Impact of Mobile Computing

Anticipating the Effects on the Campus

by Colin Currie

*Familiarity with mobile web use and the incorporation of that technology
into our teaching and learning practices are quickly becoming key literacies.*

Rapid advancements in mobile technologies and the widespread adoption of mobile devices will likely impact how we conduct many aspects of our daily lives. These occurrences will also likely significantly impact how we deliver educational content, how we interact with our students and each other, and even how our students learn.

Increasingly, mobile computing is affecting university communications, changing application design, and raising new data security concerns. According to the joint EDUCAUSE/Gartner report *Field Research: Mobility in the Age of Consumerization* (Disabato 2012), students, as well as faculty and staff, now look at smartphones and tablets as preferred interfaces for interaction and for accessing and working with university data.

The growth and maturation of mobile computing is about much more than just the next generation of cell phones or tablet computers. It's about merging communication mediums with the vast capabilities of the Internet and combining them into a portable, powerful, intuitive device that can play a valuable role in assisting, and even improving, many aspects of our daily lives.

The advent of the personal computer put the power of computing into most of our hands for the first time. It was impactful first at work and then at home and represented a major step in the evolution of computing. Soon after came the widespread use of cellular technology, which was made possible by a rapidly growing cellular network, advancements in handset technology, and greater affordability. As the PC was in the evolution of computing, the cellular revolution was a major step in the evolution of communications.

Concurrent with the cellular explosion came the widespread use of the Internet, aided by simplified access via Internet service providers, the large and growing number of people with access to a PC, the critical development of the Internet browser as a standardized presentation layer, and an explosion of content making it all worthwhile. Initially, the PC was isolated or at best connected to a restricted network. The combination of the Internet and the browser set the PC free. Like the PC itself, the Internet was another major step in the evolution of computing.

The evolutionary leap that mobile computing represents is significant because it is the point of connection between the three technologies discussed above: the personal computing device, cellular communications, and the Internet. This leap is, of course, made possible by the arrival of the mobile computing device. Never before has so much information and so much computing power been available so simply and inexpensively in the palm of your hand. The opportunities that the mobile revolution represents are tremendous—if we can find the means to capitalize on them.
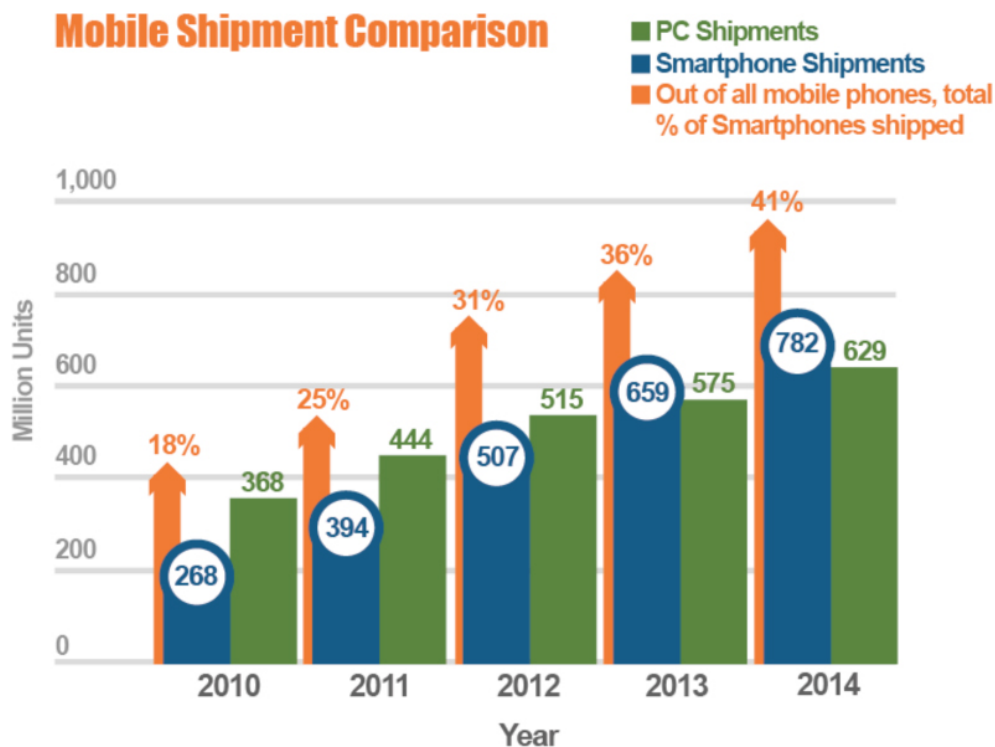
The opportunities that the mobile revolution represents are tremendous—
if we can find the means to capitalize on them.

