

O'REILLY

Velocity

Web Performance and
Operations Conference

<FAST> <SCALABLE>
<EFFICIENT> <AVAILABLE>

Go With the Reflow

Experiments testing browser rendering

Lindsey Simon
Google UX Developer

June 23, Velocity 2009
4:45 – 5:05pm Regency 2

What is Reflow?

- Everything on the page is really just a box.



What is Reflow?

- “Reflow is the process by which the geometry of the layout engine's formatting objects are computed.”

Chris Waterson, <http://www.mozilla.org/newlayout/doc/reflow.html>

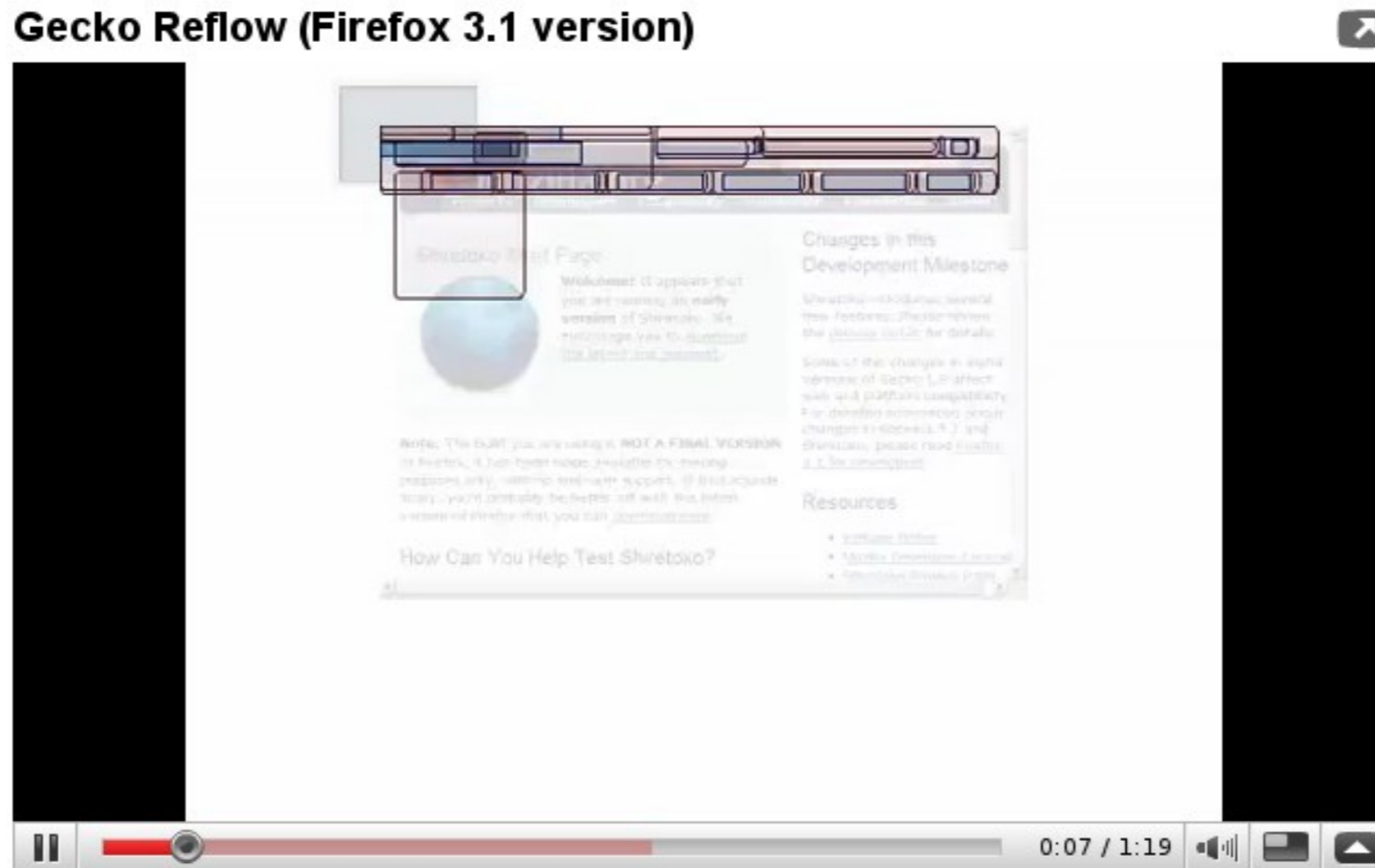
And that matters because?

