Google

# Above the Fold Time: A Graphical Approach to a Browser Independent Latency Metric

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http://www.webperformancecentral.com/wiki/Main_Page

# Motivation

Google

**Compare latency of different:**

- webpages
- browsers

# New latency measure needed

Google

## What should latency measure?

# What is the latency of this page?

Google

## Watch video of www.verawang.com loading in IE8

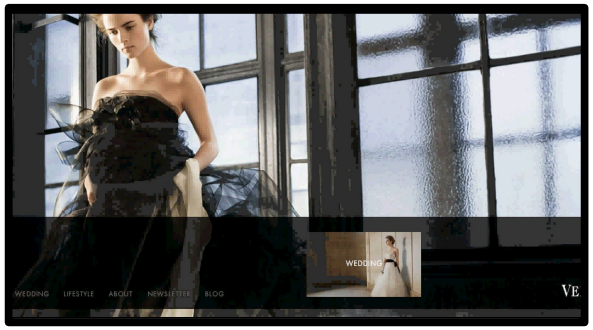
# What is the latency of this page?

(0)

(6)

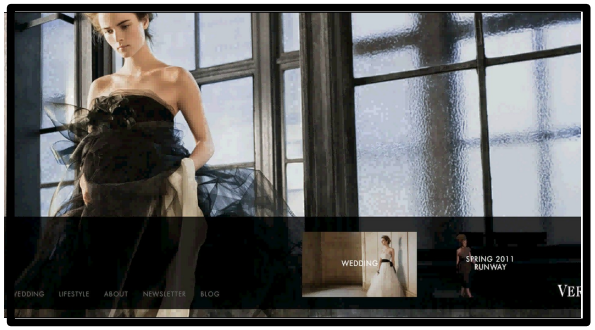
name brand flashed


(7)



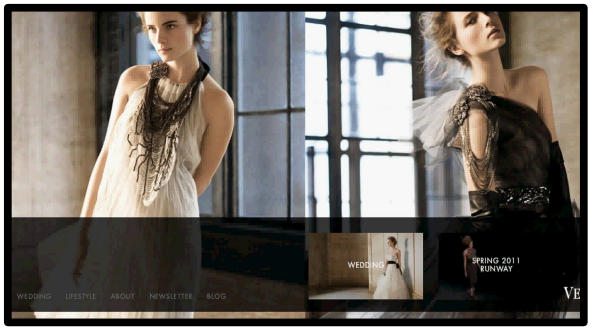

(11)

bottom right video appears




(15)

bottom right video starts




(20)

# Latency: people disagree

Google

Latency should measure how fast:

- functionality becomes available
- content is rendered
- the site “feels”

Latency is subjective

- depends on the particular user
- users perceive and use sites differently

# Summary so far

Google

**People disagree.**

**What about browser events?**

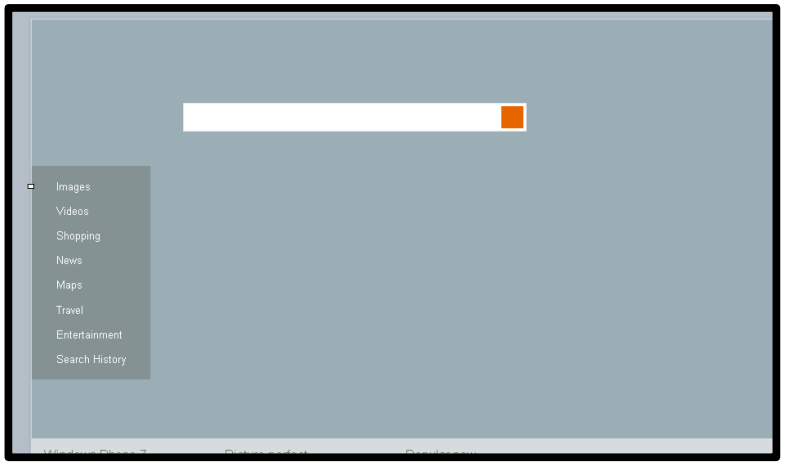
# Latency: browsers disagree

Google

## Screens differ at same browser event

- load www.bing.com in FF and IE

**Onload Event in Firefox**




**Onload Event in IE**

## Event triggers differ between browsers

- IE *does not* wait for extern JS in websearch results page
- Firefox and Chrome *do* wait for extern JS

# Summary so far

Google

People disagree.

Browsers disagree.