WHAT IS A MOBILE DEVICE?

Mobile computing devices fall into two broad categories: the smartphone and the tablet computer. Both share the characteristics of portability, a simplified (even intuitive) user interface, multifunctionality (typically combining Internet access, e-mail, geolocation, camera, phone capability, etc.), and easy connectivity via cellular and/or Wi-Fi connection. Increasingly, tablets will come with built-in cellular connectivity capability and will be thought of as a large smartphones.

The rate at which these devices are being adopted contributes to the urgency for us to take on mobile computing (see figure 1). The rapid adoption rate is driven by the devices' comparative simplicity of use, the relative affordability of the technology, the power these devices now possess, and the availability of connectivity for them. We are quickly seeing a shift in user preference from traditional business and web application user interfaces to those designed for use with mobile devices.

Figure 1 **Mobile Shipment Comparison for Americans Aged 18–29**

Source: Xcel Mobility, 2012

WHERE IS THIS CHANGE COMING FROM?

From a campus computing standpoint, the mobile wave was initially brought to us by our students. Students have been coming to campus with personal computing devices for over 30 years, but never in that time have the devices been so prolific, varied, multifunctional, or powerful. Unlike the PC revolution of the 1980s that started with business, the mobile revolution started at home and is largely student-driven. We need to respond to it now.

Most of our students grew up with an Internet connection always available at home and at school. They now expect that connection to be with them wherever they go. In terms of web-based applications (including everything from Quickoffice and Google Apps to most of our enterprise applications), users can do just about anything with a mobile device that they can with any computer. Familiarity with mobile web use and the incorporation of that technology into our teaching and learning practices are therefore quickly becoming key literacies. If we do not incorporate these kinds of technologies into our students' learning, then they will leave our institutions lacking experience in what will be a critical skill set as they move forward.

*Familiarity with mobile web use and the incorporation of that technology
into our teaching and learning practices are quickly becoming key literacies.*

EXTENT OF MOBILE ADOPTION

In the United States, the shift to mobile computing has been swift. In 2011, 52 percent of mobile phones shipped to users aged 18–29 were smartphones; for undergraduate students the number was 55 percent (Dobbin et al. 2011). According to comScore (2012), 110 million Americans owned a smartphone as of April 2012, up 44 percent from the previous year. According to XcelMobility (2012), that trend will continue to accelerate with mobile device sales outpacing PC sales by 2013.

The breadth of available functionality for mobile devices is already staggering, and this technology is still in its infancy. "There's an app for that" will extend to all kinds of areas we can hardly imagine now. The physical products we're used to are being transformed into software; this has been the case with music for years. (In fact, in 2012 the music industry reports that revenues from the sale of digitally downloaded music will outpace those of music sold on CD in the United States. By 2015 it is expected that this will be true on a global level [Abmuku.com 2012].) The same is increasingly true for books, magazines, newspapers, credit cards, motion pictures, television programming, keys, and toys. And this is just the start.

Of all the applications currently geared toward mobile users, social networking is likely to be the most impactful to education. Consider the students now coming to campus who have spent the last several years thinking of social interaction as an activity that occurs largely online. This is social interaction in the bigger sense. It's not just interacting with friends; it's interacting with people anywhere and for any purpose regardless of whether they actually "know" each other. Additionally, for many of these users, their device has become a physical extension of themselves. It is with them at all times, including when they sleep. Whatever data, wherever, whenever is their expectation.

