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How Web Development Is Changing In Response to Mobile Technology

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In this research report I will provide a literature review of how web development is changing in response to mobile technology.

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Chapter I: Introduction

In this research report I will provide a literature review of how web development is changing in response to mobile technology. The intent is not to provide an exhaustive research review and analysis but to highlight key areas of importance and concern in the 2013 development environment and beyond. The market for tools to create consumer and enterprise facing apps is complex with well over 100 potential tools and vendors (Petty, 2012). In addition to the vast array of tools developers must decide on, they must also make decisions on what devices they will need to develop for. Mobile apps are device independent and apps for iPhone devices will not work on other mobile devices such as Android, Windows or Blackberry devices. Developers can use mobile websites to address some of the incompatible app development issues as mobile websites can be accessed on all devices because all smartphones have an HTML browser (Martin, Pastore, & Snider 2012). These are just a few of the hurdles developers are facing today in our world of growing mobile technology.

Problem Statement

One current problem in web development is that developers are struggling to deliver high performance quality content across multiple mobile operating systems and hardware platforms. The many changes developers need to make to accommodate mobile technology can lead to frustration when creating a mobile experience that needs to work for 550 million people across 7,000 different kinds of phones (Colao, 2012). With the current rise in popularity and usage of the iPhone and other Smart Phone technologies user expectations for the mobile experience has grown exponentially.

Chapter II: Current Status of Technology

Mobile Growth

The proliferation of mobile devices has had an influence on development technology. Apple changed everything with the release of the iPhone, and industry and consumer expectations for mobile experiences were completely reset (Charland, & Leroux, 2011). The popularity of the iPhone brand increased consumer adoption of mobile technology and led the way for widespread smartphone mobile usage worldwide. In addition to Apple products, many other vendors began to capitalize on the consumer's consumption for mobile technology. With all the mobile vendors having their own proprietary mobile solutions it would take an army of programmers to maintain support for each operating systems platform and device available to the world market place. Vic Gundotra, VP of engineering at Google, claimed that "even Google was not rich enough to support all of the different mobile platforms from Apple's App Store to those of the BlackBerry, Windows Mobile, Android, and the many variations of the Nokia platform,"⁶ and this was before HP webOS, MeeGo, and other platforms emerged (Charland, & Leroux, 2011).

In an effort to make web development more standardized, manageable and cost efficient, business and industry professionals have begun to work together toward a potential solution. Ian Jacobs, editor of the World Wide Web Consortium (W3C)'s HTML4 recommendations and other standards stated that: "The Web is now a platform for applications with two driving forces. First is the proliferation of diverse devices joined with the variety of browsers, this has complicated life for developers, who want to "write once and deploy everywhere." Second, is, "the Web has now embraced the social networking model which can enable businesses to reach

hundreds of millions of more customers” (Anthes, 2012). The web can now be accessed from mobile smartphone and tablet devices and as the use of these devices continue to increase developers will be constantly challenged to develop applications, tools, products and services to meet the needs of consumers and business managers and executives.

Mobile Usage Trends

Advances in mobile technology have had worldwide implications on consumer use and adoption rates. The International Telecommunication Union reported in December 2011 that there are now 5.9 billion mobile cellular subscribers worldwide (Martin, Pastore, & Snider, 2012). The Pew Research Center, found that 27 percent of the population now accesses news on mobile devices (Esco, 2012) and according to mobiThinking.com, there are 5.9 billion mobile subscribers — 87 percent of the world population (Esco, 2012). In analysis of recent trends in 2013 Brinker & Khan from Deloitte Consulting found that 13% of all Internet traffic originated from mobile devices and reported that a survey of Web-enabled phone owners found that 80% of the participants multitasked on their mobile device while watching TV (Brinker & Khan, 2013).