- “Reflows are very expensive in terms of performance, and is one of the main causes of slow DOM scripts, especially on devices with low processing power, such as phones. In many cases, they are equivalent to laying out the entire page again.”

Mark 'Tarquin' Wilton-Jones <http://dev.opera.com/articles/view/efficient-javascript>

What is Reflow?

- CSS rule matching + position recalc + re-paint
- Satoshi Ueyama's tweaked-Firefox3.1 reflow video

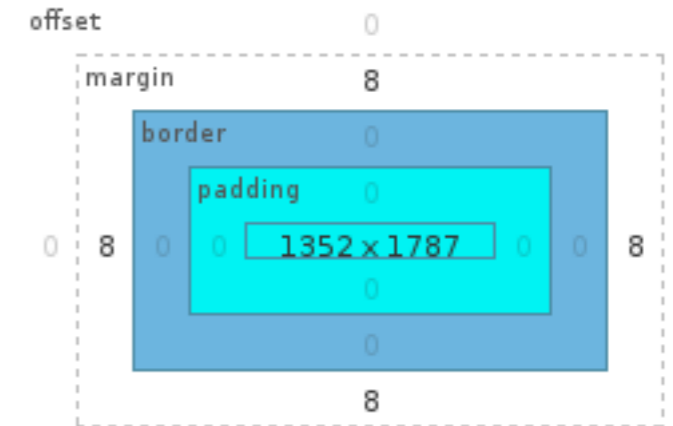


<http://www.youtube.com/watch?v=AKZZIj8I55I>

<http://blog.mozilla.com/gen/2009/04/09/how-to-make-your-own-gecko-reflow-video/>

What Can Cause a Reflow?

- Browser resizing
- Setting properties on `element.style`
display, padding, margin, font, position, top, left, etc..
- Changes to the live DOM tree
appendChild, innerHTML, etc..
- `element.offsetHeight` or `element.offsetWidth`

