

*CS 641, Haik Sahakian*

---

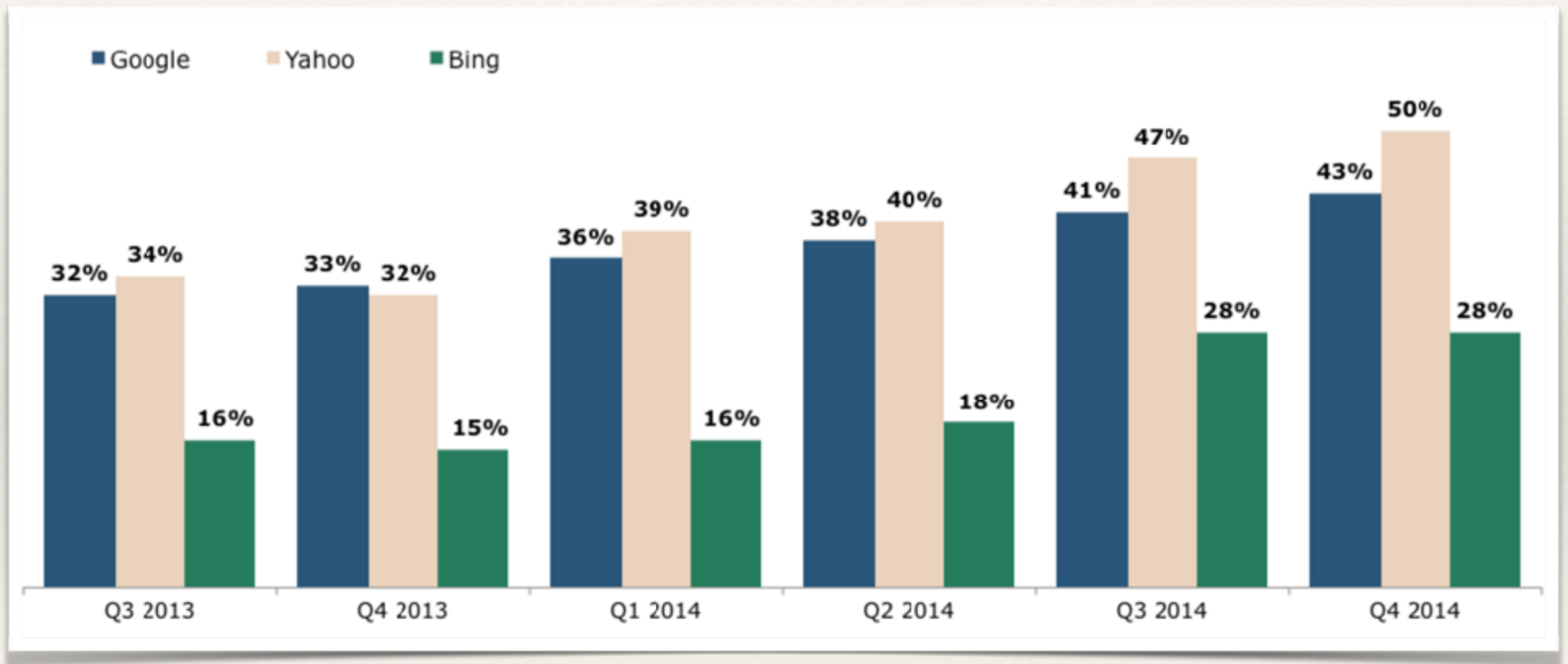
# Mobile Web Development

---

Choosing a Mobile  
Development Strategy

# The Fast Growth of Mobile

# Mobile Share of US Searches



---

# Paypal 2009-2014

---

- ❖ Paypal payments via mobile in 2009: \$141M
- ❖ Paypal payments via mobile in 2014: \$4B

# Mobile Development Options

---

# Mobile Development Options

---

- ❖ Native Apps
- ❖ Hybrid Apps
- ❖ Progressive Apps
- ❖ Responsive web sites
- ❖ Dedicated mobile web sites



