What Is Going Wrong with My Phone?
A Survey of Reported Issues with Mobile Phone Applications

Fatemah Panahi

University of Wisconsin, Madison

`fpanahi@wisc.edu`

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Abstract

A survey of common issues with the mobile phone applications is performed in 2 levels. First, issues that users experience with default applications on their platforms. And second, issues that users face with the platform's App World which provides additional applications for users to download. The issues and different approaches that users take for resolving these issues are categorized respectively and examples are provided. We believe that this research will provide valuable insight for future research on mobile phone applications.

1   Introduction

Number of mobile phone subscribers in the world is growing rapidly. According to CTIA-The Wireless Association, 90 percent of people living in the United States have mobile phones. Today, these phones are not used only for making calls. They provide their users with many functionalities that they need during the day; from being an alarm clock, to web browsing, checking E-mails, listening to music, and playing games. Therefore, Mobile phones are becoming an essential part of every person's life. As users continuously demand new features and vendors compete in the market, very quickly even the basic subscription policies will include the currently advanced features. Moreover, the introduction of open-source mobile platforms such as the Android platform will trigger enormous amount of applications being developed for mobile phones.

At this point in time, we believe that it is necessary to investigate carefully the implications of such an expansion in the userbase and application developments. Therefore, in this paper we try to understand the risks, issues, and bottlenecks with regards to the mobile phone applications that need to be mitigated to facilitate an optimal outcome for the users and the vendors. We hope that our findings will provide insights for future research to be done on the mobile phone applications.

The rest of the paper is organized as follows. In section 2 we introduce the mobile phone application categories and resources. Subsequently, we will describe our survey method in section 3. In sections 4 and 5, we will describe the results of the survey. We then provide some insights for future research based on the results in section 6. We will discuss the related works in section 7 and conclude this paper with section 8.

2   What Are the Applications?

Before looking at the issues that users face with regards to mobile phone applications, it is necessary to understand what the typical applications that run on mobile phones are. Moreover, we should have an understanding of the resources available to these applications and the bottlenecks for developing new applications on the mobile phones.

2.1   Application categories

In order to get an idea of the typical applications running on mobile phones we looked at the application categories in the Android developer challenges. Android has performed 2 developer challenges in which it has called for applications to be developed on the platform. The application categories called for can be representative of the most popular applications that today run on mobile phones. The categories are as follows:

- Education/Reference
- Games: Casual/Puzzle
- Games: Arcade/Action
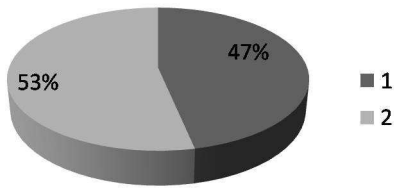- Social Networking
- Lifestyle

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Figure 1: Applications with some interaction (1) and no interaction (2) with the environment

- Productivity/Tools

- Media

- Entertainment

- Travel

- Misc

As you can see, the popular application categories on mobile phones are very diverse in their scope. They expand from education to traveling. However, by looking at the applications that are developed in each of these categories we can see that they are mostly about everyday life matters for the users, such as facilitating shopping or studying. The other category of applications that is getting popular is applications that provide real-time feedback to the users such as business and commerce applications.

2.2 Resources available to mobile phone applications

Most of the Mobile phones today have sensors that are capable of gathering data from their surroundings. This has triggered a trend in development of mobile phone applications in that they are becoming more and more context-aware. People always carry their mobile phones with them. Therefore, what the phone senses about the environment can be an accurate estimation of what the user is going through. For instance, it is safe for these applications to assume that the user is wherever the mobile phone is. This allows the application to give feedback to the users based on their locations. For example, an application would give the user the address of the nearest shopping center on the Google map. This resource is unique to mobile phones as desktops or laptops do not come with such built in sensors.

