

Above the Fold Time:
Measuring Web Page Performance Visually
3/15/2011

Jake Brutlag

jakeb@google.com

Zoe Abrams

zoe@fb.com

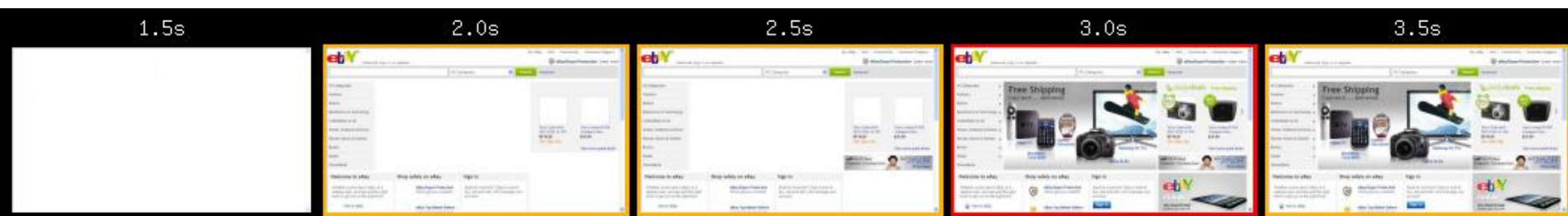
Pat Meenan

pmeen@google.com

When is the page rendered?

Q: How fast is your web page?

One answer: How long does it take the user to see all visible content?

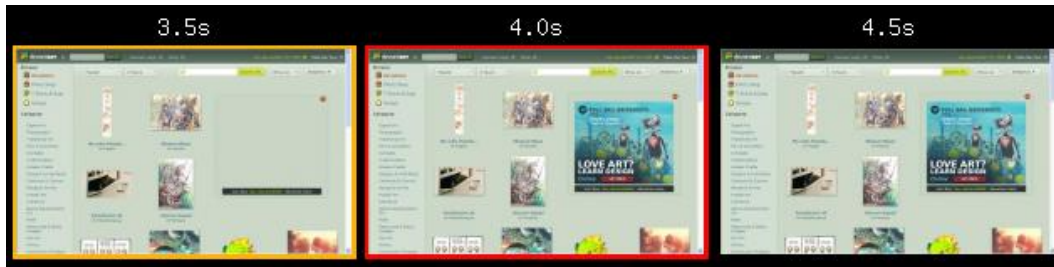


AFT

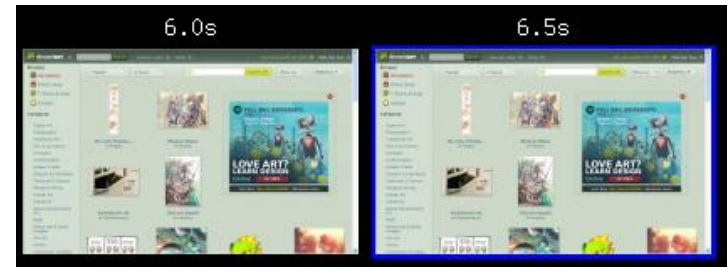
Above the Fold Time (AFT): Time when content that stops changing and is above-the-fold reaches its final state.

Browser events

Page load time (PLT): start of navigation until browser Onload event (IE DocumentComplete) for document
Can overestimate above-the-fold time