Even though data analysis indicates that mobile device use is sustaining volume and growing it also seems to indicate that businesses and developers are struggling to meet the demand. Research shows that across the Fortune 100, only 62% of companies have some kind of publicly available app. Even fewer, 52%, have mobile-oriented websites (Brinker & Khan, 2013). One particular challenge companies and developers must overcome is to determine what direction they want to take in implementing mobile technology. Wisniewski, 2011 states that which mobile path is right for you depend on many factors: your constituency, your budget, your goals, and your skill set and identifies that there are three approaches to going mobile: Native app, Mobile web and, Hybrid (Wisniewski, 2011). Wisniewski, 2011 further defines native apps

as apps that live on the mobile device itself; Mobile websites are websites that live on a web server. Hybrids apps offer the persistence of a native app with easier, user-friendly, and familiar development tool and programming languages (Wisniewski, 2011). With Native app and Mobile web being the most common approaches to mobile development I will look to provide additional literary review specifically related to these two approaches.

As mobile consumer adoption and use rates rise “mobile first” became a rallying cry in 2012, calling for each project, solution, or investment to strongly consider a mobile component (Brinker & Khan, 2013). As business and developers look for opportunities to integrate mobile technology into their products and solutions usability and interoperability problem arose. Most noticeability was mobile device usability problems, such as physical limitations, software limitations, dependence on available networks and speeds, and physical environment considerations (Fuegen, 2012). Mobile devices are much smaller than traditional laptops and personal computers and development approaches to mobile devices has forced developers to try and accommodate for the physical differences in web enabled device platforms. The common usability problems that are centered on the small physical size of the mobile phone features are limited screen resolution, limited user input, and operating limitations (Martin et al, 2012). In addition to the usability problem, few industry standards across vendor solutions on device hardware manufacturing and development, has created interoperability issues. Applications, product and services developed for one specific vendors device will often not work or not work as well on another vendors mobile device. Interoperability issues result due to the platform fragmentation of mobile devices, mobile operating systems, and browsers (Martin et al, 2012). Mobile native apps are often one area of development that is vulnerable to the interoperability issues seen today.

Mobile Apps

Though interoperability issues exist with mobile apps they are still widely used in mobile smartphone and tablet device development. Typically developers will only develop to 1, 2 or 3 of the most popular devices as they will often need to develop and maintain multiple versions of the same code to support each device platform they are marketing to. Some developers and business choose to not deliver their products and solutions to mobile customers via an app but elect to do so with a mobile optimized web site. "In many cases, whether an app or a mobile-optimized site is more preferred depends on the retailer's customer base and the strategic value of mobile to their organization," says John Andrews, vice president of product strategy at Oracle (Liyakasa, 2012). Some companies may choose to develop both apps and mobile websites as native apps can be more efficient and powerful in delivering specific technologies and user experiences. John Andrews of Oracle also stated that "Mobile-optimized Web sites are great catchalls for quick hits and high-volume sites," but factors like network and device limitations can hinder mobile access and create latency issues for mobile Web sites, he adds (Liyakasa, 2012). Some developers believe that to deliver the best user experience native app would be the preferred development approach over mobile website technology. The web technology stack has not achieved the level of performance we can attain with native code, but it's getting close (Charland, & Leroux, 2011). There are some advantages to web development not achieved in working with a native app such as their can be less interoperability issues. HTML developed websites has the potential to work more seamlessly across different device platforms with little modifications versus having to create multiple native apps for each mobile operating system vendor platform. Steve Pinches, FT group product head for emerging technologies, says there is always likely to be a market for native apps for specific brands or when deeper integration with

the hardware or super-fast performance are required (Williams, 2012). Mobile web and HTML 5 hold hope and potential for developers that an industry standard can emerge that will help to minimize the current problems in mobile development usability and interoperability concerns.

