Future of Search

Insights in Engineering Leadership White Paper

Abstract

Many service providers gained strong brand recognition (e.g., Amazon for consumer purchases, Yelp for business reviews). These service providers gain prominence and cannibalize web search engine traffic. To make up for this loss, the search engines should offer extra value to the user that the service providers cannot provide alone.

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Authors
EJ Campbell/ *Yahoo*
Annie Cheng / *Yahoo*
Rajesh Desai / *NetApp*
Ben de Waal / *NetApp*
Evgeniy Gabrilovich / *Google*
Ikhlaq Sidhu / *Faculty Advisor, UC Berkeley*

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I. Introduction and Observation

Through the past decade, web search used to be the single place to translate user's intent (query) to information (knowledge) and action (purchase, print out map, install software). Now service providers such as Yelp, Flixter, Facebook, Twitter and Amazon are satisfying these intents via their web portal and gain dominance via easy to access and personalized mobile apps.

In order for search engines to stay part of a user's transactional experience and counteract the threats of service providers, two things must happen:

1. Search engines must use their vast knowledge of the entire web and app content, combined with their intimate knowledge of their users, to provide superior search results.
2. Search engines must provide comprehensive deep links into native mobile apps. This will ensure they can continue to provide the optimal search results for every query.

II. Existing Service Provider Marketplace

In May of 2012, the average US smartphone user had 41 applications installed and the spent 39 minutes a day using them. It is expected that app downloads will quadruple in the next four years. [1], [2]

A more recent study [3] from April 2013, showed that when Smartphone and Tablet use is combined, US consumers spend 2 hours on their devices and spend 80% of that in applications, with 50% of that spent on Facebook or playing games. Consumers spend just 20% of their time in a web browsers. Users are also becoming comfortable with installing and using applications, with the average apps opened increasing from 7.2 to 7.9 per day from 2010 to 2012.

Table A-1 shows the monthly unique users of top service providers and how that compares to Web search usage.

Table A-1 monthly unique users of top transactional sites

Property	Monthly Unique Users (US) -- Sept 2013
Google Search (web)	68-75MM
Google Search (app)	55-65MM
Yelp (web)	21-28MM
Yelp (app)	7-10MM
Ebay (web)	27-34MM

Ebay (app)	14-20MM
Amazon (web)	44-58MM
Amazon (app)	11-23MM

Source: Comscore Mobile Metrix 2.0 Key Measures September 2013 (data approximated)

While the above data shows that mobile web site are still significantly more popular way of accessing these sites, apps are growing fast:

Table A-2 Apps reach growth

App	June 2012 to Feb 2013 Growth Rate
Google Search	-2%
eBay	+30%
Amazon Mobile	+25%

Source: Comscore Mobile Dashboard June '12 and Feb '13

As we see, the installation base of the Google Search app has plateaued, while Ebay and Amazon mobile apps have significantly increased their reach.