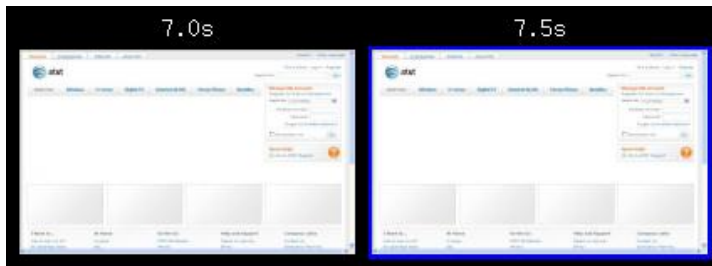


AFT



PLT

Can underestimate above-the-fold time

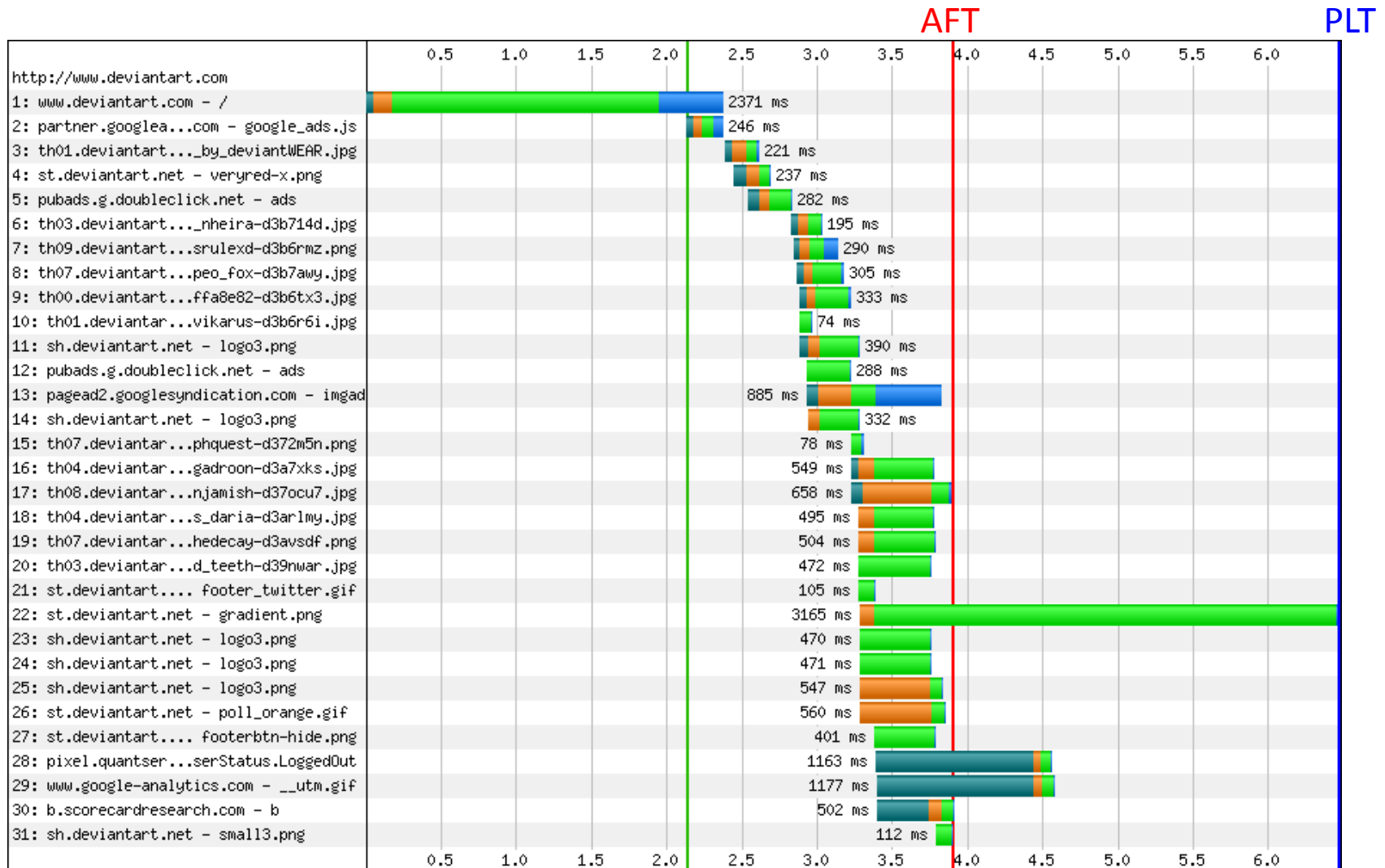


PLT



AFT

deviantart.com overestimate

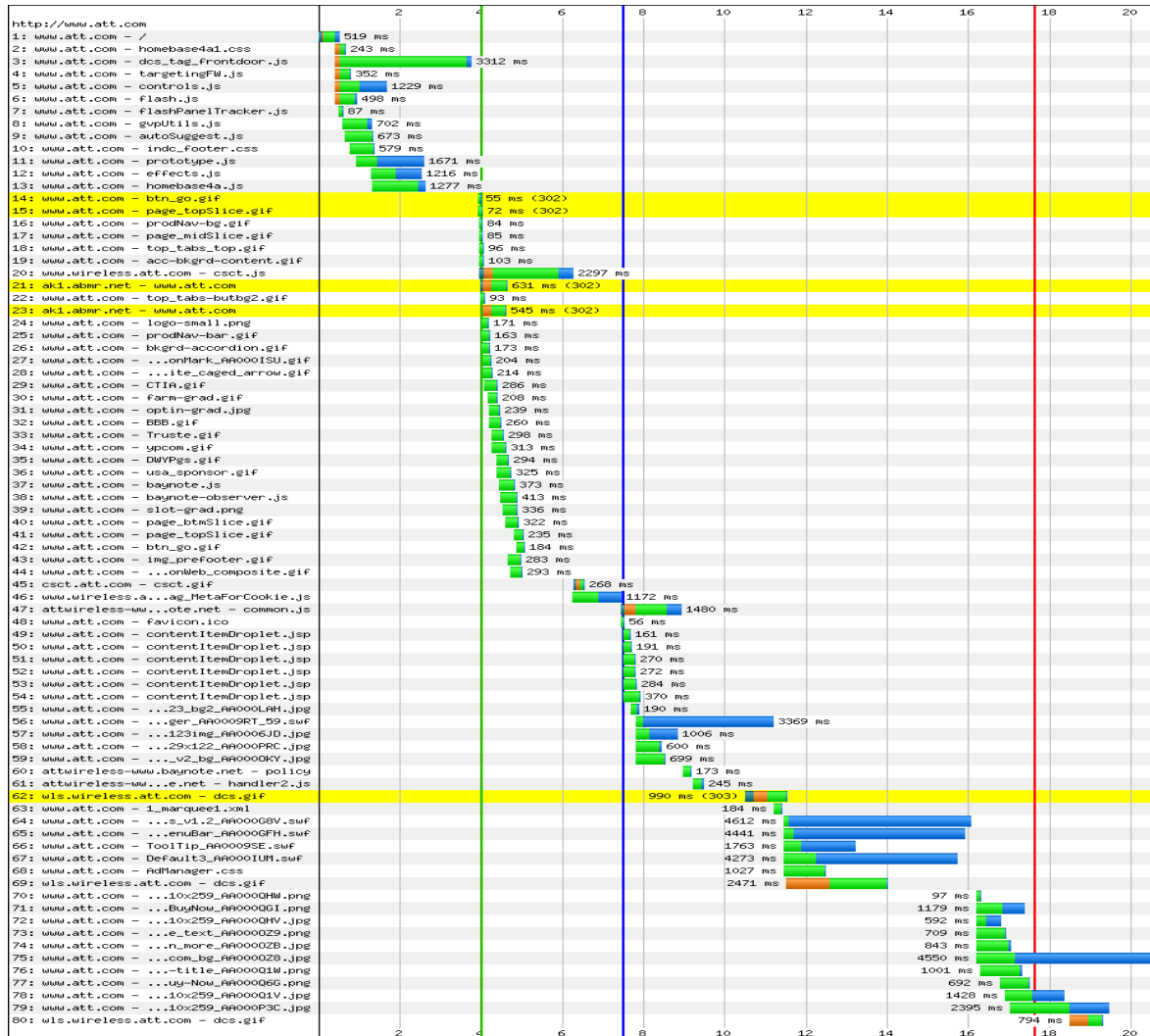


Below the fold (not visible) content pushes out Onload