Agreement is essential for comparison.

Latency metric:
- agrees with itself (selects comparable images)
- directly corresponds to our users' experiences

# Above the fold time (AFT) latency metric

Google

**AFT: Time when content that stops changing and is above-the-fold reaches its final state.**

**AFT selects comparable images**
- **content in final state is equivalent**
- **regardless of progressive rendering**
- **regardless of os, network, or browser variability**

# AFT in Vera Wang example

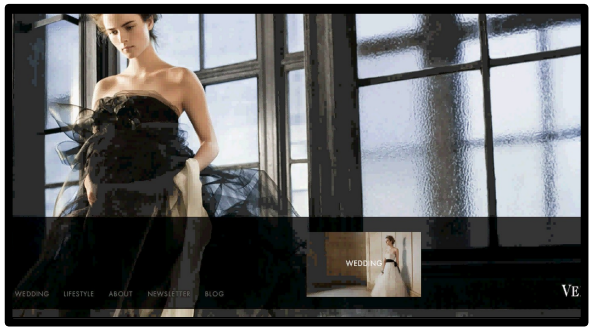
## White text on bottom right video is latest content that doesn't change after it appears

(0)

(6)

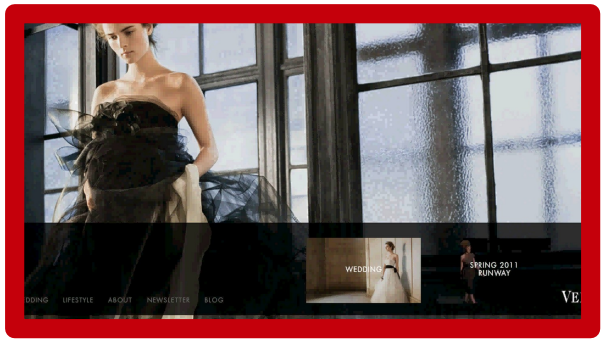
name brand flashed


(7)




(11)

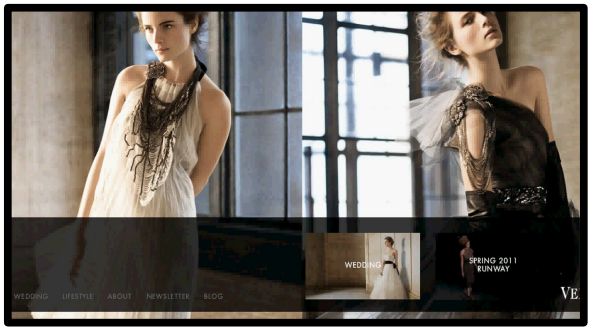
bottom right video appears




(15)

AFT

bottom right video starts




(20)

# Paradigm shift: coder → user perspective

Google

**Coder perspective: measure point in sequence of code execution**

**User perpective: measure point in sequence of graphical changes on the screen**

**AFT directly correspond to our users' experiences**

# Summary

Google

**People disagree.**

**Browsers disagree.**

**AFT agrees (selects comparable images).**
**AFT corresponds directly to users' experiences.**

# AFT challenges

Google

**AFT: Time when content that stops changing and is above-the-fold reaches its final state.**

**Distinguish**

- **continuous animation** ×
- **finite animation** ✓
- **progressive rendering** ✓
- **frame flow** ✓