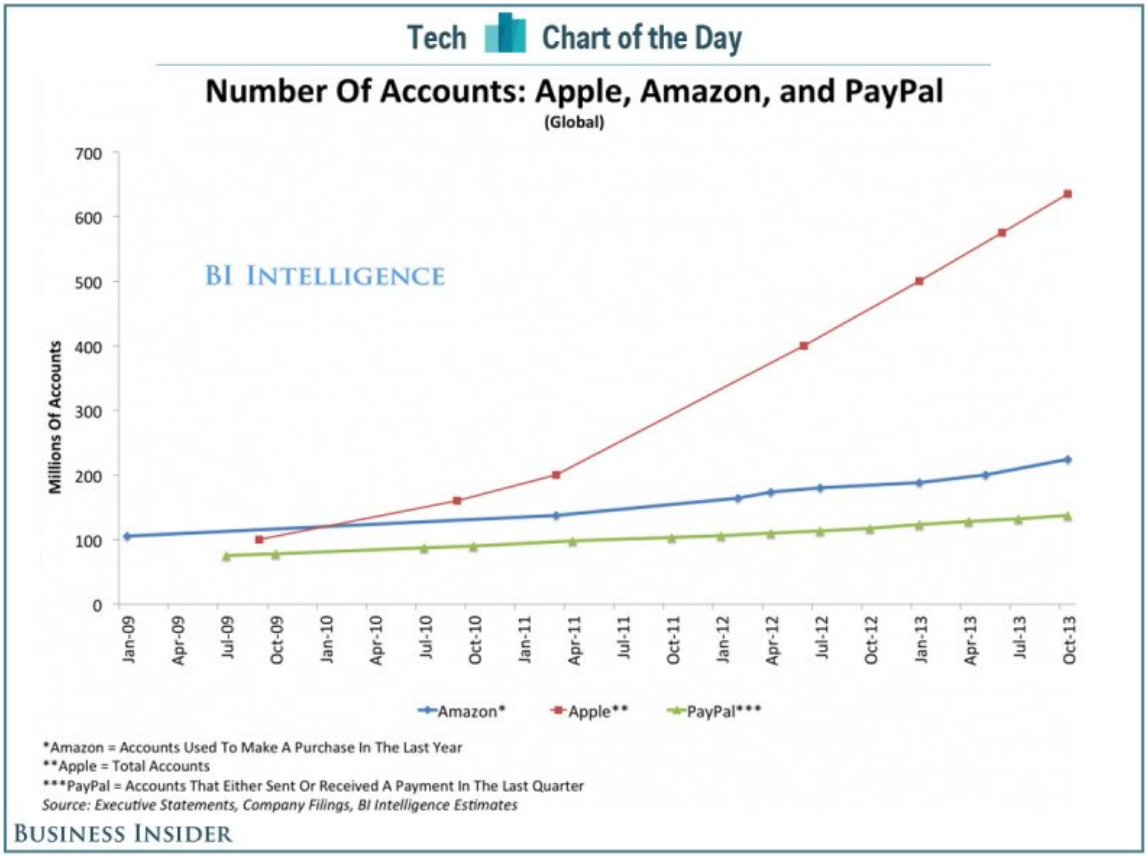
This poses an existential threat to the search engines. If special purpose applications become dominant, large sites like Amazon and eBay could find it in their best interest to stop spending money on AdWords. The bet would be that consumers will move from starting their transactional and actionable queries on a search engine to specialized apps and sites, cutting out intermediaries and weakening their competition by limiting exposure to competitive results. This strategy worked well for Southwest Airlines. For more than a decade, they've blocked access to their fares from travel sites like Expedia, forcing consumers to visit [4] southwest.com instead. This cuts out the middle-man and gives Southwest Airlines full control over the customer relationship.

Twitter.com also employed a similar strategy when they cut off access to Google's firehose [5], eliminating Google's ability to answer real-time queries (e.g. a user asking "what is the source of that fire?"). Losing this access was so significant that Google was forced to shutter their real-time search product search, ceding control to twitter for these queries. Search engines can't let the same thing happen to the much more lucrative e-commerce traffic.

Apple itself is a significant threat to search engines. Over the past two years, Apple has added digital wallet capabilities to the iPhone and iOS through innovations such as Passbook, fingerprint scanning, iBeacon [15] and Bluetooth Low Energy support [16]. Apple has over 600 million [6] users on file, many linked with a credit card. This gives Apple the ability to become a significant player in e-commerce infrastructure. Apple could choose to extend their App Store model to provide a way for native

applications to sell goods and services with these ID's on Apple devices. We already see this will virtual goods sales in mobile game apps and music sales through ITune app. Apple has a huge incentive to weaken Google in any way possible given that they are Apple's fiercest competitor [7], making this scenario all the more likely.

Figure A-1 Number of Accounts: Apple, Amazon, and PayPal



Finally, mobile messaging apps are also eroding the Search engine's traditional place in the transactional commerce ecosystem. During a recent promotion, WeChat, a mobile messaging app popular in China, was able to sell 150,000 Smartphones [8] in under 10 minutes. E-commerce revenue for Line increased 32x year over year. Facebook is also in an excellent position to start eating into Search Engine's position as the jumping off point for e-commerce searches, given the time spent in the app and the closely held knowledge of the user's social graph.

III. Technology: App vs the Web

We can divide how the internet is consumed into two general categories:

1. Traditional - using a web browser usually in harmony with a powerful search engine
2. Apps - using dedicated programs to streamline online transactions

Looking at web search, there are three broad categories people satisfy [17]:

1. **Informational** - the need is for information or knowledge. A user either wants to learn about something that is archived somewhere, or they would like to consume events, such as the news or sports results.