att.com underestimate

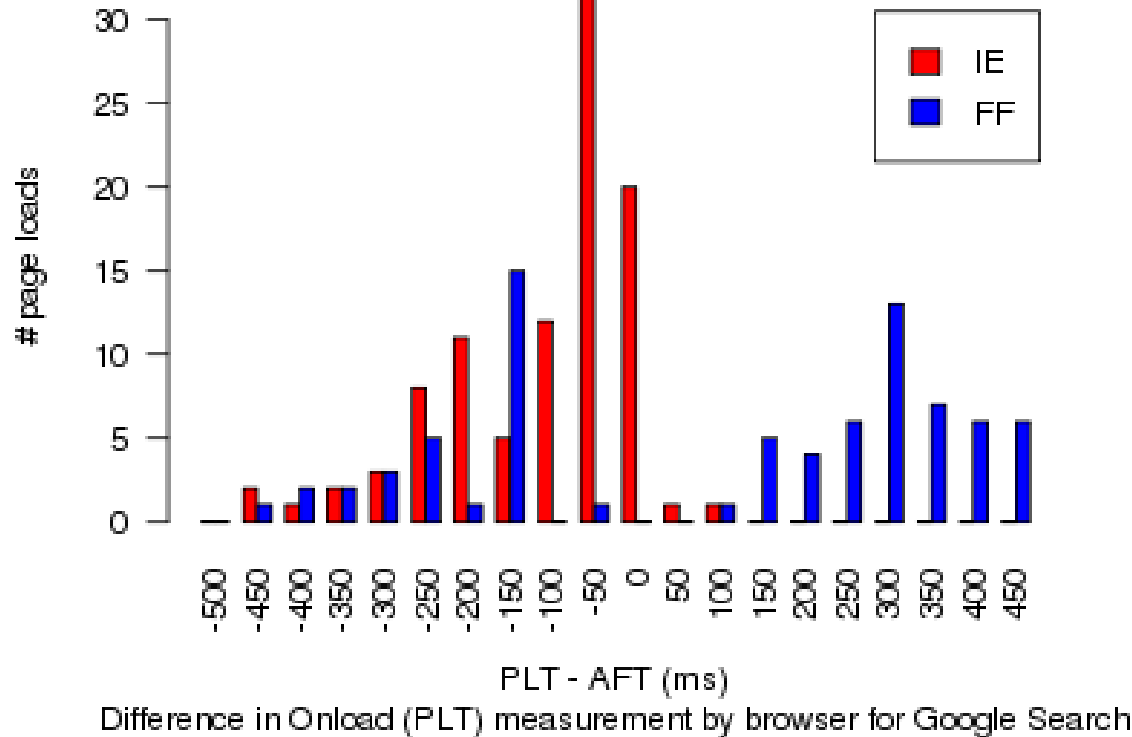
PLT

AFT



Above-the-fold
content loaded by
JS and Flash
occurs after
Onload

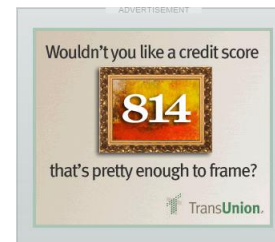
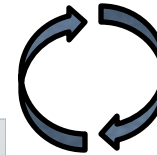
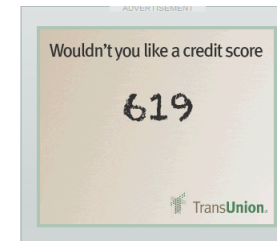
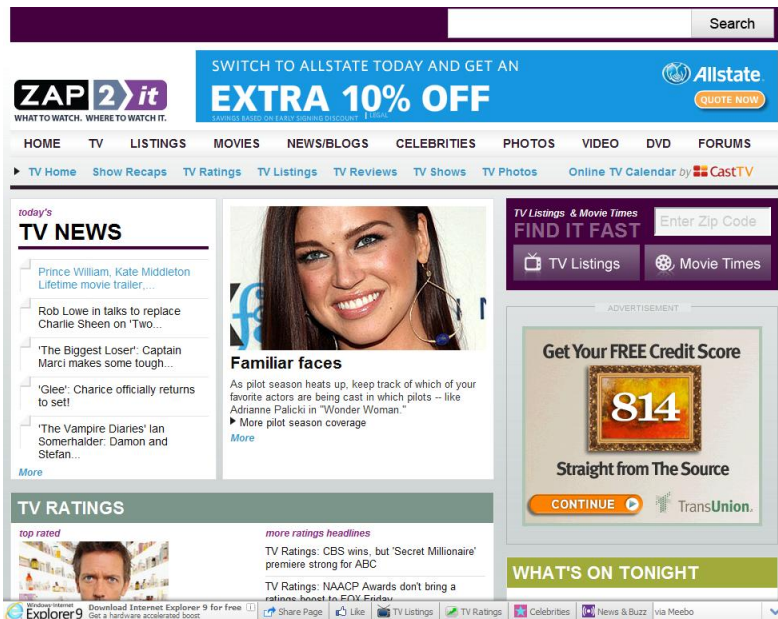