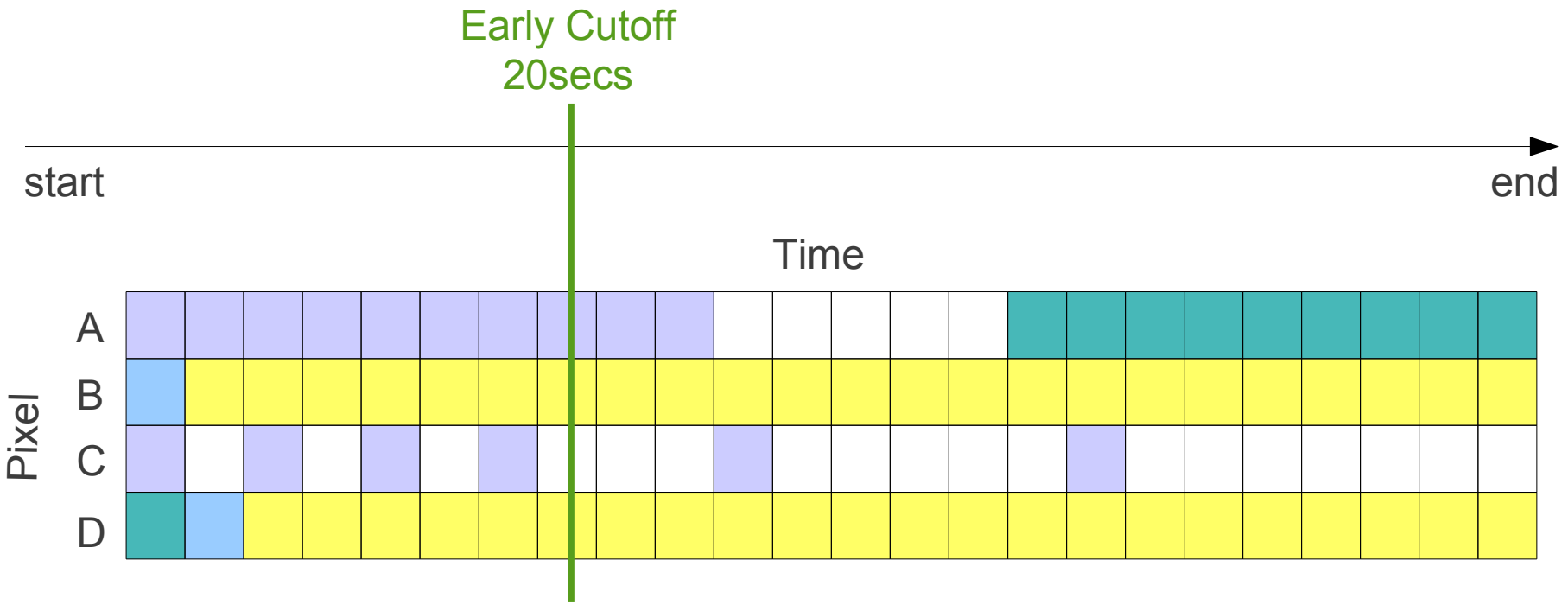
# Continuous animation changes late in load

