

facebook

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facebook

Ajaxifying, Caching and Pipelining Facebook Website

Changhao
Jiang

The Velocity Conference
Dec 7th, 2010, Beijing, China

The beginning - 2004



[thefacebook]
home search global social net invite faq logout

Brian Moore's Profile Puget Sound

quick search

- My Profile [edit]
- My Friends
- My Groups
- My Parties
- My Messages
- My Account
- My Privacy

Summer Jewish Adventure
Newark City

Picture

[Send Brian a Message](#)
[Poke Him!](#)

Information

Account Info:
Name: Brian Moore
Member Since: May 21, 2005
Last Update: July 19, 2005

Basic Info:
School: Puget Sound '09
Status: Student
Sex: Male
Residence: Todd 311
Birthday: 09/02/1986
Home Town: Shorewood, WI 53211
High School: Shorewood Hi '05

Contact Info:
Email: bmoore@ups.edu

Connection
You are in a relationship with Brian.

Today

The image shows a screenshot of a Facebook news feed. The top navigation bar includes the Facebook logo, a search bar, and links for Home, Profile, and Account. The user's profile, Changhao Jiang, is visible on the left. The main feed shows a post by Steven Grimm about Git configuration, followed by a post by Yongyan Liú about snowboarding. The right sidebar contains sections for Events, Sponsored ads (including a 'Facebook is hiring' ad), and Questions.

facebook Search Home Profile Account

Changhao Jiang
Edit My Profile

News Feed Messages 1 Events 2 Friends 63

国语黑帮 (mandarin s...
Facebook
Happy Parents
Groups Team
非死不可
More -

Application Requests 11
Game Requests 11
Photos
More -

Friends on Chat

News Feed Top News · Most Recent

Share: Status Question Photo Link Video

Steven Grimm · e
I'm fiddling with the configuration of `/data/git/tfb` on shared dev servers and `/home/engshare/git/tfb` today, both to get rid of their connection to my personal account (about bloody time!) and to hopefully make `/home/engshare/git/tfb` less susceptible to the random corruption issues we've seen in the past.

Follow along on task #266767 if you care about the details. If you are simply a consumer of one of those directories you shouldn't notice any difference. Drop me a note if you see something screwy.

3 hours ago · Like · Comment · Subscribe

Elliot Lynde likes this.

Girish Patangay Thanks for letting us know. I'll give the merge tool a try (which uses the repo in data) later when I get online.
about an hour ago · Like

Write a comment...

Yongyan Liú
Go snowboard! Tried double diamond unintentionally this afternoon...
18 hours ago via iPhone · Like · Comment · Share

Zheng Shao, Peng Luo and 2 others like this.

View all 9 comments

Dong Guo go together next time!
7 hours ago · Like

Yongyan Liú @Abhi, we went to heavenly yesterday. I was trying to went back to California lodge following round-a-bout, a blue one. It takes me too long until it's completely dark. The only way down with light near me is the last part of east bowl, which is a

Events See All

What are you planning?

Bobby and Ann's Housewarming ×
Sunday, December 5 at 2:00pm
RSVP: Yes · No · Maybe

"H1B"乐队party与演唱会 ×
Saturday, December 11 at 6:30pm
RSVP: Yes · No · Maybe

Sponsored Create an Ad

Software Engineer, Tools ×
Are you passionate about helping those around you be more effective? If so click here.

Facebook is hiring

Questions See All

Will mirrorless cameras dethrone DSLR? ×
Asked by Xin Qi

What are your favorite cheap (< \$10) restaurants in San Francisco and why? ×
Asked by Phillip Fung

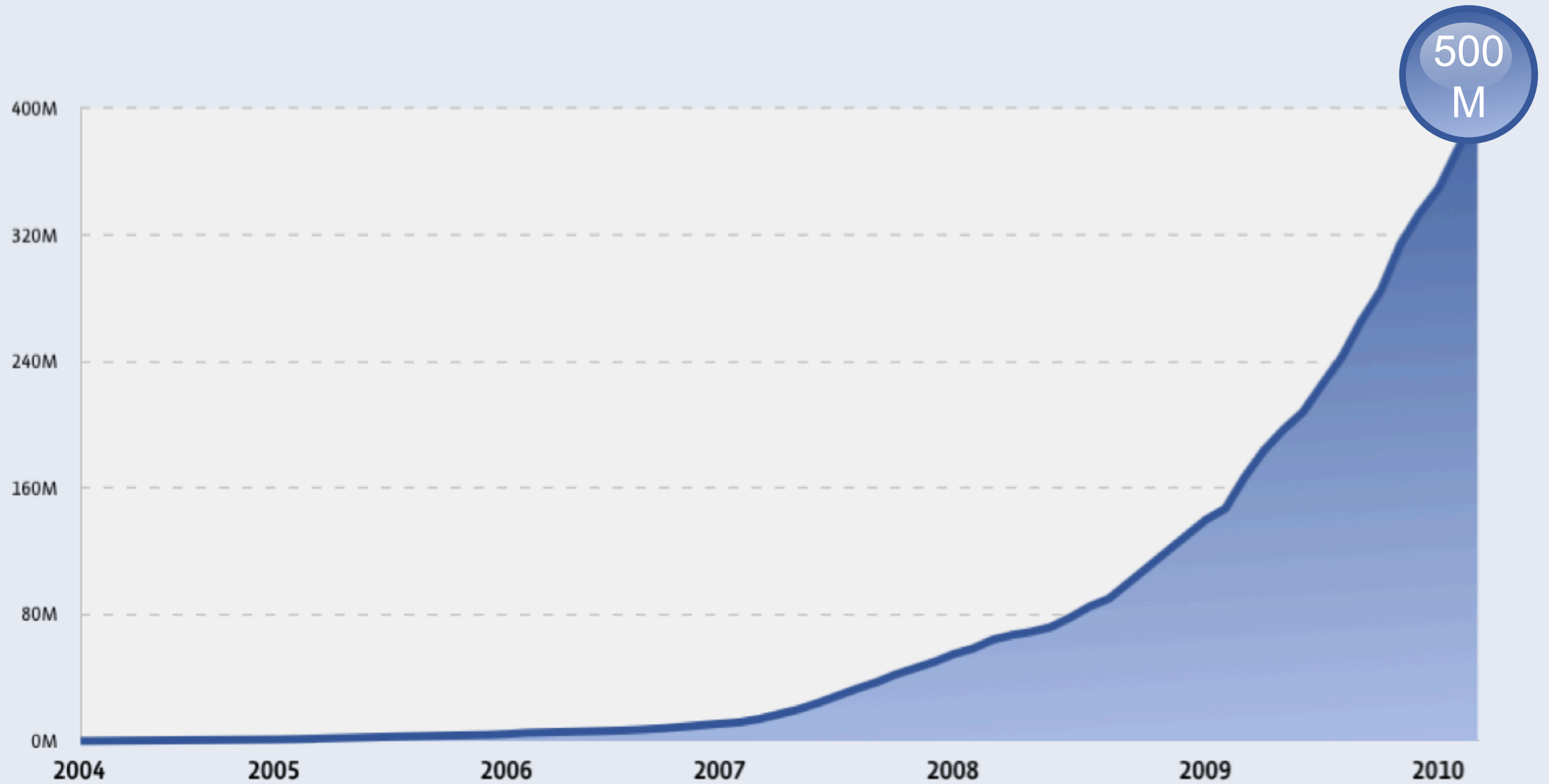
As an admin of a "page", how can I post status updates using my normal Facebook username instead of... ×
Asked about Facebook

Re Chat (33)

Mission

Give people the power to
share and make the world
more open and connected

500M Users



Today's reality



facebook

5hr 25min

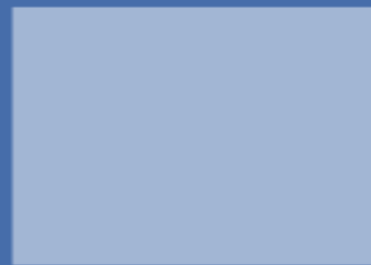


Average hours per month per user!

2hr 17min



1hr 52min



1hr 41min



1hr 17min



1hr 14min



facebook

YAHOO!

AOL

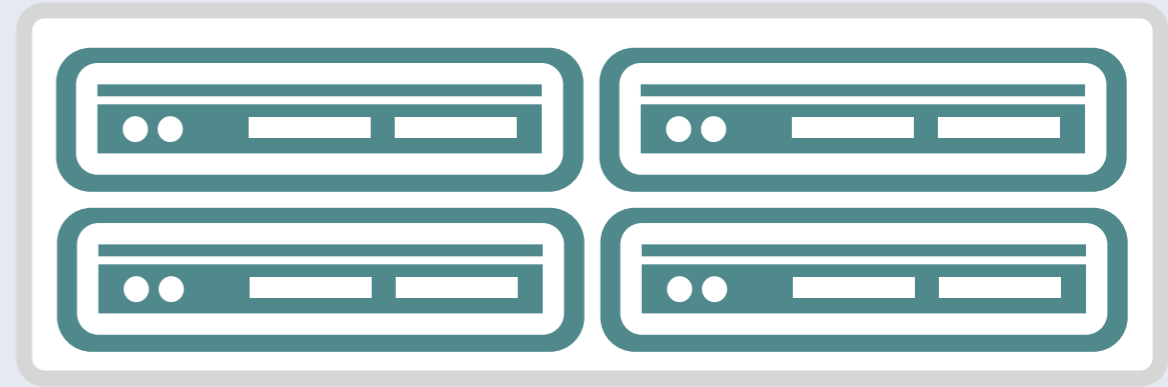
msn

You Tube

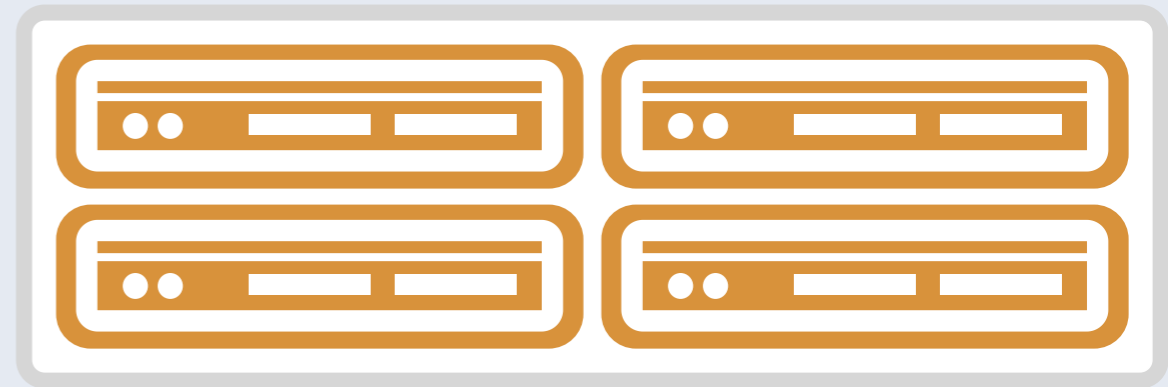
Google

Site speed is critical to Facebook!