Browser events are not cross-browser



Difference is not primarily a rendering difference.
But JS blocking for Onload in FF, non-blocking for IE.

Estimating AFT (1)

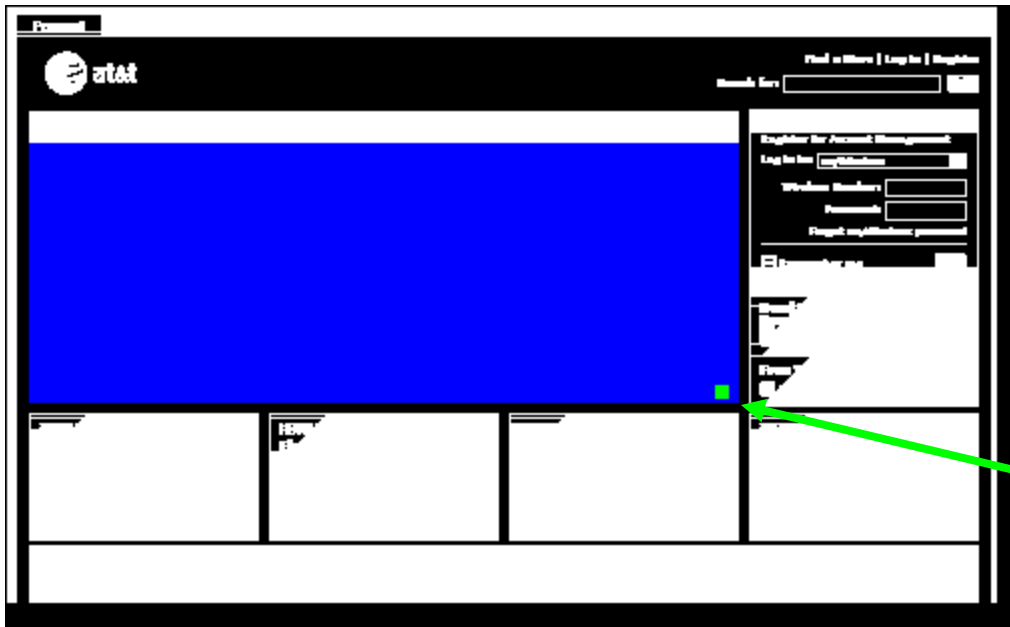
Naïve: AFT = time of the last pixel change above-the-fold