This will have important implications for how we interact with our students, even before they become our students. The school that has the friendlier, more supportive, more complete mobile app that helps shepherd a student through the application and material submissions process will fair far better when that student is choosing between several offers of admission. We will need to engage with students on their own terms if we expect to be successful with them. These shifts in communication styles will extend far beyond admissions. They will impact how we communicate, distribute information, foster group discussions, and much more.

Most impactful of all will likely be the next generation of electronic textbooks, which will be engineered around the notion of the mobile device user. In the context of the mobile-enabled, always-connected, social-network-savvy user, the e-textbook will change everything. Every student who uses a particular e-textbook, no matter at what school or what place on earth, will have access to the same instantly updateable content that includes everything that's in the traditional textbook along with video, lectures from the world's experts on any topic no matter how obscure or esoteric, built-in exams with instant grading, and the ability to easily connect and collaborate with any other student using the same e-textbook anywhere on earth. The e-textbook will do a great deal to level the playing field across all institutions of higher education in terms of what information and teaching tools are available. A whole library's worth of information will be available in a portable, simple, affordable, multifunctional device that's already incorporated in almost all of its users' daily lives.

SHIFTING TO THE MOBILE WEB

There has been a great deal of talk about the potential impact of mobile devices on campus. EDUCAUSE lists "supporting the trends toward IT consumerization and bring-your-own device" as its #2 IT issue for 2012 (Grajek and Pirani 2012). Indeed, there are many important issues to be addressed.

The first challenge is deciding what content to make available to mobile users. The vast majority of the content we need to build meaningful mobile applications already exists somewhere within our campus systems. The question will be how to transform this information into a format that will work on the smaller screens and in the simplified interfaces mobile users expect.

The typical campus mobile application consists of a single software environment built from many data sources. Unlike with traditional campus applications where users launch different programs or navigate to different sites in order to accomplish two or more tasks, the mobile application typically provides a single environment where multiple tasks can be completed. Download any institution's mobile application and you will usually find a breadth of capabilities that span a variety of functions ranging from simple campus navigation to dining choices, course offerings, and a schedule of events. While all of these disparate functions are delivered from a single application, the sources of the information can be highly scattered and stored in various formats.

Therefore, an important initial step in developing a mobile application is determining what data the application will contain and locating the definitive source for each data element. Those varied pieces of information then need to be stored in a place that is reliably accessible by the mobile application. Finally, a well-integrated, intuitive interface that is specifically intended for the smaller screens of mobile devices can be created.

Along with identifying and locating data for the application, decisions will need to be made on how it will be developed. A mobile application can be anything from a simple reworking of an existing web page to better display on a small screen to a downloadable application that is designed to take advantage of a specific mobile computing platform such as Android or iOS. Initially, mobile applications tended to be more along the lines of the latter: applications that were downloaded and designed for specific devices. Increasingly, however, schools are finding wisdom in building mobile applications that are flexible enough to work on a variety of device types and that don't require downloading.

A number of standard frameworks have been built to simplify the creation of mobile applications that are device agnostic. Examples that have come from higher education include UCLA's Mobile Web Framework, CampusEAI's myCampus, and Kuali Foundation's KME. As well, HTML5 includes the ability to notice what kind of device a visitor to a website is using and to automatically adjust the presentation of information according to screen type. Not surprisingly, there is also a growing industry of companies that specialize in creating custom mobile web pages and applications. Some specialize in extending the mobile presentation of business applications, such as PeopleSoft, through a third-party software offering.

WHAT WILL BE THE CRITICAL APPLICATIONS IN HIGHER EDUCATION?

With the limited availability of application development resources on most of our campuses, it will be a challenge to determine how many of those resources should be redirected toward mobile development efforts. According to the ECAR report *Mobile IT in Higher Education,* 2011 (Dobbin et al. 2011), applications focused on teaching and course management dominated the list of those deemed most desirable for higher education (see figure 2).