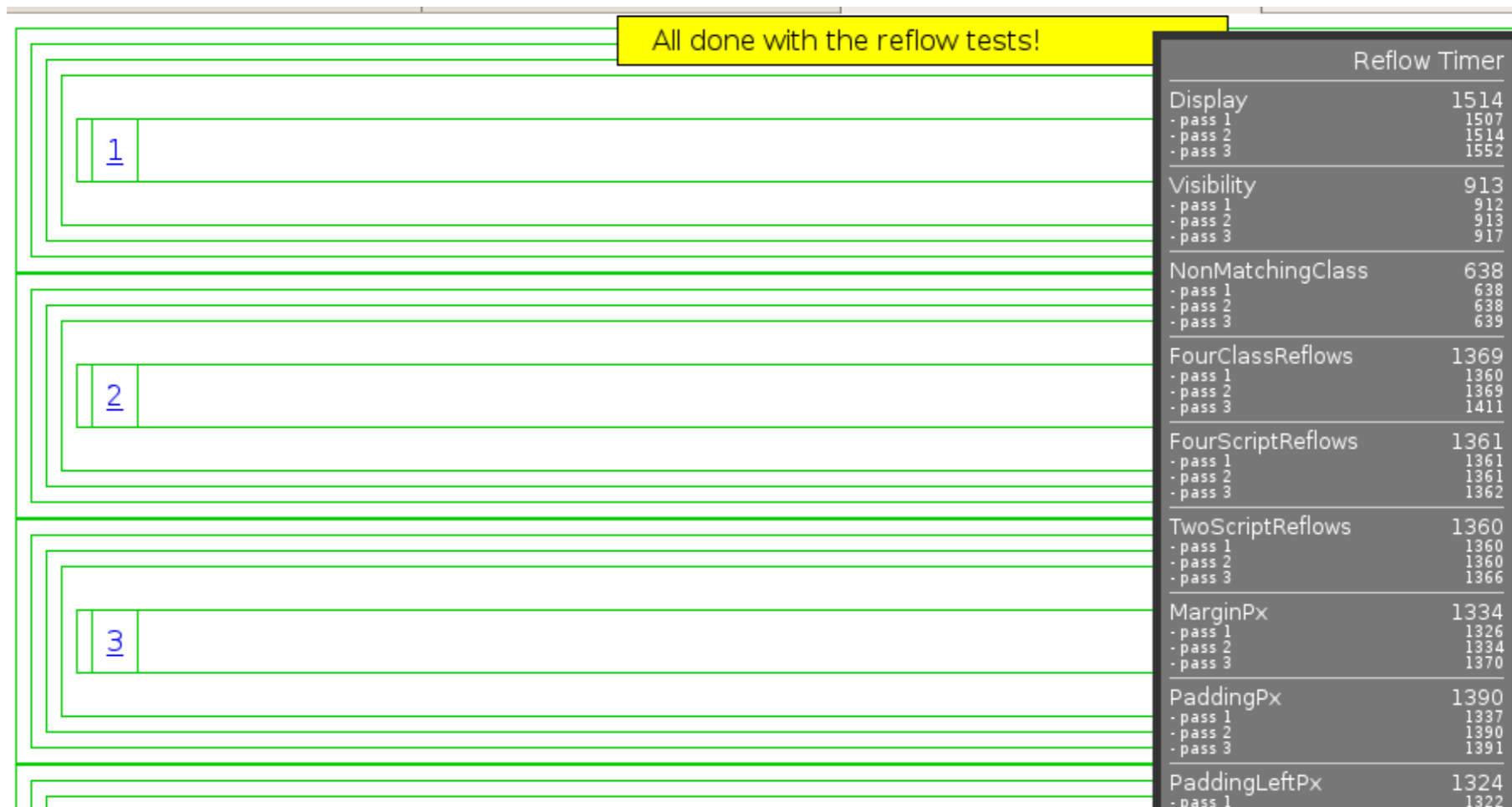


What Makes Reflows Slow?

- Number of elements
- Depth of the DOM tree
- Number of CSS rules (selector matching)
- CSS rule efficiency (selector matching)
- Type of change
 - display:block vs. visibility:hidden for instance
- Your (user's) browser choice ;)

BrowserScope for Testing

- 400 elements, 1000 CSS rules, 2-10 nesting, Different CSS specificities



How Slow?

