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Cross-platform mobile development with PhoneGap

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Abstract

The aim of the thesis was to develop feedback software for Nestronite Oy running on Android, iOS and Windows Phone using the PhoneGap framework. PhoneGap enables software development using web development technologies such as HTML, CSS and JavaScript.

Nestronite Oy had developed a remotely similar application a few years earlier. As the technology has greatly improved during the last few years, Nestronite Oy felt the need to improve the already existing Jaxber feedback application.

A small group of students developed a new version of the Jaxber feedback application during multiple courses and practical training. First a prototype version on the application was developed which was slowly modified towards a market ready product. The usage of PhoneGap was justified as the group of developers was small and the number of required operating systems was large. By using PhoneGap it was possible to produce a version for each required operating system using the same source code. PhoneGap enabled the usage of the target mobile device features such as camera, sound recorder and memory card, which is not possible using traditional web development technologies.

Jaxber application consists of the phone application, web based management site and REST interface. The thesis focused on the phone application as the rest of the components do not utilize the PhoneGap framework.

As a result the client received a marketable mobile application which works on all three mobile operating systems as specified in the requirements. The finished application was published on the marketplaces of all three mobile operating systems.

Keywords/tags (subjects) PhoneGap, Android, iOS, Windows Phone, Mobile

Miscellaneous

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Työn ohjaaja(t) Rantala, Ari

Toimeksiantaja(t) Nestronite Oy

Tiivistelmä

Opinnäytetyön tavoitteena oli kehittää Nestronite Oy:lle Android-, iOS- ja Windows Phone -käyttöjärjestelmässä toimiva palautesovellus käyttäen PhoneGap-sovelluskehystä. PhoneGap mahdollistaa sovelluskehityksen käyttäen HTML-, CSS- ja JavaScript-verkkoteknologioita.

Nestronite Oy oli kehittänyt hieman aihetta sivuavan sovelluksen jo muutamaa vuotta aikaisemmin. Koska teknologia on kehittynyt valtavasti viime vuosina, koki Nestronite Oy tarpeelliseksi uudistaa jo olemassa ollutta Jaxber -palautesovellusta.

Pieni opiskelijaryhmä kehitti uuden version Jaxber-palautesovelluksesta usean opintokurssin sekä työharjoittelun aikana. Ensin sovelluksesta kehitettiin prototyyppi, jota hiljalleen alettiin muokata kohti markkinakelpoista tuotetta. PhoneGapin käyttö sovelluskehityksessä oli perusteltua, sillä kehitysryhmä oli pieni ja vaadittujen käyttöjärjestelmien määrä suuri. Käyttämällä PhoneGapia pystyttiin samasta lähdekoodista helposti tuottamaan versiot eri mobiilialustoille. PhoneGap mahdollisti mobiililaitteiden ominaisuuksien kuten kameran, ääninauhurin ja muistikortin käyttämisen, joka perinteisillä verkkoteknologioilla ei ole mahdollista.

Jaxber-sovellus koostuu puhelinsovelluksesta, verkkopohjaisesta hallintasivustosta sekä REST-rajapinnasta. Opinnäytetyössä keskityttiin puhelinsovelluksen kehitykseen, sillä muut komponentit eivät käytä hyväkseen PhoneGap-sovelluskehystä.

Työn tuloksena tilaaja sai myyntikelpoisen mobiilisovelluksen, joka toimii vaatimusten mukaisesti kaikilla kolmella mobiilikäyttöjärjestelmällä. Valmis sovellus julkaistiin ladattavaksi kaikkien kolmen mobiilialustan omassa sovelluskaupassa.

Avainsanat (asiasanat) PhoneGap, Android, iOS, Windows Phone, Mobiilisovelluskehitys

Muut tiedot

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Terminology

Android

Android is a mobile operating system based on the Linux kernel. Android primarily targets mobile devices with touch screen such as smart phones and tablets. Android currently has about 52.1% marketshare in the mobile and tablet market (Netmarketshare 2015).

API

API, short for "Application programming interface" is a set of routines and tools for building software applications. API is usually used as common boundary between two applications allowing them to communicate with one another.

APK

APK, short for Android application package is the file format used for Android software distribution.

CLI

A command-line interface is a way of interacting with a computer program were user issues commands to the program as lines of text.

CSS

Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language. CSS makes it possible to separate presentation instructions from the HTML content.

GUI

GUI, short for "Graphical user interface" is an interface that allows users to interact through graphical icon and visual indicators.

HTML

HyperText Markup Language is the standard markup language to create web pages or other documents. HTML5 is the latest version of the language.

HTTP

Hypertext Transfer Protocol is a protocol that is used to transfer data between browser clients and web servers.

iOS

iOS, is an operating system developed by Apple. iOS is used in Apples iPhones, iPods, iPads and TV's. Android currently has about 40.8% marketshare in the mobile and tablet market (Netmarketshare 2015).

REST

REST, short for "Representation State Transfer", is an architectural model based on HTTP-protocol for creating application programming interfaces.

SVG

Scalable Vector Graphics is a file format that defines a vector-based image in XML format.

Windows Phone

Windows Phone is a mobile operating system developed by Microsoft. Windows Phone currently has about 2.6% marketshare in the mobile and tablet market (Netmarketshare 2015).

ZIP

ZIP is an archive file format using the filename extension .zip. ZIP file may contain one or more compressed files or directories.

1 Introduction

1.1 Mobile development

"Consumers are increasingly relying on their smartphones and tablets for research, entertainment, sharing content, and shopping online compared to desktops" (Saccomani 2015). Mobile applications have become increasingly popular as the number of handheld devices such as mobile phones and tablets has steady been increasing in the resent years. "Apps allow marketers to use custom tools and content that makes

it easier for mobile users to reach the content they're looking for faster and more conveniently" (Saccomani 2015).

"Generally clients want to develop apps in one coding language or domain for all platforms to optimize time and money, for both the software engineers and company" (Sitanshu 2015). Native application development means using the native programming languages of the devices to build the application. To build a native application for three different mobile operating systems the developer may be required to use different programming language for each platform. This will result a lot more work and time spent to develop an application.

In cross-platform development, also called hybrid app development, it is possible to use common web technologies like HTML5, CSS and JavaScript on all platforms. With hybrid app development, the developer can build the application once and submit it to all platforms. This way the developer will save money by not having to build the app using native programming language of each platform. Using cross-platform development framework such as PhoneGap, it is relatively simple to prototype and launch an application on multiple platforms quickly.

The reason for choosing a cross-platform framework was that the size of the development team was small and the given tight.

1.2   Nestronite Oy

The client, Nestronite Oy, is a small startup company founded in 2011. The company spon up from the Digile Cloud Software -program that received funding from Tekes - the Finnish Funding Agency for Technology and Innovation. Currently Nestronite Oy is owned by four persons and two companies. "Nestronite is a expansive company which is aiming for the international market" (Turunen 2012).

The company has been involved in the development of FreeNest, an open source based platform designed to streamline team work and project management. In 2012 Nestronite Oy was selected as the entrepreneurship act by Suomen korkeakoulujen yrittäjyysfoorumi, the Finnish academic business forum.

Currently Nestronite Oy offers consultant services and markets and develops the Jaxber product that is used for qualitative and quantitative data gathering.

1.3 Project background

In 2013 Nestronite Oy developed the first prototype of Jaxber. Jaxber was a problem solving application for Android using a game-like experiences with a system of rewards.

> *The application is for collecting user feedback about products or services. The feedback can be given in three forms: image, audio or video. The user can, for example, buy a meal and tell his or her opinion on that in audio format. The restaurant can then use all those user reviews to improve their services and learn about the customers' likings. (Laukka 2014, 12.)*

The prototype for JAXBER was developed with cross-platform framework called PhoneGap. During that time PhoneGap was a fairly new technology and the development had its pitfalls.

A new implementation of a course called "the basics of software engineering" was starting at JAMK University of Applied Sciences in the fall of 2014. The objective of the course is to learn the basic skills required in software engineering. The course consist of lectures as well as project studies. Nestronite Oy was one of the clients for whom the course students would work for.

A group five students, including the author, chose Nestronite Oy as employer for the previously mentioned course. Nestronite Oy commissioned the project group, Coperino Pastarino for a new and improved version of Jaxber.

2 Objectives of the project

The primary objective of this thesis was to develop and publish an improved version of Jaxber. The new version was scheduled to be developed during the the basics of software engineering course during the autumn of 2014 and spring 2015. During the initial requirement specification there were only a few strict requirements. The development team was given the freedom to use the principles, practices and techniques they felt were suitable for the project.

The new version of Jaxber was required to run on three platforms: Android, iOS and Windows Phone and the project was carried out with the purpose of producing an application for gathering qualitative and quantitative feedback with some sort of

gamification elements. The initial requirements included the ability to capture feedback in video, image and audio format as well as in plaintext. Jaxber was also required to have some kind of social interaction possibilities such as commenting, liking and browsing feedbacks. It was decided by the development team to carry out the project using agile development methods and cross-platform development framework. Agile development methods do not usually impose detailed requirements for the project in the begining, rather the requirements are specified during the development. Appendix 1 displays how the requirements have been specified over time in the Jaxber project.

As a secondary objective, this thesis explains the differences in native and cross-platform development and presents different kinds of cross-platform development tools. The used tools and technologies are briefly introduced, keeping the main focus on the actual Jaxber cross-platform development process.

3   Developing native applications

3.1   Introduction to native applications

Native applications are specific to a certain platform, for example iOS or Android. Developing a native application is carried out by using development tools and a programming language supported by the respective platform. The native applications usually achieve the best performance, and the general feeling to the end user is familiarity with the product. Other advantages of native applications include fast and fluid animations, full access to the hardware of phone or tablet and multi touch support as well as the latest APIs.

There are not many downsides as for developing native applications. However, if the developer plans to release a version of the app on multiple platforms, the code must be rewriten for each target platform. Very little, if any code can be reused on different platforms. This process can be time consuming for complex applications.

3.2   Android

Usually Android applications are developed in Java programming language using the Android SDK. Android software development kit includes a wide variety of development tools. The Android SDK also offers a device emulator, Android Virtual Device which can be used for testing. Currently the official IDE, integrated development environment, for Android is Android Studio, developed by Google. Android development is possible using most major Linux distributios, Windows or Max OS.

Compliled Android applications are distibuted in APK (Android application package) format. APK files contain the program's code, resources, assets and certificates. APK files are actually archive files in compressed zip format. Play Store serves as the official app store for Android.

3.3   iOS

Native applications for iOS are developed using a programming language called Objective-C. Xcode is used as the development tool alongside with the iOS software development kit. Xcode offers a simulator, virtual iOS device emulator, on which one can test an application. However, not all APIs function when using the simulator and user may be required to use a physical device for testing. To compile iOS applications Mac operating system is required.

Compiled iOS applications are distributed in IPA fileformat in App Store. IPA files contain the binary file for ARM achitecture and can only be installed on iOS devices. IPA files are compressed zip archive files.

3.4   Windows Phone

C#, alongside with XAML markup language, is the most common programming language used in native Windows Phone development. Microsoft Visual Studio is used as integrated development enviroment for Windows Phone. Windows Phone SDK contains all the tools required to develop with Windows Phone framework.

Windows Phone applications are distributed in the Windows Phone Store as XAP packages. XAP packages are in compressed zip format. However, the XAP packages are encrypted and they cannot be extracted like normal zip packages.

4 Cross-platform development and tools

4.1 What is cross-platform development

For a software or application to be considered cross-platform, it must be able to be run on multiple operating systems. Developing cross-platform applications can be very time-consuming because different operating systems use different kinds of APIs.

One solution to this problem is to develop a multiple codebase application were distinct codebases with same functionality are maintained for different platforms. This, however, requires a great effort maintaining the code, however, that may proof beneficial if the requirement for native code is high.

It is also possible to tackle this problem using a single codebase approach. In single codebase strategy the same source code can be complied for multiple platforms. One technique to achieve this is to use conditional compilation were the common code for all platforms is not repeated. The parts of the code that are only relevant to certain platforms are made conditional and only compiled when needed.

Graceful degradation is a techique that attemts to mitigate the problems of cross-platform development by diminishing the application functionality to a least common denominator. This technique is obviously quite restricting, and it is mostly only used when developing applications for web browsers.