Mobile Web and HTML 5

If developers chose to take the mobile web approach there are web development tools and plug-ins that can help developers optimize their websites for use with mobile devices. Some of the plug-ins can detect when someone accesses your website from a mobile phone or tablet device and format your site so that it displays properly. Of Alexa's top 20 web-sites, 18 have a device detection feature that adapts the website to the mobile phone that it is displayed on (Esco, 2012). HTML 5 is one development tool growing in popularity and can be used by developers to create mobile friendly websites. On December 17, 2012 the World Wide Web Consortium (W3C) published the complete definition of the HTML5 (World, 2012). Now developers have a standard in web development that they can begin to use to address some of the interoperability, browser fragmentation and hardware design issues seen today. HTML 5 is beginning to have an impact in web development. Web developers are changing the way they build websites because of HTML5, a set of standards designed to make website development easier in a mobile multimedia world (Soder, 2012). Williams 2012 reported that one company, The Financial Times (FT), choose to use HTML 5 web development over native app development. FT was able to reach two million users with their HTML 5 app and dropped their native iPad app. (Williams, 2012). FT's group product head, Steve Pinches stated that by eliminating the native app the company was able to speed up the development process, provide a rich user experience and reduce cost.

Many industry analyst and professional have cited the benefits of HTML 5, Soder 2012 states that HTML 5 allows developers to incorporate animation, video and other multimedia elements into websites without using software tools such as Flash, which has been criticized for using too much processing power and exposing web users to viruses (Soder, 2012); In a recent Kendo UI survey of more than 4000 developers, 63 percent indicate that they are "actively developing with HTML5" (World, 2012); Tony Mujic, ProgressBook product manager Software Answers Inc., said this fall the company plans to start releasing HTML5 versions of its ProgressBook education software products, to ensure the software works well on any device eliminating the need to develop a iPhone and Android app (Soder, 2012).

One big early supporter of HTML 5 was Facebook. Facebook attempted to unite their mobile efforts across one consistent architecture, using HTML5 (Colao, 2012). Facebook developer Jonathan Dann stated that

“By allowing us to write once and ship across multiple platforms, HTML5 has historically allowed us to keep the Facebook mobile experience current and widely available, and has been instrumental in getting us to where we are today. We chose to use HTML5 because not only did it let us leverage much of the same code for iOS, Android, and the mobile web, but it also allowed us to iterate on experiences quickly by launching and testing new features without having to release new versions of our apps.” (Colao, 2012)

Although Facebook was an early supporter over time they found that HTML 5 did not meet their development needs and eventually end up releasing native apps to meet their end-user performance needs. Facebook took a hybrid approach, leveraging their HTML5 efforts from the mobile Web to work in native applications in iOS and Android. The result was disappointing

(Colao, 2012). Facebook began receiving negative reports from their user based concerning the performance and reliability of their HTML 5 Facebook apps and decided that they needed to make a change on how they were doing mobile web development. Dann also said

“while utilizing web technology has allowed Facebook to support more than 500 million people using Facebook on more than 7000 supported devices, they realized that when it comes to platforms like iOS, people expect a fast, reliable experience and our HTML 5 iOS app was falling short, since Facebook released a new, wholly native version of its iOS app, ratings have jumped from 1.5 to 4 stars in just a few weeks” (Colao, 2012).

For the Facebook mobile users it seems that the HTML 5 app was lacking in performance and reliability and not delivering the mobile experience users wanted. Facebook CEO Mark Zuckerberg stated “I think the biggest mistake we made as a company is betting too much on HTML5 as opposed to native,” (Colao, 2012). Early research shows that HTML 5 can be a beneficial tool for some eliminating the need to code the same web products and services for multiple mobile devices, while still be a hindrance for others lacking the ability to deliver the richest most powerful mobile user device experience. HTML5 is one part of the equation, but Chris Ruff, President and CEO of UIevolution, agrees that it isn't at the point where it can deliver a user experience comparable to what can be had with a native application (Berg, 2012). Research suggest that html 5 in its initial state may not be the tool to completely resolve all the developer issues and concerns with delivering content to mobile users. Developers and business professionals must still make smart native versus web mobile design choices based on their market and users' needs balanced against the best ROI provided for their business goals.