In order to further investigate the context-awareness trend in the mobile phone applications, we took a closer look
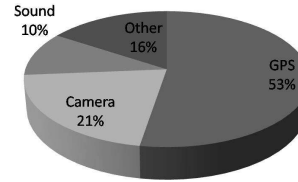
Figure 2: Common sensors used in mobile phone applications

at the 30 applications that won the second Android developer challenge in 2009. As figure 1 shows, more than 50 percent of these applications gathered some kind of information from their surroundings or interacted with the environment using their sensors. We can see in figure 2 that among the popular sensors that are used in these applications are GPS, camera, and sound recording; with GPS being used in more than half of the applications.

Even though mobile phone applications have the advantage of having sensors available to them, most of their resources are more limited than desktops. For example, smaller screen size, limited available energy, high cost of data transfer, smaller memory size and less processing power compared to desktops limits the features that these applications can provide to the users. Another limitation of mobile phone applications is that for each application, each session's time should be limited. This is because unlike desktop users, mobile phone users use the applications available to them on the go. Therefore, users should be able to finish different application sessions in limited amount of time. With all these limitations, a developer then is challenged to make best use of the limited resources to provide the highest functionality in these applications.

2.3 Diversity: A bottleneck for developing new applications

Diversity in the mobile phones is twofold. First, compared to desktops, there are many more mobile phone platforms. And second, for each platform, different handsets have different features such as screen or memory size available to them. This diversity in the handsets and the platforms that they run on is a bottleneck on the features that developers can provide to the users. The reason is that for example when developing games, companies have to publish them for several phone models to be commercially feasible. Often the least advanced phone model that is supported defines what features can be included in the game [3]. This is unique to mobile phones as desktops run on

few platforms and the resources available to the applications are mostly standard.

3   The Survey Method

After having an understanding of the categories of applications that run on mobile phones and the resources available to them, we try to identify the issues about mobile phone applications from the users perspective.

3.1   Where the data comes from

We gathered data from issue lists and support forums regarding to different platforms. Users that face difficulty with their phones come to these forums and report their issue in hope for help. We looked at the issues that users report in 2 different levels. First, general issues that users report about the default applications running on their mobile platform. Second, issues that users report regarding platform's App World which provides them with numerous applications. The advantage of a leveled approach in analyzing the issues is that each level can give us a different insight about the users' experiences regarding the applications. Specifically we looked at:

- Level 1: Android platform issue database [1]

- Level 2: Blackberry App World support forum [2]

3.2   Data gathering

For gathering the data, we copied the relevant issues to an spreadsheet for further analysis and categorization. In gathering the reported issues, our focus was on the users' perspective, and issues regarding the difficulty of the developers in developing applications on the platform were not considered. Moreover, issues that were simply because the user did not know how his phone works were eliminated.

3.3   Limitations

The results of this survey are limited to what people have observed of the issues with applications running on their phones. Moreover, the issues reported in these Web sites are only a subset of the issues that users are facing every day. Since the reports that we looked at were only a subset of these reported bugs, this survey is by no means a comprehensive survey. Another limitation of this survey is that many of the issues were not resolved, or no suggestion was made on how they should be fixed. Therefore, in many cases the root cause was not clear and we used the users' comments to guess the root cause. Furthermore, the reports themselves were sometimes not detailed enough

to help us understand the symptom or the root cause of the issue. However, even with these limitations, we were able to categorize the issues and the proposed solutions to them, and hope that the results will give insight for future research in this field.

4   Level 1: Issues with Default Platform Applications

Level 1 issues are about basic applications provided with the platform itself. For investigating these issues, we looked at the Android platform's issues data base. We specifically looked at defects reported by users. In this database, users can star the issues to receive E-mail notifications about their status. After reviewing many of the reported defects in this database, we limited ourselves to the top 10 starred reported defects for a deeper analysis on the root cause and the prescribed solutions. These defects were starred by 100-284 people and had an average number of 89 comments for each defect. Each of the comments either confirmed the issue, proposed a solution for the issue, or expressed concern with the defect. Therefore, even though we limited ourselves to the top 10 defects, with analyzing their comment threads we were able to get interesting results.

