Challenges in Mobile Apps: A Multi-Disciplinary Perspective

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Theme: Smart Interactions

Integrated Solution: Software Delivery Platform

Abstract:

Motivation and Justification

The popularity of mobile devices, i.e., smart-phones and tablets, has been rapidly growing. These mobile devices run mobile apps. Mobile apps are small software applications that are intended to achieve specific functionalities. For example, some mobile apps are used for gaming; others are used for everyday banking.

Mobile apps are made available through app stores. The largest app stores, offered by the platform vendors, are Google Play, Apple App Store, Windows Phone Marketplace, and Blackberry App World. It is estimated that these aforementioned app stores contain more than 1.5 million apps that users can easily download and install on their mobile devices.

There has been decades of research on mobile devices, with respect to their hardware, power related performance, and network capabilities. However research related to "Mobile Apps" is in its infancy stage. Therefore the central theme of this workshop was examining the research challenges in mobile apps.

The software engineering research community has over the past few decades made giant strides in observing, understanding, and improving software that is run of desktop devices and backend servers. However, mobile apps are very different from such software. One key difference is that mobile apps are often distributed through centralized market places called "App Stores". In such markets even small team of developers can be highly successful. A considerable number of apps are very small in size and sometimes tends to follow no particular design principle.

Additionally the mobile devices for which such apps are designed for are always connected to the internet, run on batteries (as opposed to a steady power source), and have fairly limited resources like screen size, CPU, and memory, while having unique new hardware attachments like accelerometers, global positioning systems, and cameras. Such differences introduce further challenges in mobile app development.

Examples of some of the most common challenges with respect to mobile apps are:

1) Privacy and Security of user information

2) Power consumed by the apps

3) Monetization challenges

4) Run time analytics challenges

These challenges are in addition to typical developer challenges during the implementation of the app, like debugging, quality control, and maintenance.

The expertise needed to address these challenges goes beyond any single discipline. A collaborative effort by researchers from various computer science disciplines, such as software engineering, privacy, security, data mining, and power and non-computer science areas such as business and legal is needed.

Challenges in Mobile Apps - A rapidly expanding research topic

Ruiz [1] conducted several empirical studies on a l arge collection (from thousands to hundreds of thousands) of Android apps from the Google Play market. He found out that there is wide spread reuse of source code in Android apps. On average 61% of the classes in the apps in each category under study are not unique to a specific app. He also found that the rating system for Android apps does not encourage developers to improve the quality of the apps. In a final study, he examines the maintenance effort required to keep the ad libraries up-to-date, since advertisements play a critical role in monetizing free mobile apps. He found that a third of the apps examined had an ad-library that does not serve any ads at all.

Syer [2] compliments the above work by examining the development of mobile apps. In his work he examines a set of open source Android apps to determine if they have similar properties to desktop apps and mobile apps from other platforms. He finds that mobile apps are considerably smaller than desktop apps (which was also independently verified by Minelli and Lanza [3]) and are also built by much smaller development teams. In the 15 OSS Android apps that he examined, most of them had 1 or 2 developers who made more than 80% of the commits. This is in sharp contrast to the typical desktop software that has been examined by the SE community. However, he found that not all desktop apps are different from mobile apps. He found that several utility apps such as 'joe' and 'wget' were very similar to mobile app development. Additionally he compared five Android apps with the same apps on the BlackBerry platform. He found that the less code is required to implement the features in the Android versions of the apps. He also found that Android apps rely more on the underlying platform. Hence in a follow up study, he examined the the relationship between defects and dependence on the underlying platform. He found that files that depended on the underlying platform more than other files in the same app were more defect-prone.

Similarly the software engineering community over the last few years have started to look at mobile apps specifically. There have been studies on quality [4], power management [5], testing [6], security [7], user's perspective [8], developer's perspective [9], and the economics [10] of mobile apps. Additionally there are also workshops [11], and tutorials [12] on mobile app related challenges, and even an IEEE Software special issues titled 'Next Generation Mobile Computing' to be published next year. We intend this workshop to be a platform for discussion between the researchers and practitioners to facilitate the identification of the next set of challenges to work on.