Google

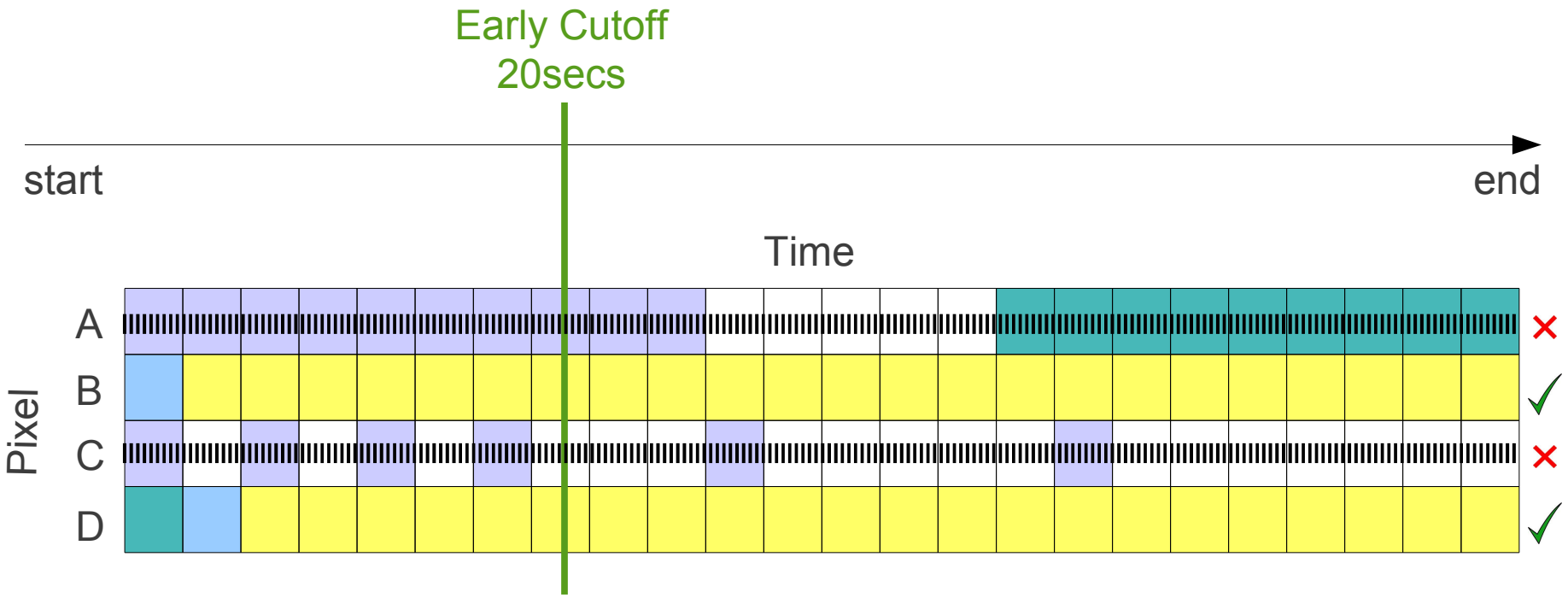
## Early Cutoff

- upper bound after which the page is surely loaded
- content that changes after early cutoff is 'continuous'

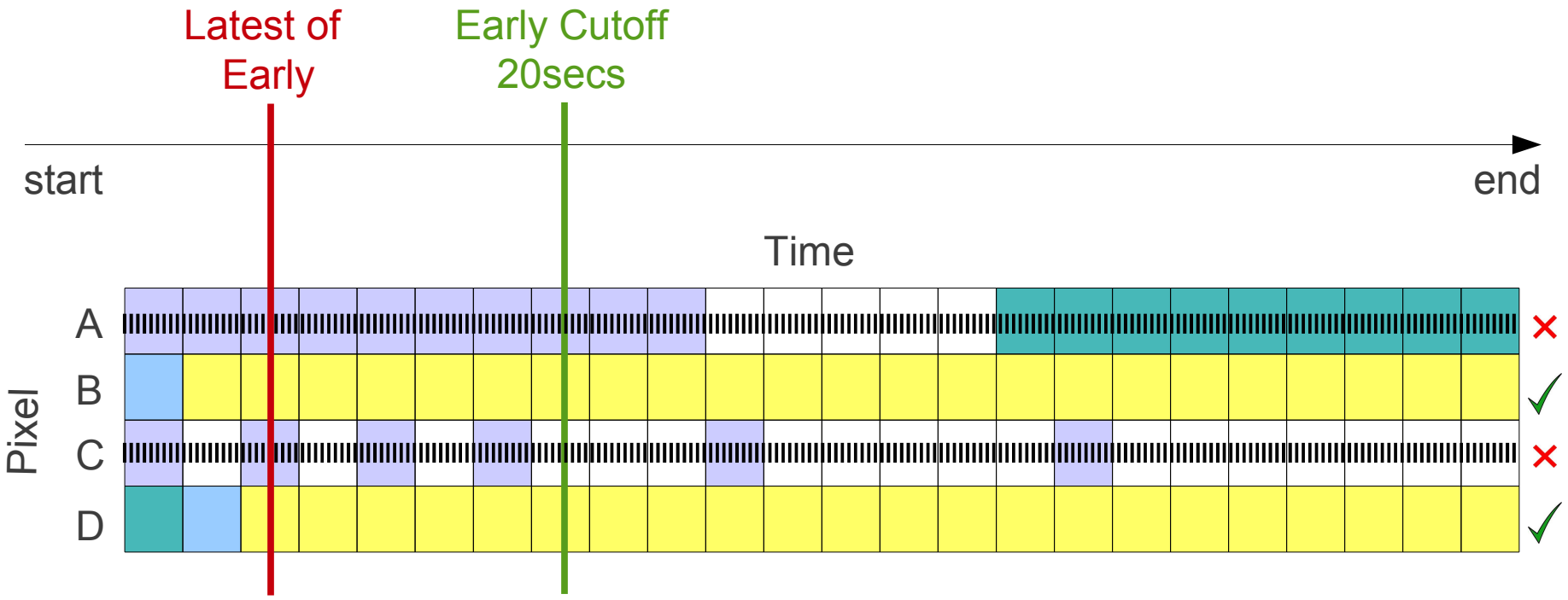
# Latest of Early example



# Latest of Early example



# Latest of Early example



# Latest of Early: low confidence results

Google

**Animation ending before early cutoff**
- www.verawang.com
- www.bing.com (flashing squares)
- www.newyorktimes.com (watch page load video)
- ad that animates 10s then stops

**New content or animation after early cutoff**
- www.figaro.fr (watch page load video)
- youtube watch page (watch page load video)

