

# The Coming Paradigm Shift in Computing Interfaces and How Academic Libraries Need to Adapt

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# The coming paradigm shift in computing interfaces and how academic libraries need to adapt

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## **Abstract**

Recent reports by IT research groups argue that recent developments in mobile devices and the mobile web will lead to the majority of Internet users accessing web services via mobile devices in the next few years. An analysis of web access statistics for mobile web browsers confirms that, if trends continue, web service access from mobile devices should exceed desktop access by end 2013.

Due to the rise in popularity of mobile devices the interface paradigm of keyboard, mouse, windows and pointers that has been in place for the last 20 years is changing to one of touch, gesture, speech and video. Browse based interfaces are changing to search based interfaces and mobile device services are becoming increasingly contextually aware.

In the face of these changes educational institutions need to provide new interfaces for their services in formats suitable for mobile devices. Traditional library web services should be simplified in form and function and provided to users alongside traditional desktop computer services

Curtin University Library has developed two solutions for mobile users, a mobile website and a library app for Apple devices. Experience in development has highlighted the benefits of a mobile website over a mobile app, including reaching a wider range of clients, reduced development costs, faster content updates and more ready access for users. While there are benefits to device specific applications, it is argued that mobile development for libraries should prioritise mobile website development over mobile app development.

## ***Introduction***

While mobile devices have been available for over twenty years it is only in the last few years that we have started to see a rapid rise in the popularity of mobile devices. The advent of multi-touch smartphones in 2007 and the release of multi-touch computing tablets in 2010 have caused a rapid increase in mobile device usage. Today mobile devices are ubiquitous and are causing a shift in the technological landscape not seen since the advent of the Internet.

This paper provides an overview of the current state of the mobile web worldwide with context given to academic libraries. It uses the experiences of Curtin University Library in developing for mobile as examples in a discussion about how libraries should adapt their services for their clients using mobile devices.

## ***Mobile Devices***

For the purposes of this paper mobile devices are defined as handheld, portable, computing devices. They are generally Internet connected and can access the Internet from anywhere with a wireless or mobile network. Laptops are not generally considered to be mobile devices because they are not handheld and cannot be used well while moving about. Laptops also do not generally have a constant Internet connection and have a relatively short battery life. Mobile devices are purpose built to be carried around and used anywhere. They have a simplified user interface and typically have a constant Internet connection.

Mobile devices currently fall into two main classes - small and large screen devices. Small screen devices include smart phones and hand held media and gaming devices while large screen devices include tablets and LCD based eReaders. Large screen devices work reasonably well with our current service interfaces and while advances are being made in interface design for tablet formats the need for change is not so pressing.

Due to their size, small screen mobile devices on the other hand work poorly with current service interfaces. This paper will discuss the need to change library interfaces for small screen mobile devices. For the sake of brevity, further mentions of 'mobile devices' throughout this paper will be referring specifically to small screen mobile devices.

## ***The mobile Web***

Use of the Web on mobile devices prior to smart phones was a frustrating experience, with sites being difficult to use and not well formatted for mobile Web browsers. Web sites simply had too much content to fit into a small display. Usability was not helped by traditional Web user interfaces being designed around large screens requiring the use of mice and keyboards for precise control. Mobile devices with very small screens and awkward interface controls such as numeric pads and miniature physical keyboards made the Web very unattractive to use on mobile devices.

The introduction of multi-touch technology on mobiles enabled screen sizes to be increased and the controls made more responsive. As a result high quality multi-touch enabled web browsers on smart phones allowed a great deal more of the Web to be usable on a small mobile device. With the release and the rapid increase in popularity of the first smart phones the Web finally became realistically accessible on mobile devices driving the adoption and use of the Web on mobile devices.

The World Wide Web that a user encounters when they access the Web through a browser on a mobile device is called the 'mobile web'. A 2011 United Nations report (International Telecommunication Union, 2011) stated that in rich countries almost half the population has a device capable of connecting to the mobile web. Google's 2012 mobile survey results demonstrated that in developed countries more users are using mobile web enabled phones than computers (Leverich, 2012).