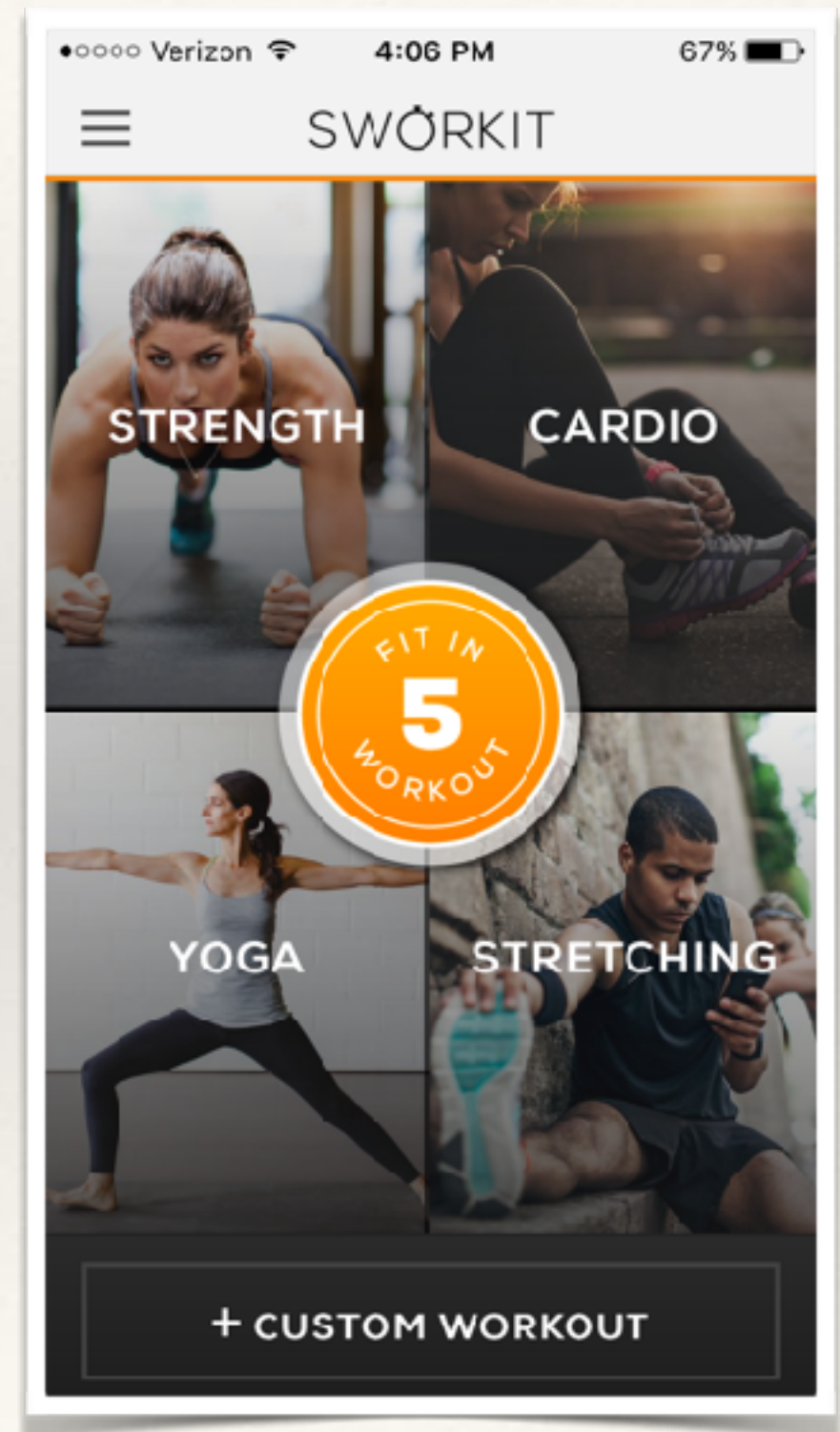
# Native Apps

- ❖ Written in the language recommended by the OS maker. Swift for iOS, and Java for Android.
- ❖ Example: Grand Theft Auto



# Hybrid Apps

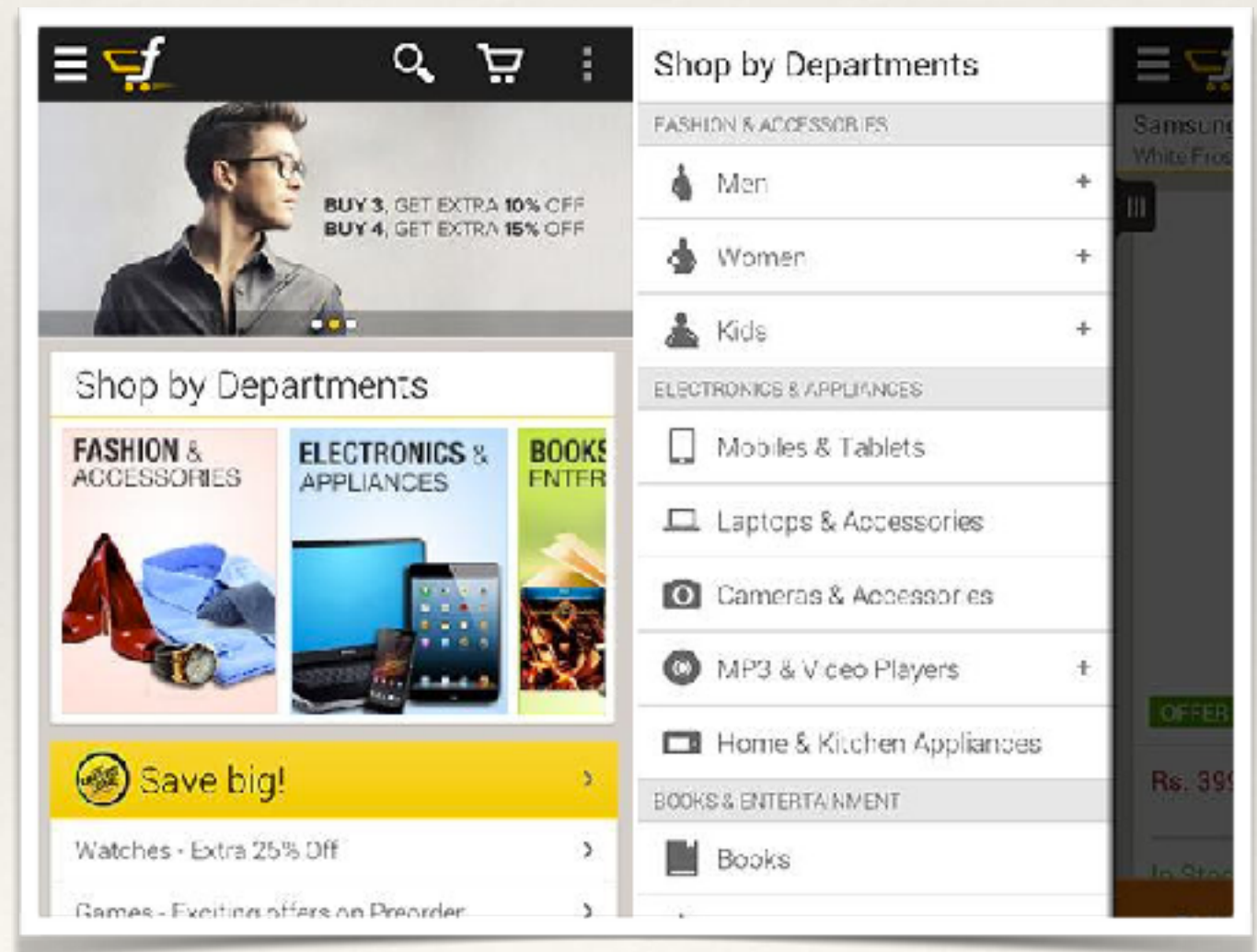
- ❖ Native apps that embed a browser, and then load a web page into it.
- ❖ Example: Sworkit