4.1   Issue Categories

80% of the symptoms are unexpected behaviors from the phone, and 20% are about missing functionalities that are present in other platforms. We were able to categorize the root cause of the first group of the symptoms as follows :

- Defect caused by an update, 25%

- Defect due to diversity in the userbase, 25%

- Defect due to synchronization issues, 25%

- Defect due to lack of interoperability, 25%

4.1.1   Defect caused by an update

Many of these defects are caused by an update or release of a new version of the platform. The issue, "Browser lags when scrolling after 2.0.1 Update on Motorola DROID", which was starred by 225 users and commented by 114, is an example for this category. A user describes the issues as "Speed of the OS as a whole seems to be faster, however the scrolling speed on the browser seems to have taken a large step backward". This issues is more sensible while browsing graphic intensive pages. From the users' comments it seems that a minor configuration change in how often the page is re-rendered while scrolling has caused

this lagging. This issue shows how minor changes between different versions can have a huge impact on the user experience, and proves the necessity of an effective testing approach before each release.

4.1.2 Defect due to diversity in the userbase

The other category of reported defects are due to diversity in the userbase. For example, each of these platforms and applications running on them support users from different countries with different languages and date settings. In the issue titled "Gmail erroneously uses localized versions of "Re:" prefix for replies", users of different languages are having difficulty since Gmail is not behaving as expected for their languages. This could have been avoided if there was a way for Google to do proper testing in a timely manner on the diverse machines that would be using the product.

4.1.3 Defect due to synchronization issues

Users today use the applications such as E-mail and calendar from both their desktops and mobile phones. They expect their experiences to be similar and straightforward. However, in many cases they have a hard time synchronizing their E-mails, calendars, and contacts with the mobile phones. For example, in the issue titled "Contact Groups does not include "Friends", "Family", or "Co-workers" from gmail" these default contact groups do not synchronize properly on the phone's contacts application. This complicacy is unique to mobile phone users/applications as laptops and desktops can have direct access to such information and do not need a synchronization mechanism.

4.1.4 Defect due to lack of interoperability

Mobile phones are having more and more features everyday. Many applications run on them at the same time. Given that they have very limited resources compared to desktops, it is a challenge for developers to make sure that these applications operate and interact as expected with respect to other applications running on the phone. For example, some times some applications have side effects on the system that would prevent another application to behave correctly. To illustrate this consider the issue titled "No sound or vibrate by alarm clock when set to be on". The issue is that in some circumstances message notifications or alarms are disabled without a particular reason. One of the users suggests the following steps to reproduce the issue :

1. Make a call or receive a call

2. Switch call to speaker mode

3. End call

4. You will no longer get any type of notifications from apps.

These steps show that how a simple event such as switching calls to the speaker mode has the side effect of disabling notifications on this particular phone.

4.2 What are the prescriptions?

Reported issues that are simply because the platform does not support the functionality are resolved in the subsequent releases of the platform. Unfortunately, in this issue data base, the root cause and the code for resolving the issue is not released. However, the users themselves in some cases prescribe interesting solutions for these issues in the related comments. The prescriptions provided by users are categorized as follows:

- Reboot

- Workaround

4.2.1 Reboot

In 50% of the reports investigated, a reboot would fix the issue or at least was tried by the user. Specifically, a reboot would solve the issues related to interoperability of different applications and side effects mentioned above in "all" cases. Let us revisit the mentioned issue of the alarm clock making no sound. 6 users in this thread have tried or prescribed a reboot for this issue. Reading different reports, it seems that a reboot is a natural solution that comes into mind when something is wrong with mobile phones. We can see that in the following quote:"I'm pretty sure a reboot will sort it as it always has before."

4.2.2 Workaround

In many cases, users look for workarounds while the developers are trying to solve an issue in the system. Let us revisit the synchronization issue of non-syncing default contact groups mentioned above. A user has proposed this workaround for this issue:

1. Create a fake group such as "Family 2" on your computer

2. Add people to this group

3. Sync your phone, the group will appear on it

4. Rename the group into "Family" on the phone (since the web version will not allow you to do so)

5. That's it. Even if the group in the web version appears as "Family 2" , on the phone it will appear as "Family" and all the contact added to "Family 2" are sync to "Family" on the phone.

