.8K	Total size	56.3K	61Images	0.0K	61Images
86	HTTP requests	86	HTTP requests	209.3K	Total size	51.6K	Total size
				91	HTTP requests	86	HTTP requests

- User experience performance improvement 13% - 25%
- Network outbound traffic cut in half

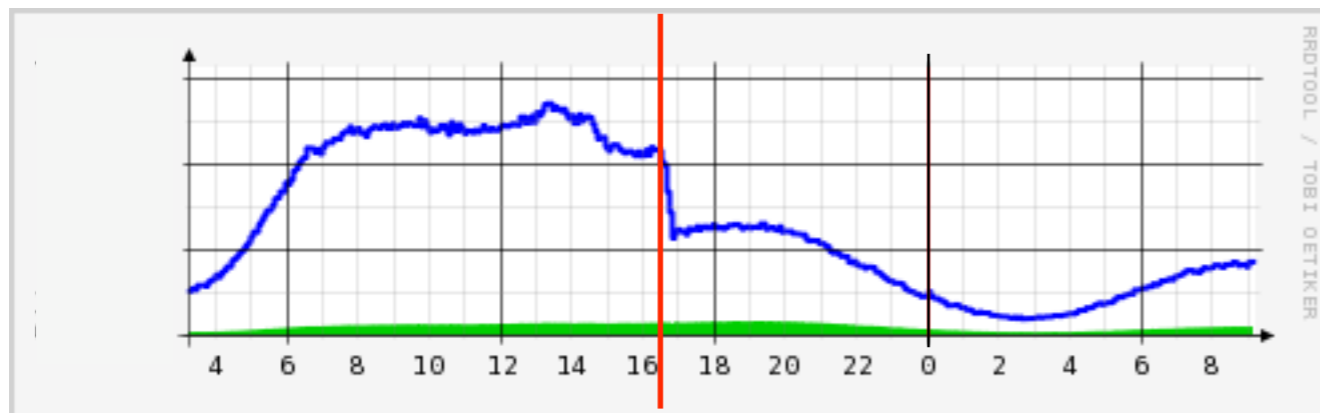


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Empty Cache		Primed Cache		Empty Cache		Primed Cache	
804.8K	1HTML/Text	804.8K	1HTML/Text	51.6K	1HTML/Text	51.6K	1HTML/Text
284.5K	3JavaScript Files	284.5K	3JavaScript Files	0.0K	1XMLHttpRequest	0.0K	1XMLHttpRequest
73.4K	2Stylesheet Files	73.4K	2Stylesheet Files	63.9K	3JavaScript Files	0.0K	23CSS Images
8.0K	20CSS Images	0.0K	20CSS Images	15.4K	2Stylesheet Files	0.0K	61Images
55.0K	60Images	0.0K	60Images	21.9K	23CSS Images	0.0K	61Images
1225.8K	Total size	1162.8K	Total size	209.3K	Total size	51.6K	Total size
86	HTTP requests	86	HTTP requests	91	HTTP requests	86	HTTP requests