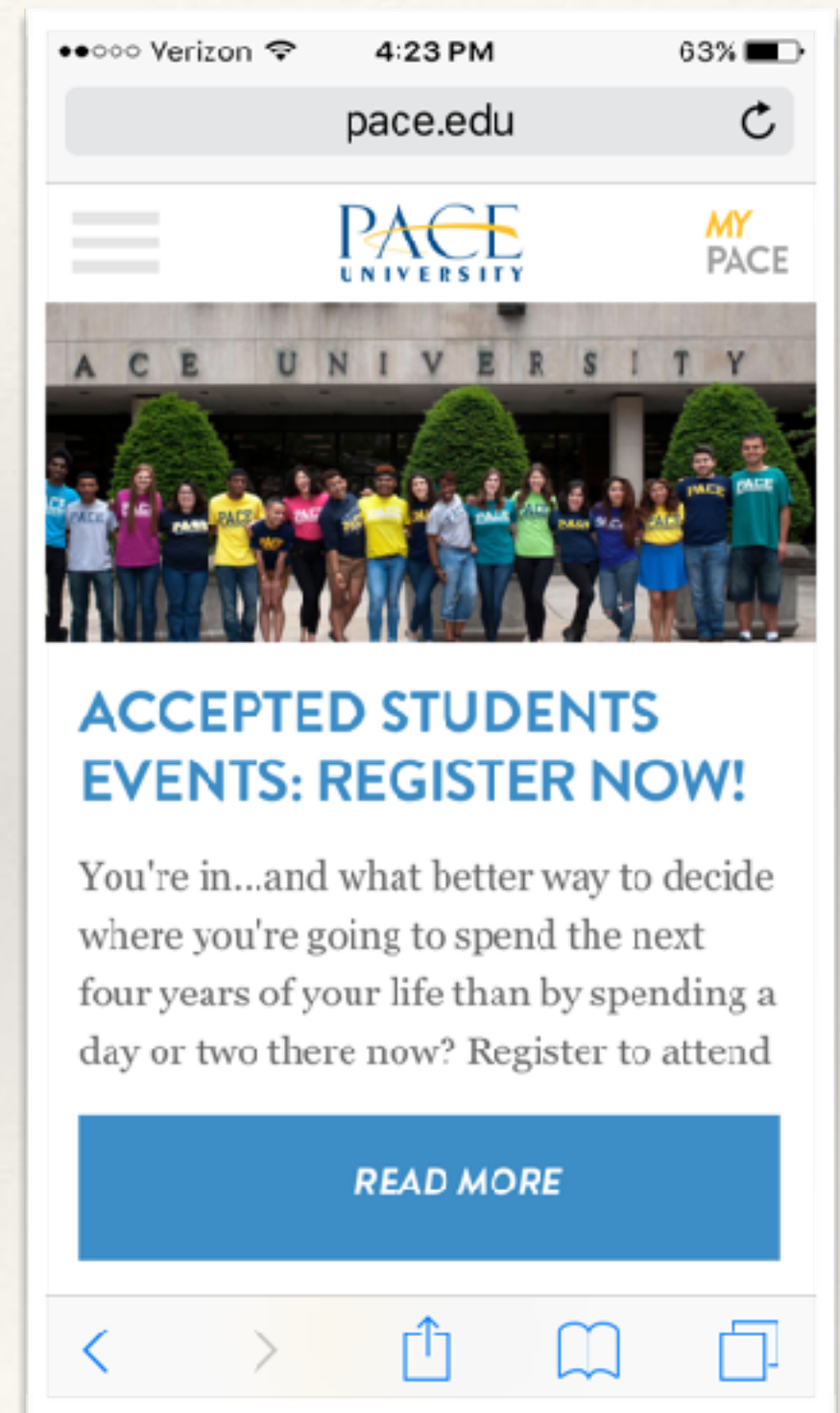
# Progressive Apps

- ❖ Mobile sites that get upgraded to run full screen and have their own icon on a phone's home screen.
- ❖ Example: Flipkart