As cross-platform development has become more popular, multiple commercial and free tools have been released to assist developers in cross-platform compatibility. The following section covers some of the many possible cross-platform development tools.

4.2 Xamarin

Xamarin Studio is an IDE for application development for iOS, Mac and Android. If the developer decides to purchase a business lisense, Xamarin Studio can be integrated to Visual Studio thus enabling the possibility to develop for Windows Phone. C# is used as the programming language for development when using Xamarin. Xamarin has over 1.2 million developer customers (Xamarin 2015a).

Using Xamarin is fairly expensive. Xamarin offers three different kinds of licensing options; indie, business and enterprise (Figure 1). Each licence is for one developer and one platform. If the developer wants to use Xamarin for iOS, Android and Windows Phone, they must purchase three business licences.

Xamarin also offers a free Xamarin Starter Edition. The Starter Edition is limited to iOS and Android platforms and the final application cannot exceed 128 kilobytes.


Figure 1. Xamarin licensing options (Xamarin 2015a.)

4.3   Appcelelator Titanium

Appcelelator Titanium is an open source framework for creating native, hybrid and mobile web applications for multiple platforms including iOS, Android, Windows Phone, BlackBerry OS and HTML5. Titanium uses JavaScript-based SDK to access APIs for multiple platforms.

"Alloy is an MVC app framework built on top of Titanium that provides a simple model for separating the app user interface, business logic and data models" (Appcelerator 2015a).

Even though Titanium is open source, the usage still requires the developer to buy a licence. Appcelerator offers three different licencing options (Figure 2). One license is for one developer. For example if the company has five developers it must purchase five licences. "The Platform is free for use for development with all the features of the Team plan. You only need to choose your preferred plan and pay when you're ready to deploy your app(s) to production." (Appcelerator 2015b).

	Indie $39/mo. Paid monthly or annually* Single seat. Everything you need to build & measure your own mobile apps	Team $259/seat/mo. Paid annually Perfect for teams and growing mobile businesses	Enterprise Call us! 1 (877) 909-4589 Premium support, customizable setup, enterprise scale
Apps: Build native mobile apps for any OS, using JavaScript			
Appcelerator Studio IDE	✔	✔	✔
iOS, Android, and Windows	✔	✔	✔
Unlimited apps	✔	✔	✔
Unlimited app end-users	✔	✔	✔
Certified SDK Releases	✔	✔	✔
Premium modules 🛈	✘	✔	✔
App Designer (beta) 🛈	✘	✔	✔
App Preview (beta) 🛈	✘	✔	✔
MDM/MAM one-click publishing	✘	✘	✔
Mobile test automation	✘	✘	Available

Figure 2. Appcelerator pricing (Appcelerator 2015b)

4.4   Unity

Unity is a cross-platform game engine. It is developed by Unity Techologies and used for creating video games for PCs, consoles, mobile devices and websites. Programmers can use JavaScript, C# or Boo when developing apps with Unity. Unity is notable for its ability to target games to multiple platforms.

Unity offers a free Personal Edition for professional developers, Indies, hobbyists and studios with revenue under 100000 USD. With Unity Personal Edition user is allowed to make commercial games and content as long as they do not earn or receive more than 100000 USD in revenue in year. If the revenue limit is exceeded Unity Professional Edition needs to be purchased (Figure 3).

Figure 3. Unity licensing options (Unity 3d 2015)

4.5 Qt

Qt is a cross-platform application framework that is used to develop applications that can run on various platforms. Qt supports Windows, Linux and OS X on desktop and Android, iOS and WinRT including Windows Phone on mobile. Some other embedded platforms are also supported.

Qt is available with commercial and open source licenses. To develop a commersial application with Qt you need to purchase the commercial license (Figure 4). Each developer needs to have their own license and it is not allowed to mix open source and commercial licenses.

C++ is the most supported language for Qt programming; however, it is possible to use many other languages such as Ada, Basic, C#, D, Go, Haskell, Java, JavaScript, Lisp or Lua.

Order Confirmation

1 x Qt for Application Development ($ 350.00 / Interval*) $ 350.00

Taxes   + $ 0.00

* This subscription is automatically invoiced at 1 months Intervals

Figure 4. Qt application license order form

4.6   PhoneGap

"PhoneGap is a free and open source framework that allows you to create mobile apps using standardized web APIs for the platforms you care about" (PhoneGap 2015). PhoneGap is licensed under Apache 2.0 license so it will always be free for private and commercial use. PhoneGap is built on top of Cordova ecosystem and developed by Adobe.

PhoneGap supports development for multiple platforms, including iOS, Android, Windows Phone and multiple other less used operating systems.

Furher details about PhoneGap and Apache Cordova are covered in the next section.

5   Tools and technologies

Cross-platform development with PhoneGap framework involves a wide variety of tools. These tools are like builing blocks used togeter to develop the final application. Some tools are only used if the developer is targeting at a specific platform. For example Android SDK is used only when targeting Android devices.

5.1   Apache Cordova

Cordova is an open source framework for building and developing cross-platform applications using web techologies such as HTML, CSS and JavaScript. Using Cordova it is possible to develop an application that uses these common web techologies and packages them into a format that can be installed on mobile devices.

Cordova offers interfaces to native features such as camera, sound recorder and memory card of mobile devices, which is not possible using traditional web development technologies. This makes it possible to develop applications using web technologies that utilise the native features of the target platform. When developing for multiple platforms at the same time, this is a huge time saver as the same source code can be used on all platforms.

5.2   PhoneGap

PhoneGap is a distribution of Apache Cordova.

> *You can think of Apache Cordova as the engine that powers PhoneGap, similar to how WebKit is the engine that powers Chrome or Safari. Over time, the PhoneGap distribution may contain additional tools that tie into other Adobe services, which would not be appropriate for an Apache project. (PhoneGap Blog 2012a).*

The only real difference between PhoneGap and Cordova is the download package name.

PhoneGap packages the JavaScript, CSS and HTML 5 into a native container (Figure 5). This native container contains a web view that works in same way as a regular web browser instance.
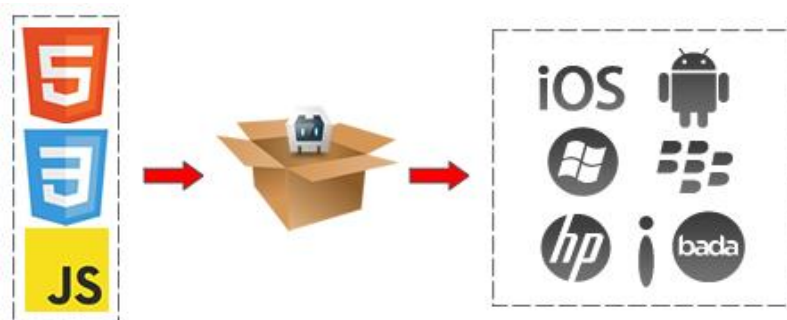
Figure 5. Packaging web technologies with PhoneGap (PhoneGap Blog 2012b)

As one of the requirements for the project was functionality on multiple platforms, PhoneGap was the obivous choice, which was supported by the fact that the size of

the development team was only five people and there were not enough resources to develop a native application for all platforms.

5.3   Apache Ant

"Apache Ant is a Java library and command-line tool whose mission is to drive processes described in build files as targets and extension points dependent upon each other. The main known usage of Ant is the build of Java applications." (Apache Ant 2015). Apache Ant is an open source software developed by the Apache Software Foundation and released under the Apache License 2.0.

5.4   Node.js

"Node.js is an open-source, cross-platform runtime environment for developing server-side web applications" (Wikipedia, Node.js 2015). Node.js makes it possible to create web servers and applications using JavaScript and core modules. Node.js was used to install PhoneGap and to run required build hooks during PhoneGap build process.

5.5   npm

npm, short for Node Package manager is the default package manager for Node.js. After Node.js version 0.6.3, npm is built and installed automatically with the Node.js environment (Node changelog 2011). "npm makes it easy for JavaScript developers to share and reuse code, and it makes it easy to update the code that you're sharing" (What is npm? 2015). Node Package manager allows users to install applications that are available on the npm registry.

5.6   Android SDK

The Android SDK includes a variety of tools that help to develop mobile applications for the Android platform. The tools are classified into two groups: SDK tools and platform tools. "SDK tools are platform independent and are required no matter which Android platform you are developing on. Platform tools are customized to support the features of the latest Android platform." (Android Developers n.d.).

5.7   Java Development Kit

Java Development Kit is a collection of programming tools for software development in cross-platform environment developed by Orcale Corporation. It includes the Java Runtime Environment (JRE), an interpreter/loader (java), a compiler (javac), an archiver (jar), a documentation generator (javadoc) and other tools needed in Java development (Techopedia n.d.).

5.8   jQuery and jQuery Mobile

jQuery is a fast, small, and feature-rich JavaScript library. It makes things like HTML document traversal and manipulation, event handling, animation, and Ajax much simpler with an easy-to-use API that works across a multitude of browsers. With a combination of versatility and extensibility—. (jQuery 2015).

jQuery Mobile is a HTML5-based user interface system designed to make responsive web sites and apps that are accessible on all smartphones, tablets and desktop devices. It is built on the rock-solid jQuery and jQuery UI foundation, and offers Ajax navigation with page transitions, touch events, and various widgets. jQuery Mobile is a project of the jQuery Foundation. It is completely open source and is one of the most popular Mobile frameworks— (jQuery mobile 2015).

jQuery Mobile supports wide range of mobile operating systems and browsers (Appendix 2).

5.9   less

"Less is a CSS pre-processor, meaning that it extends the CSS language, adding features that allow variables, mixins, functions and many other techniques that allow you to make CSS that is more maintainable, themable and extendable." (Lesscss 2015).

Less was used to generate the CSS files on the fly when the Jaxber application was lauched, which allowed the usage of variables in the stylesheets. For example some images could be resized acording to the target device specifications.

5.10 Xcode

Xcode is Apple's integrated development environment (IDE) that is used to build apps for Apple products including the iPad, iPhone, Apple Watch, and Mac. "Xcode

provides tools to manage your entire development workflow—from creating your app, to testing, optimizing, and submitting it to the App Store." (Apple Inc. 2015).

Xcode was first released in 2003, the latest release, version 7.1 is available from Mac App Store. During Jaxber development Xcode was used to build iOS version of Jaxber application from the Xcode project files generated by PhoneGap when targeting iOS platform.

5.11 Microsoft Visual Studio

Microsoft Visual Studio is an integrated development environment from Microsoft. Visual Studio features a code editor, debugger and bunch of other development tools. When developing cross-platform applications using PhoneGap, Visual Studio serves the purpose of building and debugging environment for Windows Phone. PhoneGap generates Visual Studio project solution files when the target platform is Windows Phone.

5.12 PhoneGap plugins

"A plugin is an bit of add-on code that provides JavaScript interface to native components. They allow the app to use native device capabilities beyond what is available to pure web apps." (Apache Cordova 2015). On 21st April 2015 the Apache Cordova team announced that core and third party plugins will be moved to npm ecosystem.

"Plugins compromise a single JavaScript interface along with corresponding native code libraries for each supported platform. In essence this hides the various native code implementations behind a common JavaScript interface." (PhoneGap 2014).

Jaxber application uses multiple PhoneGap core and third party plugins for added functionality (Appendix 3).

6   Developing the Jaxber application

Jaxber is a commercial product, thus it is not possible to explain the inner workings in detail. The software source code is considered as confidential information, under the

section 1.a.iv of the non-disclosure agreement with Nestronite Oy and cannot be made public.

This section describes the Jaxber development process without revealing details about the actual technical aspects of the application. The section presents the Jaxber application functionality and problems encountered during the development.

6.1 Schedule

Jaxber project started in the week 37 2014 as a part of the the basics of software engineering course. The work on the project was done during the hours scheduled for aforementioned course. Basically, this meant that the development team worked once a week for eight hours a day. Every now and then the team needed to be more flexible with meeting times to fit the clients, Nestronite Oy, schedule.