**Automated tag of 'low confidence' results**

# Change frequency determines confidence

Google

**Low confidence if**

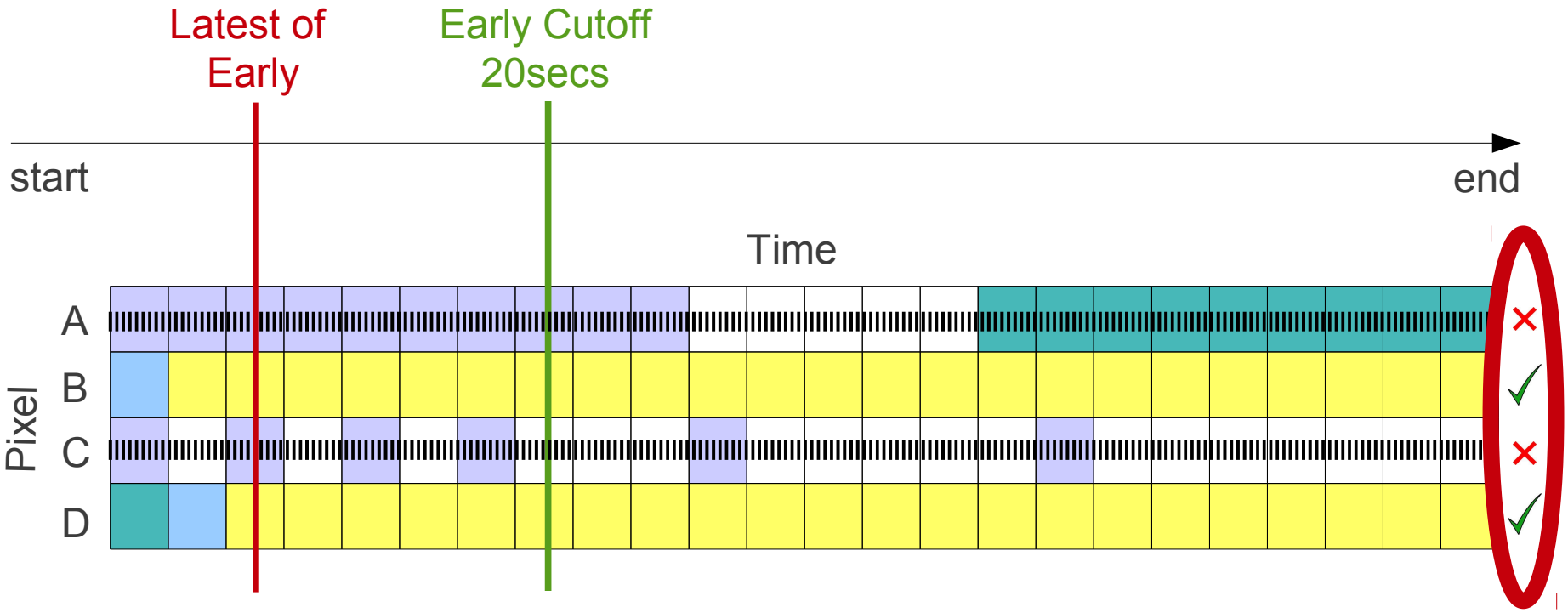
- **pixels change frequently, then stop early in load**
- **pixels change seldom, then change late in load**