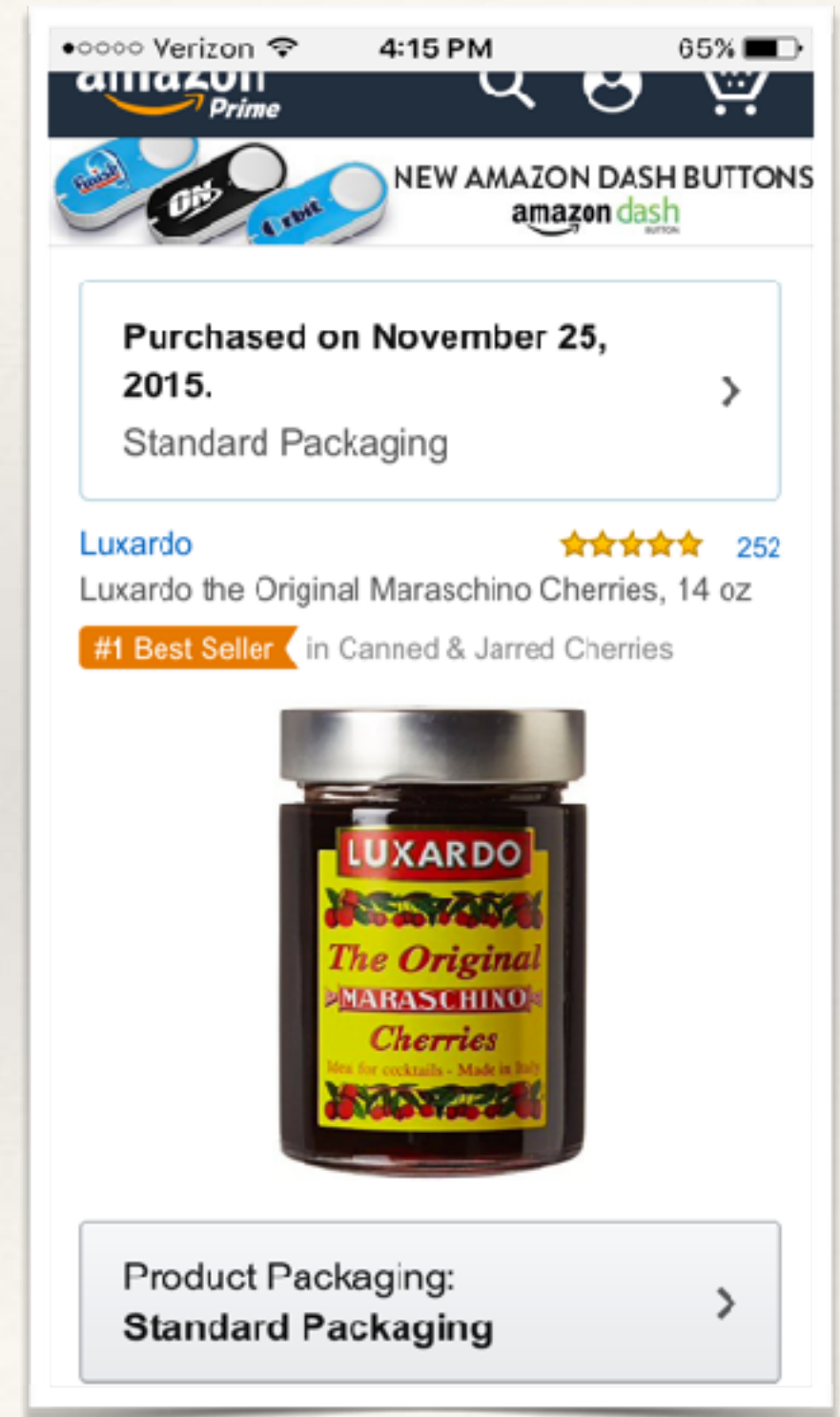
# Responsive Web Sites

- ❖ Web pages that adapt their layout to fit any size device, typically using one column layouts on phones and multi-column layouts on PCs.
- ❖ Example: [www.pace.edu](http://www.pace.edu)



# Dedicated Mobile Sites

- ❖ A separate web site for mobile devices from that for PCs.
- ❖ Example: amazon.com



---

# Key Differences

---

- ❖ *Cost*

Number of codebases, developer skills.

- ❖ *Performance*

Currently the web is noticeably slower.

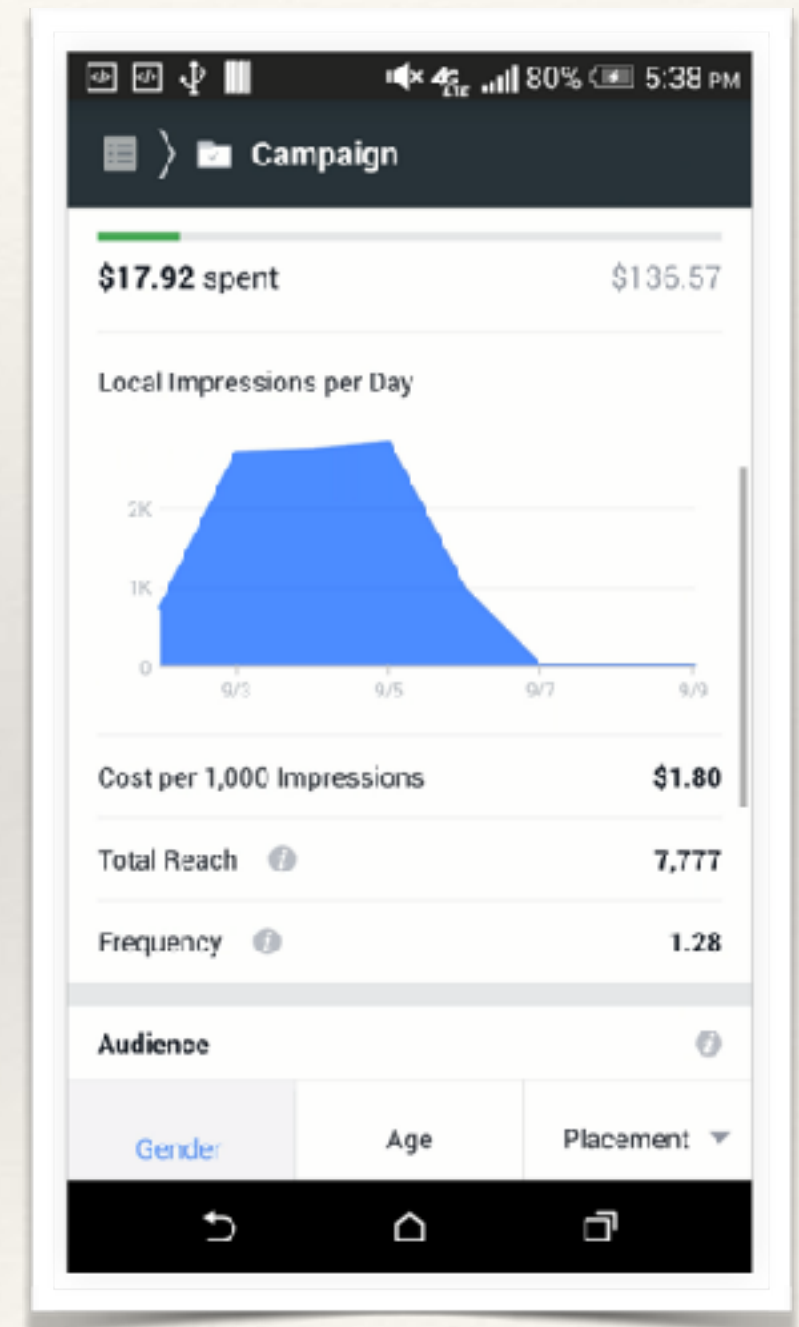
- ❖ *Usability*

The web has built-in search-ability, accessibility, printing, semantics, security, and doesn't need to be installed.



# React Native is now Multi-Platform

- ❖ First cross-platform app was released in 2015.
- ❖ The Android version of React Native was released in September 2015.





Data

---

# Data

---

- ❖ Which mobile platforms are customers using?