As you can see for a small bug in the system, a multi-step workaround is proposed which might not be intuitive to all users. As mobile phones get more complex and more applications run on them at the same time, these workarounds will become less intuitive and users will be looking for more help.

5 Level 2: Issues with the Platform's App World

For investigating issues with the platform's App Worlds we looked at the issues reported in the Blackberry App World support forum. The downloaded applications from the APP world are beyond the basic functionality provided by the platform and are purchased separately by the users. Unfortunately, this forum did not have a starring mechanism so that we could identify the most popular issues. However, after reviewing many reports, we realized that we can get the most valuable information from the threads where many people have reported the same issue. Therefore, as our sampling method and for a deeper analysis, we chose 10 recent issues with reported reply count of equal to or more than 10.

5.1 Issues categories

For 60% of the issues the symptom is that some part of an application which was working perfectly fine before stops working. In 20% of the reports the application will not open properly, and for the next 20% users see some unexpected behavior from their mobile phones. We can categorize these issues as follows:

- Issue appeared after an upgrade

- Issue appeared after installation

- Issues with downloading from the App World

5.1.1 Issue appeared after an upgrade

A common characteristic in all these issues is that these applications were working "just fine" before the upgrade was performed. This upgrade can be on the application itself or on the operating system. The following scenario is an example for this category:"I just upgraded my OS to 4.6.0.266. after I upgraded it, my calendar doesn't sync with my face book calendar. Before I upgraded my OS with this version, it worked". The root cause for 70% of the issues were perceived to be an upgrade.

5.1.2 Issue appeared after installation

In 30% of the issues, either the issue was related to installing/un-installing an application, or the program sim-

ply would not work after installation. Here is an example where an installation seems to have completed without an error but the application would not operate properly: "I have a situation where I cannot use the apps - they don't open, only a blank screen of gridlines appears". Moreover, sometimes strange behaviors have been observed during the install/un-install process, such as: "I un-installed an application (Maclean's Mobile) and 4 new ones appeared that I can't delete."

5.1.3 Issues with downloading from the App World

In 10% of the issues, the user had difficulty with downloading an application from the App World. For example, sometimes the license key would not work, or App World would refuse downloading to the phone falsely mentioning that the phone is incompatible.

As you can see in most of the reported issues, even when users where experiencing unexpected behavior, there was something related to install, un-install, upgrade, or downloading applications. Based on the title of the forum which is "Blackberry App World-General Discussions", we did not expect to get such a high percentage of issues related to installation and configuration of mobile phones. This indicates that people are frequently facing installation issues with their mobile phone applications.

5.2 What are the prescriptions?

Even though some of these issues were not resolved, or the prescriptions were not confirmed to be correct, it is worth to take a look at what users usually try or are advised to do for resolving their issues. We were able to observe the following categories regarding to the prescriptions :

- Un-Install/Reinstall the app

- Revert to an older version/Try newer version

- Delete the existing configurations

5.2.1 Un-install/Reinstall the app

This approach was very common and was tried in about 50% of the reported issues. However, in all cases, it did NOT help resolve the issue. We believe that this is because this is a natural solution that comes to mind, and users who report in these forums are the ones who have already exhausted this opportunity.

5.2.2 Revert to an older version/Try newer version

In 40% of the cases the users either would try a newer version, or if their issue appeared right after an upgrade, they would attempt to revert to the older version (which was not

always possible). For example, the issue of applications not opening properly mentioned above was ultimately resolved by installing an alternate version of the application.

5.2.3 Delete the existing configurations

In many cases where the easier approaches do not suffice, users try clearing the phone's application cache, reinstall the operating system or reverting the phone back to the factory settings. This not an straightforward approach as can be seen in the following steps for clearing the application cache. These steps were tried by the same user who had difficulty opening the installed application:

1. Open App World

2. Go to My World

3. For keyboard-based BB's, Hold down the ALT key and then press, in sequence R, then S, then T

4. For Storm/Pearl, Hold the num-lock (!?123) button so it locks and then press, in sequence 3, then 4

5. If your BB locks after issuing the cache clear, perform a battery pull reboot

In this example, you can clearly see how diversity in the mobile phones makes life harder for the support teams and for the users as different instruction sets are needed for each handset. Moreover, these steps are not intuitive at all for a normal user.