The development phase that took place during the basics of software engineering course was concluded in the week 18, 2015. Few members of the development team continued to maintain and further develop the Jaxber application as their practical training. In the week 37, 2015 a new group of students from the course joined the Jaxber developement team. Figure 6 displays the members involved.
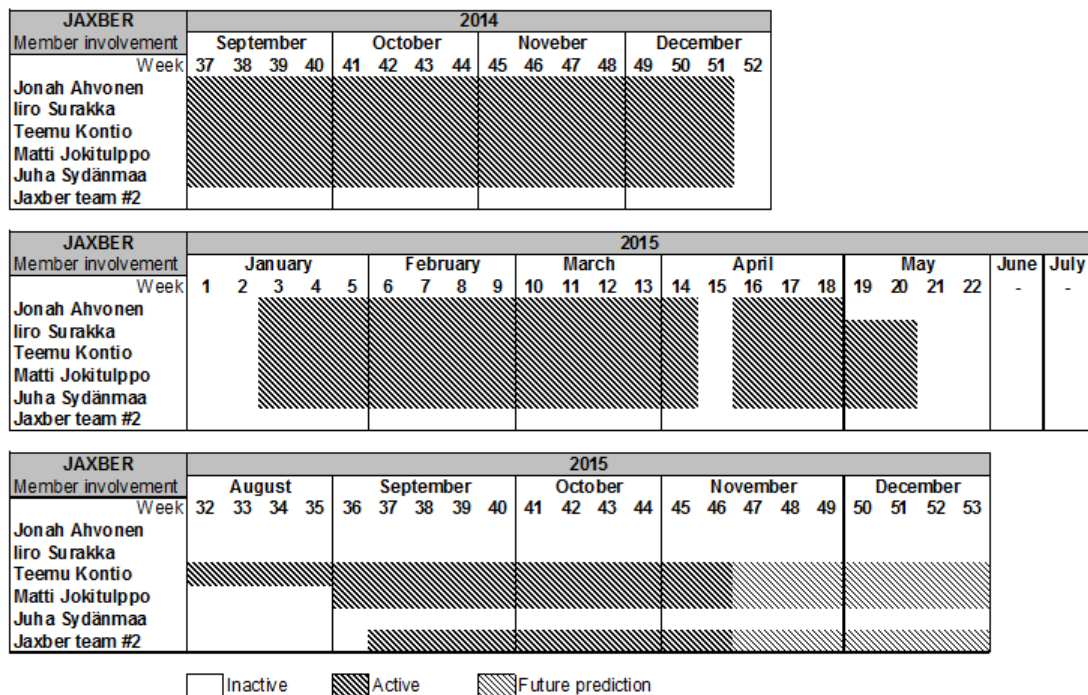
Figure 6. Schedule and members involved

6.2   Development method

Jaxber was developed using a agile development methodology called Scrum. The key principle of Scrum is that the customers can change their minds about what they want and need. Scrum methodology accepts that a problem cannot be fully understood or defined and focuses on maximizing the development team's ability to deliver quickly.

When developing with Scrum, work is done iteratively and incrementally. The product being developed is slowly perfected as the development cycles (sprints) pass. Each spirint is a perioid of one to four weeks. For each new sprint, a sprint backlog is created from features that are the most important in the current project state.

A sprint review is held at the end of each sprint where the development team presents the features that have been compleated during the sprint. Scrum also features a daily meeting called the daily scrum. Daily scrum is a short, timelimited discussion inside the development team. In the daily scrum each member tells the rest of the team what they have been doing since the last daily scrum, what they are going to be doing next and if they are having any problems.

The basics of software engineering course required that the teams would practice the usage of Scrum during application development. However, Scrum was not able to show its full potential because of the course schedule. As the work on the project was only done once a week, daily Scrums quickly turned into mix of sprint review and requirement specification. The usage of Scrum was nevertheless worthwhile as it allowed the team to use more time on the actual development than planing.

6.3   Setting up the development environment

This section covers the steps required to setup the development environment for Windows desktop. Windows was used as the main development platform on desktop computers. Building applications for Windows Phone requires that the system is running Windows 8.1 or later. Mac OS X was only used for building and testing the application on iOS devices such as iPads and iPhones.

Setting up the development environment for Mac OS X requires the same tools, just the Mac OS versions of them as on Windows desktop, with the addition of Xcode installation. Xcode can be installed from Mac App Store application.

Java JDK

Java development kit was first downloaded from http://www.oracle.com/technetwork/java/javase/downloads/index.html. Once the download is completed it is possible to install the Java JDK simply by double clicking on the downloaded application, which will start the interactive setup process. There is no need to change the default settings and the setup can simply be executed by pressing next. Users should take note of the installation path, as it is required to be added as Windows system variable later. In this example the install location was *'C:\Program Files\Java\jdk1.8.0_65'*.

Node.js

Node.js installation is just as simple as Java JDK. First the installer was downloaded from https://nodejs.org/en/download/. Double clicking on the downloaded installer will begin the installation process. Once again, the default settings suffice and only the installation path needs to be noted (Figure 8). The path will later be added as Windows environment variable. In this example the install location was *'C:\Program Files\nodejs'*.
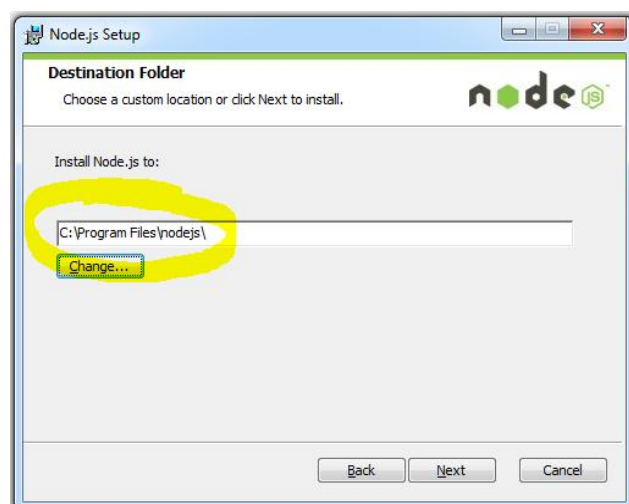
Figure 7. Node.js install path during setup

Android SDK

Android SDK was downloaded as a compressed ZIP file from
https://developer.android.com/sdk/index.html#Other. The 'SDK tools only' package
was selected as there was no need for Android Studio software. The installation is
done simply by uncompressing the file into user selected location on the computer.
Once again the uncompressing location should be noted as its needed later during
the install process. In this example the install location was ' *C:\android-sdk'*.

Apache Ant

Apache Ant is available as ZIP archive from http://ant.apache.org/bindownload.cgi.
Like Android SDK the installation is done by uncompressing the ZIP archive into user
selected location and taking a note of the path. In this example the install location
was ' *C:\apache-ant-1.9.6'*.

System variables

On Windows machines it is required to set up some system variables so that all the
installed components can be found by Windows. The system variables can be set up
under *'Control Panel - System - Advanced - Environment variables'* as seen in Figure 8.
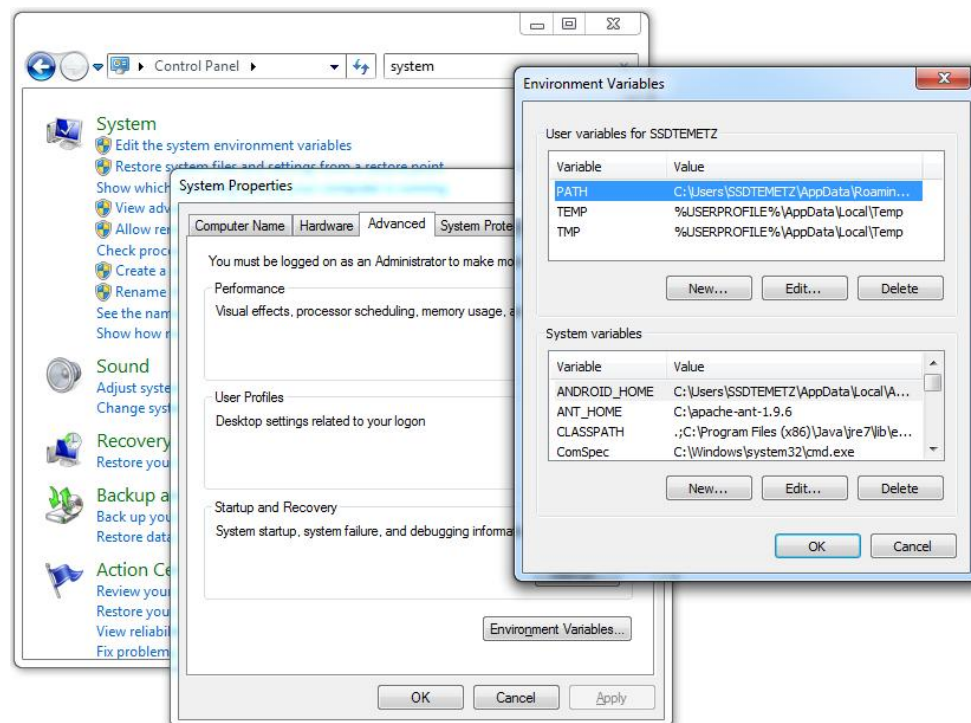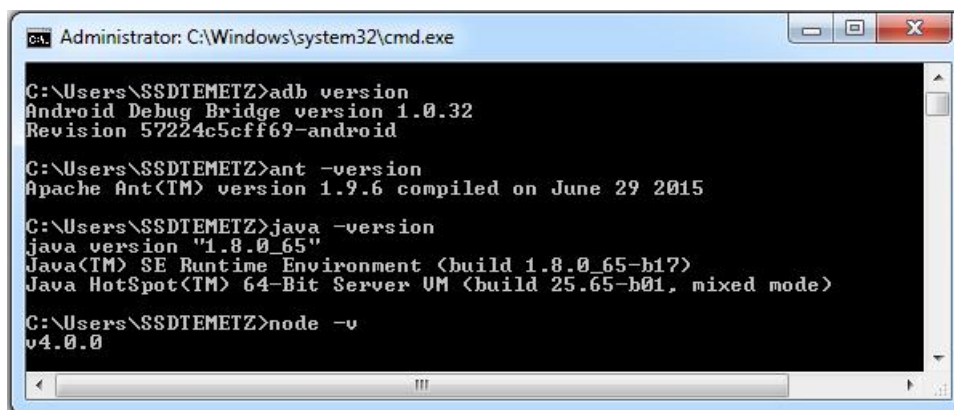
Figure 8. Setting Windows environment variables

Add the following as new system variables:

- *'ANDROID_HOME'* with value *'C:\android-sdk'*

- *'ANT_HOME'* with value *'C:\apache-ant-1.9.6'*

- *'JAVA_HOME'* with value *'C:\Program Files\Java\jdk1.8.0_65'*

Locate the variable named 'Path', choose edit and add the following to the end.

;%ANDROID_HOME%\platform-tools; %ANT_HOME%\bin;%JAVA_HOME%\bin; C:\Program Files\nodejs\;

Verify that everything is correctly setup so far by opening a new command window and typing the following commands followed by enter; *'adb version'*, *'ant -version'* ,*'java -version'*, *'node -v'*. The commands should not return any errors and display the installed version numbers of the components as seen in Figure 9.

Figure 9. Checking installation of development environment dependencies

PhoneGap

When all the previous dependencies have been successfully installed, the actual PhoneGap setup is simply executed by typing the command *'npm install -g phonegap@latest'.* The command will fetch the latest PhoneGap version via node package manager and install it globally. If the setup is successful, *'phonegap -v'* can be run that should display the installed version number as seen in Figure 10.

Figure 10. Checking PhoneGap installation

6.4 Jaxber application

Jaxber consists of three main components, the actual mobile application, REST API and web based administrator service. PhoneGap was only used during the mobile application development. REST API and web based administrator are suportive services for the actual mobile application and use their own techniques.

The web based administrator interface is used by Jaxber system administrators who create and edit campaigns for paying customers. The paying customers also use the admin interface to manage their campaigns and the feedbacks gathered.

The REST API is a server side component that provides the mobile application and web administrator a gataway to access common data storages. The REST API is a key feature that enables the mobile application to communicate with background services and the possibility to display dynamic content. Without the REST API, the mobile appication would only be able to display static content; content that was already present when the end user installed the application.