---

# Time Spent on Mobile

---

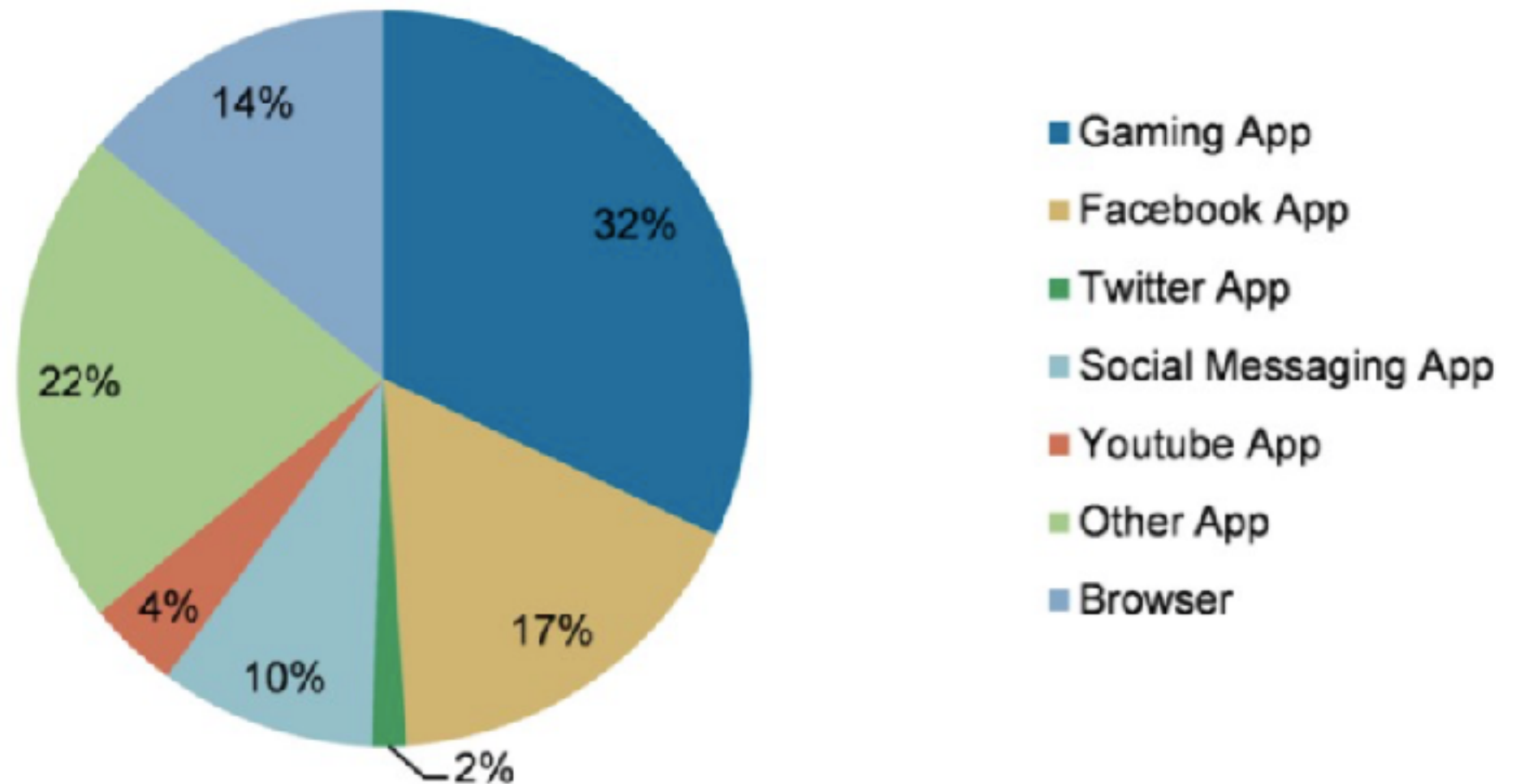
Analytics firm Flurry, which tracks app usage on “over a billion active mobile devices”, says that US consumers spend an average of 158 minutes every day on phones and tablets.

Two hours and seven minutes of that is in apps, and only 31 minutes is in a browser.

Source: <http://venturebeat.com/2013/04/03/the-mobile-war-is-over-and-the-app-has-won-80-of-mobile-time-spent-in-apps/>

# Time Spent on Mobile

Time Spent on iOS and Android Connected Devices- US



Source: Flurry Analytics, Morgan Stanley Research

<http://venturebeat.com/2013/04/03/the-mobile-war-is-over-and-the-app-has-won-80-of-mobile-time-spent-in-apps/>

# Desktop Still Important

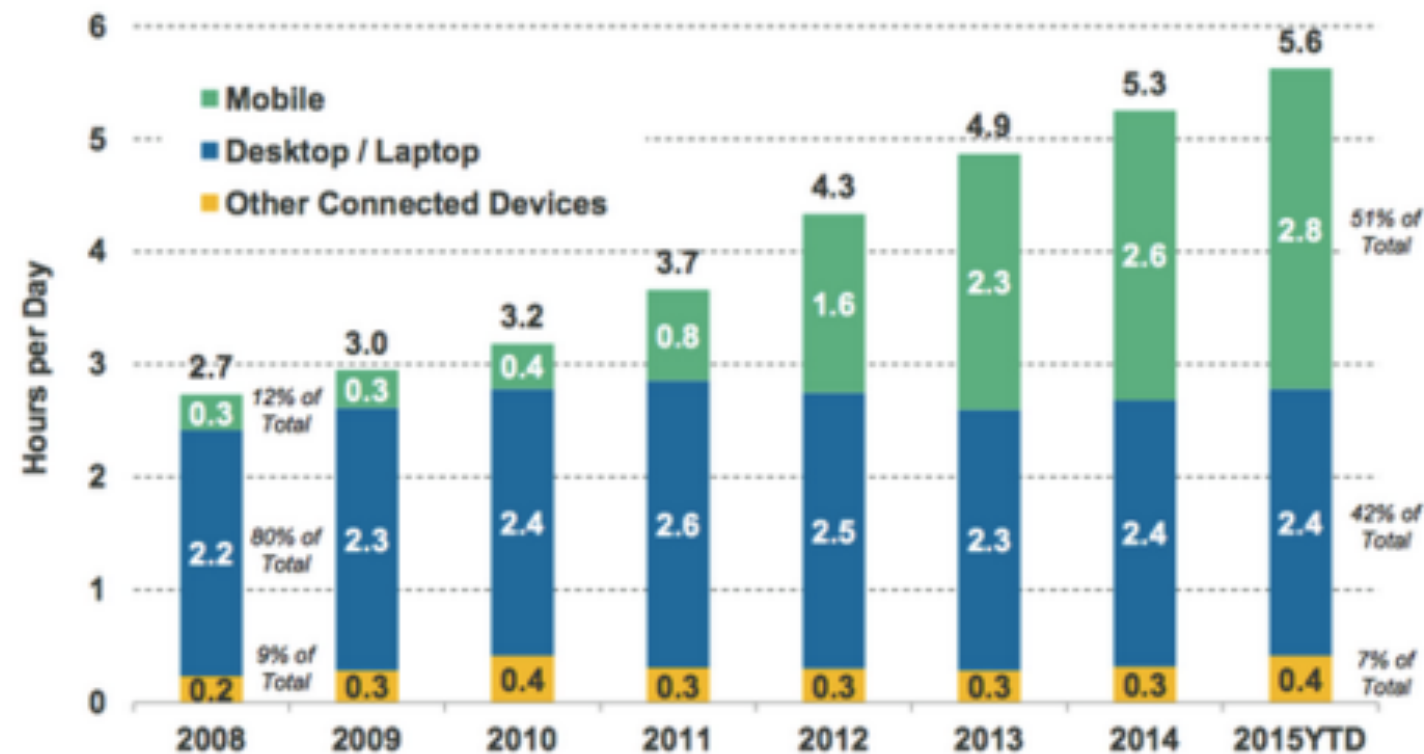


Rand Fishkin @randfish · 20 Dec 2015

Mobile isn't killing desktop. It's killing all our free time.