Figure 2 **Applications Most Desirable for Higher Education**

Application	% of Responses
Student Services	25%
Learning Management System	25%
Messaging and Calendaring	14%
Social Network	6%
Personal Productivity	6%
Classroom Technology	6%
Portal	4%
Collaboration	2%
eLearning	2%
ERP	2%
Other	19%

Source: Dobbins et al. 2011.

Making access to these kinds of functions available to mobile device users represents quite a step forward from the typical campus map and events calendar found on most university mobile applications. Extending mobile access to this kind of data raises concerns around how secure the data will actually be. We're essentially talking about granting access to unprecedented amounts of private data to our least security-savvy constituents who will use the data on the least secure and controllable devices we've ever had on campus. Important decisions on whether and how campuses will display this potentially sensitive data will need to be made carefully and deliberately. At the very least, campuses should adopt policies around what data can and cannot be used in these kinds of applications so that there is some parity across departmental practices.

The security of mobile applications comes into question primarily due to the vulnerability of the devices themselves. It's one thing to leave a laptop unattended and have it fall into the hands of an unintended user. It is far easier to leave a smartphone or tablet where it can be stolen or misused. Additionally, most mobile device users forgo securing their devices with a password or PIN, making access to all of their data even more vulnerable.

According to the Ponemon Institute (2012), 39 percent of companies have experienced a security breach due to employees using unauthorized or unsecured mobile devices. In May 2012, IBM disabled public file-transfer programs such as Apple's iCloud and Dropbox and turned off iPhone's Siri and other applications on employee-owned mobile devices used to access IBM's network. Unfortunately, given the current state of technology, short of taking drastic steps like these there is little we can do other than simply try to educate our users on the importance of good mobile device security practices.
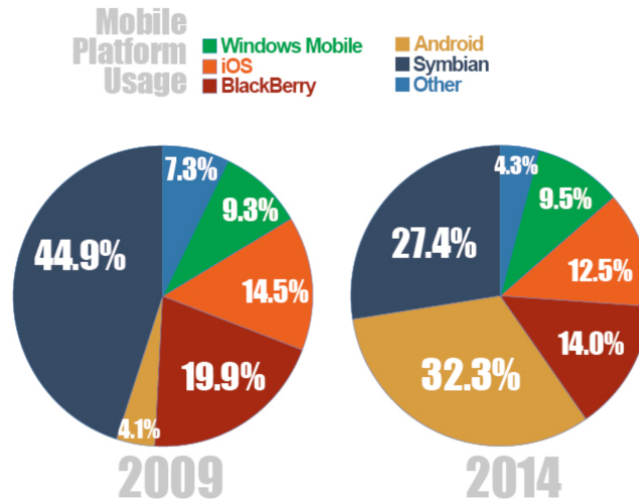
The next wave of mobile software development will enable "containerization," which will allow IT departments to turn off certain elements of applications that might jeopardize security. In the meantime, if nothing else, we should emphasize the criticality of requiring a PIN or password before a mobile device can be used.

WHAT ARE THE CHALLENGES?

Choosing what kind of information to display in mobile applications and how to keep it secure are not the only two decisions schools will need to make as they move forward. Other challenges will need to be addressed, including how to keep this rapidly evolving technology up to date, what kind of support will be made available to users, and, maybe most importantly, how the campus will coordinate and collaborate on development in order to foster a cohesive institutional presentation.

