

Mobile Application Development

The Challenges and Best
Practices

A bitHeads White Paper
January 28, 2009



www.bitheads.com

Mobile Application Development

The Challenges and Best Practices

The Mobile Rush

Over 10 million new smartphones are sold each month and the market for mobile applications is exploding. Within just seven months of launch, the iPhone App Store listed over 15,000 new applications and served over 500 million downloads. Other application marketplaces, such as the BlackBerry Application Storefront, are also launching and expanding quickly. Mobile software vendors with products on one platform are rushing to launch versions for the BlackBerry, iPhone, Windows Mobile, Symbian, Android and other devices. Internet companies in entertainment, social networking, travel, and other categories are urgently planning and building their first mobile applications, as are many enterprise and desktop software vendors. The biggest gains are being delivered by innovative mobile applications that enable new services or user experiences, not applications that simply port or reformat existing desktop or web applications.

Unfortunately, many companies are missing the tremendous opportunities of the mobile market because their applications are launched late, over-budget and with extremely poor usability. Even the most seasoned software vendors have painfully discovered how deceptively difficult it is to build great mobile applications. Mobile applications are fundamentally different from applications intended for desktop interaction and, because the category of mobile application software is relatively new, there are few designers and developers with the experience necessary to master those differences.

This paper explores the unique challenges of mobile application development and shares some hard-learned lessons and best practices for the efficient development of applications that users will love to use.

The Mobility Difference

Mobile users with handheld devices lead to completely different user experiences. Those differences are often significantly underestimated by first-time mobile application creators. Desktop PCs and notebook computers using wireless networks both access data, present information and gather user input in the same, well-understood way using large screens, QWERTY keyboards and pointing devices. Also, users are usually comfortably seated with both hands free and able to interact with complex applications for a reasonable length of time. Not only is the mobile device smaller, with a tiny screen and restricted input methods, the user might be using an application with one hand while standing on a noisy, bumpy subway ride and trying to complete a context-specific task such as accessing directions.

The Challenges of Mobile Application Development

Mobile application adoption is driven by the user experience more than for any other type of application. Mobile users typically have urgent needs to access information or complete a specific task. Mobile users are impatient and the slightest problem with performance or usability results in a disproportionately large level of user frustration. When compared to developing software for desktop interaction, the many constraints and challenges peculiar to mobile applications include:

- The challenge of designing and developing multiple versions of an application to run on a wide variety of platforms (BlackBerry, iPhone, Windows Mobile, and others) and significantly different device models on a given platform (e.g. BlackBerry Bold, Storm, Curve, Pearl Flip) in a manner that exploits the unique capabilities of each device while maximizing software reuse and development efficiency;
- Small screen size means that less of a page or form can be displayed, making it more difficult to maintain the user's sense of location within the application and navigation scheme;
- A variety of different screen sizes, resolutions and orientations (portrait, landscape, switchable) to design for;
- Limited input devices and a variety of possible interaction methods (keypad, stylus, touch screen);
- Text input is particularly cumbersome;
- Limited battery life requires that power-consuming activities must be carefully managed;
- Limited processing power;

- Limited storage and working memories;
- Unpredictable network connection, limited coverage and lower network bandwidth than a fixed connection;
- Bandwidth cost considerations where network connectivity is charged per data volume; and
- A range of challenging usage environments, including extremes in ambient lighting, noise and temperature (the user may be wearing gloves or lose dexterity in cold conditions) - all affecting the user's ability to interact with the device.

Mobile application designers and developers face the challenge of dealing with these severe constraints while striving to create applications that are highly usable in a wide range of demanding user contexts. The overall architecture of the solution, the detailed design and the specific software implementation of each component must be carefully crafted to create a highly usable application that is as efficient as possible in consuming constrained device resources.

Additional challenges for R&D teams include the need to learn proprietary technologies, toolsets and APIs for the wide variety of mobile platforms. Designers and developers with the specific experience and skills needed are scarce and ramping up existing R&D staff is a long-term process.

Mobile Design and Development Best Practices

Given the challenges of mobile application creation, designers and developers must take full advantage of the lessons learned and best practices developed by industry pioneers like bitHeads. The following tips and checklist items can be used to start new projects on the right footing, keep current projects on track and to recognize when the help of external mobile development experts should be engaged.

Design for Usability

Context is king for mobile applications. A thorough understanding of the user's context and objectives is paramount. A robust product management process and iterative approach to design, development and testing is critical.