Login and register view

Login view, as shown in Figure 11, is the first content displayed to the user when they first open the application. The users need to login with their account before they are able to perform anything else. If the user does not have an account they have the option to create one from the register view (Figure 12). If the user has forgotten their password, they may use the recover password option to initialize the password recovery process. If the user has previously logged in and has selected the remember me option, they will be logged in automaticlly when they open the application.
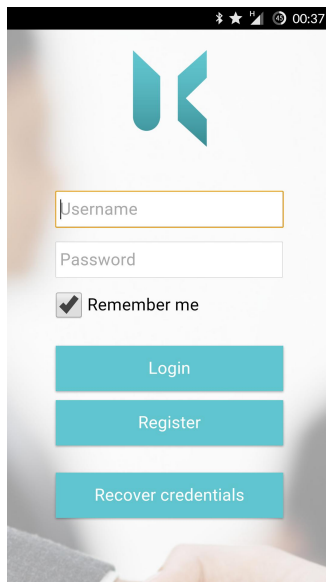
Figure 11. Jaxber - login page
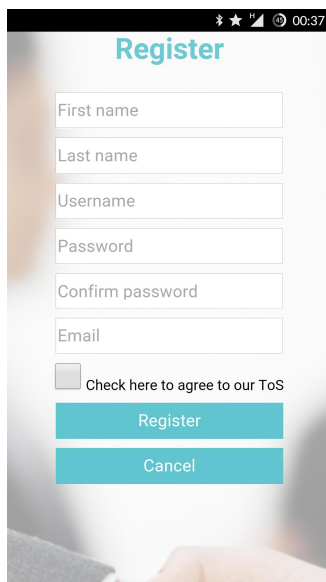
Figure 12. Jaxber - user registration page

Campaign selection

This view, as seen in Figure 13, displays all campaigns that are available for selection. User is located by GPS and the campaigns are listed so that the closest ones are displayed first. The user also has the chance to search for campaigns manually. This is extremely useful in cases where the user cannot be located by the GPS. The campaign owner may also set hashtags in the administrative interface to identify their campaign. The end users may use the manual search function to search for a campaign hashtags. Once the user selects a campaign, they are forwarded to that

campaign's browse view. Users may switch between campaigns by tapping on the top navigation bar.
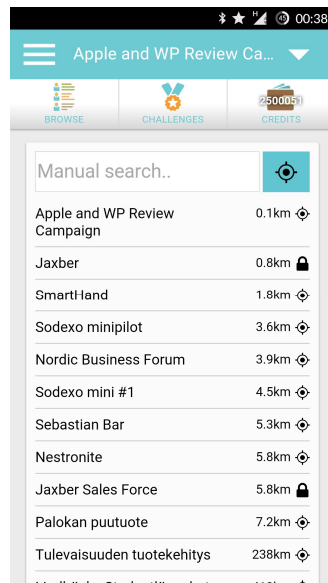
Figure 13. Jaxber - campaign selection view

Browse view

The feedbacks sent for the selected campaign are displayed in this view once they are reviewed by the campaign owner (Figure 14). From this view users are able to browse and review feedbacks send by others. The users may also choose to filter the feedbacks by different modifiers. Users can also like the feedback if they think it provides valuable obsercations that they agree on.

The campaign owner may allow feedbacks to be published without a review, by changing settings from the administative interface. In this case users will automatically be granted credits for providing feedback.
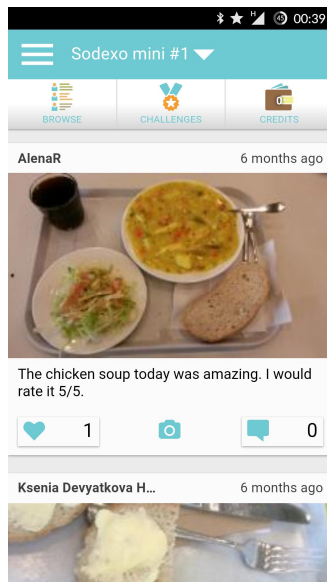
Figure 14. Jaxber - feedback browse view

Challenges view

Jaxber encourages the users to give feedback in form of challenges (Figure 15). The campaign owner is able to define challenges in the administrative interface. By creating challenges the campaign owner can direct the users to give feedback on a subject that the campaign owner feels important.

The challenges can be setup so that they can be answered during a specifc time period. Other settings include the maximum times the challenge can be completed and the maximum number of credits the user can earn.

The users are also able to give freestyle feedback on any subject. Freestyle feedback can be given in any format without any time or completion limitations. The campaign owners are able to grant credits for freestyle feedback, but the amount of credits users recieve is usually significantly less than when completing a challenge.
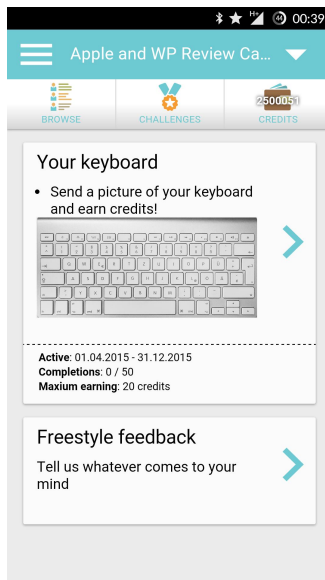
Figure 15. Jaxber - challenges view

Feedback can be given in four different formats; audio, video, image or text (Figure 16). The campaign owner can define what format the users give the feedback when creating the challenges. When the users complete the challenge by giving feedback they earn credits. The credits can then be exchanged for goods or services provided by the campaign owner.
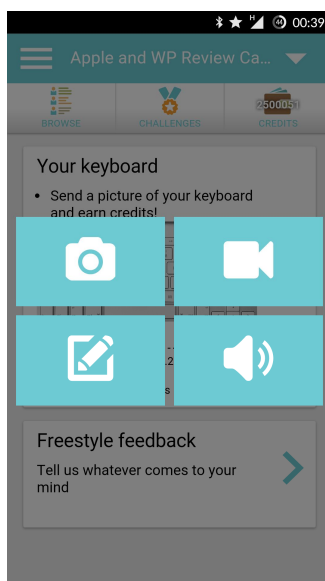
Figure 16. Jaxber - challenge feedback types

Other views

Other less significant views, shown in Figure 17, include the wallet where users can see their credit balance, user profile where users change their preferences, news subpage that displays the log of last user actions. Users can also view their own feedback from the pull menu on the left.

The pull menu can also host custom content that the campaign owner has created. The custom content may include for example food menus, promotions or other information regarding the campaign. The pull menu items are campaign-specific and can be defined in the web administrator interface.
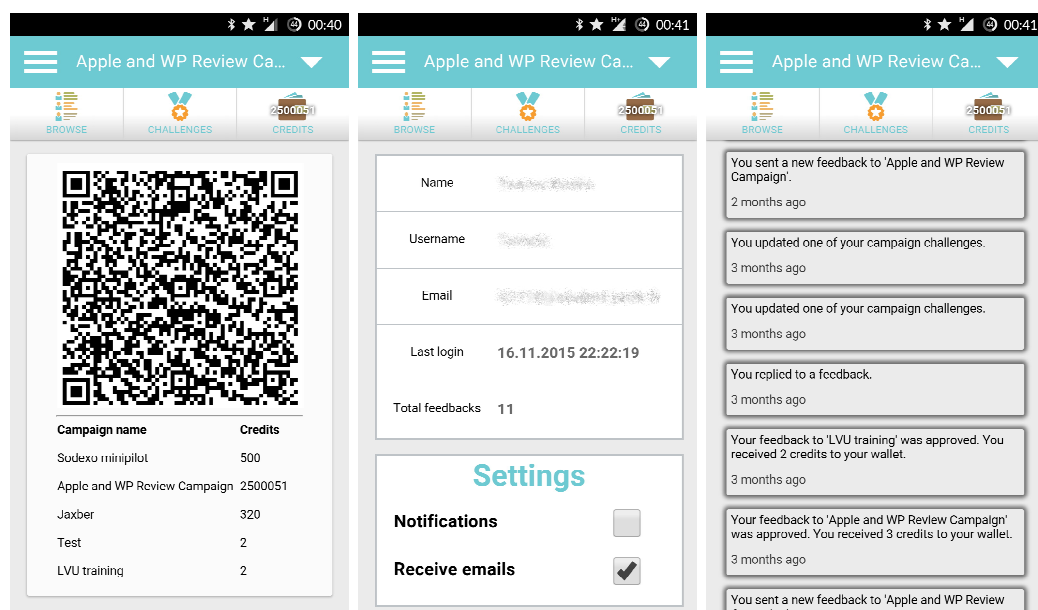
Figure 17. Jaxber - other views

6.5 Application testing

Not much time was spent on testing the Jaxber application, mostly because of the tight schedule of the project. The lack of proper testing led to a situation were multiple bugs and errors were left undetected in some release versions. The shortage of time spent on testing is a common problem in software development and Jaxber was no exception.

Testing was mostly performed while developing new features to the Jaxber app. The developers' own mobile devices were used as test devices alongside with a few iOS devices and a Nokia Lumia phone running Windows Phone 8.1 provided by

Nestronite Oy. Therefore, the selection of test devices only covered a minor amount of the actual devices Jaxber app was going to be running on.

In April of 2015 a master test plan containing a set of 25 manual tests was written to tackle the problems of testing (Table 1). Even with the master test plan in place there was not a proper plan how to utilize it. Most of the bugs and errors were discovered by the end users when piloting the application. This should not be the desired outcome of software testing, however, the lack of time forced the development to take shortcuts.

Table 1. List of manual test cases

Login, register and forgot my password
Login to Jaxber
Register to Jaxber
Cancel buttons
Recover password

Campaign selection
Automatic campaign selection with GPS
Manual GPS campaign search
Selecting a campaign
Changing campaign selection
Searching campaigns by text

Challenges
Challenge listing
Challenge feedback sending

Feedback sending
Feedback sending
Empty or short text feedback
Cancel video or photo feedback
Select from gallery

Feedback browsing and viewing
My feedback
Feedback listing

Hamburger menu
Opening and closing hamburger menu
Hamburger menu admin button

Basic features (misc. views and such)
News
Wallet
Profile
Disclaimer
Custom pages
Logout

In an optimum environment Jaxber would have an automated process where unit, functional, system and performance tests would be run. However not all testing can be automated. For example, usability testing always requires the clients perspective.

6.6   Software publishing

To make the application available to the users it needs to be published in the mobile platforms respective app store. Publishing to each platform requires a different set of tools and procedures and it also demands the most manual labour. After the publish-

ing process is completed the application becomes available for download in plat-forms respective app store.

Updating the application is a relatively simple process once the initial setup for each app store is completed. A progressive update system is used in all app stores where an update is gradually enrolled instead of making the update available for everyone at the same time.

6.6.1 App Store

App Store is a distribution platform for mobile apps developed for iOS. App Store is developed and maintained by Apple Inc. Before an app can be published on the App Store, the developer needs to register as a member to iOS Developer Program. The registration process is fairly slow and may take up to two weeks to complete. The Developer Program membership costs 99 USD per year.