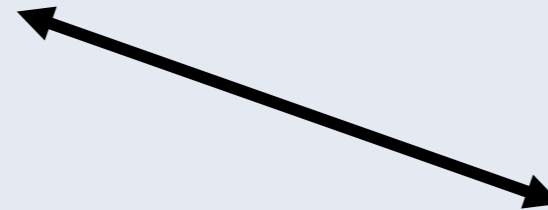
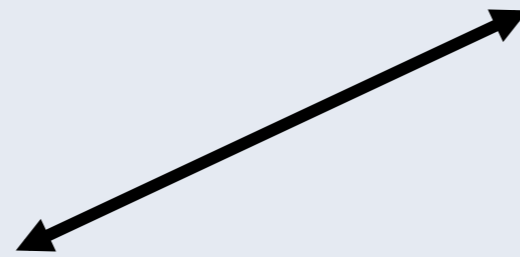
What do we measure?



Facebook

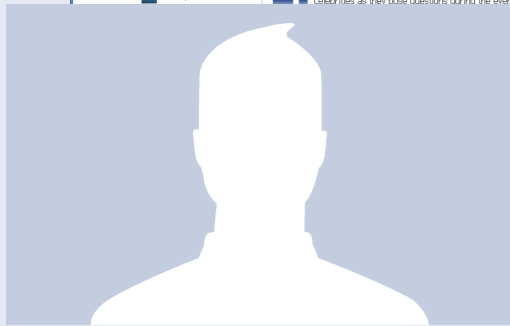


CDN



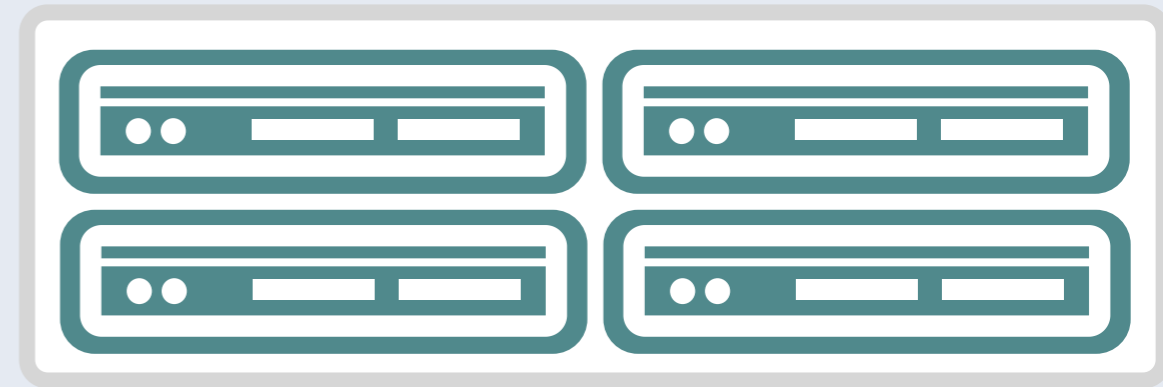
What do we measure?

client/render time

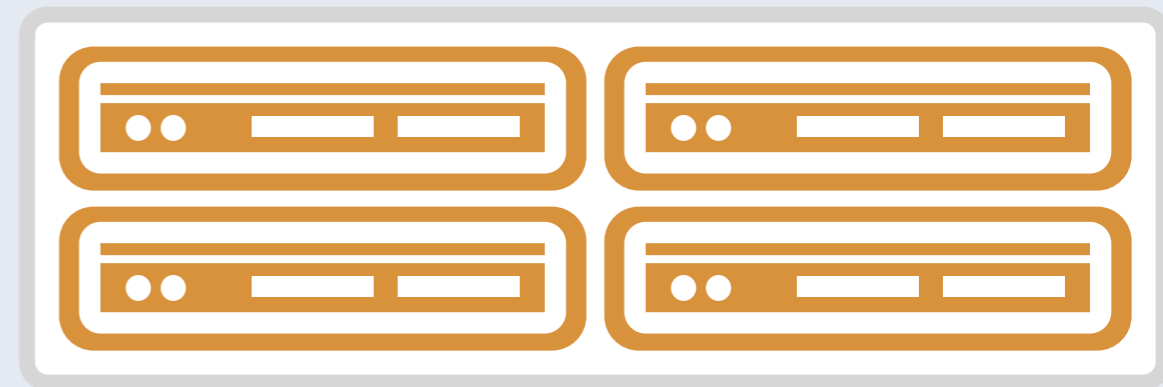


network time

server time



Facebook



CDN

Time-to-Interact (TTI)

The image shows a screenshot of the Facebook website interface from 2011. The browser address bar shows 'www.facebook.com/home.php?'. The page layout includes a top navigation bar with 'facebook', a search bar, and links for 'Home', 'Profile', and 'Account'. On the left side, there is a user profile for Jason Sobel and a sidebar menu with options like 'News Feed', 'Messages', 'Events', 'Photos', 'Friends', 'Applications', 'Games', and 'SCRABBLE'. The main content area is the 'News Feed', which features a status update prompt 'What's on your mind?' and several posts. The posts include: Mark Kilgore's post about a 9pm-Midnight email clearing drill; Koun Han's post about stopping email checks after 9pm; Nicole Sullivan's post about procrastinating; Alex Li's post about Joe Button; and Steven Grimm's post about a Panasonic lens. An Amazon.com advertisement for a Panasonic lens is also visible. On the right side, there are sections for 'Events' (with a 'What are you planning?' prompt), 'Keep in Touch' (with messages from Jen Beser and Vicki P. Daniels), 'Sponsored' (with a 'Free Facebook Credits' ad), and 'Get Connected' (with options like 'Who's on Facebook?'). At the bottom right, there is a 'Chat (79)' indicator.

Time-to-Interact (TTI)

The image shows a screenshot of the Facebook home page from approximately 2010. A red rectangular box highlights the left-hand navigation menu and the main news feed content. The navigation menu includes links for News Feed, Messages, Events, Photos, Friends, Applications, Games, and SCRABBLE. The news feed contains several posts, including one from Mark Kilgore about an email clearing drill, one from Koun Han about checking emails, one from Nicole Sullivan about procrastinating, one from Alex Li about Joe Button, and one from Steven Grimm about a Panasonic lens. An Amazon.com advertisement for a Panasonic lens is also visible. The right-hand side of the page features sections for Events, Keep in Touch (with friends like Jen Beser and Vicki P. Daniels), Sponsored content (Free Facebook Credits), Get Connected, and Get a Facebook Sneak Peek.

facebook

Search

Home Profile Account

Jason Sobel
Edit My Profile

News Feed

Messages

Events

Photos

Friends

Applications

Games

SCRABBLE

More

Friends Online

- Adam Hupp
- Aditya Agarwal
- Carlos Bueno
- David Reiss
- Helen Min
- Keith Adams
- Mark Kilgore
- Molly Graham
- Nicole Sullivan
- Sarah Smith

See All

News Feed

Top News · Most Recent

What's on your mind?

Mark Kilgore the 9pm-Midnight email clearing drill might be one of the more productive parts of my day...you've been warned...
4 minutes ago · Comment · Like · Share

Stacy Tse likes this.

Koun Han I was just thinking that I should just stop checking my emails after 9pm o_o
3 minutes ago · Like

Write a comment...

Nicole Sullivan is procrastinating...
7 minutes ago via Twitter · Comment · Like · @stubbornella on Twitter

Alex Li what up Joe Button!
12 minutes ago · Comment · Like · Share

Steven Grimm Wish I'd had this in Hawaii for shooting those lava flows -- they might have come out as something other than distant specks of light. But I can't *quite* convince myself I'll use it enough to want to both buy it and cart it around on subsequent trips.

Amazon.com: Panasonic 14-140mm f/4.0-5.8 OIS Micro Four Thirds Lens for Panasonic Digital SLR Camera
www.amazon.com
Amazon.com: Panasonic 14-140mm f/4.0-5.8 OIS Micro Four Thirds Lens for Panasonic Digital SLR Cameras: Camera & Photo

14 minutes ago · Comment · Like · Share

Chuck Rossi I've had this lens since April and while it does add some bulk, it's still way better than lugging around an SLR. I'm going to be taking in to all sorts of places in July on two different vacations so I'll let you know how much of a pain it is.

Events

See All

What are you planning?

Ez/Fuzz, please don't go
Thursday 5:30pm

Keep in Touch

See All

Jen Beser
Say hello.
Send her a message

Vicki P. Daniels
Catch up on Facebook.
Send her a message

Sponsored

Create an Ad

Free Facebook Credits

Credits are the best way to enhance your game playing experience on Facebook. Collect some for free!

Collect & Play

Get Connected

- Who's on Facebook? Find your friends
- Who's not on Facebook? Invite them now
- Who's here because of you? Track your invites
- Connect on the go Try Facebook Mobile

Get a Facebook Sneak Peek

Apply to be a beta tester and get the first look at upcoming Facebook products.

Chat (79)

Time-to-Interact (TTI)


Facebook | Andrew 'Boz' B... x

www.facebook.com/boz?ref=ts#!/photo.php?pid=39412424&id=1681

facebook Search Home Profile Account

Andrew 'Boz' Bosworth's Photos - Game Day 2k10 - Album B

Photo 70 of 188 Back to Album · Andrew's Photos · Andrew's Profile Previous Next



In this photo: Anikka Fragodt (photos), Alvin James, Alok Menghrajani, Scott Chun-Yang Chen (photos), Tanmay Khirwadkar, Mark Schonbach (photos), Miguel Velazquez (photos), Jimena Almendares (photos), Peter Yongwen Liang (photos), Ashish Shah, Chris Pan (photos)

Added June 4 · Comment · Like

Michael Eyal Sharon, Bubba Murarka and 2 others like this.