Internet Usage (Engagement) Growth Solid  
+11% Y/Y = Mobile @ 3 Hours / Day per User vs. <1 Five Years Ago, USA

Time Spent per Adult User per Day with Digital Media, USA,  
2008 – 2015YTD



@KPCB

Source: eMarketer 3/14 (2008-2010), eMarketer 4/15 (2011-2015). Note: Other connected devices include OTT and game consoles. Mobile includes smartphone and tablet. Usage includes both home and work. Ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking.

14



7.6K



4.5K





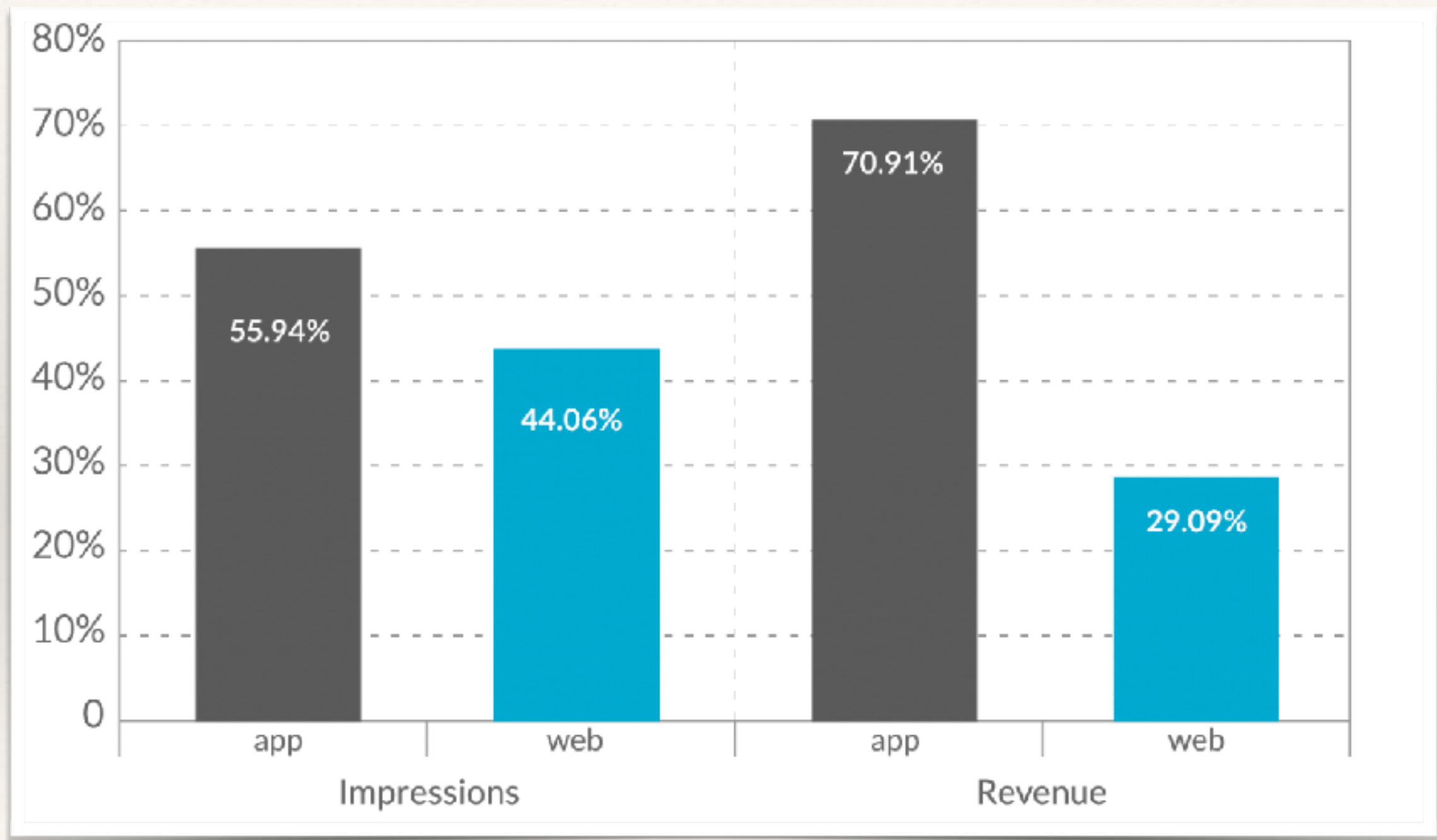
---

# Desktop Still Important

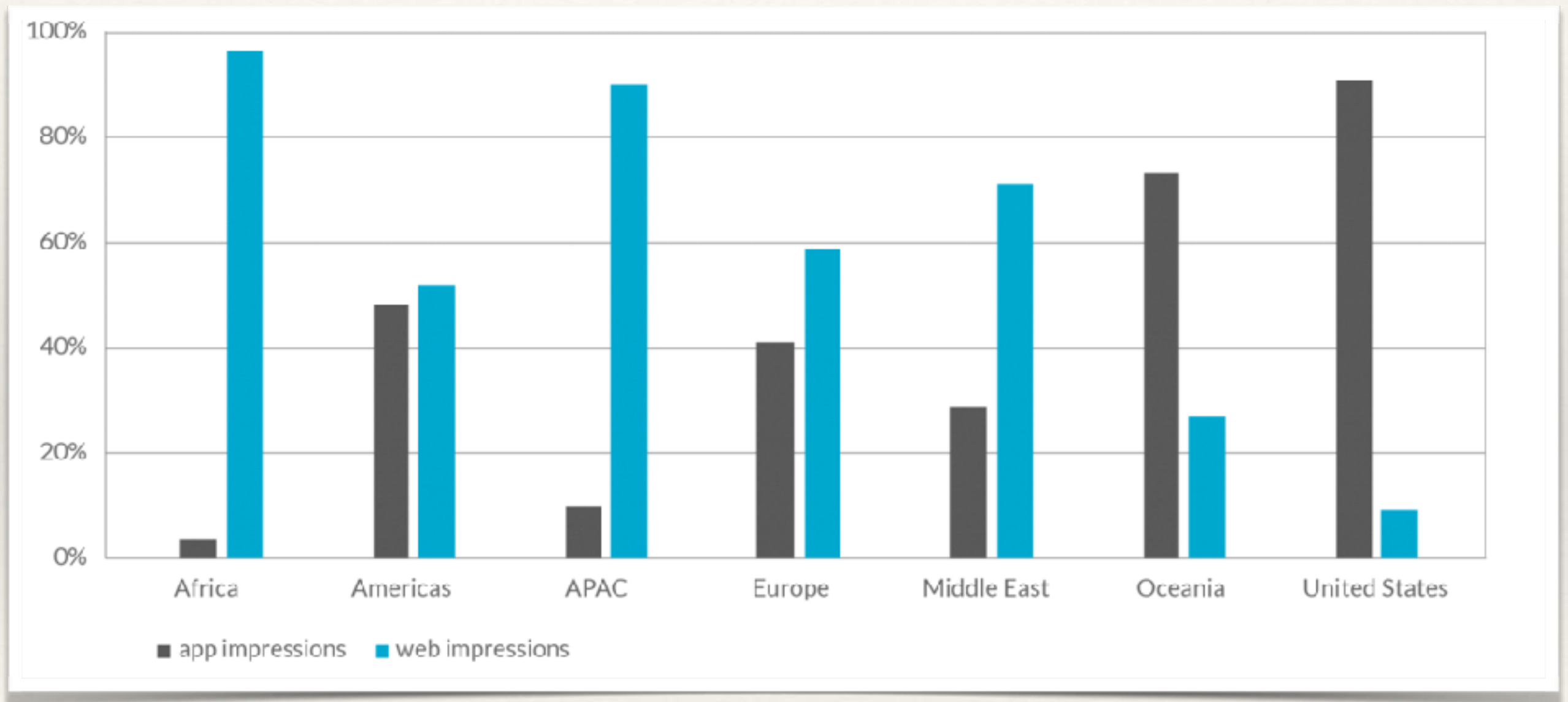
---

- ❖ From June 2010 to June 2013, the amount of consumers' Internet browsing time on smartphones increased 359%, compared with 4% on desktops.