Mobile design

For those developers and business that may elect to use HTML 5 and web development as their primary design philosophy there are other important design decisions to be made. One consideration in mobile design currently being debated is if businesses should have two separate websites one for mobile device users and one for traditional web desktop and laptop users. Jakob Nielsen, usability expert and publisher of the mobile usability guidelines stated: “Good mobile user experience requires a different design than what’s needed to satisfy desktop users. Two designs, two sites, and cross-linking to make it all work” (Lawson, 2012). Not all developers agree with Mr. Nielsen assessment of mobile design requirements. Some believe that one well designed website should be capable of meeting the needs of both mobile and traditional web users. Josh Clark author of Tapworthy: Designing Great iPhone Apps stated that over 25% of people in the US who browse the Web on smartphones almost never use any other platform (Lawson, 2012). Mr. Clark also stated that we should all start and build a single website and then gradually enhance the experience to adapt to the capabilities of the specific device. Most likely the trend that more and more users will only use small mobile devices for web browsing will continue. With internet and television content constantly merging the ability to access the internet on large screen HD television screens will also grow and the user experience and expectations most likely will still be very different. Developers will also need to develop new design skills to deliver touch-optimized mobile applications that operate across a range of devices in a coordinated fashion (Petty, 2012). The challenge to provide a one size fit all website for all users will continue to be an industry and developer community challenge in the near future and beyond.

Chapter III: Future of Mobile Web Development

Mobile Devices

The future of mobile web development will need to be able to deliver content to more users than ever before. Mobile hardware and operating systems platforms for mobile devices seem to be expanding as other merchants and manufactures look to capitalize on the mass worldwide consumer adoption of mobile technologies. Gartner predicts that by 2013 mobile phones will overtake PCs as the most common Web access device worldwide and that by 2015 over 80 percent of the handsets sold in mature markets will be smartphones (Petthey, 2012). In addition the continued mobile smart phone growth explosion developer will also need to be prepared for the needs of the many tablet users. By 2015 media tablet shipments will reach around 50 percent of laptop shipments and Windows 8 will likely be in third place behind Google's Android and Apple iOS operating systems (Petthey, 2012). Industry analysts believe that internet access by mobile devices will increase significantly over the next 2 to 3 years. Global mobile traffic will increase by a factor of 26 by 2015 (Thiagarajan, Aggarwal, Nicoara, Boneh, & Singh, 2012). Industry analysts are predicting that eventually with the rapidly expanding growth of mobile access to the Internet, access from tablets and phones will soon exceed that from desktops and laptops (Vertal, 2012). Brinker & Khan, 2013 found that mobile is a fast-moving engine that is fundamentally reshaping operating models, business models, and marketplaces (Brinker & Khan, 2013).

The future expectation is that mobile technology will have a large impact on web content development. Opportunities for content and application development in education and training utilizing mobile technologies are beginning to emerge. GSMA Mobile Education Landscape 2011 report found that the mobile learning market in the United States reached \$958.7 million in

2010, and is projected to reach \$1.82 billion by 2015 (Martin et al., 2012). If these predictions hold true developers will be tasked to meet the needs of the market and will be obligated to develop, enhance and maintain even more mobile code than ever before. Martin 2012 found that as a result of increased interest from business and industry on mobile based instruction, it is important for graduate programs to teach students to design and develop instructional content for the mobile web (Martin et al, 2012).