Shoshana Sternlicht Boz, where can i get a copy of this photo?
June 4 at 2:12pm · Like · Flag

Andrew 'Boz' Bosworth I put one version up here: http://thesha.me/temp/_BOZ8594.jpg but I can put this version up too if you would like. message me.
June 4 at 6:10pm · Like · Flag

Ryan McElroy Hm, that big version I'm pretty hard to see. A few different large ones to sift through would be nice.
June 5 at 11:18am · Like · Flag

Write a comment...

From the album: Game Day 2k10 - Album B by Andrew 'Boz' Bosworth

Uploaded via: Bloom: the best photo uploader!

Share
Tag This Photo
Report This Photo

Sponsored Create an Ad

University of Maryland University College Can you stop the Hackers? Earn Your BS/MS in CyberSecurity and Join the Cyber War Against Hackers, Thieves, Terrorists and Spies! Flexible & Affordable program!
Like

Shannon Wass, Realtor Is now the right time for you to purchase your first home? Do you have questions about the housing market? Contact me today!
Like · Dan Kelmenson likes this.

Disney Pixar Want to see Toy Story 3 for free? Add the Disney Tickets Together application today for a chance to win!
You and Ari Steinberg like this.

Facebook © 2010 · English (US) About · Advertisements · Chat (72)

Three frontend optimizations at Facebook

Quickling

transparently ajaxifies the whole web site

PageCache

caches user-visited pages in browser

BigPipe

pipelines Facebook website

facebook

Quickling: *Ajaxify* the Facebook site

Motivation: remove redundant work

The screenshot shows a Facebook News Feed for user Changhao Jiang. The main post is by Steven Grimm, titled "Your Brain at Work: Strategies for Overcoming Distraction, Regal...". The post includes a book cover and text: "Steven gave 4 stars to Your Brain at Work: Strategies for Overcoming Distraction, Regaining Focus, and Working Smarter All Day Long on Goodreads. The forays into neurobiology, however high-level and simplified for non-biologist readers, make the concrete suggestions here more credible. There ar...". It has 4 likes and was shared 4 hours ago via Goodreads Books. The right sidebar shows events like "Bobby and Ann's Housewarming" and "Facebook! Speaker Series...".



The screenshot shows a Facebook photo album titled "Doug Beaver's Photos - Kaanapali Beach Day One". The main image is a palm tree against a blue sky. The caption reads: "The sky is so blue that it freaks me out." It was added on November 24 and has 0 likes and 0 comments. The right sidebar shows sponsored ads for "Rails" and "Silicon Valley Rocks 2010".

Motivation: remove redundant work

This screenshot shows a Facebook News Feed. The top navigation bar, including the Facebook logo, search bar, and links for Home, Profile, and Account, is enclosed in a red border. The main content area displays a post by Steven Grimm titled "Your Brain at Work: Strategies for Overcoming Distraction, Regal...". Below the post, there are social sharing icons for Facebook, Messenger, Email, Print, and Chat (28), which are enclosed in a red box. The left sidebar shows the user's profile and various navigation options.

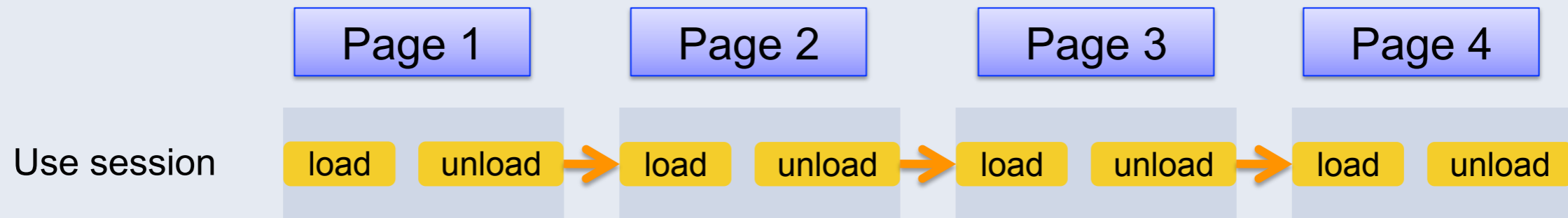


This screenshot shows a Facebook Photo Album titled "Doug Beaver's Photos - Kaanapali Beach Day One". The top navigation bar, including the Facebook logo, search bar, and links for Home, Profile, and Account, is enclosed in a red border. The main content area displays a large photo of a palm tree against a blue sky. Below the photo, there are social sharing icons for Facebook, Messenger, Email, Print, and Chat (28), which are enclosed in a red box. The right sidebar shows various photo albums and sponsored ads.

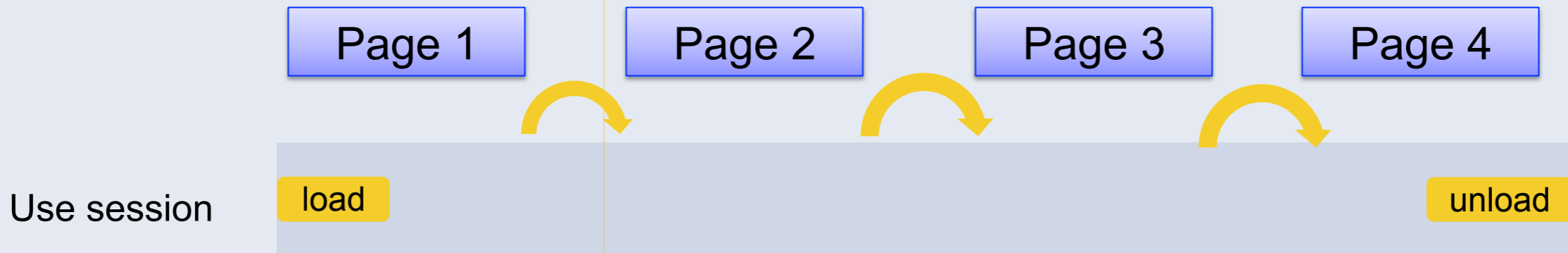
Remove redundant work via Ajax



Full page load



Ajax call



How Quickling works?

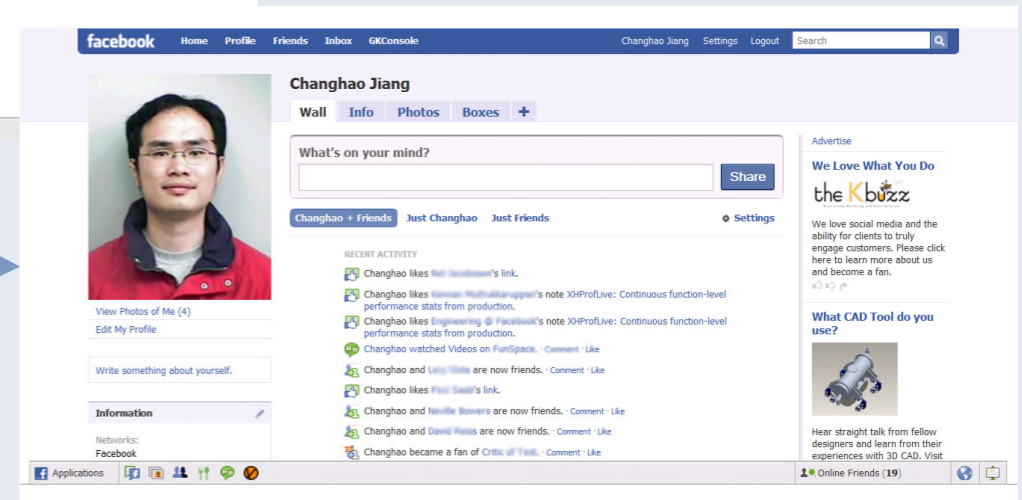
1. User clicks a link or back/forward button
2. Quickling sends an ajax to server
3. Response arrives