# Ad Traffic and Revenue, App vs Web



# App vs Web Visits by Region



# Ad Traffic and Revenue by OS

OS / device	% of traffic	% of revenue
Android	63.72%	47.66%
Phone	61.30%	42.22%
Tablet	2.42%	5.44%
iOS	21.74%	47.16%
iPhone	17.30%	30.22%
iPad	3.51%	15.51%
iPod	0.92%	1.43%
BlackBerry	0.79%	0.32%
Symbian	3.81%	0.99%
Windows	0.19%	0.09%
Other	9.74%	3.79%

---

# App vs Web Traffic

---

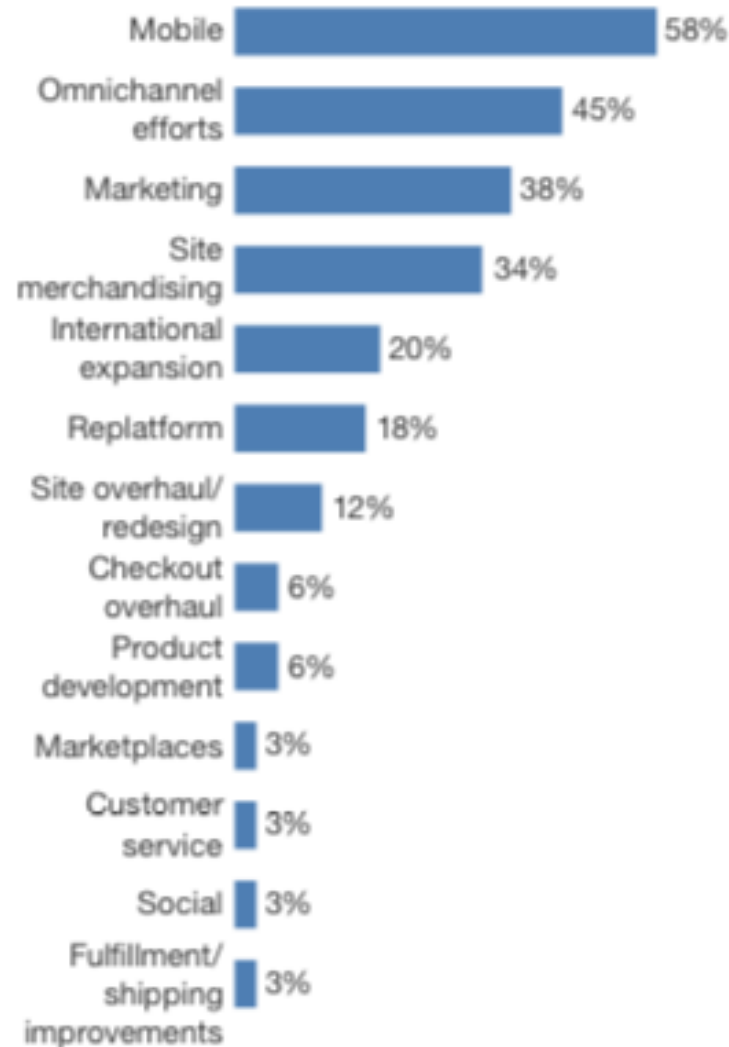
- ❖ 12 of the top 50 mobile sites have more app traffic than web traffic.
- ❖ Only two of the top 30 U.S. retailers drove more than 50 percent of their visits via app — Amazon and Walmart.