[1] Israel Jesus Mojica Ruiz, "Large-Scale Empirical Studies of Mobile Apps", Master's Thesis, School of Computing, Faculty of Arts and Science, Queen's University, Ontario, Canada, 2013.

[2] Mark D. Syer, "Empirical Studies of Mobile Apps and Their Dependence on Mobile Platforms", Master's Thesis, School of Computing, Faculty of Arts and Science, Queen's University, Ontario, Canada, 2013.

[3] Roberto Minelli, Michele Lanza. "Software Analytics for Mobile Applications - Insights & Lessons Learned", In Proceedings of CSMR 2013 (17th IEEE European Conference on Software Maintenance and Reengineering), pp. 144-153.

[4] Mario Linares-Vásquez, Gabriele Bavota, Carlos Bernal-Cárdenas, Massimiliano Di Penta, Rocco Oliveto, Denys Poshyvanyk, "API Change and Fault Proneness: A Threat to Success of Android Apps", In

Proceedings of ESEC/FSE 2013 (21st ACM SIGSOFT Symposium on the Foundations of Software Engineering).

[5] Ding Li, Shuai Hao, William G.J. Halfond, Ramesh Govindan, "Calculating Source Line Level Energy Information for Android Applications", In Proceedings of ISSTA 2013 (International Symposium on Software Testing and Analysis).

[6] Aravind Machiry, Rohan Tahiliani, Mayur Naik, "Dynodroid: An Input Generation System for Android Apps", In Proceedings of ESEC/FSE 2013 (21st ACM SIGSOFT Symposium on the Foundations of Software Engineering).

[7] Yajin Zhou, Xuxian Jiang, "Dissecting Android Malware: Characterization and Evolution", Proceedings of the 33rd IEEE Symposium on Security and Privacy (Oakland 2012).

[8] Hammad Khalid, "On identifying user complaints of iOS apps", In the Student Paper Track of ICSE 2013 (35th International Conference on Software Engineering).

[9] Mona Erfani, Ali Mesbah and Philippe Kruchten, "Real Challenges in Mobile App Development", In Proceedings of the ESEM 2013 (7th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement).

[10] Mark Harman, Yue Jia, Yuanyuan Zhang, "App store mining and analysis: MSR for app stores", In Proceedings of MSR 2012 (9th Working Conference on Mining Software Repositories).

[11] Grace A. Lewis, Jeff Gray, Henry Muccini, Nachiappan Nagappan, David Rosenblum, and Emad Shihab, "1st international workshop on the engineering of mobile-enabled systems (MOBS 2013)", In Proceedings of ICSE 2013 (35th International Conference on Software Engineering).

[12] Emad Shihab, Ahmed E. Hassan, "Software Engineering for Mobile Apps: Research Accomplishments and Future Challenges", In Tutorial Track of ESEC/FSE 2013 (21st ACM SIGSOFT Symposium on the Foundations of Software Engineering).

Invited Speakers

Academic:

1) William G.J. Halfond, University of Southern California

2) Mayur Naik, Georgia Tech

Industry:

1) Tariq Tahir, Enryda

2) Samer Fahmy, BlackBerry

3) Brian Vanpee, BlackBerry

Goals and outcomes

The goal of this workshop was to bring together researchers from various disciplines of computer science and practitioners, to discuss challenges, solutions and best practices in the area of mobile apps. We provided a p latform for these researchers to collaborate with practitioners and researchers from other disciplines, to come up with innovative ways to address the critical challenges facing the mobile app

industry. In particular, the workshop focused on areas related to quality assurance, power consumption by apps, privacy and security of user information, monetization of apps, and testing of mobile apps.

Workshop Structure

The half-day workshop featured invited presentations from some of the most prominent and experienced researchers and practitioners in the area of mobile apps. In order to facilitate collaboration we made the workshop interactive by having open discussions at the end of each talk. We also held a panel at the end of the workshop with the mobile app developers, which provided a forum to discuss their current and future challenges.

Latest information about the workshop (including title, abstract and slides of the various talks) is available online at: http://sailhome.cs.queensu.ca/~mei/MobileAppChallenges/