Once the registration is completed the developer is given access to Apple Developer Center and iTunes Connect were the developer can publish their apps. After logging in to the iTunes Connect (https://itunesconnect.apple.com/) it is possible to begin the publishing process. The developer is required to enter some details like the name and price, as well as screenshots of the application (Figure 18).
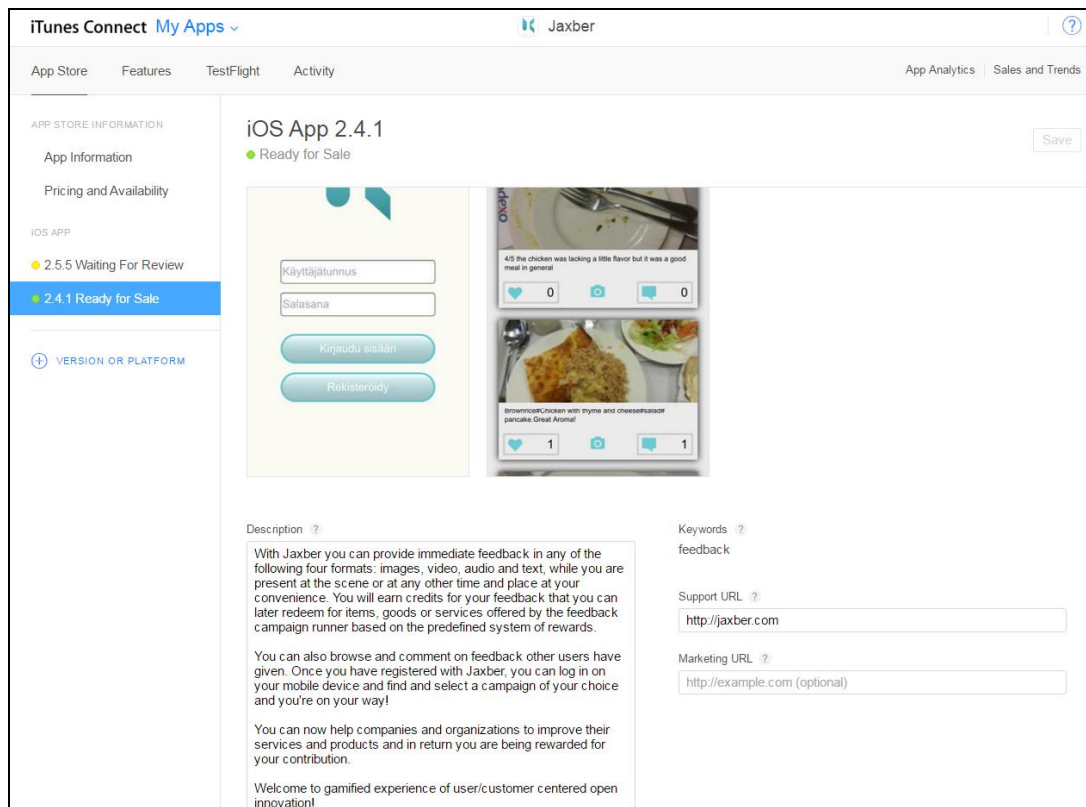
Figure 18. iTunes Connect portal with application information filled

To combine the iOS app with the iTunes Connect submission, the app is built and archived in Xcode as an IPA package. To use Xcode developers are required to have a computer that runs Mac OS X, such as MacBook laptop or iMac. First the developer needs to log in using their iOS Developer Program account to fetch the required identity and certificate keys from Apple that are used to sign and verify the application. Xcode automatically handles the initial generation of the identity and certificate files. The files are also stored in the iTunes Connect service.

To build the release version of the application for iOS, the developer selects *"Build - Archive"* from Xcode. Once the building, archiving and verification process is completed, Xcode will prompt the user for desired action, in this case *"Submit to App Store"*. Xcode will automatically sign the application with the release certificate during the building process. After the IPA package is uploaded the next step is to add it to the iTunes Connect submission. Adding the package is just as simple as selecting the uploaded application package from a list in iTunes Connect portal. When the developer is satisfied with their submission the submission can be send to review.

All App Store submissions are manually reviewed by Apple Inc. The review process can take anywhere from a few days up to few weeks. Apple has a really strict review policy to ensure that all apps are high quality and do not exhibit bugs. The application may be rejected from store if it does not pass the quality control or contains content not suitable for children.

To update an existing application in the App Store, the same process as releasing a new app is performed. The updated application must be signed with the same identity and certificate as the initial release. The updated application must also have a higher version number compared to the previous submission and it must pass the manual review by Apple Inc.

6.6.2   Play Store

Play Store serves as the official distribution platform for Android applications. Play Store is operated and maintained by Google. Play Store offers a wide variety of paid and free applications. In the beginning for 2015 Play Store had about 1,5 million applications available (Number of Android applications 2015). To publish an app in Play Store you need to register a Google Play Developer account. The registration process is streamlined compared to iOS Developer Program membership registration. The registration as Google Play Developer costs 25 USD and is a single time payment.

Android applications are packaged as APK files. Building a release version of the application can be done using any operating system that has the PhoneGap framework and Android SDK installed.

"Android requires that all apps be digitally signed with a certificate before they can be installed. Android uses this certificate to identify the author of an app, and the certificate does not need to be signed by a certificate authority." (Signing Your Applications 2014).

First a keystore file needs to be generated using Java's keytool utility using the following command: *"keytool -genkey -v -keystore my-release-key.keystore -alias alias_name -keyalg RSA -keysize 2048 -validity 10000"*.

> *Keytool prompts you to provide passwords for the keystore, provide the Distinguished Name fields and then the password for your key. It then generates the keystore as a file called my-release-key.keystore in*

the directory you're in. The keystore and key are protected by the passwords you entered. The keystore contains a single key, valid for 10000 days. The alias is a name that you — will use later, to refer to this keystore when signing your application. (How can I create a keystore? 2013).

The generated keystore file was placed in the root directory of the PhoneGap project for easy access. A new file named 'release-signing.properties', containing the keystore location, password, alias and alias password (Figure 19), needs to be added under 'platforms/android'. Phonegap will automatically utilize this keystore file when it is commanded to build a release version of the application.

```
1  key.store=../../example-release-key.keystore
2  key.store.password=examplekeystorepassword
3  key.alias=examplekeyalias
4  key.alias.password=examplealiaspassword
```

Figure 19. Example Android keystore file

By executing PhoneGap CLI using the command *"phonegap build android --release -- verbose"* PhoneGap will build and sign the release version of the Android application. Once completed successfully an APK file named 'android-release.apk' can be found from 'platforms/android/build/outputs/apk' folder.

Now the developer still needs to prepare the submission for Play Store via the Google Play Developer Console (https://play.google.com/apps/publish/). The submission requires some basic information like the application name, description and a few screen captures (Figure 20). Previously built and signed APK file is uploaded though the Google Play Developer Console interface. If the developer is satisfied with the submission, they may choose to publish the application in the Play Store.
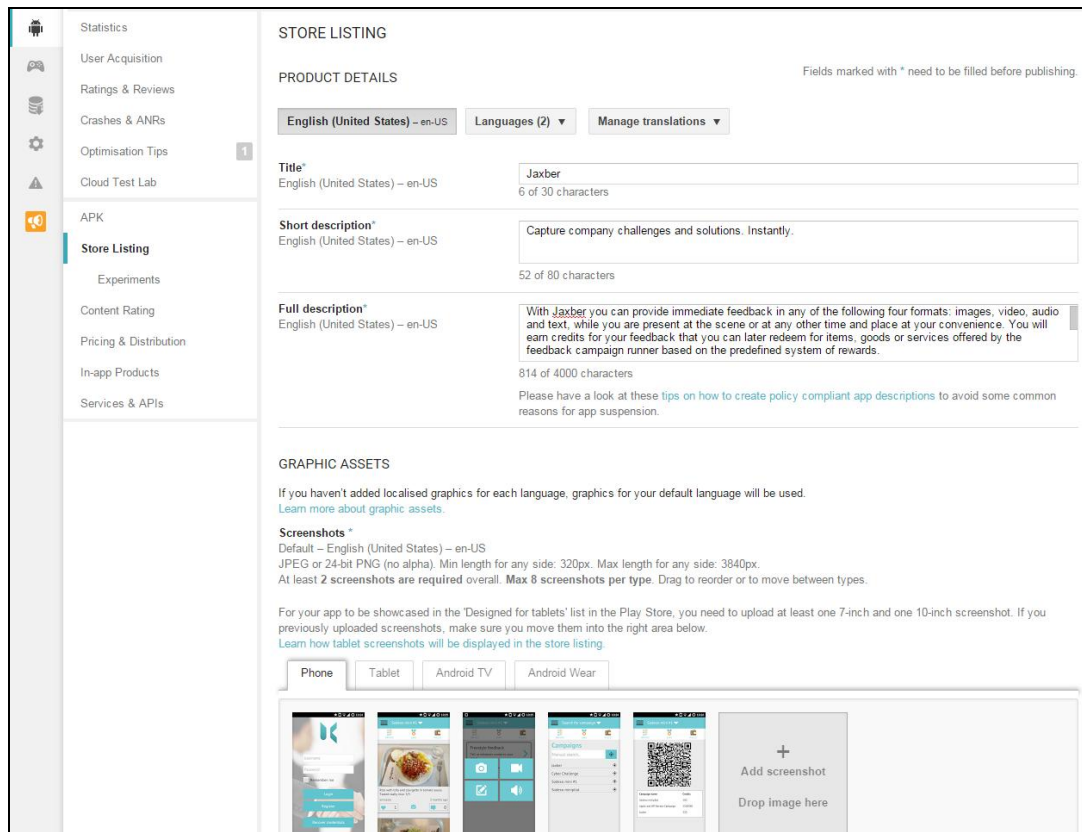
Figure 20. App details in Google Play Developer Console

Play Store does not have a review process in place. Applications published in the Play Store are available for users almost instantly. Updating the Android application is just as simple as uploading a new version of the app via the Google Play Developer Console.

6.6.3 Windows Phone Store

Windows Phone Store is a distribution platform developed by Microsoft for Windows Phone. Publishing apps in Windows Phone Store requires a Microsoft Developer account. Registering as Microsoft Developer costs a single payment of USD 99 or EUR 75 depending on region. Windows Phone applications are distributed as XAP packages.

Out of the three platforms Windows Phone is the most complex. PhoneGap is used to build the Microsoft Visual Studio project by executing the PhoneGap CLI with command *"phonegap build wp8 --verbose"*. This will output a Visual Studio solution under 'platforms/wp8' folder.

Visual Studio solution is opened once the PhoneGap build process finishes. Windows Phone apps do not feature any sort of certificate signing process like Android or iOS apps. Windows Phone apps use the identity information provided in the 'WMAppManifest.xml' file in the 'Properties' folder. In order to pass the application verification process, the combination of ProductID, Publisher and PublisherID need to be supplied in the 'WMAppManifest.xml' file.

XAP package can be built by selecting *"Build - Build Solution"* from Visual Studio. Once Visual Studio build is completed, the release version, 'applicationname.xap', can be found from 'Bin/Release' folder.

Just like with Play Store and App Store, Windows Phone Store requires some basic information like application name and description as well as screen captures (Figure 21). Once the required information is entered, the application can be manually uploaded to Windows Dev Center (https://dev.windows.com).
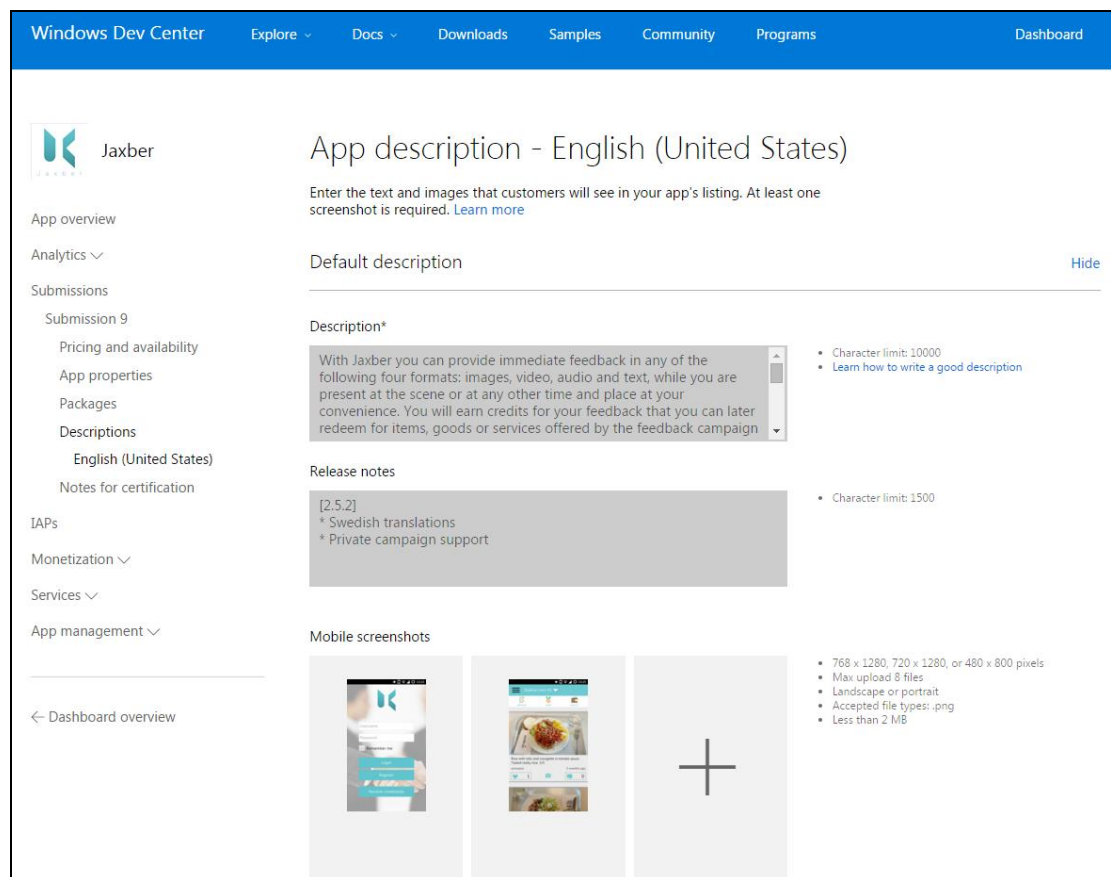
Figure 21. Application details in Windows Dev Center

Windows Phone Store enforces a semi-automatic review process. The application is automatically checked for required icons and properties. The review process also features a manual check by humans. Compared to Apples App Store, the Windows Phone Store review times are extremely short and it usually takes under 24 hours to complete after which the app is published to the Windows Phone Store.