**Pixels that change frequently ↔ change >5 times**

# Latest of Seldom Changed example

Google

## Change late in load that is not animation (like www.figaro.fr example)



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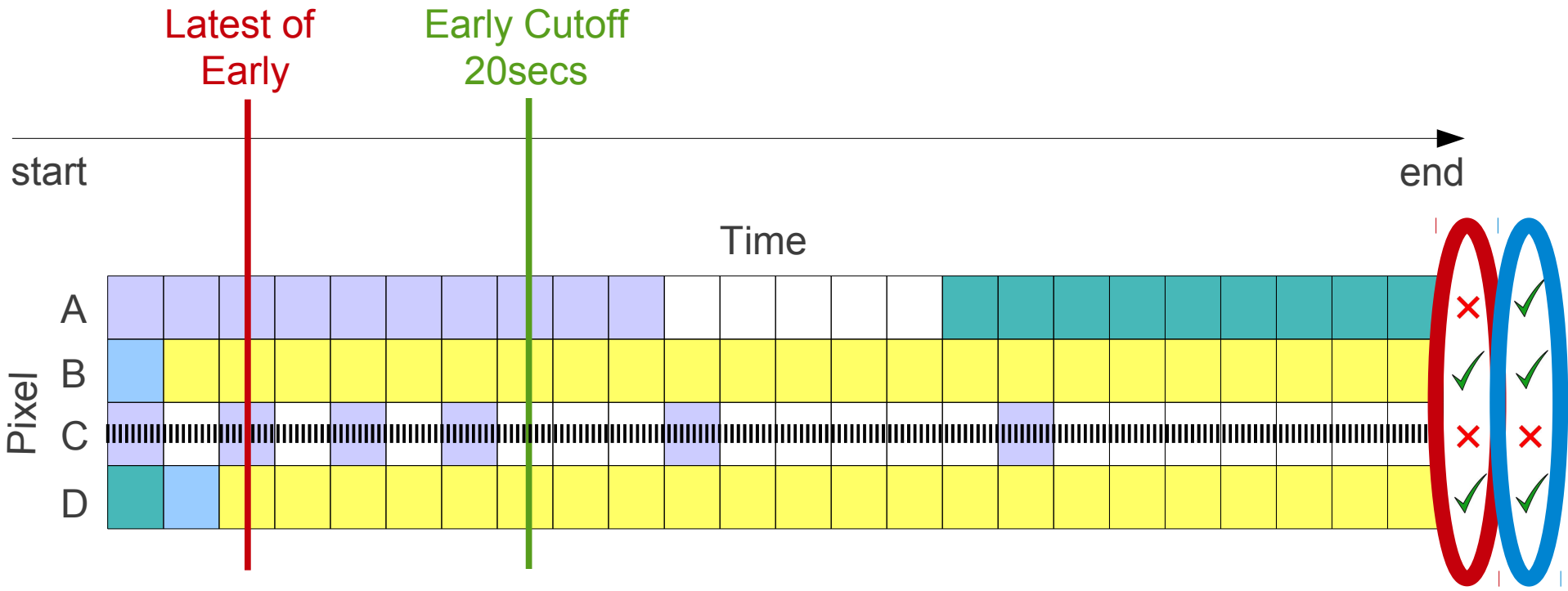

# Latest of Seldom Changed example

Google

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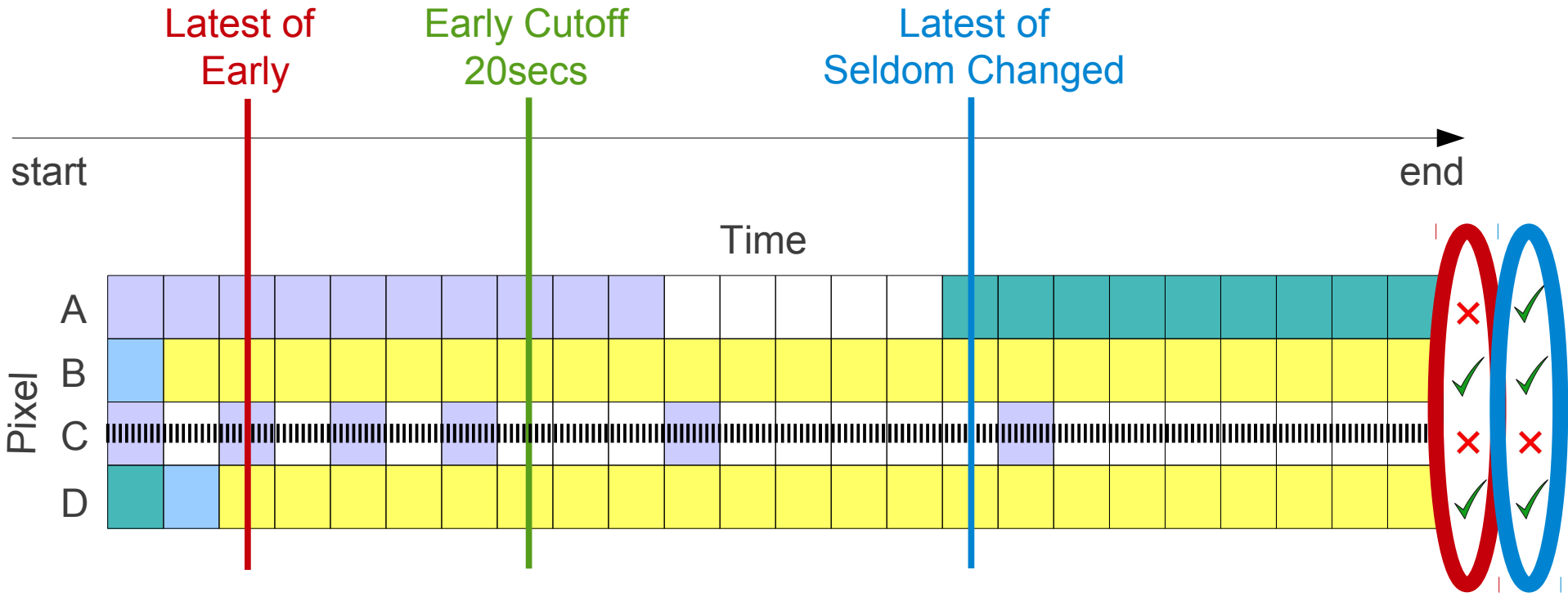