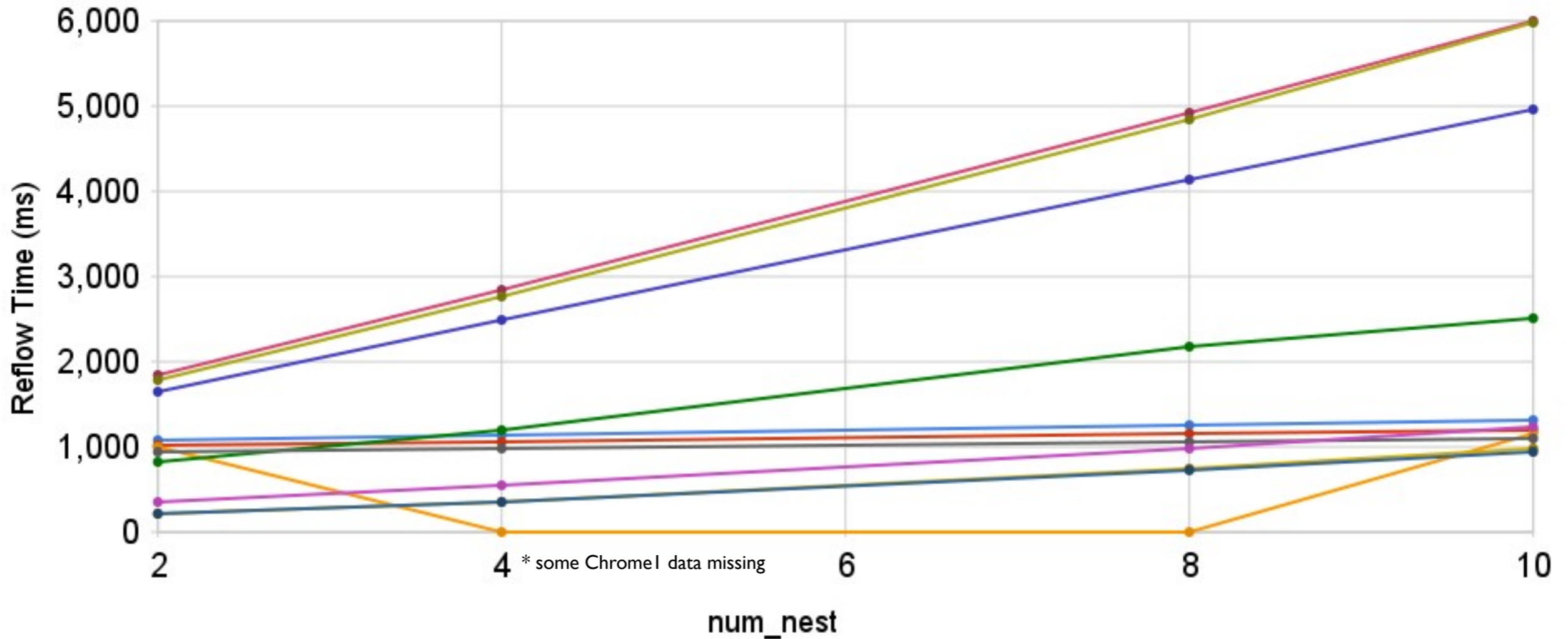
reflow time by browser

DHTML action	Chr1	Chr2	FF2	FF3	IE6,7	IE 8	Op	Saf3	Saf4
className	1x	1x	1x	1x	1x	1x	1x	1x	1x
display none	-	-	-	-	1x	-	-	-	-
display default	1x	1x	1x	2x	1x	1x	-	1x	1x
visibility hidden	1x	1x	1x	1x	1x	1x	-	1x	1x
visibility visible	1x	1x	1x	1x	1x	1x	-	1x	1x
padding	-	-	1x	2x	4x	4x	-	-	-
width length	-	-	1x	2x	1x	1x	-	1x	-
width percent	-	-	1x	2x	1x	1x	-	1x	-
width default	1x	-	1x	2x	1x	1x	-	1x	-
background	-	-	1x	1x	1x	-	-	-	-
font-size	1x	1x	1x	2x	1x	1x	-	1x	1x

reflow performance varies by browser and action
"1x" is 1-6 seconds depending on browser (1K rules)

How Slow?