Challenge: Animation/video = pixels keep changing

Estimating AFT (2)

- Specify an upper bound, the AFT cutoff time, on the page load
 - Function of connection speed/quality, i.e. 45 s for DSL
- Classify pixels as static or dynamic
 - Static = pixels that change < 5 times and don't change after AFT cutoff
 - Dynamic = pixels that change ≥ 5 times and keep changing after AFT cutoff
 - Capture video for period $>$ AFT cutoff to identify dynamic pixels with confidence
- AFT = latest change of a static pixel before the AFT cutoff



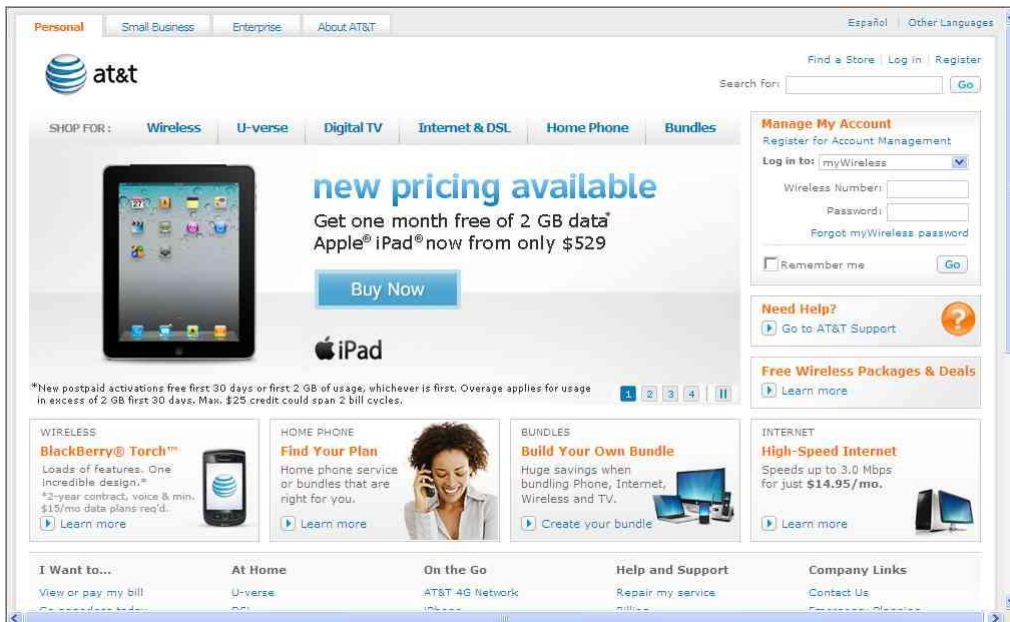
AFT for att.com

Black = unpainted pixels

White = static pixels

Blue = dynamic pixels

Green = last static pixels to change → AFT



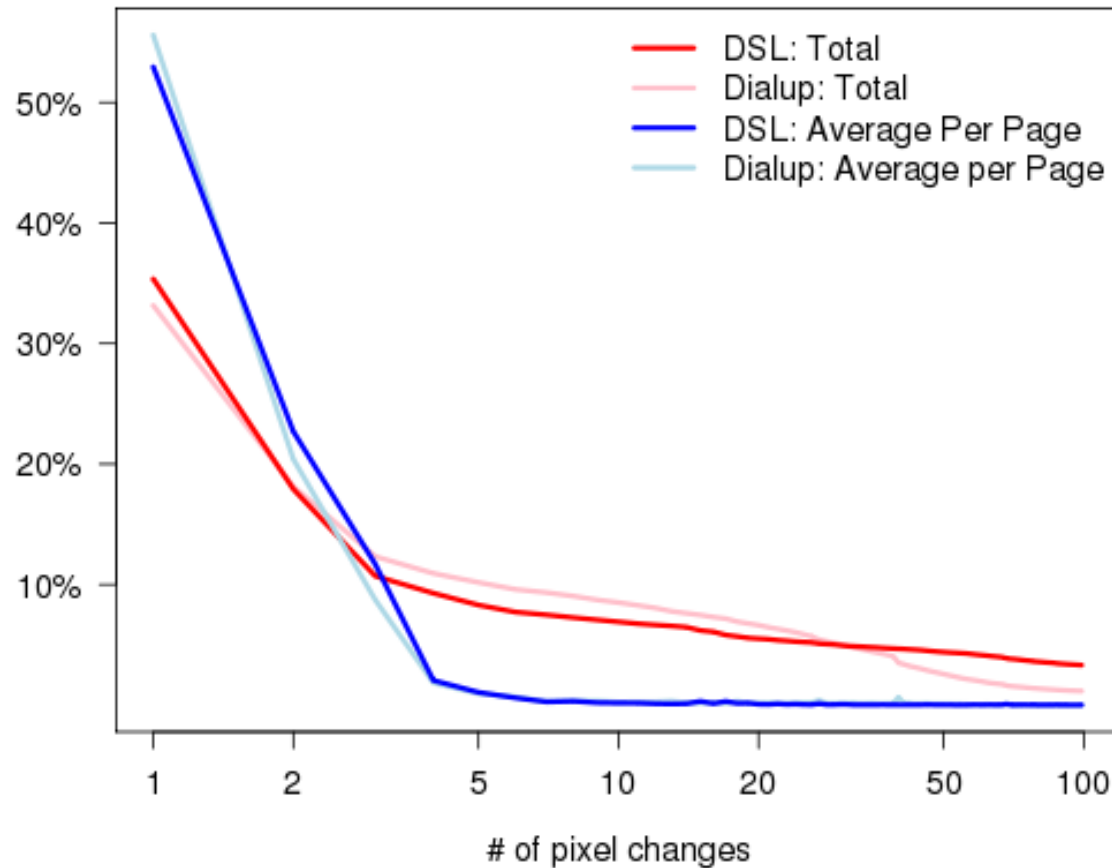
Rotating content panel = dynamic pixels

AFT is defined by the Pause button.

Button rendered once panel is initialized.

5 pixel change heuristic

Alexa Top 200 Home Pages,
% of Pixels Rendered by # of Pixel Changes



90% pixels rendered
in the Alexa Top 200
home pages change
fewer than 5 times.

Similar pattern for DSL
and Dialup, despite
more progressive
rendering on Dialup.

Test a website's performance

[Analytical Review](#)[Visual Comparison](#)[START TEST](#)

Test Location