Keeping the technology up to date is a challenge primarily because of the rapid pace of change in this relatively immature space and the different approaches that various vendors take to creating functionality. According to XcelMobility (2012), the mobile device landscape is far from settled (see figure 3).
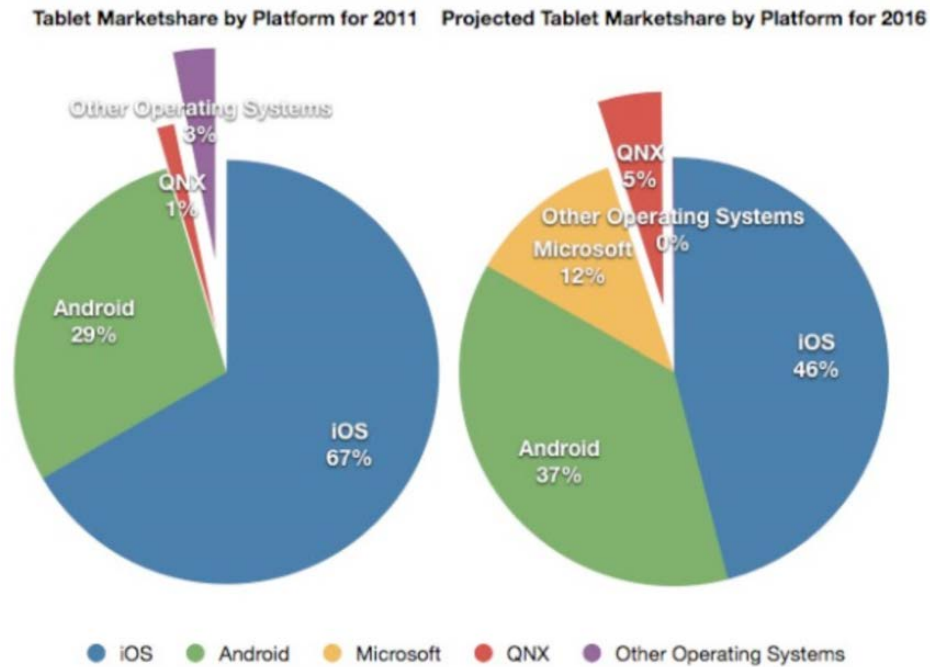
Figure 3 **Mobile Platform Usage**

Source: Xcel Mobility, 2012

While Apple iOS-based products enjoy a significant presence in the higher education space, it is difficult to ignore that the iPhone has already been surpassed by Android-based products in the smartphone category. However, Microsoft is still a competitor, and with Nokia shifting from the highly popular Symbian OS to Windows Mobile for its mobile devices it is likely that Microsoft will maintain an approximate 10 percent of the marketplace in the next several years to come (XcelMobility 2012).

According to Gartner, a similar shift from iPad dominance to a stronger Android-based presence is expected to take place in the tablet market in the near future (see figure 4). Again, Microsoft also figures to play an important role in the tablet arena going forward.

Figure 4 **Comparison of Tablet Marketshare by Platform**

Tablet Marketshare by Platform for 2011   Projected Tablet Marketshare by Platform for 2016

Other Operating Systems 3%
QNX 1%
Android 29%
iOS 67%

QNX 5%
Other Operating Systems 0%
Microsoft 12%
iOS 46%
Android 37%

● iOS ● Android ● Microsoft ● QNX ● Other Operating Systems

Source: Gartner 2012.

This presents a challenge for the developers of mobile applications. It's little wonder that most development teams trying to make smart decisions on what applications will serve the university best into the foreseeable future are doing their development using a device-independent approach.

Support for mobile applications presents a special challenge. It is one thing to provide phone support to users of applications like your course system or your dining card when the assumption is that users will be on your network using some flavor of a Mac or PC. It is another thing altogether when users can be accessing these applications from a large variety of devices, each containing a varied set of OS versions and browsers and connecting from a number of carriers. This is the very issue that "supporting the trends toward IT consumerization and bring-your-own device" refers to in EDUCAUSE's top 10 issue list of 2012.

Overriding all of these challenges is the critical need for the campus to work cooperatively to extend a cohesive mobile view of the institution to the outside world. However, because of the constant and fast pace of change in this area, mobile policy will be "more of a journey than a destination" (Dimension Data n.d., p. 22). Uncoordinated mobile development will quickly create chaos, inefficiency, and, potentially, security issues.