Source: Morgan Stanley, [http://linkback.morganstanley.com/web/sendlink/webapp/f/e49099bq-3pb2-g000-a9cf-005056028001?store=0&d=UwBSZXNIYXJjaF9NUwBkMjYxMjIwMC02MDgwLTExZTUtOWNkYS0yYWVjNWZiMzMzMzU%3D&user=k8zaytx6tjb9-610&\\_gda\\_=1569211381\\_ddff0a14f7abbe1454f722f9c78321fc](http://linkback.morganstanley.com/web/sendlink/webapp/f/e49099bq-3pb2-g000-a9cf-005056028001?store=0&d=UwBSZXNIYXJjaF9NUwBkMjYxMjIwMC02MDgwLTExZTUtOWNkYS0yYWVjNWZiMzMzMzU%3D&user=k8zaytx6tjb9-610&_gda_=1569211381_ddff0a14f7abbe1454f722f9c78321fc)



# Priorities for Online Business, 2015

"What are your top three initiatives and priorities for your online (digital) business in 2015?"



## Examples/definitions

Responsive design, mobile site optimization, app development

In-store pickup, ship to store, cross channel inventory visibility

Brand marketing, search optimization, customer acquisition, loyalty, and CRM

Content development, on-site videos, personalization

Sales to other markets

Overhaul of back end of website

Optimization of checkout flow, integration of alternative payments

New categories, new vertically integrated products

Presenting products on other third party marketplaces, launching marketplace or drop-ship capabilities on one's own site

Implementation of features like live chat

Integration of social logins, integration with Pinterest and other social networks

Renegotiation of carrier fees, optimization of shipments and packaging

Base: 60 retailers

Source: The State Of Retailing Online 2015, a Shop.org study conducted by Forrester Research

116879

Source: Forrester Research, Inc. Unauthorized reproduction or distribution prohibited.

---

# Priorities for Online Business, 2015

---

- ❖ Mobile overall is the most important priority. 77% of retailers have a mobile optimized site, and 46% said they used responsive design.
- ❖ However, 56% of retailers said that “apps are not a key component of their mobile strategy to consumers.”

# Facebook's App

“The biggest mistake we’ve made as a company is betting on HTML5 over native.

It’s not that HTML5 is bad. I’m actually, on long-term, really excited about it. One of the things that’s interesting is we actually have more people on a daily basis using mobile web Facebook than we have using our iOS or Android apps combined. So mobile web is a big thing for us.”

*–Mark Zuckerberg, 2012*

“Right now Facebook moves fastest by writing native code. This isn't to say HTML5 won't ever be able to live up to the hype, but just that at this point Moore's Law and the web engines still have some ways to go. So we made a pragmatic decision. Eventually if HTML5 lets us move faster you could expect to see us move back to it. We are going to use whatever tech stack lets us do high-quality work at a fast pace.”

*–Facebook Engineering Manager interviewed by Matt Asay, 2012*



# Examples

---

# App Examples

---

Check out:

- ❖ Stock Touch (native)
- ❖ Discovery VR (native using React Native)
- ❖ Sworkit (hybrid using Ionic)
- ❖ Ionic Documentation (responsive)

---

# Performance Examples

---

- ❖ What kind of performance can you expect from a native app, from a hybrid app, and from a mobile web site?
- ❖ What are the limits of each technology?

---

# Performance Examples

---

Compare the performance of:

- ❖ Stock Touch (native)
- ❖ Discovery VR (native using React Native)
- ❖ Sworkit (hybrid using Ionic)
- ❖ Ionic Documentation (responsive)

# Guidelines



# Respond to the User in 100ms

## Time & user perception

Delay	User perception
0-100 ms	Instant
100-300 ms	Small perceptible delay
300-1000 ms	Machine is working
1,000+ ms	Likely mental context switch
10,000+ ms	Task is abandoned

Source: Ilya Grigorik - [High-Performance Browser Networking](#)

---

# Is HTML Ready for 100ms?

---

- ❖ The phone needs to feel like an extension of the user. Mobile web pages should show immediate visual results for user actions.
- ❖ Is HTML fast enough to offer 100ms response times to user actions? Yes, but only if its pages are designed and developed with this in mind. Animations are faster on native apps.
- ❖ Browsers are written to continuously update page layout, which is a lot of work and introduces jitters in animations.

---

# Design for Speed

---

Mobile web apps can use should try to behave as much like native apps as possible.

- ❖ Fast initialization
- ❖ Offline use
- ❖ Fast animations

---

# Local Storage

---

- ❖ Allows a web page to save data to a device.
- ❖ No difference in localStorage storage space between mobile and desktop.

## Mobile browsers:

Browser	Chrome	Android Browser	Firefox	iOS Safari
Version	40	4.3	34	6-8
Space available	10MB	2MB	10MB	5MB

## Desktop browsers:

Browser	Chrome	Opera	Firefox	Safari	Internet Explorer
Version	40	27	34	6-8	9-11
Space available	10MB	10MB	10MB	5MB	10MB

---

# Pre-Cache

---

- ❖ Pre-caching an application's files is a well known and under-used technique that speeds up a web application. It can make web pages initialize at native app speed.
- ❖ When IndexedDB or localStorage are combined with Service Workers, pre-caching becomes easy for an application to use.
- ❖ Examples: The Guardian website (fonts into localStorage), Morgan Stanley Matrix mobile app (app files into localStorage).



---

# Allow Offline Use

---

- ❖ IndexedDB and localStorage also allow pages to continue to work when offline.
- ❖ Network requests can be stored and sent when a connection is restored.

---

# GPU-based Animations

---

- ❖ Animating an object's position, rotation, scale, or opacity is generally much faster than animating other properties.
- ❖ Animating via CSS allows the browser to anticipate your animations, and optimize them more easily.
- ❖ Complex animations created with JavaScript will run in the same thread as the main page thread, and are likely to be much slower.

# Conclusions

---

# Summary

---

The first mobile need for most companies is a web site that works on both desktop and mobile.

Multithreading, offline storage, hardware-based animations, and mobile hardware APIs have enabled mobile web sites to close the functionality gap between themselves and native apps.

With time, the web will get more and more capable. But it can't currently compete with high end native apps on responsiveness and animation.

---

# Summary

---

Until the web has better performance and more powerful APIs, native apps will remain the preferred technology for building mobile apps.

Hybrid apps are faster and cheaper to build than native, and are an attractive choice for companies when decreased performance is not a problem.

Ionic, React Native, and NativeScript are the best known hybrid frameworks. Ionic embeds a browser in a native app, to allow apps to be created with web technologies. React Native and NativeScript allow native animations and API calls, but will not work on the web.