4. Quickling blanks the content area

5. Download javascript/CSS

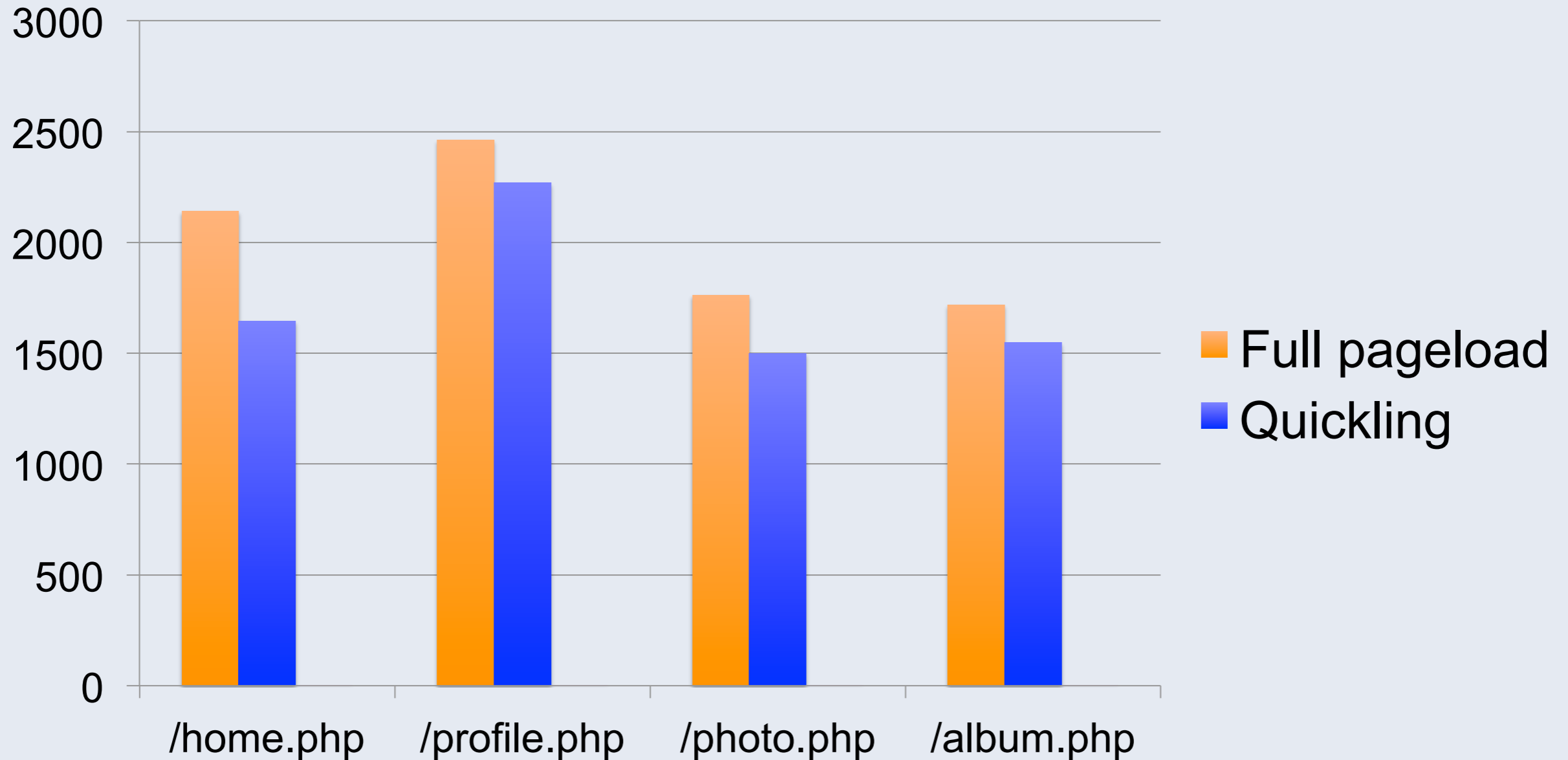
6. Show new content



Implementation details

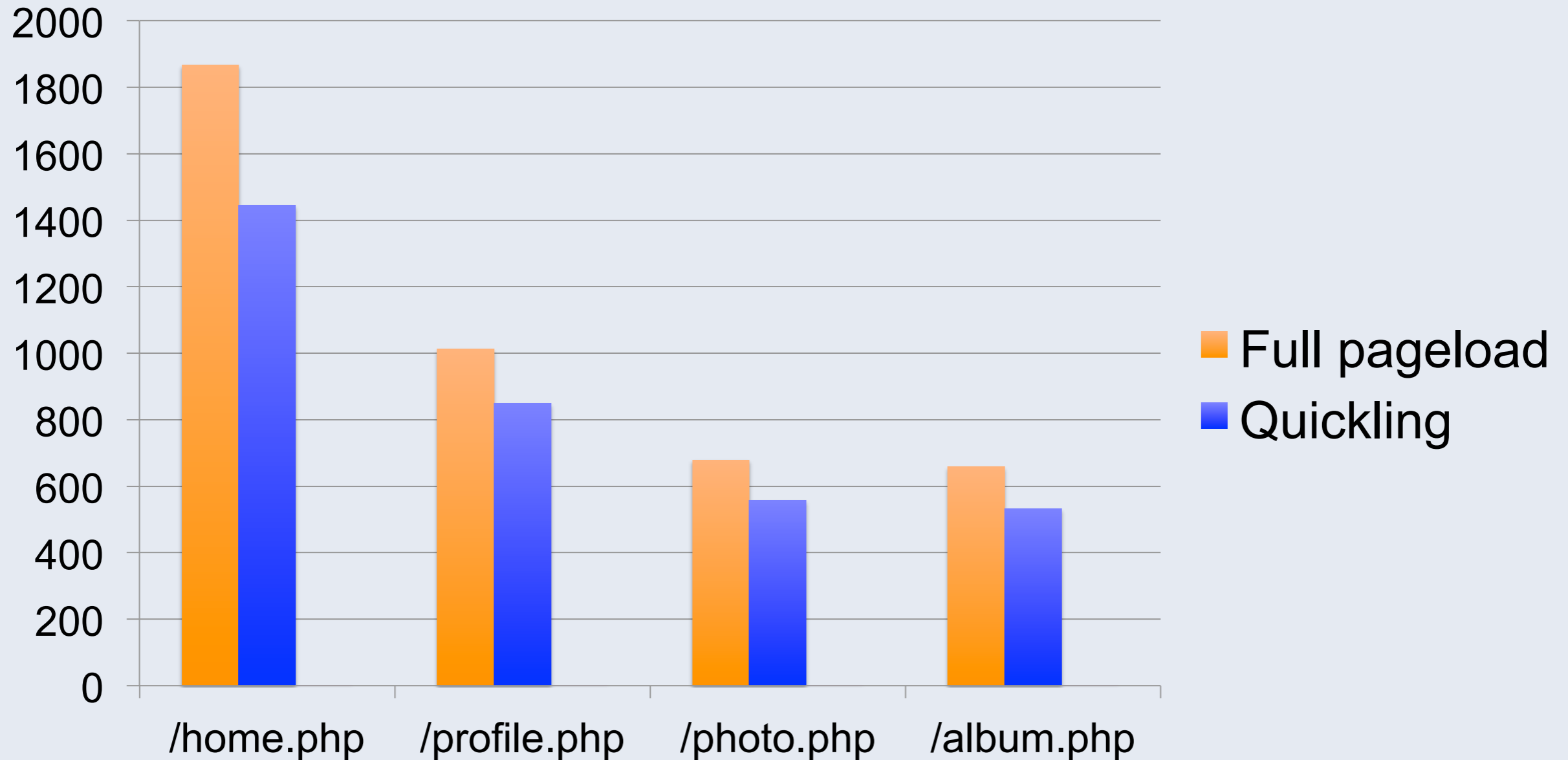
- Link Controller
- HistoryManager
- Bootloader
- Busy Indicator
- CSS Unloading
- Permanent link support
- Resetting timer functions

User perceived latency (TTI) reduction



10% ~ 30% reduction in TTI

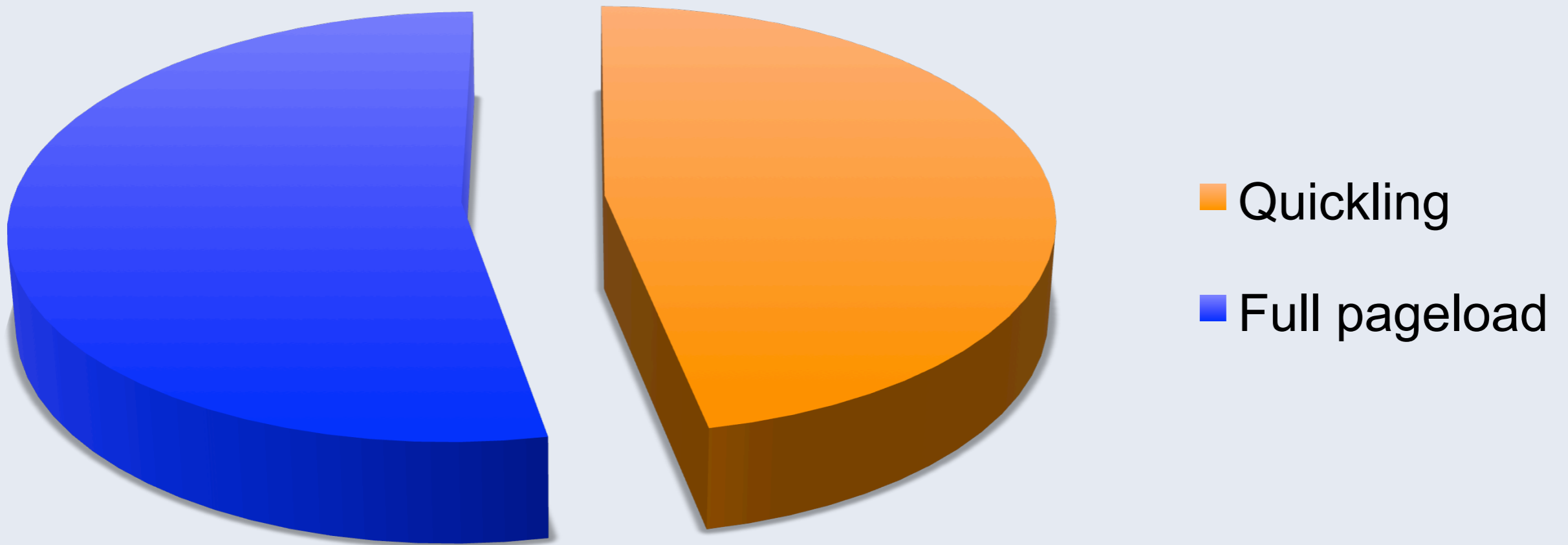
Server page generation time reduction



Quickling requests are 20% ~ 30%

cheaper

45% of page hits are Quickling requests



Quickling conclusion:

- Reduce user perceived latency by more than 10%
- Save 10% of Facebook's data center cost!

facebook

PageCache: Cache visited pages at client side

Motivation – temporal locality

- Some pages are likely to be revisited soon
 - E.g. home page (re)visited every 3 page hits:
 - *home* -> *profile* -> *photo* -> *home* -> *notes* -> *home* -> *photo* -> *photo*
- Cache them!

How PageCache works?