Gartner's 2012 report *Enterprise Mobility and Its Impact on IT* (DeBeasi et al. 2012) makes some important points about the need to reorient ourselves to take advantage of the opportunities made possible by mobility. The report points out that users will expect a seamless integration of information that comes from a variety of sources and that is controlled by a variety of functions throughout the institution. In order to achieve this, compromises will have to be made about who reveals what data to whom in what form. A failure to act in a cooperative and coordinated way will make the institution

look fragmented and confused. Instead, the Gartner report suggests that enterprises should embrace mobility as a strategic initiative and develop the appropriate organizational structures to create the policies necessary to provide effective governance for a successful and secure mobility implementation.

CONCLUSION

The mobile revolution is already here, and those institutions that embrace it, see it as a strategic initiative, plan for it, and coordinate their efforts stand to reap the benefits of this new approach to communications and computing. Those that do not will quickly recognize their mistake and be in the difficult position of having to catch up.

Since students brought the mobile revolution to us, they should be a critical part of helping us understand how to incorporate this new paradigm into the education process. Schools that have not yet included students in their mobile planning efforts should do so immediately. We all have a lot to learn from our students' perspective on how this technology can be relevant to their academic experience.

Since students brought the mobile revolution to us, they should be a critical part of helping us understand how to incorporate this new paradigm into the education process.

REFERENCES

Abmuku.com. 2012. Digital Music Sales Expected To Outpace CD and Vinyl in 2012 Due to Streaming–Social Media. August 17. Retrieved January 28, 2013, from the World Wide Web: www.abmuku.com/2012/08/17/music/digital-music-sales-to-outpace-cd-vinyl-in-2012-due-to-streaming-social-media/.

comScore. 2012. The Great American Smartphone Migration: Nearly Half of Feature Phone Subscribers Who Acquired a New Device in April Switched to a Smartphone. News release, July 25. Retrieved January 28, 2013, from the World Wide Web: www.comscore.com/Insights/Press_Releases/2012/7/The_Great_American_Smartphone_Migration.

DeBeasi, P., G. Creese, M. Diodati, M. Disabato, K. Knoernschild, E. Maiwald, J. Santos, E.

Siegel, and C. Wolf. 2012. *Enterprise Mobility and Its Impact on IT*. Stamford, CT: Gartner, Inc. Retrieved January 28, 2013, from the World Wide Web: www.gartner.com/resources/233400/233483/enterprise_mobility_and_its__233483.pdf.

Dimension Data. n.d. Merging Mobility Into the Unified Communications and Collaboration Mix. Retrieved January 28, 2013, from the World Wide Web: www.dimensiondata.com/Lists/Downloadable%20Content/MergingMobilityIntoTheUnifiedCommunicationsAndCollaborationMix_129646077558866652.pdf.

Disabato, M. 2012. *Field Research: Mobility in the Age of Consumerization*. Stamford, CT: Gartner, Inc.

Dobbin, G., P. Arroway, E. Dahlstrom, and M. Sheehan. 2011. *Mobile IT in Higher Education,* 2011. Boulder, CO: EDUCAUSE. Retrieved January 28, 2013, from the World Wide Web: http://net.educause.edu/ir/library/pdf/ers1104/ERS1104W.pdf.

Gartner. 2012. Gartner Says Worldwide Media Tablets Sales to Reach 119 Million Units in 2012. News release, April 10. Retrieved January 28, 2013, from the World Wide Web: www.gartner.com/newsroom/id/1980115.

Grajek, S., and J. A. Pirani. 2012. Top-Ten IT Issues, 2012. *EDUCAUSEreview Online,* June 6. Retrieved January 28, 2013, from the World Wide Web: www.educause.edu/ero/article/top-ten-it-issues-2012.

Ponemon Institute. 2012. *2011 Cost of Data Breach Study*. Traverse City, MI: Ponemon Institute, LLC.

XcelMobility. 2012. The Industry. Retrieved January 28, 2013, from the World Wide Web: www.xcelmobility.com/markets/the-industry.

AUTHOR BIOGRAPHY

Colin Currie is executive director, Office of Information Technology at Princeton University in Princeton, New Jersey.