HTML 5

Developer will still need to decide how best to deliver educational and other content and apps to user, so the debate over whether to use native apps or emerging HTML 5 technologies will persist. Some have predicted that there will be a long term shift away from native apps to Web apps as HTML5 becomes more capable. Other developers are less convinced that HTML 5 will meet all the future needs of mobile users and developers. Pettey, 2012 states that native apps won't disappear, and will always offer the best user experiences and most sophisticated features (Pettey, 2012). Gavin Davies, a software developer at Box UK, says: HTML5 is unlikely to be set in stone until at least 2014, but we're already seeing a number of benefits, including powerful audio and video support (Williams, 2012). HTML 5 is being used by some developers today but not all current browsers support all the features of HTML 5. If all the future version of mobile browsers developers embraces the HTML 5 standard mobile technology may begin to move toward more standard open solutions and away from closed proprietary apps. The W3C HTML Working Group will conduct a variety of activities to ensure that the HTML 5 specifications may be implemented compatibly across browsers, authoring tools, email clients, servers, content management systems, and other Web tools (World, 2012).

The adoption rate, success, and enhancements to HTML 5 could be important to the future and potential to establish a common reliable and stable industry standard for mobile development. The W3C group will also analyze current HTML5 implementations, and establish priorities for test development. The Working Group has planned for this implementation phase to last into mid-2014, after which W3C expects to publish the final HTML5 Recommendation (World, 2012). HTML 5 as implemented today will not meet all users and developers needs and native and hybrid solutions are still required to achieve some high performance and rich user experiences development objectives. While HTML5's limitations are many, it's definitely not being abandoned. In fact, most believe the technology has a bright future that will be driven by continued innovation in both the software and hardware departments (Berg, 2012).

HTML 5 is important to today's developers but the future of mobile technology can mean many different things to many different people. While Webb 2012 stated that for e-books and content in general, HTML5 is the future (Webb, 2012), most consumers and developers equate mobile technology to cell phones not tablets and e-reader technology. With the popularity of the Apple and Android tablets mobile technology has begun to merger closer to PC and laptop technology. As mobile technology grows the potential for it to expand into other industries, services and professions would be a logical next step for mobile technologies. Mobile potential goes far beyond smartphones and tablets to include voice, gesture and location-based interactions; device convergence; digital identity in your pocket; and pervasive mobile computing. The very definition of mobile is changing (Brinker & Khan, 2013).

Chapter IV: Impact Analysis

Native vs. Web

Some developers and analyst believe that HTML 5 will have a significant impact on mobile and web development. The three categories of CSS3 and HTML5 that are having the biggest impact on web development are the reduction of images being used, transitions and animations, as well as the audio and video tags (Shaw, 2011). It is thought that HTML5-compliant smartphones may lead to a reduction in the power of closed app platforms such as Apple iOS and Google Android (HTML 5, 2011). This could potentially open the smartphone market up to more vendor solutions and consumer options which could drive down the cost for consumers and spark even further innovation and competition.

For businesses that operate both a mobile website and a traditional website HTML 5 has some potential to provide operational and cost efficiencies in maintaining and updating code. HTML 5 let Facebook push code once to update m.facebook.com, and both apps simultaneously. It also let Facebook rapidly deploy small tests to segments of its mobile users without forcing them to download new versions (Constine, 2012). The impact HTML 5 has on rapidly deploying features was a plus for some developers. Facebook developer Jonathan Dann stated that stories in news feed consist of headers, profile pictures, timestamps, messages, photos, videos, the "Like" and "Comment" buttons, and more. HTML5 allowed us to add these features and update our designs quickly (Colao, 2012).

Although Facebook did achieve some benefits with their HTML 5 implementations there were also some reported negative implications in the area of end users performance and needs. Facebook eventually developed and released native apps to meet the needs of their user community. Release of Facebook for Android 2.0, replaces the HTML 5 hybrid native/webview

code with an all-native infrastructure to answer years of complaints by making the app much faster (Constine, 2012). Facebook also stated that “the Android 2.0 infrastructure in place will continue to let us make the app even faster, smoother, and feature-rich” and that it isn’t abandoning HTML5 entirely.