For knowledge queries, the needs are well met with traditional search engines, and typically a user would use his mobile web browser to do this. For current events, one could use a mobile web browser, or one could use one of many aggregation applications, that gathers events from feeds, usually organized by topic or interests.

2. **Transactional** - the need is to perform some action, such as posting an update, booking tickets, or finding directions to the closest coffee shop.

In many cases, vendors offer both mobile aware web sites and mobile apps. Many people choose to install the app over using the web interface. This is in part driven by simplified workflow as we'll outline below. The app becomes a kind of bookmark for future use.

3. **Navigational** - the search engine is used almost as a bookmark, to simply direct the user to the first match. For example, querying Amazon simply to get to amazon.com.

Support of navigation for apps installed on one's mobile device can be found in apps such as Aviate[10]. Depending on time of the day or location, Aviate helps its mobile user by presenting the most appropriate apps in its home phone screen. For example, instead of having to find the weather apps in the morning before getting out of the door, Aviate will showcase weather app in the morning at its home screen. Instead of finding yelp app right before lunch time, Aviate will showcase yelp app in the home screen.

Apps versus web search

Mobile applications offer a few advantages over traditional web pages:

- User interfaces are designed to fit the particular actions a user could want to take without any distraction or layout problems that browsers must deal with. Mobile apps are designed to work on small form factors and generally perform better than websites, that needs to be more generic to cater for a wide variety of browser visitors.
- Apps have user context. It can store user details (such as credit card information) more reliably than a browser can, and it can also store information relevant to the particular action it is designed to do.
- Personalization is easier because users usually are logged into the app. All usage patterns can be tracked closely for personalization.
- Apps have more access to the user's device. They can send push notifications, run in the

background, participate in geofencing (e.g. push a notification when a user is near a store), and can make significant modifications to the UI and easily appear on the home screen.
- Although a bit more subtle, mobile devices are usually set up such that the lock screen protects unauthorized access to the device, but once unlocked, a user typically do not have to re-enter his credentials for the variety of apps they use.

The workflow of mobile apps are also more efficient. For example, traditional web search typically follows this flow:

1. launch the browser
2. type a query for the search engine,
3. examine results, sometimes by clicking forward and backtracking to decide
4. navigate to the chosen site to set up the desired action,
5. potentially enter credentials and/or other details, like billing information

In contrast, mobile app flow is as follows:

1. the user selects the desired action by launching the appropriate app
2. perform transaction; all the meta information is automatically provided.

Another powerful difference is that traditional search results aren't always aware of the geographical context in which a search is performed. People use apps to find things to do locally. [9]

This tension is changing how we consume the internet and it's disintermediating the search engine.

However, the steady state would likely not be a world where browsers are extinct. There is still a need for searching for information, and it is interesting to note that online shopping itself is a category where mobile users prefer to use web browsers over mobile apps. Potentially this is due to shopping being an action that is a combination of research (i.e. information need) and an action. [11] There are also various negative social sentiments to having an app for everything. [12]

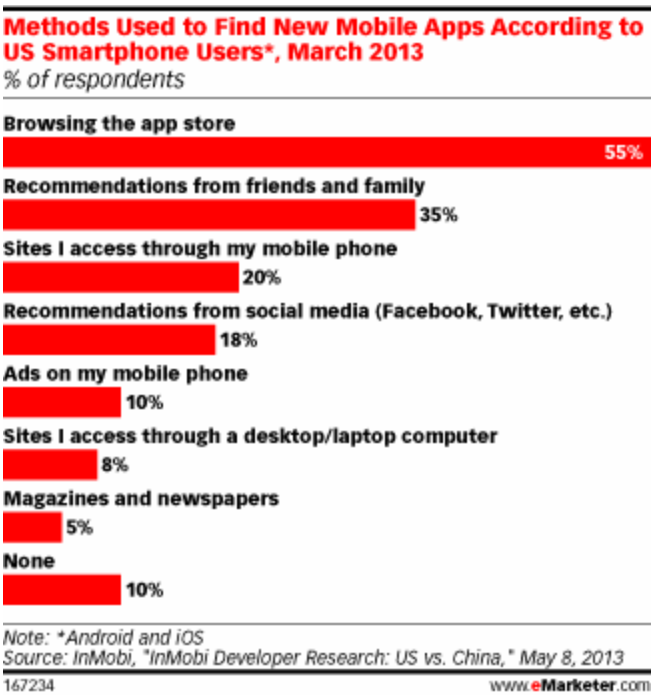
But as noted above, the reach of apps are increasing fast. The dominance of Facebook, the increasing reach of Twitter and the rise of mobile messaging apps like WhatsApp, Line and WeChat move users away from the open mobile web and into the walled gardens of native apps. While users may not want to install an app for their favorite local delicatessen, they will like be receptive to receive an offer through one of the apps they're already spending 80% of their time using.