To publish an updated version, PhoneGap is used to build a new Visual Studio solution and the solution is built as an XAP package. The package can then be uploaded to Microsoft Dev Center and sent to review. However, an update cannot be sent to review while another version is still being reviewed or an existing update is being enrolled.

6.7   Project documentation

All project documentation was exclusively written digitally to GitHub repository wiki. Also, the project source code was hosted on private GitHub repositories. GitHub is a hosting service for Git repositories. GitHub does not only host source code, but it also offers issue tracking and a wiki for documentation. Bugs encountered while developing and the ones reported by users were documented to GitHub issue tracker.

During the initial planning phase of the project, user stories, slim and high-level requirement artifacts, were written into Planbox service. Planbox is an agile project management tool that allows multiple members to plan and collaborate projects together. Planbox offered to-do lists, time tracking, file sharing and reporting functions that were very useful during the project setup. At later stage of the development the usage of Planbox was ceased, as the team felt it was too complex for this particular project. To-do lists and user stories were transferred from Planbox to GitHub issues.

For internal messaging the development team used a mix of Skype and Flowdock. After the summer of 2015 the team switched from Flowdock to Slack because of the limitations with free Flowdock organizations. Slack also offered better integration possibilities to various other services that were seen as helpful in the future.

All documentation was kept digital to allow everyone to access most up to date information. Also a short and simple document management plan (Appendix 4) was put in place to unify the coding practices between team members.

6.8 Project pitfalls

IT projects are almost guaranteed to have some sort of problems somewhere along the development process. Most of the times problems are caused because of bad management, unrealistic goals or the lack of time. During the Jaxber project most of the problems were caused by Windows Phone platform.

6.8.1 Development

During development there were no major problems. SVG images caused some trouble on Windows Phone platform. The problem was tracked down and identified as an issue with the Windows Phone WebView rendering engine. Windows Phone uses the Internet Explorer 11 as the rendering engine that was not supporting the XML document definition that was present in the used images. The solution was to remove the XML definition from the file after which the images worked as indented.

Internet Explorer on Windows Phone did not allow HTML5 video- or audio element to play local content on the mobile devices, as seen in Figure 22. This was not a problem with the videos and audios sourced over the internet, however, files recorded with the mobile device could not be reviewed before they were sent.
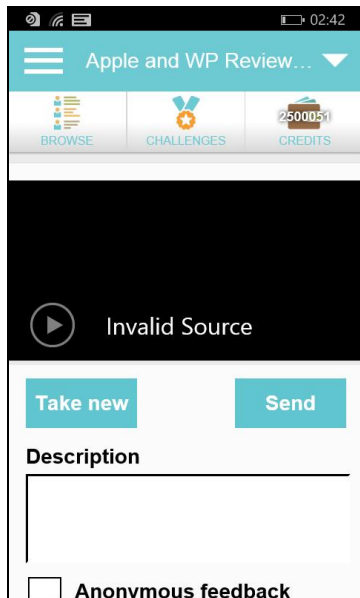
Figure 22. Windows Phone video and audio tag error

There were also times when the requirement specification was changed during the ongoing sprint, which sometimes caused the development team to work overtime to meet the new requirements.

6.8.2 Testing

The lack of testing was one of the major pitfalls of the entire project. Most certainly the amount of bugs accidentally left in the application would have been significantly lower if an automated test process had been in place. However, when the development time is limited, time spent on testing is usually minimal.

Without automated tests, it would have been wise to have a manual test plan in place as soon as the development started. However even with the manual test plan, it was not really followed as precisely as it should have.

Most of the bug reports were received from actual end users that were using the application during a pilot run. However most of the bug reports received from the end users were usually very low quality and rarely provided any actual help to identify, let alone fix, the bug.

6.8.3   Publishing

Out of the three platforms, Android was the only one were the team did not experience any problems when publishing the application. Windows Phone and iOS were equally painful platforms to publish applications on.

On iOS most headaches was caused by the app review process by Apple. As the review is done manually, it sometimes might take incredibly long time to get a new version of the application approved by Apple. The average review times vary from five to eight days (Figure 23). That is a very long time to wait, especially if the customers are requesting a new feature to be available. Sometimes after a long wait it was really annoying to see that the app was being rejected for a reason or another.

Figure 23. Average iOS App Store review times (Shiny Development 2015)

It also was not possible to update the application while it was waiting for a review. The only way was to withdraw the review request, update the application and send it back to review, which caused the application to be sent to the end of the review queue.

The problems with Windows Phone publishing were mostly caused by the requirement to build two separate applications; one for Windows Phone 8.0 and one for Windows Phone 8.1. The two versions have very minor differences, but still require two different versions to be build that takes way more time than you would believe.

Windows Phone versions also require a review before being published in the Windows Phone Store. The purpose of this review remains unknown as sometimes an app would pass the certification even if it would not launch on the mobile device.

Even though Windows Phone does not require any signing process, it still requires that the developer and application id are correctly supplied with the application package. This information was not automatically checked when uploading a new version of the app to the Windows Phone Store. The lack of proper application or developer id caused the application to be rejected from the store. The check for proper ids was not done during the upload of the new version and these kinds of errors would come up in the automated review process multiple hours later. With Android, these kinds of checks were done during the application upload so they could be corrected immediately.

7 Results and conclusion

PhoneGap turned out to be a very good choice, especially when working with very limited time, budget and resources. However, it must be remembered that native applications provide better performance and provide more fluid and responsive user experience. PhoneGap is a great alternative for native development when the application being developed is relatively simple.

In the beginning PhoneGap takes quite some time to set up and get used to. Once the setup is completed, PhoneGap development is very efficient and straightforward. The time lost in the beginning can easily be regained when it becomes to building the application for multiple platforms. Development using common web technologies, that are easy to learn, makes it easy for any developer to start experimenting with PhoneGap.

Because Jaxber consists of three main components, the actual mobile application, REST API and web based administrator service, it was possible to utilize the limited development team resources efficiently. Parts of the team could focus on building the required background services as others developed the mobile application. Some members of the development team were already familiar with using and setting up

the PhoneGap environment, so not much time was lost in the research. All team members also had a strong knowledge on common web technologies.

As there were no graphics designers amongst the development team, the overall appearance of the application is not the most appealing. It would a be good idea to have someone with graphical design skills to design something which would improve the user experience and the overall feel.

To improve the application's performance it might be wise to get rid of jQuery and jQuery mobile and switch to Intel AppFramework. Overall jQuery was a decent choice even though it might lower the performance slightly. Even though the application is not experiencing any noticeable performance issues, it is worth noting in the future.

The most important task regarding the future of Jaxber project would be the implementation of proper automated testing. Automated tests would enormously help the reliability of the application as they would be likely to catch a large amount of the bugs that currently go unnoticed.

Overall the project can be considered a success. Although there were some difficulties with Windows Phone, the problems were solved relatively quickly. The application was able to meet all requirements and the client was pleased with the result. This does not however mean that the development of the Jaxber application and other background services has stopped. Like with all commercial products, the application and other services need to be maintained over time and the customers will come up with new features to be added.

References

Android Developers. n.d. Tools Help. Accessed on 10 November 2015. Retrieved from http://developer.android.com/tools/help/

Apache Ant. 2015. Apache Ant. Accessed on 10 November 2015. Retrieved from http://ant.apache.org/

Apache Cordova. 2015. What is a Cordova plugin?. Accessed on 10 November 2015. Retrieved from http://cordova.apache.org/plugins/

Appcelerator. 2015a. Appcelerator Open Source. Accessed on 11 November 2015. Retrieved from http://appcelerator.org/#titanium

Appcelerator. 2015b. Appcelerator Pricing. Accessed on 11 November 2015. Retrieved from http://www.appcelerator.com/pricing/

Apple Inc. 2015. Xcode Essentials. Accessed on 10 November 2015. Retrieved from https://developer.apple.com/library/ios/documentation/ToolsLanguages/Conceptual/Xcode_Overview/

How can I create a keystore?. 2013. Accessed on 10 November 2015. Retrieved from http://stackoverflow.com/questions/3997748/how-can-i-create-a-keystore

jQuery Foundation. 2015. jQuery Mobile 1.4 Browser Support. Accessed on 11 November 2015. Retrieved from https://jquerymobile.com/browser-support/1.4/

jQuery mobile. 2015. About. Accessed on 10 November 2015. Retrieved from http://jquerymobile.com/about/

jQuery. 2015. What is jQuery?. Accessed on 10 November 2015. Retrieved from https://jquery.com/

Kohan, P., Montanez, J. 2015. Native vs Hybrid / PhoneGap App Development Comparison. Accessed on 6 November 2015. Retrieved from http://www.comentum.com/phonegap-vs-native-app-development.html

Laukka, T. 2014. Asynchronous File Transfer Between iOS and Cloud. Thesis. JAMK University of Applied Sciences, Technology, communication and transport, Degree programme in Software Engineering. Referenced on 7.11.2015. http://urn.fi/URN:NBN:fi:amk-201404285074

Lesscss. 2015. Getting Started. Accessed on 10 November 2015. Retrieved from http://lesscss.org/

Netmarketshare. 2015. Mobile/Tablet Operating System Market Share August 2015. Accessed on 14 November 2015. Retrieved from https://www.netmarketshare.com/operating-system-market-share.aspx?qprid=8&qpcustomd=1&qpsp=199&qpnp=1&qptimeframe=M

Node changelog. 2011. Accessed on 10 November 2015. Retrieved from https://raw.githubusercontent.com/joyent/node/v0.6.3/ChangeLog

Number of Android applications. 2015. Accessed on 9 November 2015. Retrieved from http://www.appbrain.com/stats/number-of-android-apps

PhoneGap Blog. 2012b. PhoneGap Explained Visually. Accessed on 11 November 2015. Retrieved from http://phonegap.com/2012/05/02/phonegap-explained-visually/

PhoneGap. 2014. Plugin Development Guide. Accessed on 10 November 2015. Retrieved from http://docs.phonegap.com/en/4.0.0/guide_hybrid_plugins_index.md.html

PhoneGap. 2015. PhoneGap homepage. Accessed on 11 November 2015. Retrieved from http://phonegap.com/

PhongeGap Blog. 2012a. PhoneGap, Cordova, and what's in a name?. Accessed on 11 November 2015. Retrieved from http://phonegap.com/2012/03/19/phonegap-cordova-and-what%E2%80%99s-in-a-name/

Saccomani, P. 2015. Building mobile apps for content marketing?. Accessed on 6 November 2015. Retrieved from http://www.mobiloud.com/blog/2015/08/content-marketing-mobile-apps/

Shiny Development. 2015. Average App Store Review Times. Accessed on 9 November 2015. Retrieved from http://appreviewtimes.com/

Signing Your Applications. 2014. Accessed on 9 November 2015. Retrieved from http://developer.android.com/tools/publishing/app-signing.html

Sitanshu, J. 2015. Native vs Cross Platform Application Development. Accessed on 6 November 2015. Retrieved from http://blog.zymr.com/native-vs-cross-platform-for-application-development

Techopedia. n.d. Java Development Kit (JDK). Accessed on 10 November 2015. Retrieved from https://www.techopedia.com/definition/5594/java-development-kit-jdk