StatCounter, one of the largest trackers of Web usage worldwide, has been tracking mobile Web usage since the start of 2009. Its figures demonstrate that mobile Web access has risen from less than 0.7% of total Web usage in January 2009 to 8.5% in January 2012, a twelve fold increase in the last three years ("Mobile vs. Desktop from Jan 2009 to Mar 2012," 2012). StatCounter published a press release in February 2012 stating their statistics indicate that 'Mobile internet usage is doubling year on year' ("Mobile internet usage is doubling year on year," 2012).

As the population of smart phone users becomes dominant the amount of users with a fully functional web browser in their hands wherever they are will increase dramatically. If current trends continue mobile web usage should overtake desktop web usage in the next three to five years. IDC New Media Market Model states that 'By 2015, more U.S. Internet users will access the Internet through mobile devices than through PCs' ("More Mobile Internet Users Than Wireline Users in the U.S. by 2015," 2011) while the 2011 Horizon Report argues that by 2015 the vast majority of people will be accessing the internet from mobile devices (Johnson, L., Smith, R., Willis, H., Levine, A., and Haywood, K., 2011).

### ***New paradigm***

While the popularity of the new breed of mobile devices in recent years has instigated a very large increase in mobile Web usage, the interaction is still difficult and at times frustrating. Since the early 1990's the World Wide Web has evolved in parallel with desktop personal computers and Web content has been adapted to these personal computers. As more users are starting to access the Web through their mobile devices a large number of limitations have become evident. Limitations of mobile devices for Web browsing include the small screen size, the lack of a traditional Graphical User Interface (GUI) with windows, lack of precise screen interaction (mouse) and the slowness and cost of 3G networks. The rise in mobile usage has thus placed pressure on Web content creators to adapt their sites to accommodate these limitations.

In the last five years there has been rapid adaption of traditional web sites and services to mobile device formats. All of the world's top 25 websites and the vast majority of the top 100 as ranked according to Alexa ("Alexa Top 500 Global Sites," 2012) have adapted their services for the mobile Web. The accommodation of mobile devices has become so prevalent that some are arguing the approach of a paradigm shift for user interfaces. Gartner ("Gartner Identifies the Top 10 Strategic Technologies for 2012," 2011) has the following to say about mobile interfaces:

The user interface (IU) paradigm in place for more than 20 years is changing. UIs with windows, icons, menus, and pointers will be replaced by mobile-centric interfaces emphasizing touch, gesture, search, voice and video. These changes will drive the need for new user interface design.

Apart from just driving change to the Web, mobile user interface design is also feeding back into desktop user interfaces. Microsoft will be releasing Windows 8 in 2012 with significant adaptations for touch screens and gestures while the recent release of 2011 release of Apple Mac OSX Lion is clearly encouraging trackpad user interface control over mice driven control by enabling and encouraging swipe and gesture interaction on Apple Macintosh computers very similar to their mobile device offerings.

Mobile adaptation is permeating interface design so thoroughly that Internet professionals are starting to see mobile as the basis for all user interface design. Many now argue for a 'Mobile First' approach to all web and application design (Wroblewski, 2011).

### ***The path forward***

Given the recent rise in popularity of mobile devices, the resulting increase in use of the mobile Web and the shift toward a mobile centric design for user interfaces it is appropriate for educational institutions to reassess their web offerings and provide new interfaces in formats suitable for mobile devices.

The discussion above demonstrates the worldwide adaptation of services for mobile devices. The need for adaptation in university services is even more critical. The largest uptake of mobile devices and the mobile Web has been among the age groups most dominant at universities. In the US last year the top two age brackets for smart phone adoption were ages 28-24 at 62% and 25-34 at 54% (Nielsen, 2011). As a result university students will have high expectations for mobile services across all university services including academic libraries.