IV. Social & Identity Factors

The apps people have on their devices say something about their interests and their social circles. Cornell University conduct a study [13] that identifies a user as a specific 'appitypes'. An 'Appthusiast' is a user who searches out and downloads the latest apps. An "Appcentric" uses a mobile phone as their main computing device.

The social aspects of these app provide a vehicle for users to receive trusted reviews from their

friends. A recent study [14] found that over 74 percent of users relied on social networks to help guide purchases.



Choosing the right app is hard, so this is a worthwhile problem to address. in 2010, one in four apps were discarded after first use. [15]

A search engine could use the apps installed to build a better user profile - potentially suggesting new apps that would be most compatible with a user's preferences, all based on what other people similar to the user chose. A search engine could also utilize a user's app usage information to have user re-engage with the app or use it as as a negative filter to not suggest certain app.

V Future for Search Engine & Challenges

Search dominates seeking of information on desktop. With internet user traffic shifting to mobile, the decreasing usage of search on mobile will require search vendors to take action in order to defend their advertising revenue.

Most apps by themselves do not make money. There are a handful of apps that derive advertising revenues, and these are often apps that have a companion presence on the desktop (e.g. Facebook, LinkedIn, Amazon).

The primary revenues for standalone apps come from the services that are procured through them (e.g. Fandango, OpenTable, etc.). These service providers are interested in becoming the premier purveyors of their service.

As such, there is incentive for apps to be tied to advertising, and search engines are currently the best advertising vendor since they know their users so well.

We see the following outcomes for our hypothesis. Search vendors:

1. can pretend nothing happened
2. can expand their relationship with users by acquiring competing services or building an app suite
3. offer deeper integration indexing apps
4. consolidate
5. offer a paradigm shift

Let's evaluate each of these:

1. **Search vendors can pretend nothing happened:**

This seems like an unlikely outcome, given that they already see Revenue per Search going down.

2. **Search vendors can expand their relationship with users by acquiring competing services or building an app suite:**

The idea here is to establish alternatives to the leading brands to entice users to spend more time in their walled gardens. You build or buy.

This outcome seems unlikely since building would require tremendous energy - you're trying to outdo an established business with divided focus and a late start. Acquisition is a better choice, but even here you may have to settle for the number 2 or 3 player.

3. **Search vendors can integrate much deeper with apps:**

Apps can integrate with search indexing in a way that search results could include pointers to apps users already have installed. The integration can be made powerful enough to launch the app and navigate automatically to the right context when such a result is selected.

4. **Search vendors can consolidate:**

They're going to try to beat each other up first. This could happen eventuality if they fail at all their other options, but this probably longer term than the scope of our hypothesis.

5. **Search vendors can offer a paradigm shift:**

The idea here is that they change the game in such a way that they become indispensable.

Reduction in complexity for users

The test we apply to offer likely outcomes is related to the burden users face today. As mentioned, the traditional web search and even using apps are all fairly cumbersome methods to get things done. The shift from web search to using apps directly is actually a movement towards simplicity.

If we take simplifying to the extreme, our prediction is that search engines could evolve into virtual assistants, much like Siri, Google Now and Cortana.

Basically they provide seamless and almost magical experience.

We see applications integrate into the back-end of these assistants in a way the user do not interact with them directly, but instead just benefit from their services.

Users will benefit from lower cognitive load choosing the right app or service, and will benefit from superior personalization. Search engines know their users well since they understand their broad interests. Apps know their users well in their particular vertical domain. The combination is even more powerful.

VI Summarize and Predict Opportunity

As app and brand service provider gains eyeballs, money follows. This posts significant threat to the search engines' lucrative revenue stream.