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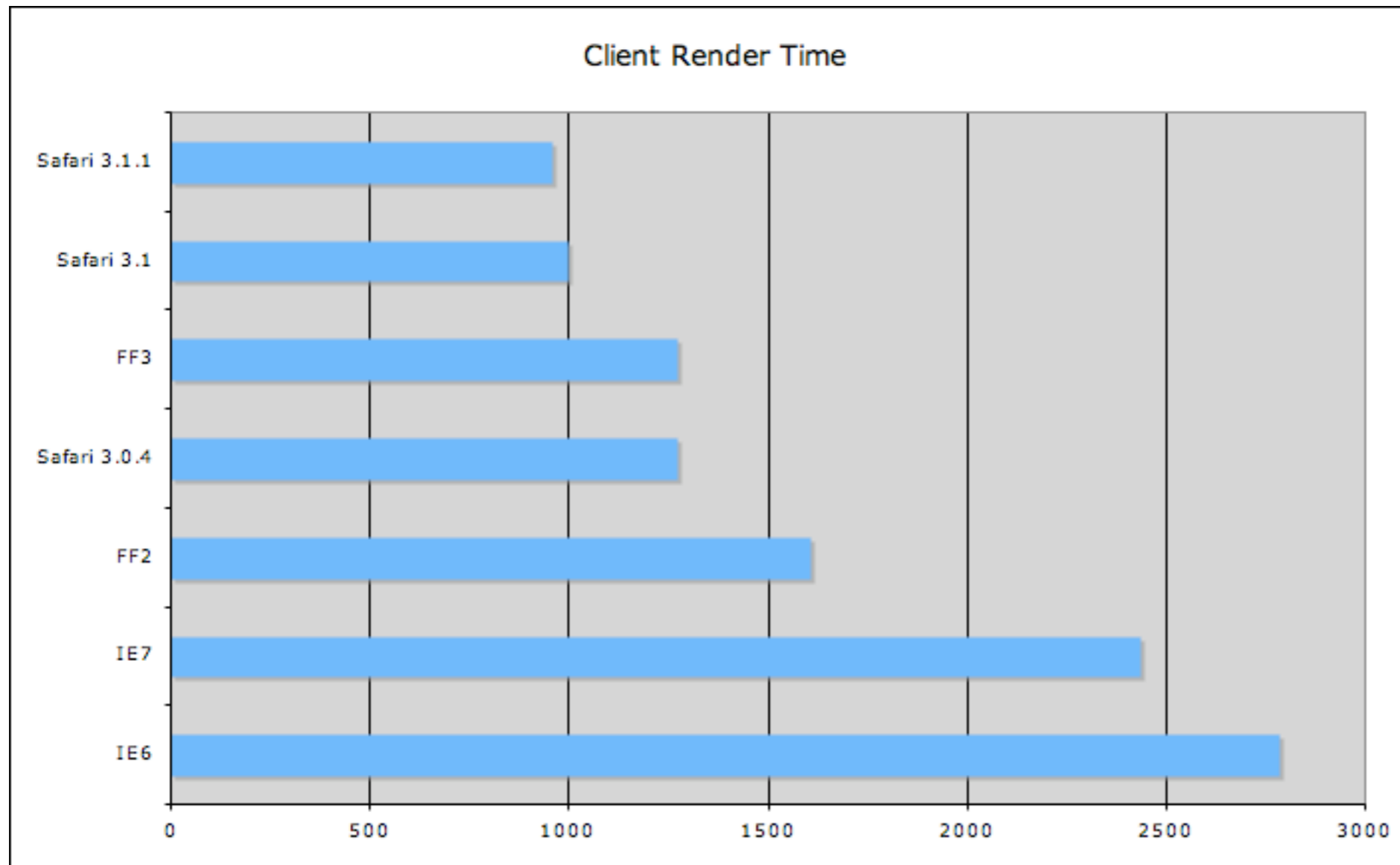
Queue Refactor

- Queue was completely re-written from scratch
 - Changed from Java generated HTML to JSP generated HTML
 - Moved to jQuery
- Performance slightly degraded for page load
- But interactivity ready time improved dramatically (5-10x)
- Gzip bought back any loss in larger payload (white space) and then some



Interesting Browser Stats (from the Queue)

- Safari 3.1.1 is 3x faster than IE6





Lessons

- Most of the Yahoo! recommendations are a sure bet (far futures, gzip, etag, etc.)
- Not all pages are created equal
- A lot of time is spent fetching images
- Nothing beats simple design, separation of concerns, clean architecture
- The surest way to improve performance is to measure, measure, measure
 - Use some way to capture the full user experience time
 - Be able to log & graph trends
 - Median works best
 - Make sure your numbers are statistically significant

Announcement: Jiffy Firebug Extension

- Firebug extension available that works with Jiffy-Web to give you a graphical view of your measurement data
- <http://billwscott.com/jiffyext>