During the last year the author did two independent informal surveys across all 39 Australian university libraries. In October 2011 it was found that 48% of university libraries had adapted their library catalogue for mobile and 28% had adapted their library website for mobile. In March 2012 it was found that 67% of university libraries had adapted their library catalogue for mobile and 41% had a mobile library website. While services had improved significantly in the six-month period the majority of university libraries still had no adaptations for mobile users encountering the library homepage on their devices.

The Web is expanding past the desktop interface it started on and becoming multifaceted, with access across a multiplicity of devices. If academic libraries are to remain relevant for their clients into the future they will need to do the same for the services they provide on the Internet.

### ***The mobile Web or mobile Apps***

Given that the popularity of mobile devices has only started to be significant in the last three years we are still in the early stages of determining how to best provide services for mobile devices. Mobile Web development is at the stage where desktop Web development was in the 1990's when there was much debate about what services to provide and what technologies to use. Today that debate is mirrored by significant unresolved discussions about mobile applications (popularly known as Apps) versus the mobile Web.

Last year a US report (Newark-French, 2011) indicated that for the first time use of the mobile Web had fallen below use of mobile Apps. Use of mobile Apps over the mobile Web increased again in 2012 (Newark-French, 2012). This reinvigorated a discussion across the Web about whether the Web or Apps will be the dominant Internet model into the future and whether organisations should be putting their efforts into App based services rather than the Web. Some are arguing that the Web is dead (Anderson & Wolff, 2010) while others argue that the world needs a mobile Web and should not abandon the Web for more closed proprietary models.

The primary benefits of Apps over the mobile Web are their ability to utilise a relatively sophisticated user interface, providing a better user experience, and the ability to directly access more of the mobile device sensors such as the compass and GPS. A recent report (Newark-French, 2012) reveals that gaming and social media took up 79% of time spent in Apps. The use case for popular Apps do not reflect the use case for primary library services and as such the fact that App use is high should not necessarily indicate that Libraries should develop Apps for their services.

Libraries today predominantly provide access to electronic resources on the Web. Mobile Web sites integrate with Web based resources much better than Apps do. Apps tend to provide experiences that have limited connections with other Web resources. As a result even though the user experience of an App might be better than their experience of a website, the overall user experience for users can in some cases be reduced or cumbersome because of the poor integration between Apps and other web resources.

In 2009 Curtin University Library developed a mobile website incorporating its main Library website services as well as a catalogue search built on top of Exlibris's Aleph. Shortly after release of the mobile website the Library started developing an iPhone App that was released in 2011. To simplify the development process the initial App was developed with an interface very similar to the website. Developing and maintaining both solutions has afforded an understanding of the benefits and detriments of both solutions.

An individual mobile App is more costly to develop than a mobile website. Mobile web development requires Web and scripting skills while an App normally requires a programmer to

work with a strongly typed and compiled programming language around a full phone software development kit. As a result the Library's iPhone App development took considerably more time utilising an iPhone developer with specialised skillset.

While a website can be made to work across all modern mobile devices an App will only work on one type of device and will need to be redeveloped for each device type. Developing an App solution to have as wide a reach across mobile devices as a mobile website makes it an order of magnitude more expensive. App maintenance is significantly more costly as well and while updates to the mobile web can be made in a matter of minutes if necessary, updates to a mobile App can take weeks or more as such updates need to undergo a vendor submission and approval process.

In developing the iPhone App Curtin University Library recognised maintenance difficulties and built in a backend service hosted by the Library to update content in the iPhone application without the need to resubmit the App to Apple. While this has alleviated some of the pain in maintaining the App the customisation options are limited and a full resubmission is required if more advanced updates are required.

With the increased cost of development and the reduced range of devices, the benefits of developing an App over a mobile Web are relatively small, especially when standard services provided by an Academic Library website are mostly based on search, browse and forwarding to external resources. In summary, for library services App provide little benefit over a mobile website at a significantly higher cost.