1. User clicks a link or back button

2. Quick Pages in the ajax to server

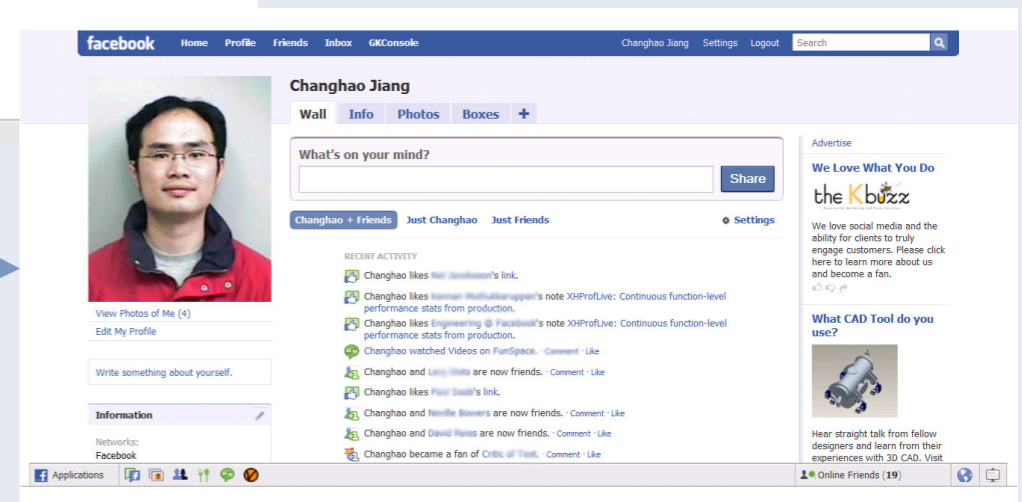
3. Response arrives

3.5 Save response in cache

4. Quickling blanks the content area

5. Download javascript/CSS

6. Show new content



Challenges

- Real time updates
 - Page content needs to be as fresh as possible
- Cache consistency
 - Cached page should be consistent after state-modifying operations

Issue(1): Incremental updates

This screenshot shows a Facebook news feed in a cached state. The main content area contains a post from Ling Ni about San Diego, followed by an NPR article titled "Christopher Hitchens: Parthenon Sculptures Must Go Back". The post immediately following the NPR article is missing, leaving a gap in the feed. The right-hand sidebar contains sections for Requests, Suggestions, Sponsored, and Highlights.

Cached version



This screenshot shows the same Facebook news feed after a restore operation. The missing post from the cached version has been replaced by a new post from Joydeep Sen Sarma asking "Joydeep Sen Sarma is wondering whether he should go for a laptop". Below it is a post from Ling Ni about San Diego. The NPR article remains in the feed. The right-hand sidebar is updated with new suggestions and highlights.

Restored version

Issue(1): Incremental updates

Poll server for incremental updates via AJAX calls

- Provides an 'onpagecacheRegister' API to developers:
 - Invoked when a page is restored from cache.
 - Used to send AJAX to server for incremental updates, refresh ads, etc.
 - Blank the content area before incremental updates arrive to avoid flash of stale contents.

Issue(2): In-page writes

ATHO NO CARRIER



about an hour ago · Share

still great at parallel parking.
about an hour ago · Comment · Like

Show 2 more comments...

Bravo! Such an excellent skill to have.
32 minutes ago

No pics?
26 minutes ago

Write a comment...

WHE IS MY VOTE? PROTEST RALLYS: Tonight in San Francisco - Union Square from 6-8, Tonight in Sacramento- Sunrise Mall 6-8, Tomorrow in San Jose - Market/Park Fairmont Hotel 6-8!
about an hour ago · Comment · Like

opera unite

Opera Unite: Host Your Own Website
Source: computershopper.com
Opera Unite allows users to host their own Websites



about an hour ago · Comment · Like · Share

Cached version



ATHO NO CARRIER



about an hour ago · Share

still great at parallel parking.
about an hour ago · Comment · Like

Show 3 more comments...

No pics?
37 minutes ago

haha, me too!
39 seconds ago · Delete

Write a comment...

WHE IS MY VOTE? PROTEST RALLYS: Tonight in San Francisco - Union Square from 6-8, Tonight in Sacramento- Sunrise Mall 6-8, Tomorrow in San Jose - Market/Park Fairmont Hotel 6-8!
about an hour ago · Comment · Like

opera unite

Opera Unite: Host Your Own Website
Source: computershopper.com
Opera Unite allows users to host their own Websites



about an hour ago · Comment · Like · Share

Restored version

Issue(2): In-page writes

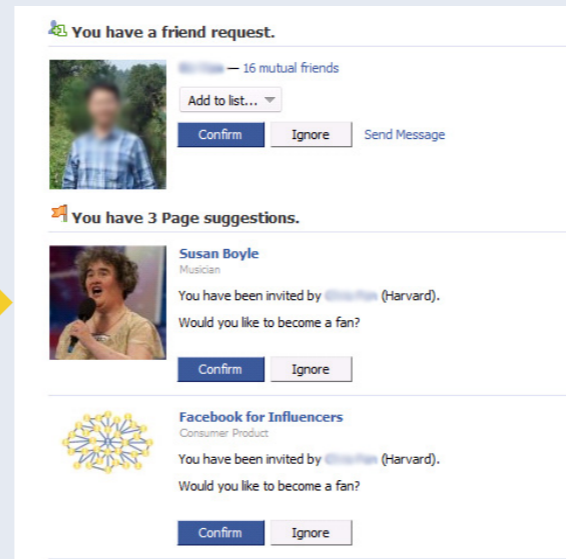
Record and replay

- Automatically record all state-changing operations in a cached page
 - All AJAX calls using 'POST' method, or those explicitly specified 'replayable' will be added to cached content.
- Automatically replay those operations when cached page is restored.
 - Cached AJAX handler callback functions already contain all the contextual information about the recorded operations due to JavaScript closure.