Even though some of these approaches are not intuitive, in our review of the reports it was amazing to see that users try many different approaches before they ask for help in these forums. Going back to the issue of non-opening application above, the user had tried re-installing the application, deleting the archived versions, clearing the phone's application cache, and a battery pull out before asking for help.

6 Discussion

As mobile phones are getting increasingly popular and more applications are developed on them, the issues that users face with regards to these applications become complex as well. Today, many people rely on workarounds and approaches such as reboots to solve their issue. Therefore, many support issues are not even reported. However, as mobile phones become more complex, workarounds will become even more complex and thus people will not be able to find them on their own and will ask for help. Moreover, people will have more applications running on their phone simultaneously. Therefore, rebooting will become more annoying and less feasible as it interrupts all running applications. Therefore, researchers should focus on providing easier means of resolving mobile phone application issues.

Diversity in the platforms and in the handsets is an important hurdle in resolving mobile phone application issues. It makes supporting these applications harder as different instructions should be provided to different users. An intuitive approach to mitigating this issue is developing standards which all vendors would follow. However, with the competitive market and with too many vendors producing handsets and applications, this is not easy to implement.

In order provide easier technical support for applications, one approach is to build applications that take into account this diversity in the platforms. This means to provide adaptation mechanisms for the applications so that they would automatically adapt to each new environment. This would reduce the amount of the issues that people are having simply because of different platforms or handsets. Moreover, a novel approach to make support easier is to gather the required information for troubleshooting while the application is running, so that the user can provide it to the support team in cases of issues. This is used by the Funambol application and as seen in their issue reports is very helpful.

Another issue that users are frequently struggling with is the installation/configuration issues. With the burst in the application development and with the relative cheap price of these applications, users are frequently installing new applications on their phones and these issues become even more prevalent. In order to mitigate this issue, better testing mechanisms are needed at the vendor site before a new upgrade is released. Currently, the testing space resulting from the diversity in the userbase for the mobile applications is very huge so that no existing testing mechanism is able to cover all its cases. Moreover, the push for releasing new functionalities in a limited time to remain competitive in the market urges the companies to release products before comprehensive testing is done on them. Again, having some standards would help in reducing this huge testing space with clustering, but this might not be feasible as mentioned. Therefore, finding an effective testing mechanism which works in a timely manner is to be resolved by future research.

7 Related Works

Studies such as [3] attempt to investigate the opportunities in mobile phone application development in different

categories; in this case the game category. Going further than exploring opportunities, [4] and [5] try to address issues regarding to development and expansion of mobile phone applications as mentioned in this paper. [4] is concerned about diversity in the mobile phone platforms and handsets and how it affects the research in ubicomp field. They propose migrating functionalities between handsets and servers, establishing some standards, and using a component-based application development approach to mitigate the issue of diversity. [5] goes a step further and tries to provide a mechanism by which a web application running on one device such as a mobile phone can successfully migrate to another device/platform such as a PC by adapting to the different features and resources of the destination setting. Having robust adaptation mechanisms for applications running on mobile phones can help mitigate the issue of diversity in the platforms. [6] proposes clustering in order to reduce the testing space when an upgrade is to be released for an application. This study focuses on desktop applications. However, we believe similar approaches can be developed to facilitate better testing before release of a new upgrade for mobile phone applications.

8   Conclusions

In our survey of the issues with mobile applications, we were able to categorize these issues from the users' perspective. These categories include diversity in the platforms and handsets, lack of interoperability between applications, and upgrade and installation issues. As mobile phones get more capable in terms of resources, and more applications are developed and run on the phones, these issues become more serious and deserve immediate attention of the researchers. We also categorized different approaches that users try in order to solve their phone's issues without the need to ask for help. These categories include, reboot, workaround, trying a newer or older version, and clearing configurations. As the mobile applications get more complex and more applications run on them simultaneously, these self-remedies will not suffice. Therefore, effective approaches for reducing the support needed and providing easy support for these applications should be developed.

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