More recently there has been discussion over hybrid models, HTML5 based webapps and hybrid phone Apps that incorporate web based technology into an App framework. Both of these solutions tread a middle ground between cost of development and user experience (Cavazza, 2011). Curtin is currently adapting its mobile website to incorporate more webapp functionality to improve interfaces for clients.

### **One Web**

As well as the App versus Web debate there has been a lot of discussion about whether mobile device users really need a separate mobile Web. The Worldwide Web Consortium (W3C), the international Web standards body, recommends a move towards 'One Web' across all devices connecting to the Web ("Mobile Web Best Practices 1.0," 2008). It argues that the same information and services should be available to users regardless of what device they are using for access.

The One Web debate encompasses two issues: how should Web content be presented on a mobile device and what Web services should be made available on a mobile device.

While there is consensus that the presentation of Web content needs to be adapted for mobile there is conflicting opinion on how to achieve that goal, with two opposing solutions put forward. The first solution, called responsive design, argues that Web designers should utilise design methods and technology to allow for the same content to be displayed for different formats. A website will display the same html, images and information and should update the page structure depending on the calling device (Lawson, 2012). The second solution works on the principle that it is not possible to use the same content without unreasonable sacrifice to performance and usability and as such a separate mobile website should be developed alongside the main desktop website (Nielsen, 2012). This is also called server side adaption as the server will detect the mobile device and present the appropriate web page (Cremin, 2011).

It would appear that advocates for responsive design are appealing more to ideals that practicality. Responsive design seldom results in an optimal user experience across all devices. This is reflected by the fact that most major Web companies have utilised server side adaption techniques instead of responsive design (Cremin, 2012).

For Curtin University Library the debate over a separate website was mainly irrelevant since the design of the library desktop website was created and managed by a separate Curtin University

governing body and was not adaptable to mobile. As such Curtin Library has had to develop and host an independent website for mobile. Interestingly, the primary mobile website links out to other mobile interfaces for library services (library catalogue, subject guides and news blog) and all these utilise responsive design. This makes the Curtin mobile site mildly but unavoidably eclectic.

The other discussion around the One Web is whether the same services should be deployed on the mobile Web as the Desktop Web and as before there are two main arguments. The first is that we should not make assumptions about how users are going to use Web services. Adaption of content for mobile devices is still in its early stages and limits should not be placed on the growth of mobile services. Adding to this argument is the fact that a significant percentage of people only access the Web from their phone and a larger percentage use it as their primary means of accessing the Web. We should not be limiting Web services for these users.

The counter argument is that mobile Web users do actually use their devices in different contexts than desktop web users and as such we should be prioritising content differently on mobile devices than the desktop. Also, mobile devices have a significantly different range of capabilities than PCs and thus the use case for mobile devices is different. Web service providers should be building mobile Web services that focus on and take advantage of the unique capabilities of mobile devices.

Given that one of the guiding principles of libraries is the promotion of free flow of information and ideas, libraries should aim to provide as many of their services across as many mobile devices as possible. That said, assessments can be made on the use of information and resources on mobile sites and reprioritisation of content can be performed through presentation changes while leaving all services intact.

Currently Curtin University Library has mapped as many services as possible from its desktop website to its mobile website and its mobile App. The library has had limitations on adapting content due to cost and feasibility but the majority of services are available with only isolated services being mobile unfriendly.

### ***Conclusion***

Mobile device usage is increasing and user interface design is changing to adapt. Academic library students are leading the population in mobile device acquisition and university libraries need to adapt to maintain relevance with their clients.

Libraries should update their Web services to provide for access from mobile devices. They should provide access to all of their services in separate custom mobile Web interfaces. To maintain a cohesive experience across their mobile Web service libraries should also advocate for mobile Web access to all Library software and resource vendor services.

If current mobile usage trends continue as is expected the majority of library users will be accessing library services via mobile in the near future. The majority of library users when visiting the library for the first time will be doing so by a mobile interface. Libraries need to ensure that the usability of services on mobile devices is optimised. When library users reach your library website using their mobile devices will your library services work, and will their experience be a positive one?

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