Issue(3): Cross-page writes



Cached version



State-changing op



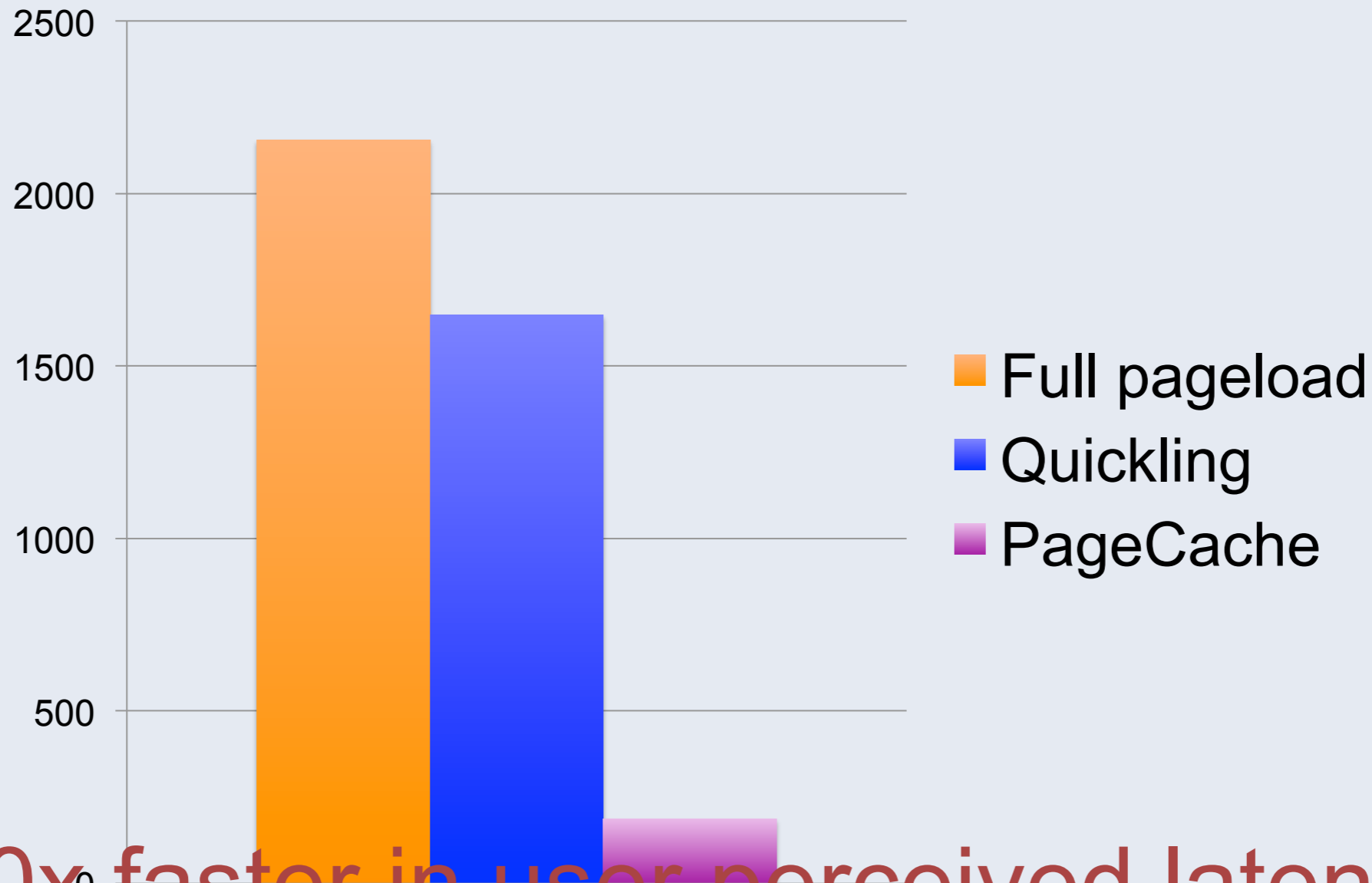
Restored version

Issue(3): Cross-page writes

Server side invalidation

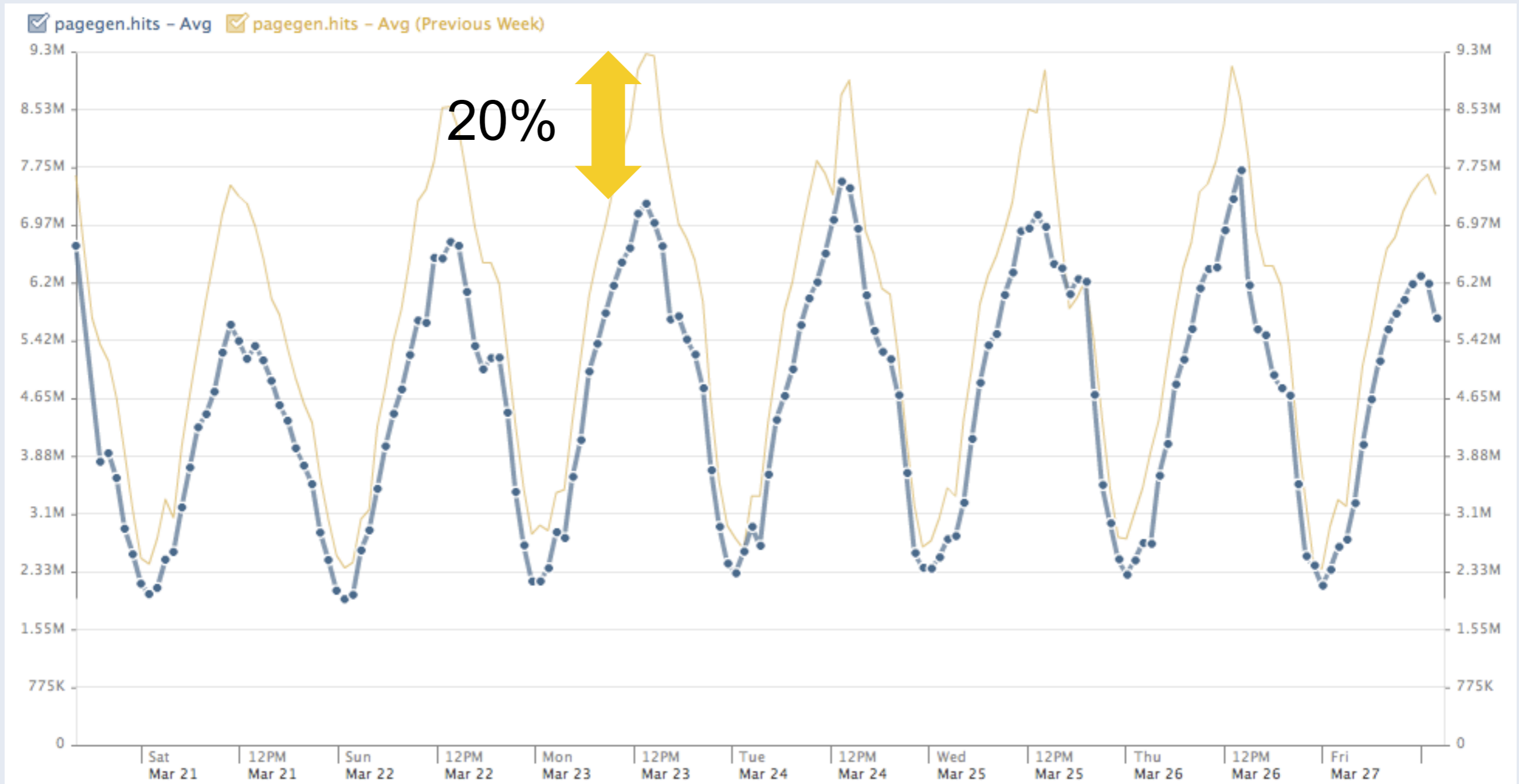
- Instrument server-side database API, whenever a write operation is detected, send a signal to the client to invalidate the cache.
- The signal (a.k.a. cache invalidation message) contain information about what persistent data has changed.
- Upon receiving cache messages, the client side can flush the whole cache or refresh only those affected page components via AJAX.

User perceived latency (TTI) reduction



10x⁰ faster in user perceived latency

Server cost reduction



~20% savings on page hits to home page

PageCache conclusion:

- 10X speedup in user perceived speed!
- Save 2% of Facebook's data center cost!

facebook

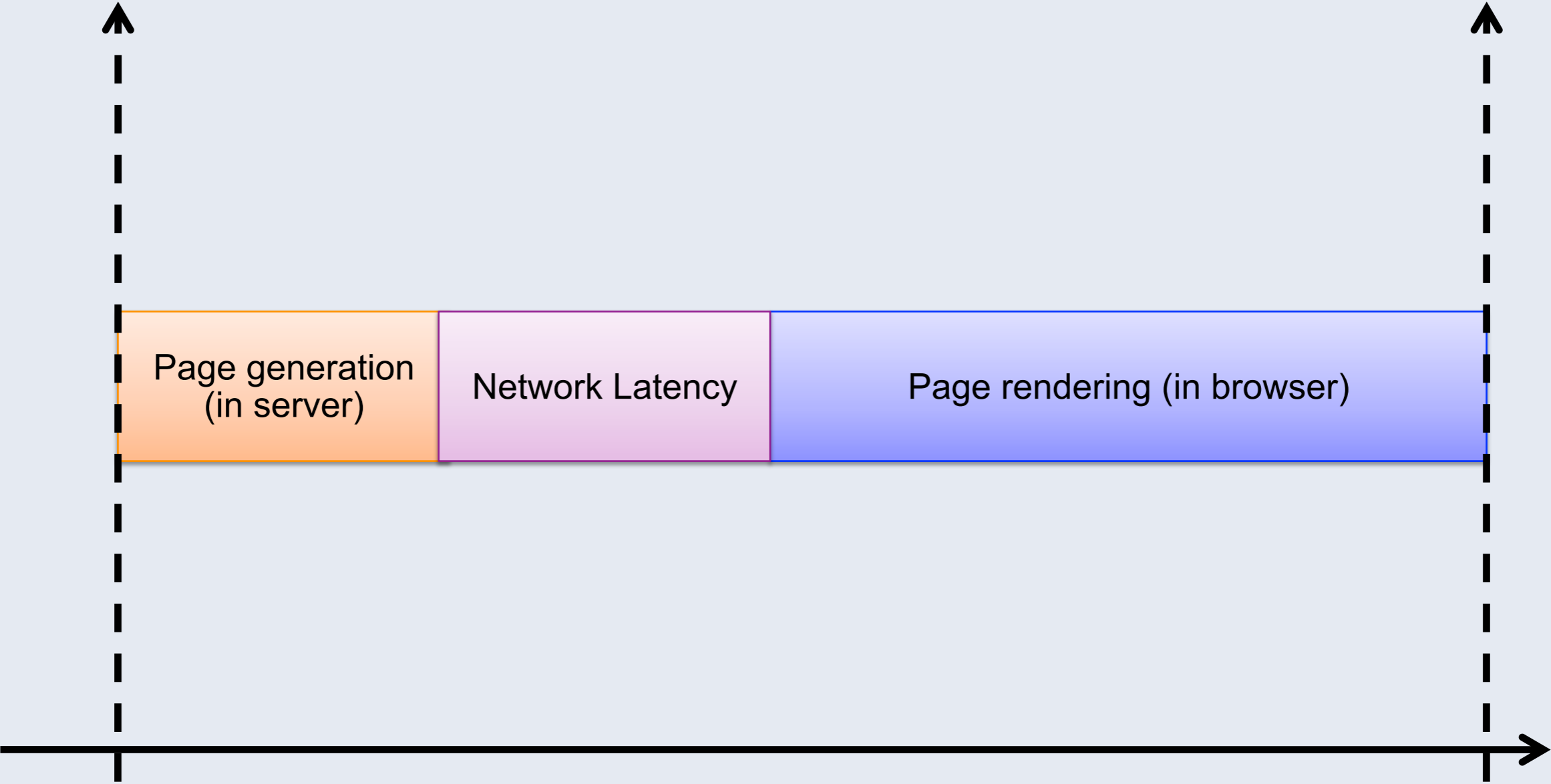
BigPipe: pipeline Facebook website

Facebook page

The image shows a screenshot of a Facebook news feed. At the top, the Facebook logo is on the left, and navigation links for Home, Profile, and Account are on the right. A search bar is located in the center of the top bar. Below the top bar, the user's profile information for Changhao Jiang is displayed on the left, including a profile picture and a link to edit the profile. A vertical sidebar on the left contains navigation options: News Feed, Messages (1), Events (2), Friends (63), and a list of groups including '国语黑帮 (mandarin s...', 'Facebook', 'Happy Parents', 'Groups Team', and '非死不可'. Below these are 'Application Requests' (11), 'Game Requests' (11), and 'Photos'. At the bottom of the sidebar is a 'Friends on Chat' section with a grid of profile pictures.

The main content area is titled 'News Feed' and 'Top News · Most Recent'. It features a 'Share:' bar with options for Status, Question, Photo, Link, and Video. The first post is by Steven Grimm, who discusses technical issues with git configurations on shared servers. Below his post, Elliot Lynde has liked it, and Girish Patangay has commented. The second post is by Yongyan Liú, who shares a snowboarding experience. The right sidebar contains sections for 'Events' (with a search box and two event listings), 'Sponsored' (with an advertisement for Facebook hiring), and 'Questions' (with three question listings). At the bottom right, there are icons for 'Re', 'f', 'f', and 'Chat (33)'.