## Low confidence result

# Latest of Seldom Changed example

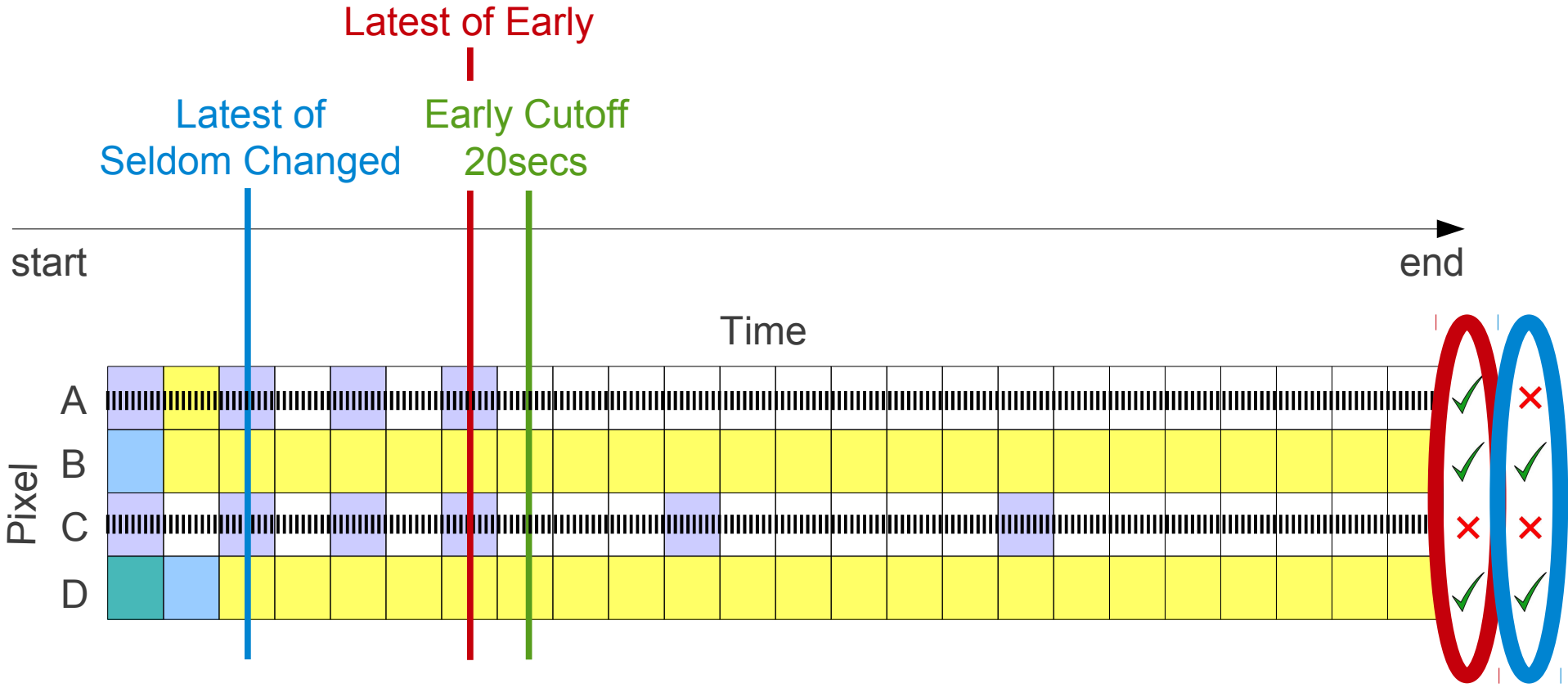
Google

**Continuous animation that ends early**
**(like www.newyorktimes.com example)**

# Latest of Seldom Changed example

Google

## Continuous animation that ends early (like www.newyorktimes.com example)

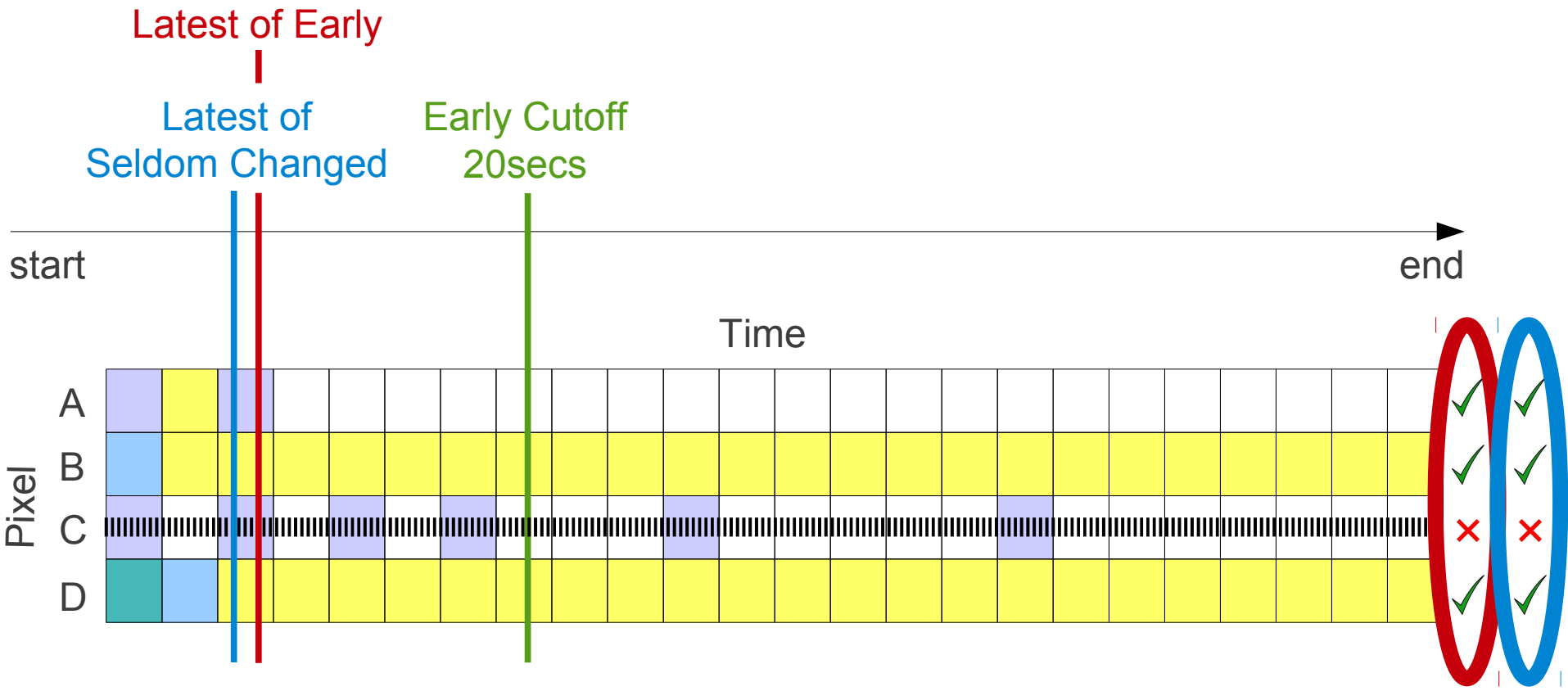



## Low confidence result

# Latest of Seldom Changed example

Google

## Limited animation that ends early (like www.verawang.com example)




## High confidence result

# Determining animation cutoff

Google

**How many changes before a pixel ignored?**

**5 changes recommended:**

**- 100% sites with no animation have ≤ 5 changes**
**(for 20 manually selected from Alexa top 100)**
**- 85% high confidence**
**(for 40 randomly selected from Alexa top 100)**

# AFT Algorithm summary

Google

**High confidence results on 85% of popular urls**

**High confidence results are comparable**

**Satifies two motivating use cases:**
- **comparing most webpages**
- **comparing browsers**

# End