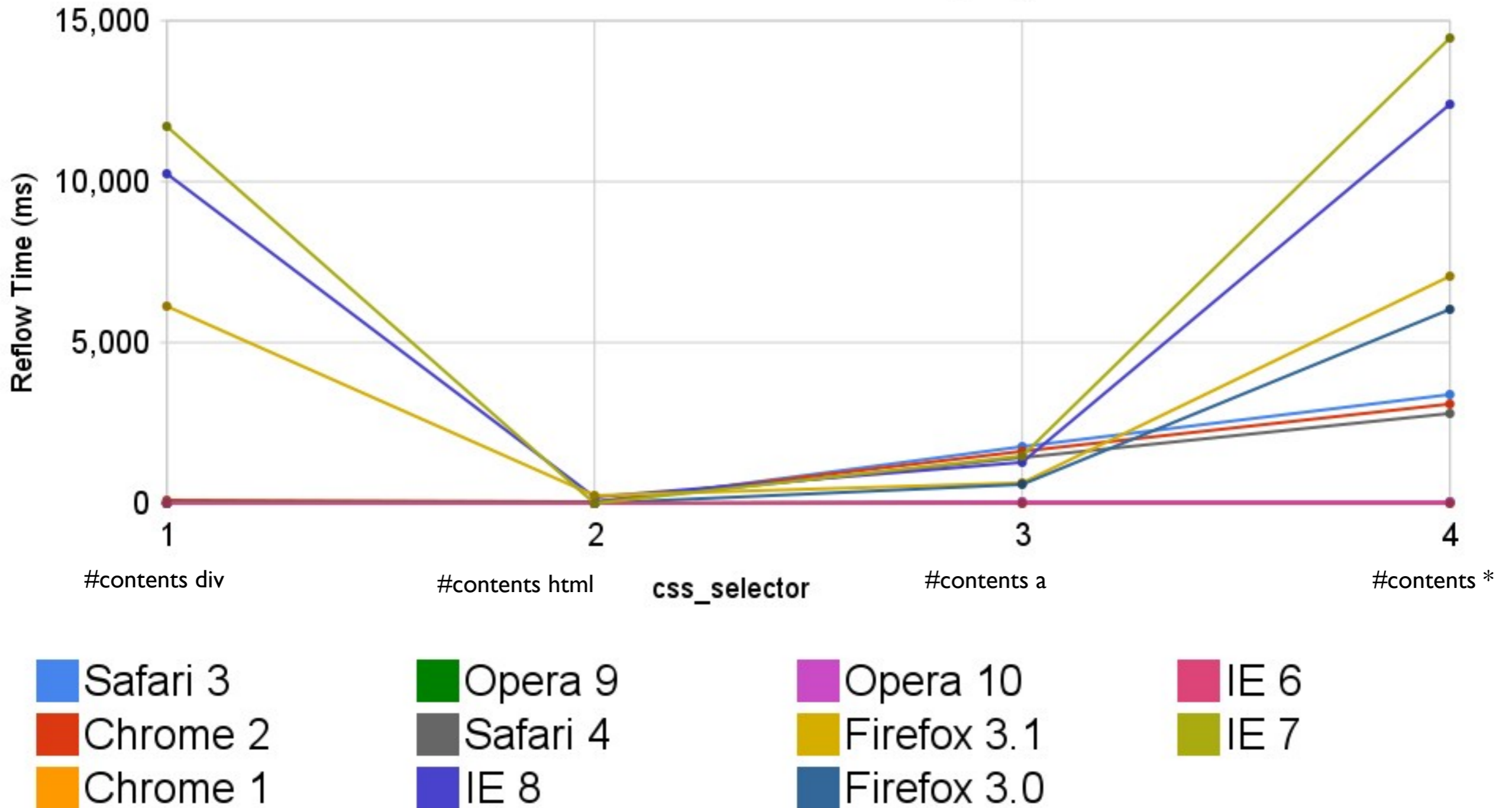
Reflow Timer: testNonMatchingClass



400 Elements, 1000 CSS Rules (#contents *)