User perceived latency

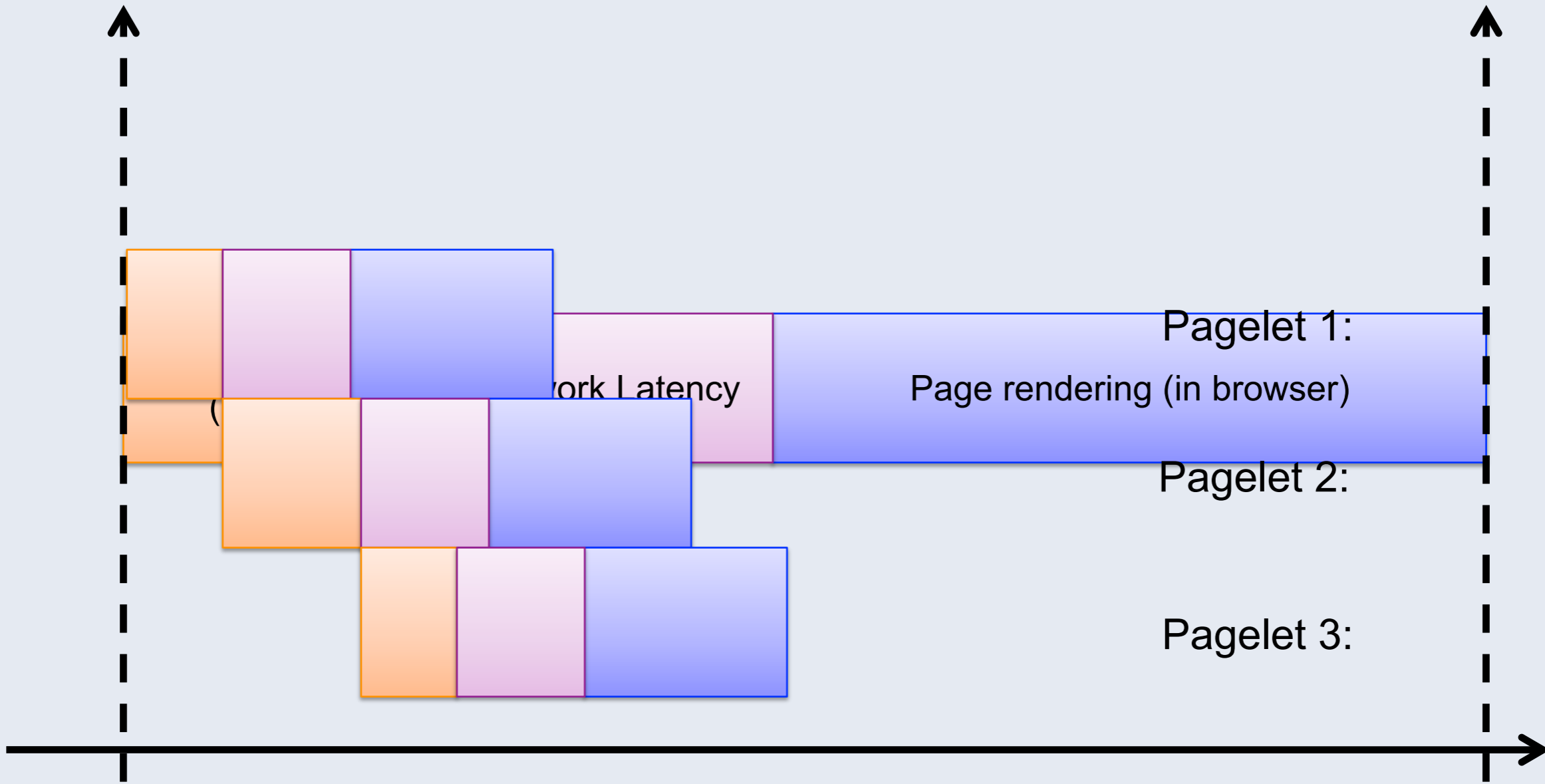


Pagelets

The image shows a screenshot of a Facebook page with several pagelets highlighted by colored boxes:

- Profile Pagelet (Red Box):** Located at the top left, it displays the user's profile picture and name, "Changhao Jiang", with a link to "Edit My Profile".
- News Feed Pagelet (Purple Box):** Located at the top center, it contains the "News Feed" header, navigation options like "Status", "Question", "Photo", "Link", and "Video", and a "Share:" button.
- Left Navigation Menu (Dark Red Box):** A vertical list of navigation options including "News Feed", "Messages", "Events (1)", "Friends (49)", "Ads and Pages", "Questions", "dwacanvas", "Facebook Live", "Slide FunSpace", and "More".
- Friends Online List (Brown Box):** A list of friends who are currently online, including "Chengkai Li", "Chris Pan", "Erling Ellingsen", "Feng Qian", "Jing Chen", "John Allen", "Makinde Adeagbo", "Josh Wiseman", "Ke Yang", and "Ming Hua".
- News Feed Content (Blue Box):** The main content area showing posts from "Jason Sobel", "George Cabrera III", "Mark Zuckerberg", and "Yishan Wong". It includes a link to a blog post titled "The REAL 'Stuff White People Like' << OkTrends" and a bar chart.
- Events Pagelet (Green Box):** Located on the right side, it shows "What are you planning?", "1 event invitation", and "Sobel-Q 2010 Saturday 12:00pm".
- People You May Know Pagelet (Yellow Box):** Located on the right side, it suggests adding friends like "Xiangrong Tan" and "Liqian Luo".
- Sponsored Pagelet (Pink Box):** Located on the right side, it features an advertisement for "Try Facebook Ads" with a "Create an Ad" button.
- Requests Pagelet (Orange Box):** Located on the right side, it lists "49 friend requests", "5 group invitations", "10 Page suggestions", and "19 other requests".
- Questions Pagelet (Blue Box):** Located on the right side, it lists questions such as "Will the military pay for your graduate loans even if the graduate degree you have is not applicable..." and "What are some ways to save money in grad school?".
- Footer (Green Box):** Located at the bottom right, it contains social media icons and a "Chat (39)" button.

User perceived latency





Search

[Home](#) [Profile](#) [Account](#)

News Feed

[Top News](#) · **Most Recent**



Search

[Home](#) [Profile](#) [Account](#)

News Feed

[Top News](#) · **Most Recent**

What's on your mind?



Search

[Home](#) [Profile](#) [Account](#)

News Feed

- Messages
- Events
- Photos
- Friends (2)

- Applications
- Games
- [More](#)

News Feed

[Top News](#) · **Most Recent**

What's on your mind?



Search

Home

Profile

Account

News Feed

Messages

Events

Photos

Friends (2)

Applications

Games

More

News Feed

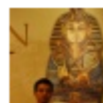
Top News · Most Recent

What's on your mind?

**Ming Hua** Food demonstration~~Venison Salad by Chef Graham Brown5 minutes ago · [Comment](#) · [Like](#) · [Share](#)**Facebook Culinary Team** Today's Snack @ Ten Fiddy: Nacho Bar8 minutes ago · [Comment](#) · [Like](#)

Ashley Watkins likes this.

Write a comment...

**Ning Zhang** any suggested kid-friendly events?**kids party**Saturday at 10:00am
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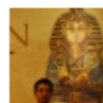
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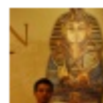
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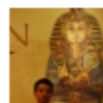
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Ashley Watkins likes this.

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kids party
Saturday at 10:00am
TBD

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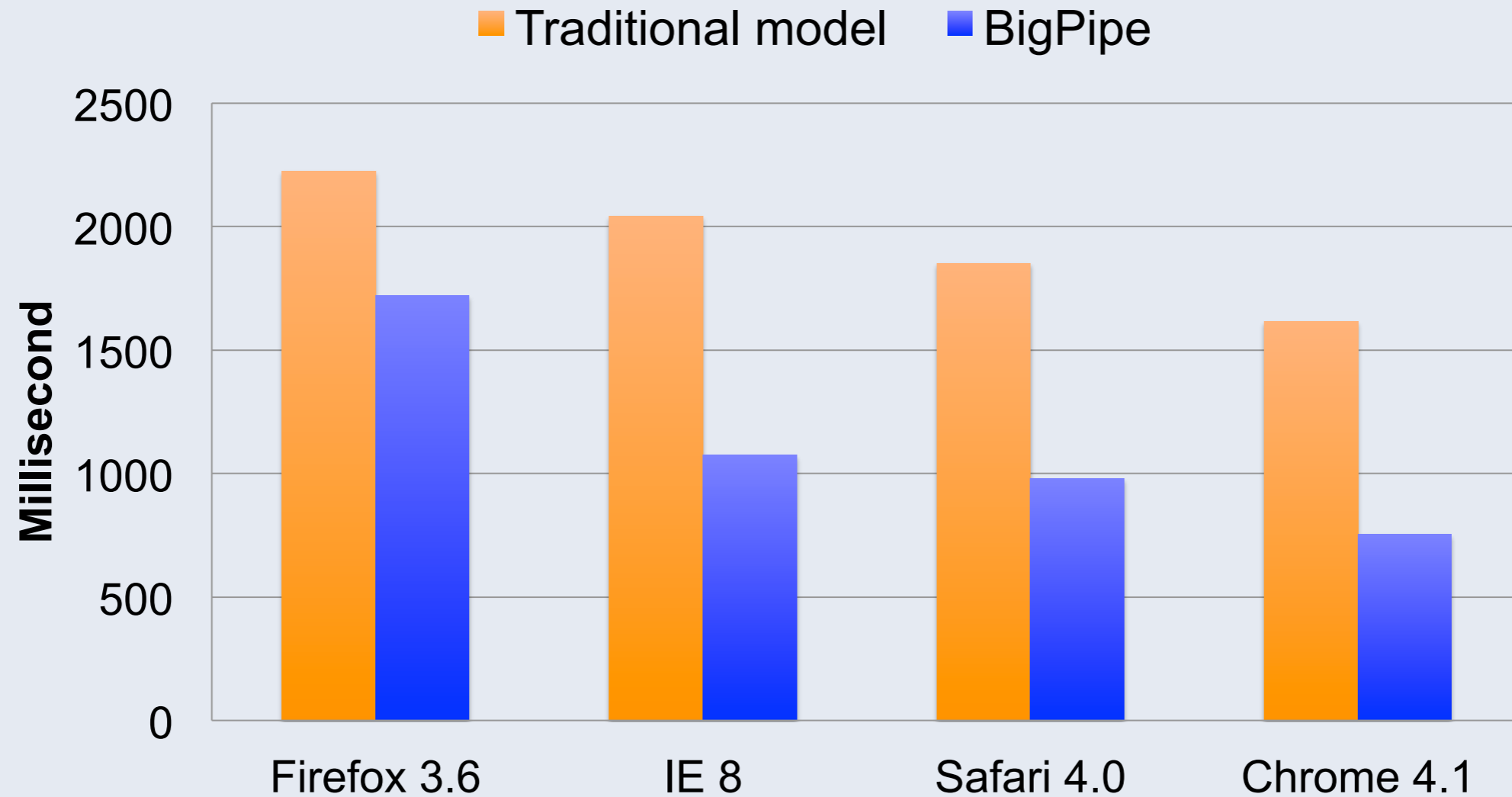
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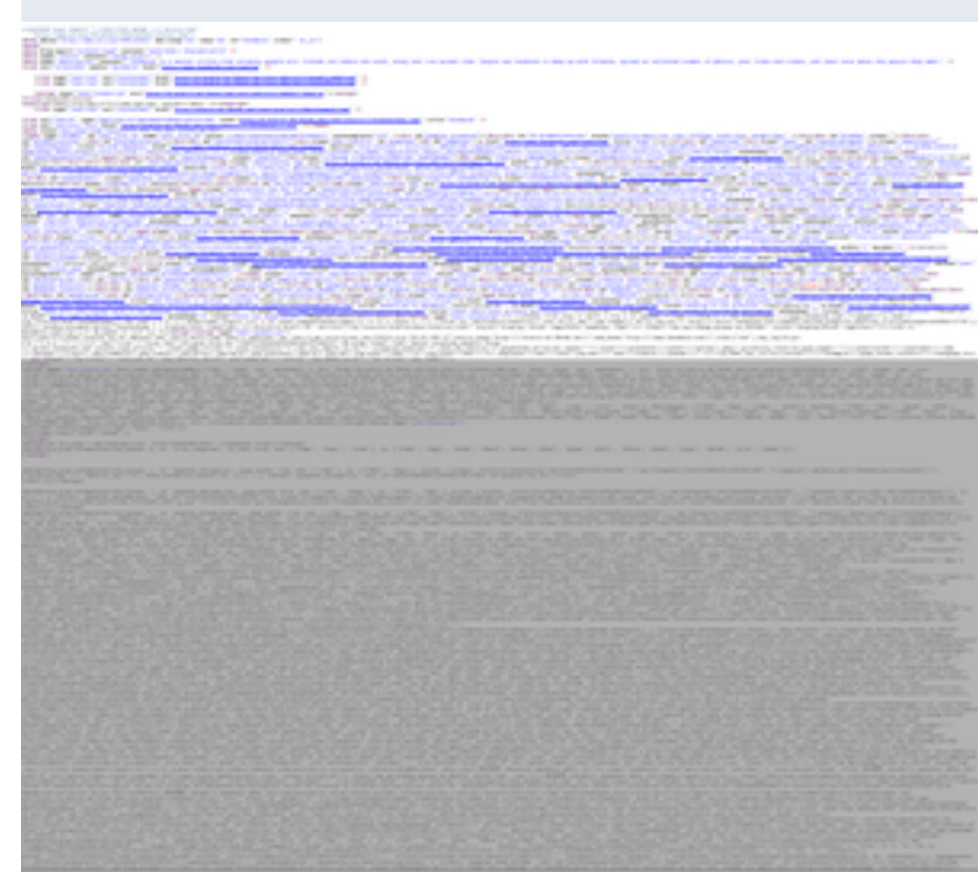
TTI improvement