[Change](#)

Browser

Advanced Settings ▼

Connection

Number of Tests to Run

Up to 10

Repeat View



First View and Repeat View



First View Only

Keep Test Private



Label

[Test Settings](#)[Auth](#)[Script](#)[Block](#)[Video](#)

Capture Video



Measure Above-the-fold rendering time (AFT)

(experimental - be patient, each run takes at least 4 minutes)

AFT Cutoff

Seconds

Ignore changes smaller than

Pixels

Video will appear in the
Screenshot page of your
results

Testing...

Url: <http://www.ebay.com>

From: Dulles, VA - IE8 - DSL

First View only

Waiting
to be
Tested

Testing

Results
Available

Test Started 1 minute ago

Your web page performance test has been submitted and is now being processed. This page will automatically update with the test status as the test continues to run and when the test is complete the final results will be available here.

You can either leave this page open in your browser until the test is complete or come back later and check on the status of the test (the browser does not need to remain open for testing to continue).



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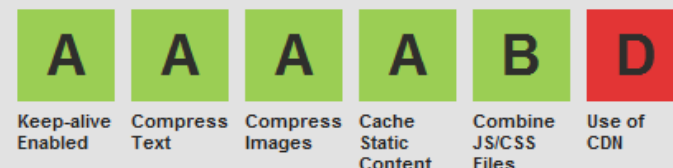
wait 4 minutes...

Page Speed Score: 90/100

[Need help improving?](#)