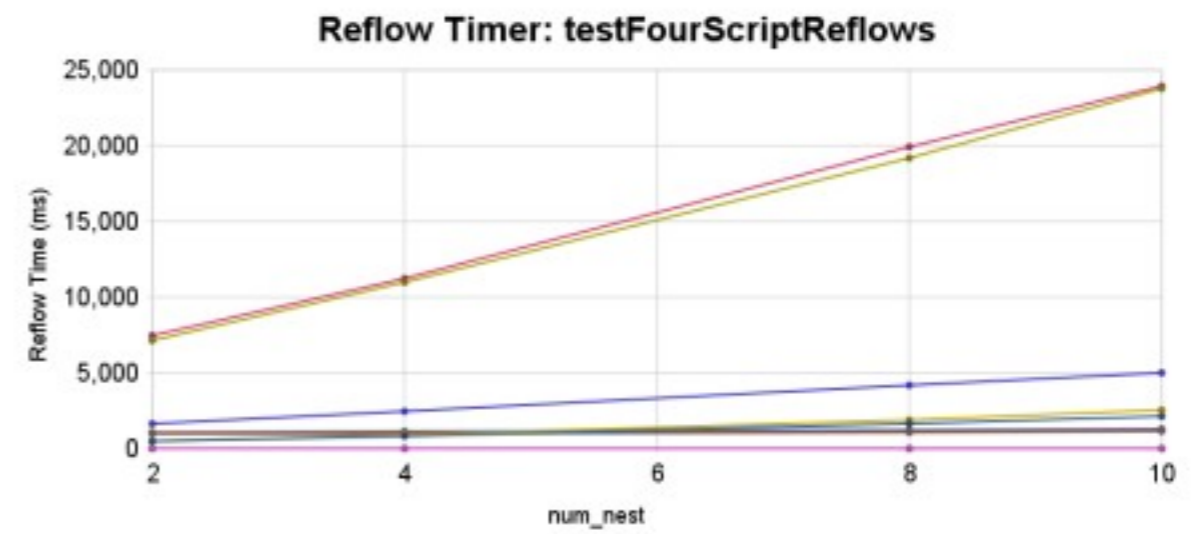
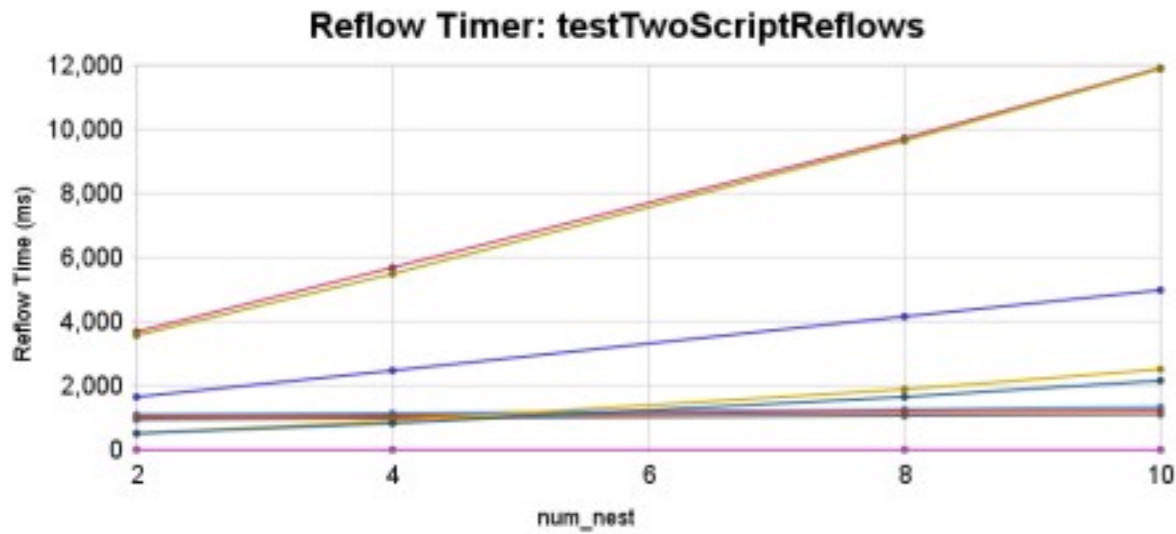
How Slow?

Reflow Timer: testDisplay



CSS Specificity Matters!

How Slow?