2X improvement in user perceived latency for almost all browsers.

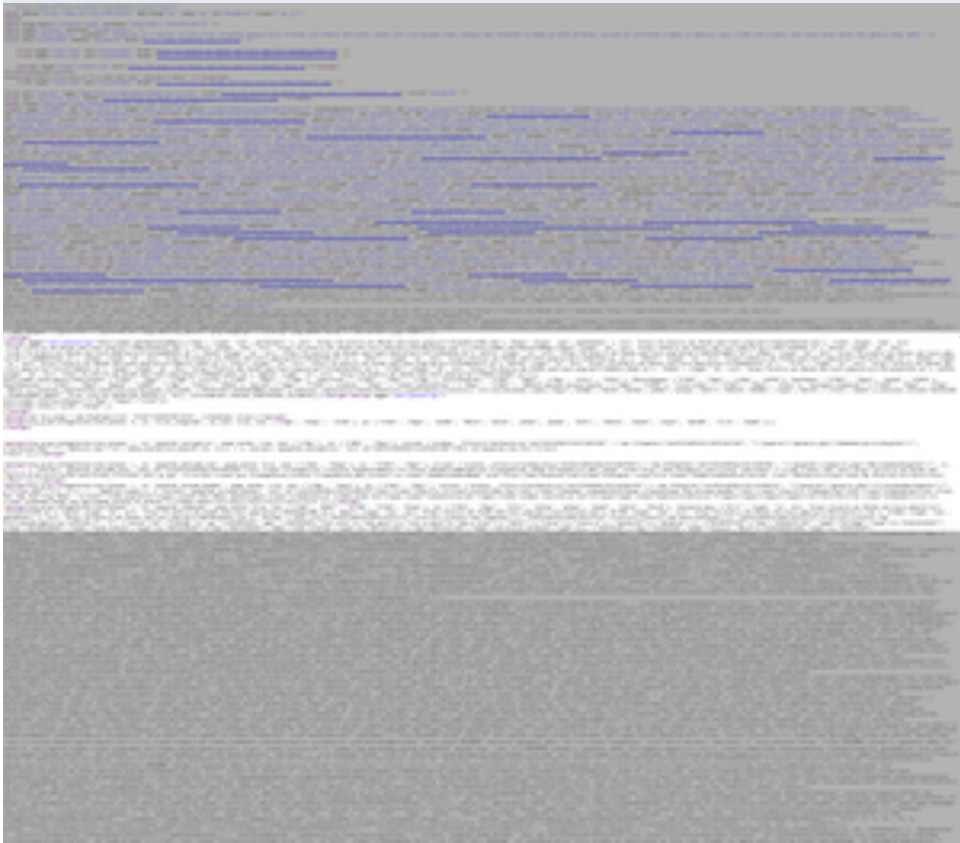
BigPipe first response

```
<html>
<head> <script src="<big pipe js>" />...</
head>
<body>
...
<div id="left_column">
<div id="pagelet_navigation"></div>
</div>
<div id="middle_column">
  <div id="pagelet_composer"></div>
</div>
...
```

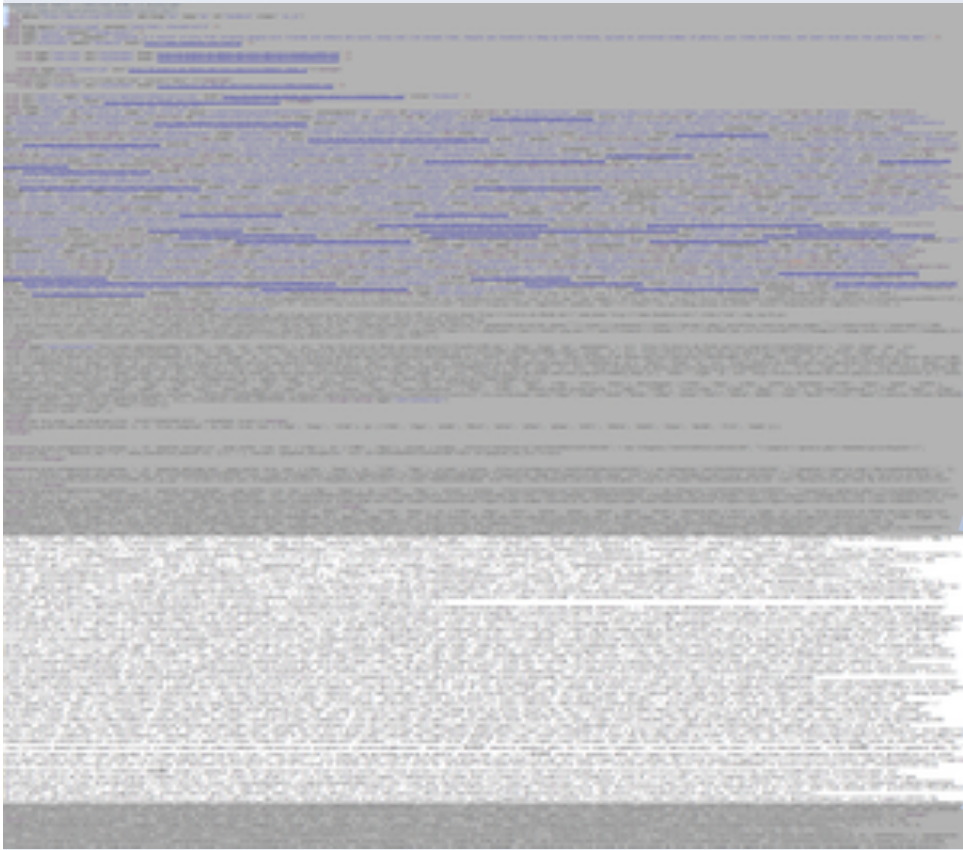


Pagelet response 1

```
<script type="text/javascript">  
  big_pipe.onPageletArrive({  
    "id" : "pagelet_navigation",  
    "css" : [ <list of css resources> ],  
    "js" : [ <list of JavaScript resources> ],  
    "content" : <html>  
    "onload": [JavaScript init code]  
    ...  
  });  
</script>
```



Pagelet response 2



```
<script type="text/javascript">  
  big_pipe.onPageletArrive({  
    "id" : "pagelet_composer",  
    "css" : [ <list of css resources>],  
    "js" : [ <list of JavaScript resources>],  
    "content" : <html>  
    "onload": [JavaScript init code]  
    ...  
  });  
</script>
```

Pagelet example

```
class AdsPagelet extends PageletResponse
{
    public function init () {
        // initialize pagelet
    }

    public function prepare() {
        // data fetching
    }

    public render() {
        // generate pagelet response.
    }
}
```

Pagelet programming model

- Self contained
 - HTML, JavaScript, CSS, onloadRegister
- Advanced features:
 - Pagelet hierarchy
 - Phased rendering
 - Cross-pagelet dependencies
 - data dependency
 - display dependency
 - JavaScript dependency

BigPipe programming model

// Step 1: create BigPipe instance

```
$big_pipe = BigPipe::getInstance(BigPipeType::PIPELINE);
```

// Step 2: Specify page layout and pagelet place holders.

```
$big_pipe->setPage(  
    '<div id="left_column">  
        <div id="pagelet_navigation"></div>  
    </div>  
    <div id="middle_column">  
        <div id="paglet_composer"></div>  
        <div id="pagelet_stream"></div>  
    </div>');
```

// Step 3: add pagelets to the pipe

```
$big_pipe->addPagelet(  
    new UIPagelet()  
        ->setSrc('/pagelet/composer.php')  
        ->setWrapperId('pagelet_composer'));
```

...

// Step 4: generate pagelets flush them out.

```
echo $big_pipe->render();
```

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```
$big_pipe->setPage(  
    <del>...</del>
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```
...
```

```
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```

```
echo $big_pipe->render();
```

BigPipe generation modes

- Single flush mode
 - Support search-engine crawlers
 - Support clients without JavaScript
- Pipeline mode
 - Generate and flush pagelets sequentially (default mode)
- Parallel mode
 - Generate pagelets in parallel and flush them out-of-order

BigPipe programming model

- Encapsulation
 - Hide implementation details
- Intuitive
 - Easy to understand mental model for developers
- Flexible
 - Different modes good for different use case.

BigPipe advanced features

- AjaxPipe

- Use iframe to pipeline Ajax response
- Used by Facebook home page's dashboards (photo, groups, etc)

- WidgetPipe

- Pipeline multiple widgets ("like" button) on third party websites

facebook

Thank you!