Even though the Initial HTML 5 implementation at Facebook was not a huge success the company seems to still see value and potential in the technology. Facebook’s mobile site will still run on HTML5 and since most of the company’s mobile users still access the social network through a browser, the potential for HTML 5 success still exist (Colao, 2012). Facebook has indicated that it will continue pushing for better HTML5 standards from mobile browser vendors in hopes it can one day do more with the protocol (Constine, 2012). As Facebook found out mobile technology can have a significant impact on the way a company does business. Mobile devices have become even more relevant and dynamic as Web 2.0 and Web 3.0 tools and social networking applications have evolved into more sophisticated products that are designed to interact with mobile devices (Fuegen, 2012).

HTML 5 has provided some impact in helping developers interact with mobile devices and deliver content to multiple hardware and OS platforms but one major drawback as stated by Peter Yared of CBS Interactive is that HTML5 doesn’t allow developers to take advantage of many of a device's sensors (Webb, 2012). When developers need to interact and engage all the hardware and OS features of a mobile device at times this is best accomplished with a native application implementation. Whether developers choose to use HTML 5 or native, the impact of HTML 5 and native apps on web development will continue to grow. Important factors contributing to this growth have been the availability of low cost mobile devices and constant access to the wireless network (Martin et al., 2012). While opportunities in academics and other

areas exist for mobile developers, Fuegen 2012 found that in the areas of distance education the portability of mobile devices, as well as the programmability their hardware, software, and operating systems provide, allows for a learning experience that can be customized to both student and faculty needs (Fuegen, 2012). As mobile technology begins to expand into other areas such as education and academics as a tool for learning the impact could be significant. Mobile web learning tools could soon be needed in the workplace as well and smartphone and tablet type devices could soon be the norm for delivering educational content to mobile users.

Other Development Concerns

It seems that HTML 5 and native app development will have the biggest impact on mobile technology web development but other development concerns may begin to also have an impact to the business and web development community. Designing energy-efficient web sites by intelligently designing web pages to reduce energy consumption may one day be required (Thiagarajan et al., 2012). It has been found that some aspect of a developers code can consume more energy than others and one day mobile consumer may be making decisions based on how energy efficient a web site or app is when running on their mobile device. Optimizing Mobile Web Pages by Shrinking JavaScript on a mobile page to contain only functions used by the page greatly reduces energy cost (Thiagarajan et al., 2012). Energy can also be saved if CSS code is web page specific and contain only the rules required by the elements in the web page. As the usage of mobile devices become more and more abundant consumers and businesses both will look for opportunities to reduce cost and create competitive and market advantages. Cost-aware mobile browsing for users whom are subject to usage based pricing data rate plans may also be needed. In addition to looking for energy efficient mobile web sites and apps, users may want web developers to reduce the amount of data downloaded to their mobile devices when using

web sites and apps. Cost-aware mobile web browsing is to associate each web page download with a cost quota that is reflective of the number of bytes that the user would need to download the page (Chava, Ennaji, Chen, & Subramanian, 2012). If developers were to identify telecom and data rate cost associated with particular web and app activities and give consumers an option to not perform certain costly activities it could have a major impact on how developers code certain web sites. In a cost-based web browsing model, a user could have the flexibility to specify the cost quota for a web page and the server could be able to provide a condensed version of the page that fits within the specified quota (Chava et al., 2012). Although consumers and business have not yet started to demand or expect this level of mobile awareness the future impact to web development would be significant if they did. With industry professionals expecting nearly 50% of all internet interaction to be on a mobile device by the year 2015, it is important that designers consider how their website will look on a mobile device (Shaw, 2011). Developers may also need to consider how their design decisions impact other areas of mobile technology from energy consumption to data cost analysis. Gary Kovacs, CEO of Mozilla, says: “We need to move beyond the silos of native operating systems and hybrid apps on proprietary platforms to device-agnostic platforms that run the full, standards-compliant and open web (Williams, 2012). The impact of mobile technology on web development is growing annually and expectations are that developers will need to continue to rise to the occasion to meet mobile consumer needs and industry demands.

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