■ Safari 3
■ Chrome 2
■ Chrome 1

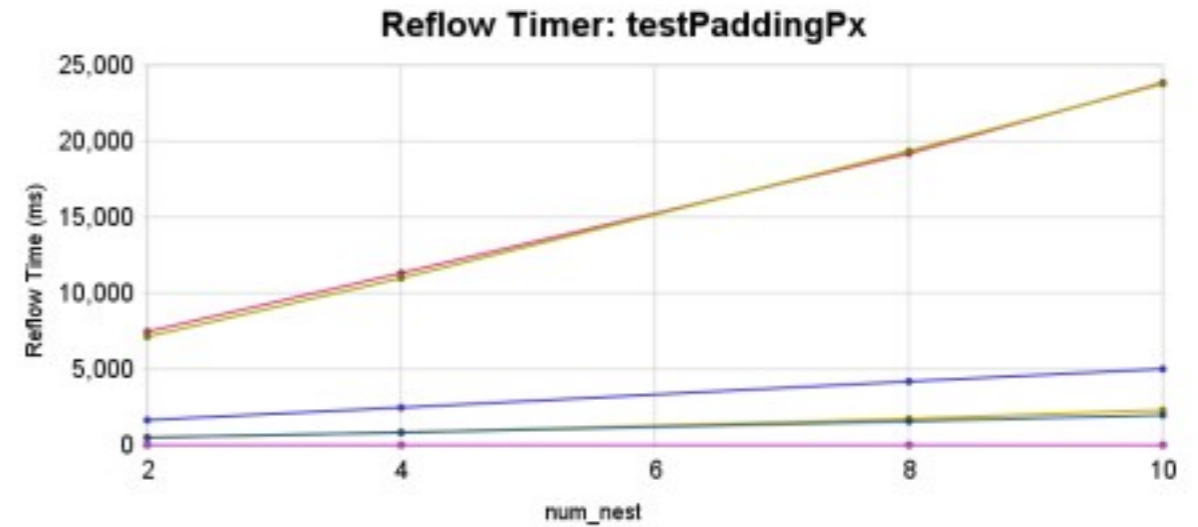
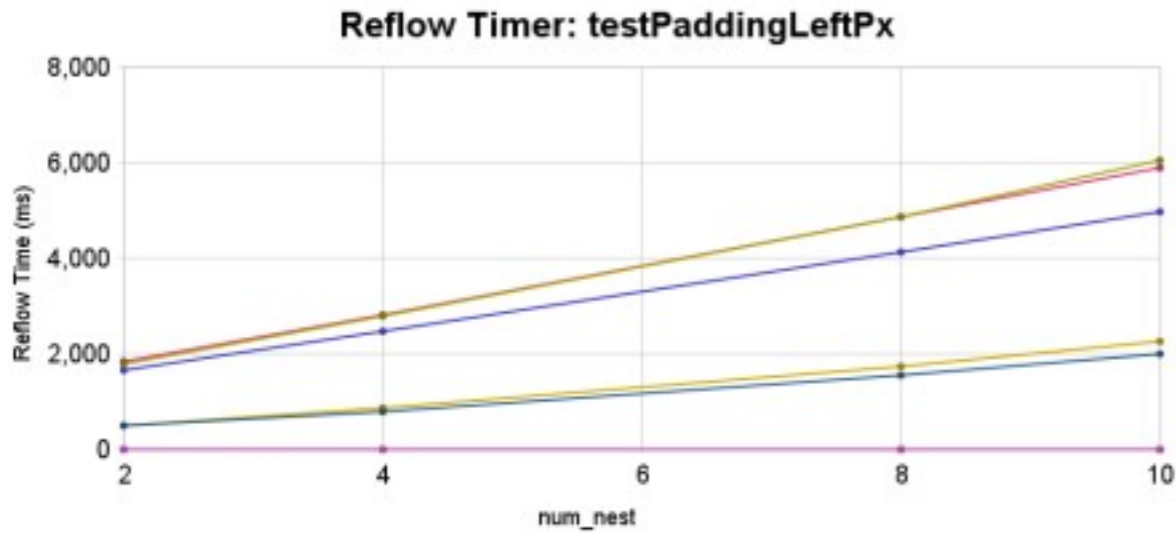
■ Opera 9
■ Safari 4
■ IE 8

■ Opera 10
■ Firefox 3.1
■ Firefox 3.0

■ IE 6
■ IE 7

2X Difference in Triton prior to IE8
Webkit is very flat = good

How Slow?



■ Safari 3
■ Chrome 2
■ Chrome 1

■ Opera 9
■ Safari 4
■ IE 8

■ Opera 10
■ Firefox 3.1
■ Firefox 3.0

■ IE 6
■ IE 7

Is the 4X time for the four sides of the box model in IE6,7?

BrowserScope

More To Come (soon)!

Speed Up Your Reflows

- Take heavy DOM or Style changes out of the flow
 - Do DOM building/manipulation in document fragments
 - Do DOM building/manipulation with `display:none`
 - Perform dynamic presentations (animations, dialogs, etc..) in containers that are `position:absolute, fixed` or otherwise out of the normal document flow
 - Change `element.className` instead of `element.style` and Avoid inline styles
(can prevent multiple procedural reflow if a browser does not do style-change queueing)
 - Trade Smoothness for Speed (the Opera motto)
 - e.g. A browser resize listener that resizes at the end of the resize vs. a listener that tries to reflow `onresize`