In order for search engines to protect its advertising revenue and counteract the threats of service providers, search engines must use their vast knowledge of the entire web and app content, combined with their intimate knowledge of their users, to provide a superior search result. In addition, search engines must provide comprehensive deep links into native mobile apps. This will ensure they can continue to provide the optimal search results for every query. Lastly, search engines should evolve into virtual assistants who solves user's problems (queries) directly with tighter integration with apps.

Bibliography

[1] “Global Mobile Statistics 2013 Section E: Mobile Apps, App Stores, Pricing and Failure Rates.” Accessed April 7, 2014. http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/e.

[2] “App Downloads Will Double in Next Four Years.” Accessed April 7, 2014. http://www.emarketer.com/Article/App-Downloads-Will-Double-Next-Four-Years/1010579.

[3] Wed, Simon Khalaf on, Apr 03, and 2013. “Flurry Five-Year Report: It’s an App World. The Web Just Lives in It.” Accessed April 7, 2014. http://blog.flurry.com/bid/95723/Flurry-Five-Year-Report-It-s-an-App-World-The-Web-Just-Lives-in-It.

[4] S, Greg, oval Staff Writer, and CNET News. “Southwest Soars without Travel Sites - CNET News.” *CNET*. Accessed April 7, 2014. http://news.cnet.com/2100-1017-881149.html.

[5] “As Deal With Twitter Expires, Google Realtime Search Goes Offline.” *Search Engine Land*. Accessed April 7, 2014. http://searchengineland.com/as-deal-with-twitter-expires-google-realtime-search-goes-offline-84175.

[6] “CHART OF THE DAY: Apple Has 600 Million Accounts, Blowing Away Every Other Company.” *Business Insider*. Accessed April 7, 2014. http://www.businessinsider.com/chart-of-the-day-apple-has-600-million-accounts-blowing-away-every-other-company-2013-11.

[7] Fiegerman, Seth. “Google Tops Exxon Mobil to Become World’s 2nd Most Valuable Company.” *Mashable*, February 7, 2014. http://mashable.com/2014/02/07/google-second-most-valuable-company/.

[8] “Xiaomi Sold 150,000 Smartphones In 10 Minutes On WeChat.” *The Next Web*. Accessed April 7, 2014. http://thenextweb.com/asia/2013/11/28/chinas-xiaomi-sold-150000-smartphones-10-minutes-using-chat-app/.

[8] “Travelers Seek Out Local Info via Mobile.” Accessed April 7, 2014. http://www.emarketer.com/Article/Travelers-Seek-Local-Info-via-Mobile/1010197.

[9] “Aviate | Tint.” Accessed April 7, 2014. https://www.tintup.com/aviate.

[10] “Global Mobile Statistics 2013 Section E: Mobile Apps, App Stores, Pricing and Failure Rates.” Accessed April 7, 2014. http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/e#appwebsubstitute.

[11] “Tumblr Blog Says What Everyone Thinks: I Don’t Want Your App.” *The Next Web*. Accessed April 7, 2014.

http://thenextweb.com/shareables/2013/05/12/this-tumblr-says-what-everyone-is-thinking-i-dont-want-to-download-your-app/

[12] "You Are What You App: Choice of Smartphone Applications Define Your Computing Style." *ScienceDaily*. Accessed April 7, 2014. http://www.sciencedaily.com/releases/2011/02/110215144423.htm.

[13] "The Rise Of Social Commerce - Incredible Statics, Facts & Figures [INFOGRAPHIC]" All Twitter. Accessed April 7, 2014. http://www.mediabistro.com/alltwitter/social-commerce_b46141

[14] "Global Mobile Statistics 2013 Section E: Mobile Apps, App Stores, Pricing and Failure Rates." Accessed April 7, 2014. http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/e#mobile-app-flops.

[15] "iOS: Understanding iBeacon." Accessed April 7, 2014. http://support.apple.com/kb/HT6048.

[16] "BLE vs. NFC: The Future of Mobile Consumer Engagement Now [infographic] | MobilePaymentsToday.com." Accessed April 7, 2014. http://www.mobilepaymentstoday.com/blog/12157/BLE-vs-NFC-The-future-of-mobile-consumer-engagement-now-infographic.

[17] Andrei Z. Broder: A taxonomy of web search. SIGIR Forum 36(2): 3-10 (2002)

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