- Do not blindly mimic designs intended to run on desktop devices;
- Remove all clutter and simplify the application down to the essential data and functionality needed for the user to take immediate action;
- Present the minimum number of options possible on any single screen;

- Minimize screen density but don't split content/interaction across so many screens that users get lost;
- Use a consistent UI design that helps users maintain a mental image of the application;
- Design the UI to behave similarly to other applications on the device with which users are familiar; if designing for multiple devices, follow established design conventions for each device and avoid the pitfall of trying to make the application behave the same across all platforms;
- Exploit the unique capabilities of each device (GPS, accelerometer, screen size, input methods) to create the most engaging user experience possible;
- Conduct ongoing usability testing throughout the design and development process, including testing on real devices, not just emulators;
- Make sure forms are easy to use and that navigation between fields is predictable;
- The less text input, the better;
- Provide clear methods for the user to recover from errors, broken links and other problems, particularly if the device does not have a simple back button;
- Avoid complex interaction patterns that require close user attention for long periods of time;
- Use highly structured workflows or wizards for infrequent tasks;
- Provide clear feedback on progress and the status of task completion;
- Use high contrast text color and select typefaces for maximum readability;
- Carefully and consistently use color throughout the design; and
- Use simple navigation structures that focus on one specific task at a time.

Get the Architecture and Design Right

Mobile application design and development is a tricky balancing act. High levels of application performance and usability must be achieved while working with many device-related constraints. The following are some of the important application architecture and design considerations:

- Use an agile-based development methodology that includes

rapid iterations of design, prototyping, development and continuous testing;

- Consider the range of devices that will be supported and the different displays, input methods and device-specific capabilities that will be used;
- Store data on the device selectively and archive less frequently accessed data on the server;
- Conserve memory by reducing the number of objects, defining proper data structures and carefully managing object handles;
- Manage power-hungry activities carefully;
- Use tables, images, client-side scripts and CSS only where they add value;
- Manage content intelligently; reduce size and reformat if required (e.g. resize and crop large bitmaps);
- Do as much processing as possible on the server;
- Anticipate user needs but send as little data as possible across the network; don't send data that will never be used; manage content that is delivered (e.g. don't send high res images) and maximize the use of push for updates that are behind the scenes, delivering data before the user needs it; and
- Effectively use multi-threading where possible to improve performance.

Accelerating the Creation of Mobile Applications

For companies developing their first mobile application and mobile ISVs looking to support additional smartphone platforms, the fastest path to market with a high quality product is often to engage a specialized development partner, such as bitHeads. bitHeads' ProductSream™ service draws from their North American staff of mobile software experts to rapidly assemble a team of world-class designers and developers for each project. A bitHeads' team can work as a flexible extension of a software company's in-house R&D organization or independently, taking full responsibility for project delivery. bitHeads uses a proven agile-based development methodology to effectively collaborate with stakeholders and reliably develop commercial grade software.

Vaultus Mobile Technologies: An Outsourcing Success Story

Vaultus Mobile Technologies (www.vaultus.com) provides an award-winning mobile application platform and development studio that has been used by E*Trade, Merrill Lynch, P&G and other leading

companies to provide mobile access to mission-critical enterprise applications. When Vaultus faced an opportunity with a tight timeline to provide a BlackBerry application that would enable real-time mobile stock trading for a leading on-line financial services company, it selected bitHeads as a development partner to bolster its capability to quickly design and build a highly usable mobile interface that would integrate with the customer's back-end trading system. bitHeads deployed a team of BlackBerry usability experts, designers and quality assurance professionals to work as an extension to the in-house staff at Vaultus. The stock-trading application was successfully launched and immediately became an award-winning service that securely manages a high volume of financial transactions.

“bitHeads’ unique expertise in mobile application usability and product development for the BlackBerry is a great addition to our team that accelerates and de-risks the roll-out of this critical product for our customer,” states David Birnbach, Vaultus CEO. “We use off-shore providers for some development work; however, for this type of project, we needed a local partner like bitHeads with specialized skill and experience.”

About bitHeads

For over 13 years, bitHeads has been a trusted behind-the-scenes mobile application development partner to companies like RIM, Vaultus Mobile Technologies, HP, EMC, InfoLogix and many others. bitHeads' many years of experience and ongoing investment to maintain a world-class team of mobile experts, enables them to quickly define solid architectures, design great user interfaces and develop high quality software. ISVs tap these bitHeads capabilities to innovate, reduce risk and accelerate new product launches. In addition to their mobile technology leadership, bitHeads' has extensive experience building transactional enterprise systems, communications products, web 2.0 applications and games. They've created applications that support millions of users and process transactions worth billions of dollars. This technical depth enables bitHeads to confidently tackle the creation of the most complex, mission-critical mobile applications.

Rising demand for its mobile application development expertise in recent years has contributed to bitHeads' ranking as the third fastest growing software and services company in the world in the \$10-30 million range on Software Magazine's prestigious 2008 Software 500. bitHeads' extraordinary performance and commitment to its employees also led to the company being recognized as a 2008 Top 100 Employer in Canada.

For more information, visit: www.bitheads.com