Turunen, I. 2012. Interview by Pauli Kuosmanen. Viikon tulos: Vuoden korkeakoulujen yrittäjyysteko Jyväskylän ammattikorkeakoululle. Accessed on 7 November 2015. Retrieved from http://www.activityblog.fi/2012/05/viikon-tulos-vuoden-korkeakoulujen-yrittjyysteko-jyvskyln-ammattikorkeakoululle/

Unity 3d. 2015. Unity 5 What's included. Accessed on 10 November 2015. Retrieved from http://unity3d.com/get-unity

What is npm?. 2015. Accessed on 10 November 2015. Retrieved from https://docs.npmjs.com/getting-started/what-is-npm

Wikipedia, Node.js. 2015. Accessed on 10 November 2015. Retrieved from https://en.wikipedia.org/wiki/Node.js

Xamarin. 2015a. About Xamarin. Accessed on 11 November 2015. Retrieved from https://xamarin.com/about

Xamarin. 2015b. Xamarin Store. Accessed on 11 November 2015. Retrieved from https://store.xamarin.com

Appendices

Appendix 1.   List of Jaxber requirements and development tasks

ID	Tittle	State	Created at	Closed at	Labels
7	Register does not take user back to login screen	closed	2015-01-14T11:09:59Z	2015-01-14T11:27:49Z	
14	Localizator spam in console	closed	2015-01-14T11:30:57Z	2015-01-14T12:00:21Z	enhancement
16	Titlebar touch should not take user to campaign view	closed	2015-01-14T12:07:04Z	2015-01-14T12:12:25Z	enhancement
13	No notification after registering	closed	2015-01-14T11:21:37Z	2015-01-14T12:34:07Z	
6	Feedback lists not updating when new feedback is sent	closed	2015-01-14T11:09:05Z	2015-01-14T13:44:32Z	
8	After video feedback is sent, the user is not brought back to feedback list	closed	2015-01-14T11:10:28Z	2015-01-14T13:46:13Z	
17	Feedback comment not visible right after sending comment	closed	2015-01-14T12:37:58Z	2015-01-14T13:46:44Z	
2	Feedback duplicating	closed	2015-01-14T11:06:24Z	2015-01-14T13:47:07Z	
15	Pressing campaign name of feedback doesn't work	closed	2015-01-14T11:58:05Z	2015-01-14T14:09:30Z	
18	When feedback open and user presses feedback tab...	closed	2015-01-14T12:47:57Z	2015-01-14T15:20:51Z	enhancement
5	Layout getting zoomed on page transition	closed	2015-01-14T11:08:30Z	2015-01-14T15:21:01Z	
11	Video feedback description automatically contains video path	closed	2015-01-14T11:16:46Z	2015-01-14T15:30:41Z	
12	Register view too much padding from top	closed	2015-01-14T11:21:23Z	2015-01-14T15:35:34Z	
27	Feedback view says No comments even when there is	closed	2015-01-21T07:49:03Z	2015-01-21T07:59:35Z	
20	Hamburger menu links conflict with new feedback buttons	closed	2015-01-15T10:29:12Z	2015-01-21T08:23:46Z	bug
19	Prevent login button spamming	closed	2015-01-14T15:27:15Z	2015-01-21T08:35:13Z	
25	Credithistory not using traslate strings	closed	2015-01-16T13:18:28Z	2015-01-21T08:45:55Z	enhancement
4	QR code scanning is not working too well	closed	2015-01-14T11:07:41Z	2015-01-21T10:21:06Z	
22	Video feedback thumbnail when viewing the feedback.	closed	2015-01-16T12:57:45Z	2015-01-21T10:28:31Z	enhancement
26	Reward management wallet id overflow	closed	2015-01-17T19:09:33Z	2015-01-21T10:33:00Z	bug
28	Feedback length limit	closed	2015-01-21T09:16:54Z	2015-01-21T12:20:12Z	enhancement
24	Reward management number grid 00-button	closed	2015-01-16T13:13:41Z	2015-01-21T12:32:48Z	enhancement
21	Can't press campaign tab when in feedback view	closed	2015-01-15T10:45:46Z	2015-01-21T12:37:20Z	wontfix
29	App does not work on Samsung Galaxy S3 (4.1.2)	closed	2015-01-21T09:45:51Z	2015-01-28T10:38:05Z	
33	Profile last login using US format	closed	2015-01-21T13:49:35Z	2015-01-28T12:21:25Z	enhancement
34	Failed login, no error message.	closed	2015-01-21T13:50:41Z	2015-01-28T14:07:40Z	enhancement
39	Localizator not working?	closed	2015-01-28T06:13:28Z	2015-01-28T15:11:51Z	question
41	Following texts (at least) not translated in Finnish	closed	2015-01-28T15:21:37Z	2015-01-28T16:09:24Z	enhancement
23	No message on charge or refund	closed	2015-01-16T13:11:54Z	2015-02-04T07:46:40Z	bug,enhancement
31	Capturing audio displays multiple messageboxes	closed	2015-01-21T13:33:39Z	2015-02-04T08:00:53Z	enhancement
32	Admin menu is displaying even user isnt admin in any campaign	closed	2015-01-21T13:48:22Z	2015-02-04T08:01:27Z	bug
38	Allow users to register only if they argee on TOS	closed	2015-01-28T05:53:05Z	2015-02-04T09:07:09Z	Fix later
30	Add video preview poster to video tag shown after taking video feedback	closed	2015-01-21T12:25:09Z	2015-02-04T11:08:27Z	
42	com.jaxber.feedmon packet name	closed	2015-01-28T16:17:48Z	2015-02-04T13:30:48Z	bug
10	GPS search supposedly not working correctly	closed	2015-01-14T11:13:09Z	2015-02-04T13:33:05Z	
36	Registration page back press	closed	2015-01-28T05:47:38Z	2015-02-04T13:34:48Z	
47	Video & audio feedbacks cant be played in phones	closed	2015-02-04T14:57:55Z	2015-02-04T15:44:58Z	bug
49	You should not be able to access video directory	closed	2015-02-04T15:02:17Z	2015-02-04T15:54:05Z	bug
45	Sending new feedback is possible without selecting a campaign	closed	2015-02-04T14:45:48Z	2015-02-04T16:01:21Z	bug
52	Username stays in registration field after logout	closed	2015-02-04T15:30:51Z	2015-02-04T16:01:21Z	bug
43	Feedback appears sometimes twice after sending	closed	2015-02-04T14:32:30Z	2015-02-04T16:10:00Z	bug
48	Admin menu visible until campaign is selected	closed	2015-02-04T14:59:32Z	2015-02-04T16:12:55Z	bug
46	FAQ page missing	closed	2015-02-04T14:52:28Z	2015-02-04T16:14:29Z	bug
9	Campaign search doesn't work right	closed	2015-01-14T11:12:40Z	2015-02-05T19:13:45Z	enhancement
59	Register page trimming emails.	closed	2015-02-09T12:16:38Z	2015-02-11T10:02:35Z	bug
61	Username is emptied after failed login	closed	2015-02-11T10:17:55Z	2015-02-11T10:18:05Z	enhancement
54	Reset header selected campaign text on login or logout	closed	2015-02-04T17:58:12Z	2015-02-11T11:17:02Z	bug
53	Plus sign to megaphone icon in the header?	closed	2015-02-04T17:31:00Z	2015-02-11T11:59:23Z	enhancement
57	Submitted feedback shows up in campaign feed until Jaxber is restarted	closed	2015-02-05T19:11:00Z	2015-02-11T12:31:08Z	bug
58	ToS -> registration page, fields are emptied	closed	2015-02-05T19:15:34Z	2015-02-11T12:31:43Z	bug
60	Like icon not obeying 'liked' parameter from backend.	closed	2015-02-10T15:26:54Z	2015-02-11T13:11:49Z	bug
44	Password min size not checked	closed	2015-02-04T14:34:03Z	2015-02-11T13:13:29Z	enhancement
55	Reset campaign feed on logout	closed	2015-02-05T19:02:10Z	2015-02-11T13:26:07Z	bug
64	Refund / Charge toast message text	closed	2015-02-11T16:30:26Z	2015-02-18T10:02:36Z	bug
56	Add a way to refresh the campaign feedback feed	closed	2015-02-05T19:08:16Z	2015-02-18T11:18:15Z	enhancement
63	Add lost password page	closed	2015-02-11T16:29:42Z	2015-02-18T12:30:29Z	enhancement
137	Backbutton doesnt work on Password recovery page	closed	2015-03-04T09:13:20Z	2015-03-04T09:13:23Z	
114	See who liked your feedback	closed	2015-03-04T08:52:57Z	2015-03-04T09:38:53Z	wontfix
115	Edit your photo before sending it	closed	2015-03-04T08:53:03Z	2015-03-04T09:38:53Z	wontfix
116	Social networking (share on Facebook etc.)	closed	2015-03-04T08:53:08Z	2015-03-04T09:38:53Z	wontfix
117	More personalisation for your profile	closed	2015-03-04T08:53:12Z	2015-03-04T09:38:53Z	wontfix
120	Localisation	closed	2015-03-04T08:53:28Z	2015-03-04T09:38:53Z	invalid
123	When searching for campaign name, manual close	closed	2015-03-04T08:53:42Z	2015-03-04T09:38:53Z	invalid,WTF
124	Swiping is not used for anything in navigation	closed	2015-03-04T08:53:54Z	2015-03-04T09:38:53Z	invalid,WTF
135	Naming your feedback file	closed	2015-03-04T08:54:55Z	2015-03-04T09:38:53Z	invalid,wontfix,WTF
80	Point overview / list	closed	2015-03-04T08:39:02Z	2015-03-04T09:39:55Z	invalid,WTF
101	App crashed	closed	2015-03-04T08:41:43Z	2015-03-04T09:39:55Z	invalid
104	Crash when capturing video on BlackBerry Android device	closed	2015-03-04T08:41:58Z	2015-03-04T09:39:55Z	invalid,wontfix
74	Some email address extensions in registrations not working (eg. .fr, .ru)	closed	2015-03-04T08:39:06Z	2015-03-04T09:40:06Z	invalid,WTF
139	Better login error messages	closed	2015-03-04T11:07:49Z	2015-03-04T11:07:54Z	
136	Timestamps for the feedbacks in feed	closed	2015-03-04T08:54:59Z	2015-03-04T11:46:43Z	enhancement
130	Upload progress bar	closed	2015-03-04T08:54:28Z	2015-03-11T11:15:06Z	enhancement
151	Remember me auto fills registration form	closed	2015-03-16T12:42:39Z	2015-03-16T20:16:15Z	enhancement
150	sorting by "worst first" feels negative	closed	2015-03-16T12:32:21Z	2015-03-18T08:06:05Z	enhancement
143	Scrolling doesn't feel good on iOS	closed	2015-03-16T12:11:54Z	2015-03-18T10:25:25Z	enhancement
1	Call utility.logout and notify user if you suddenly get Unauthorized error while logged in	closed	2014-10-23T10:45:46Z	2015-03-18T11:58:58Z	Fix later
147	Audio preview does't work on app	closed	2015-03-16T12:23:51Z	2015-03-18T12:25:30Z	bug
154	Make other buttons feel more responsive	closed	2015-03-19T07:34:28Z	2015-03-25T08:43:47Z	enhancement
109	Upload photo from gallery	closed	2015-03-04T08:52:32Z	2015-03-25T10:26:13Z	enhancement
76	Photo preview shows only part of the image	closed	2015-03-04T08:39:21Z	2015-03-25T13:59:20Z	enhancement
160	Add small down arrow next to campaign name	closed	2015-04-01T07:17:58Z	2015-04-01T08:15:24Z	enhancement