Web Page Performance Test for www.ebay.com

From: Dulles, VA - IE8 - DSL



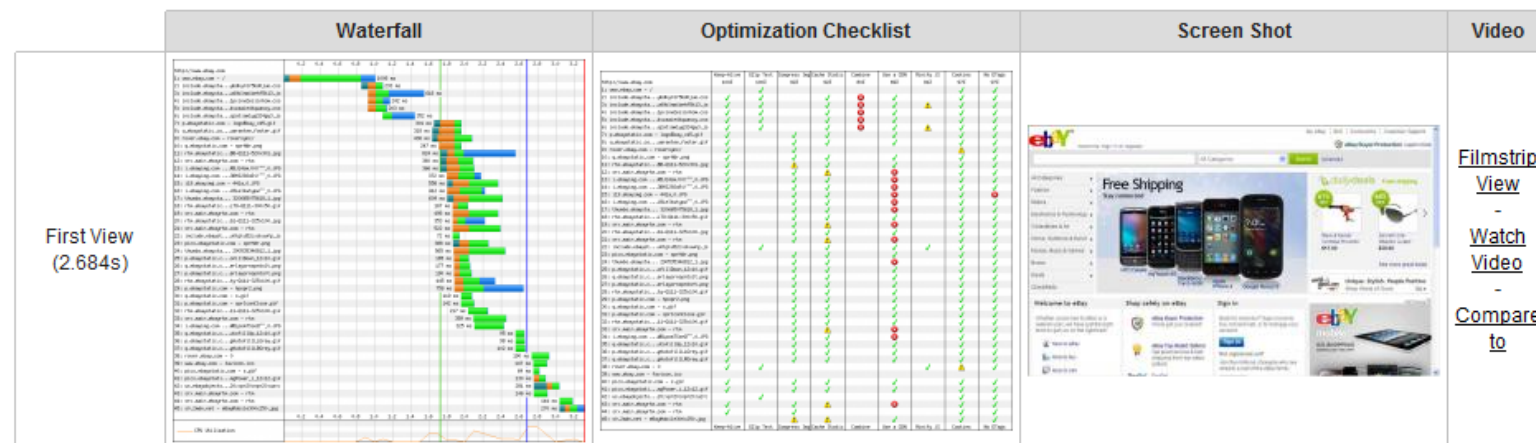
First View only

[Raw page data](#) - [Raw object data](#)

[Re-run the test](#)

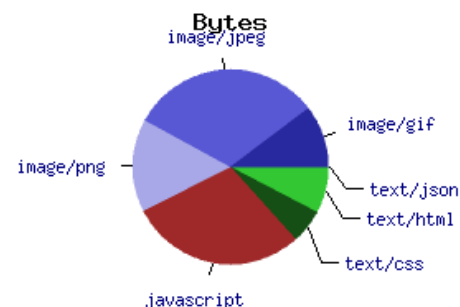
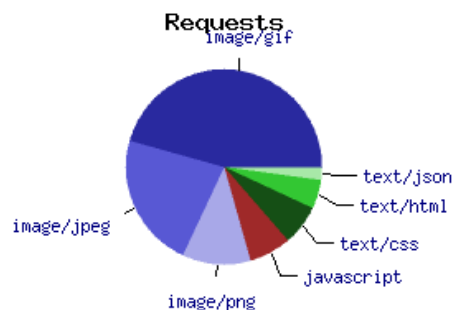
[Export HTTP Archive \(.har\)](#)

	Load Time	First Byte	Start Render	Above the Fold	Document Complete			Fully Loaded		
					Time	Requests	Bytes In	Time	Requests	Bytes In
First View	2.684s	0.849s	1.724s	3.3s	2.684s	37	237 KB	3.316s	44	261 KB

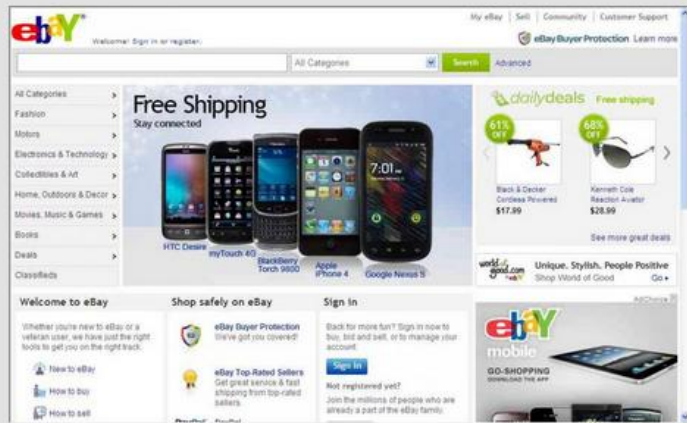


First View
(2.684s)

Content
Breakdown



Fully Loaded (3.316 sec)



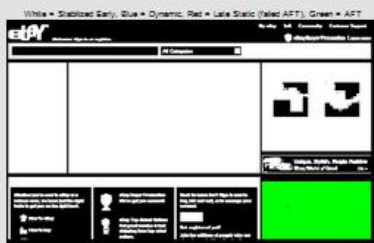
Start Render (1.724 sec)



Document Complete (2.684 sec)



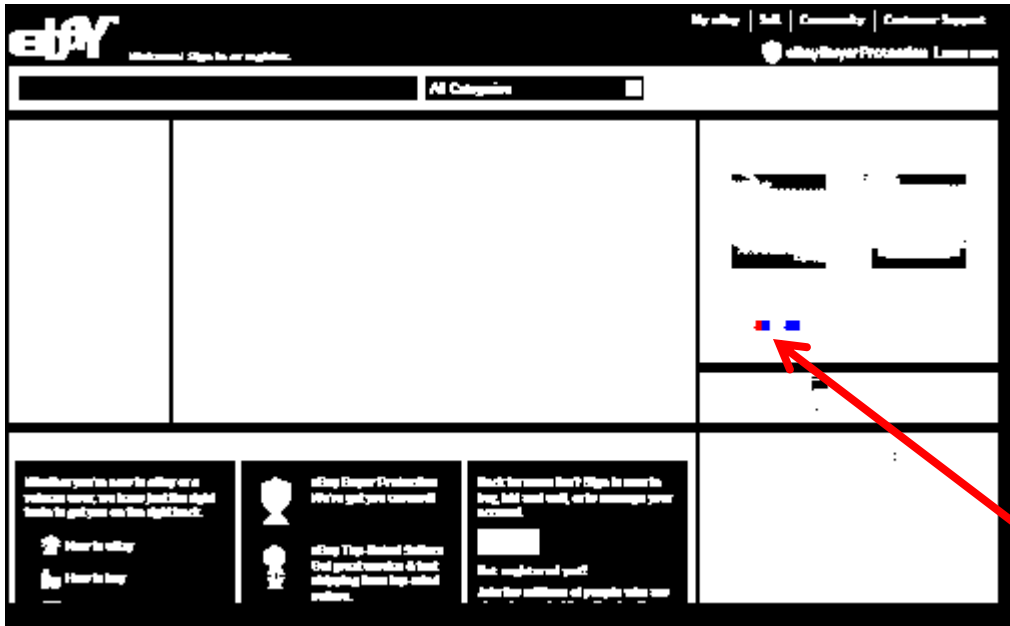
AFT Details (3.316 sec)



Key Screen Shots.

In this example, OnLoad (DocumentComplete) does not include lower right panel.

AFT often agrees with Onload/DocumentComplete or Fully Loaded (= all resources fetched).



ebay.com example
not ignoring small
changes

Black = unpainted pixels

White = static pixels

Blue = dynamic pixels

Red = Pixels that change

< 5 times with last
change after the AFT
cutoff → AFT is N/A.



Page has “daily deal”
timer: 11h 41m 46s

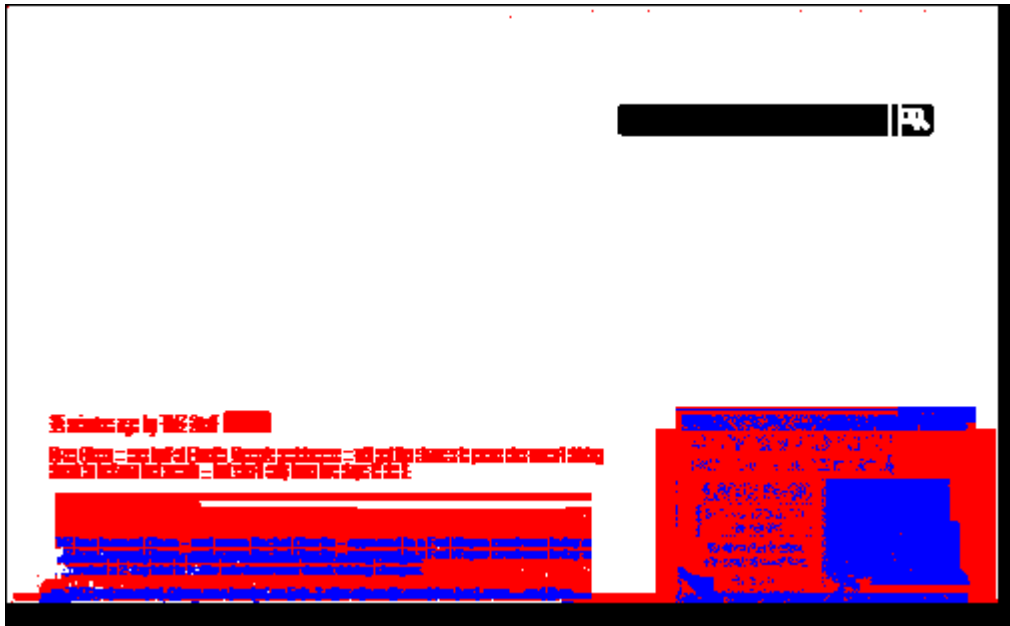
Minutes are updated
after AFT cutoff.

Wrap up

- Applications of AFT
 - Visual measure of page performance
 - Cross-browser metric
 - Validation of other metrics (i.e. JS metrics)
- Limitations of AFT
 - Only applicable to lab setting
 - Does not reflect user perceived latency based on functionality
- AFT heuristics always need further iteration
 - <http://www.webpagetest.org/forums/>

Ambiguous Cases for Estimating AFT

- One time animation: pixels that change ≥ 5 times but don't change after the AFT cutoff.
 - Should one time animation be included in AFT?
 - Current algorithm: No.
- Pixels that change < 5 times with last change after the AFT cutoff.
 - Perhaps AFT cutoff needs to be extended
 - tmz.com example
- AFT may be decided by small (perhaps not user visible) changes.
 - Previous ebay.com example



tmz.com example
DSL, AFT Cutoff=25 s

Red = Pixels that change
< 5 times with last
change after the AFT
cutoff → AFT is N/A.

Cause:

Like button forces frame
flow re-render (pushes
content down) at 40 s.

Solution:

Increase AFT cutoff from
25 s to 45 s to include
this re-render in AFT.