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ID	Tittle	State	Created at	Closed at	Labels
159	Replace home icon with new feed icon	closed	2015-04-01T07:16:12Z	2015-04-01T08:43:21Z	enhancement
156	Take new feedback function to sidebar	closed	2015-04-01T07:11:01Z	2015-04-01T08:53:11Z	enhancement,WTF
157	Change top bar throphy icon	closed	2015-04-01T07:11:53Z	2015-04-01T10:07:05Z	enhancement
158	Add $ icon to main bar	closed	2015-04-01T07:14:43Z	2015-04-01T10:07:20Z	enhancement
152	Challenge arrow is too hard to hit	closed	2015-03-18T12:42:47Z	2015-04-01T11:27:46Z	enhancement
155	Too short password empties all fields on reqistration.	closed	2015-03-26T11:39:20Z	2015-04-01T11:42:45Z	
164	New challenge type: Anytype	closed	2015-04-15T13:41:31Z	2015-04-22T12:08:00Z	
138	Implement challenge system	closed	2015-03-04T09:35:04Z	2015-04-22T12:27:56Z	enhancement
119	Promote international food menu through the app	closed	2015-03-04T08:53:22Z	2015-04-22T12:29:57Z	enhancement
122	Remember which campaign you were on	closed	2015-03-04T08:53:39Z	2015-04-22T12:29:57Z	invalid,WTF
113	List of all Jaxber using restaurants etc.	closed	2015-03-04T08:52:52Z	2015-04-22T12:30:24Z	enhancement
118	Food menu etc inside the app and nutrition info	closed	2015-03-04T08:53:17Z	2015-04-22T12:30:24Z	enhancement
111	Instructions for the challenges in the app	closed	2015-03-04T08:52:42Z	2015-04-22T12:30:35Z	enhancement
110	View only specific feedback type	closed	2015-03-04T08:52:37Z	2015-04-22T12:30:43Z	enhancement
108	Back button doesn't work	closed	2015-03-04T08:42:16Z	2015-04-22T12:30:49Z	invalid,WTF
107	Doesn't work on tablets	closed	2015-03-04T08:42:11Z	2015-04-22T12:30:55Z	invalid
106	Videos and images look too similar in the feed	closed	2015-03-04T08:42:07Z	2015-04-22T12:31:02Z	enhancement
77	No exit button	closed	2015-03-04T08:39:36Z	2015-04-22T12:33:14Z	invalid,WTF
84	Reasons behind the challenges	closed	2015-03-04T08:40:15Z	2015-04-22T12:33:14Z	WTF
85	Uploading audio not working	closed	2015-03-04T08:40:23Z	2015-04-22T12:33:14Z	bug
86	Confusing interface at first	closed	2015-03-04T08:40:30Z	2015-04-22T12:33:14Z	enhancement
88	Could not log in	closed	2015-03-04T08:40:40Z	2015-04-22T12:33:14Z	invalid,WTF
91	Bugs in UI	closed	2015-03-04T08:40:54Z	2015-04-22T12:33:15Z	wontfix
93	More detailed error messages when logging in (not just "Login failed")	closed	2015-03-04T08:41:04Z	2015-04-22T12:33:15Z	enhancement
94	Video playback starts after a long wait	closed	2015-03-04T08:41:09Z	2015-04-22T12:33:15Z	wontfix
95	Audio recording not working	closed	2015-03-04T08:41:13Z	2015-04-22T12:33:15Z	question,WTF
96	Can't find the campaign	closed	2015-03-04T08:41:18Z	2015-04-22T12:33:15Z	question,WTF
97	UI feels old	closed	2015-03-04T08:41:23Z	2015-04-22T12:33:15Z	question,WTF
100	Feedback sent twice	closed	2015-03-04T08:41:39Z	2015-04-22T12:33:15Z	bug
102	Black screen flashing for 30 seconds	closed	2015-03-04T08:41:49Z	2015-04-22T12:33:15Z	WTF
62	Add feedback sending progress bar.	closed	2015-02-11T16:28:55Z	2015-04-22T12:34:13Z	enhancement
66	Ability to send metadata with feedbacks	closed	2015-02-18T09:08:50Z	2015-04-22T12:34:13Z	enhancement
67	Cancel button to password reset screen	closed	2015-02-18T22:01:56Z	2015-04-22T12:34:13Z	enhancement
70	Implement Jaxber for other platforms	closed	2015-03-04T08:28:43Z	2015-04-22T12:34:13Z	Fix later / not important
72	QR-code not working	closed	2015-03-04T08:31:04Z	2015-04-22T12:34:13Z	WTF
73	Unclear reward instructions	closed	2015-03-04T08:38:56Z	2015-04-22T12:34:13Z	WTF
75	Remember login credentials	closed	2015-03-04T08:39:12Z	2015-04-22T12:34:13Z	enhancement
35	Login screen enhancement	closed	2015-01-28T05:44:38Z	2015-04-22T12:34:38Z	enhancement,Fix later / not important
37	Create FAQ page in the app.	closed	2015-01-28T05:51:17Z	2015-04-22T12:34:38Z	enhancement
40	Check app required permissions	closed	2015-01-28T10:38:19Z	2015-04-22T12:34:38Z	Fix later / not important
169	Show number of campaign credits next to wallet icon	closed	2015-04-29T07:58:17Z	2015-04-29T09:22:59Z	
182	challenge instructions should be visible somehow when giving feedback.	closed	2015-04-29T09:12:05Z	2015-04-29T10:23:24Z	
177	Remember me should remember password	closed	2015-04-29T09:04:59Z	2015-04-29T10:47:17Z	
179	Forgot password -> Forget credentials	closed	2015-04-29T09:08:04Z	2015-04-29T11:02:03Z	
174	Font adjustments	closed	2015-04-29T08:53:01Z	2015-04-29T11:04:35Z	
167	Give feedback on hamburger menu should link to Earn list	closed	2015-04-29T07:52:50Z	2015-04-29T11:21:22Z	
173	Replace nomnomnom face	closed	2015-04-29T08:52:16Z	2015-04-29T12:30:38Z	
183	Pressing enter at login should log you in.	closed	2015-04-29T09:12:17Z	2015-04-29T12:43:52Z	
165	External links open inside the app	closed	2015-04-20T10:27:23Z	2015-04-30T06:18:44Z	
185	When banned user logs in the error message is 'null'	closed	2015-04-29T13:00:32Z	2015-04-30T06:41:45Z	
186	App prefered language not detected	closed	2015-04-30T07:03:15Z	2015-04-30T07:05:08Z	
171	Custom page links	closed	2015-04-29T08:23:12Z	2015-04-30T08:15:57Z	
168	Challenge list arrow	closed	2015-04-29T07:53:55Z	2015-04-30T08:37:09Z	
172	Font size adjustment	closed	2015-04-29T08:23:34Z	2015-04-30T09:00:30Z	
187	Create a splash screen so @translation@ are hidden	closed	2015-04-30T09:04:24Z	2015-04-30T09:05:11Z	
189	Full-screen image preview is broken	closed	2015-04-30T10:16:08Z	2015-04-30T11:08:47Z	
166	Give any type of feedback from Earn menu.	closed	2015-04-29T07:51:05Z	2015-04-30T11:14:03Z	
191	Feedback text line breaks	closed	2015-04-30T11:15:55Z	2015-04-30T11:17:43Z	
190	Back button does not work in admin menu	closed	2015-04-30T11:12:22Z	2015-04-30T11:22:06Z	
194	Send jaxber language in restrequest	closed	2015-05-04T06:56:16Z	2015-05-04T07:04:04Z	
193	Click on gps icon on campain list causes unknown error message	closed	2015-05-01T15:59:43Z	2015-05-04T07:35:57Z	
170	Option to send feedback as anonymous	closed	2015-04-29T08:22:28Z	2015-05-04T07:53:47Z	
176	Make icons for choosing feedback type larger	closed	2015-04-29T08:55:10Z	2015-05-04T09:20:57Z	enhancement
184	add app admin page of campaign	closed	2015-04-29T09:13:03Z	2015-05-04T09:51:43Z	enhancement
196	Add timestamp to comments.	closed	2015-05-04T10:42:06Z	2015-05-04T10:43:21Z	
192	Make it more clear if campaign is not auto-approve	closed	2015-04-30T13:36:25Z	2015-05-04T11:40:50Z	enhancement
197	Inform user when GPS is not turned on	closed	2015-05-04T11:34:18Z	2015-05-04T13:02:32Z	
131	Notificate user when GPS is not turned on	closed	2015-03-04T08:54:32Z	2015-05-04T13:17:50Z	enhancement
180	edit feedbacks	closed	2015-04-29T09:11:23Z	2015-05-04T15:25:46Z	enhancement
203	Show past videos taken with app in library	closed	2015-05-05T08:34:53Z	2015-05-05T08:42:27Z	
98	Uploaded wrong video	closed	2015-03-04T08:41:29Z	2015-05-05T09:16:31Z	question,WTF
200	Delete and approve buttons look horrible	closed	2015-05-04T16:20:27Z	2015-05-05T10:44:24Z	
204	Show waveform of audio as audio thumbnail	closed	2015-05-05T08:44:53Z	2015-05-05T14:43:06Z	enhancement
201	Campaing selection top bar too wide	closed	2015-04-20T20:37:58Z	2015-05-05T15:09:50Z	
199	Failed login shows two error messages.	closed	2015-05-04T14:15:37Z	2015-05-06T08:04:15Z	
208	Register page looks horible	closed	2015-05-06T08:05:27Z	2015-05-06T09:08:22Z	enhancement
207	Add some settings under profile	closed	2015-05-06T06:48:48Z	2015-05-06T09:53:02Z	
206	Select audio from library	closed	2015-05-06T06:39:53Z	2015-05-06T12:12:06Z	
83	Edit comments	closed	2015-03-04T08:40:10Z	2015-05-06T13:39:58Z	Fix later / not important
181	delete feedbacks and comments	closed	2015-04-29T09:11:31Z	2015-05-06T13:40:20Z	enhancement
210	My feedback should show the amount of credits recived.	closed	2015-05-06T10:59:55Z	2015-05-06T14:09:03Z	

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ID	Tittle	State	Created at	Closed at	Labels
82	Delete your own feedback	closed	2015-03-04T08:40:05Z	2015-05-06T21:27:06Z	enhancement,Fix later / not important
78	Edit feedback or feedback description	closed	2015-03-04T08:39:42Z	2015-05-06T21:27:42Z	Fix later / not important
212	Audio feedback translations missing	closed	2015-05-07T06:47:17Z	2015-05-07T07:28:18Z	
188	New font size broke stuff	closed	2015-04-30T09:20:58Z	2015-05-07T07:35:06Z	question
205	Remove console.log spam from app	closed	2015-05-05T15:07:43Z	2015-05-07T07:36:28Z	enhancement
214	Wallet credit table is funky looking	closed	2015-05-07T07:39:00Z	2015-05-07T09:06:31Z	
213	Hide sidebar if selected page is the current page	closed	2015-05-07T07:30:50Z	2015-05-07T09:09:41Z	
215	Comment section on feedback should have a header 'comments'	closed	2015-05-07T08:20:29Z	2015-05-07T09:14:49Z	
202	Feedback thumbnail image size	closed	2015-04-20T09:39:28Z	2015-05-07T11:11:18Z	
216	Delete comment comfirm message wrong	closed	2015-05-07T09:58:13Z	2015-05-07T14:43:27Z	
211	Make it clear how many times you can do a challenge, and how many times you've done it	closed	2015-05-06T13:20:18Z	2015-05-08T09:00:35Z	enhancement
175	Add "read more" if feedback text is really long	closed	2015-04-29T08:53:30Z	2015-05-08T09:04:03Z	enhancement,Fix later / not important
65	Create way to show challenges / news popups	closed	2015-02-11T16:32:11Z	2015-05-08T09:04:22Z	enhancement
89	Video preview shows old video when re-shooting	closed	2015-03-04T08:40:45Z	2015-05-08T09:05:51Z	bug
90	Logs out when user changes app	closed	2015-03-04T08:40:50Z	2015-05-08T09:13:31Z	wontfix
81	Pop up when you receive points	closed	2015-03-04T08:39:57Z	2015-05-08T09:14:45Z	enhancement
71	Video upload takes a long time	closed	2015-03-04T08:28:56Z	2015-05-08T09:15:52Z	wontfix
79	Better looking interface	closed	2015-03-04T08:39:47Z	2015-05-08T09:16:28Z	enhancement,invalid
68	Video upload is not reliable	closed	2015-03-04T08:28:15Z	2015-05-08T09:17:15Z	wontfix
218	Translate: waiting for approval text and hide approved feedbacks checkbox label	closed	2015-05-08T11:48:24Z	2015-05-11T07:06:29Z	
219	Refresh my feedback if you go to it when you already are there	closed	2015-05-08T12:10:28Z	2015-05-11T07:18:07Z	
217	Comment editing throws errors	closed	2015-05-08T11:44:26Z	2015-05-11T07:24:26Z	bug
223	Closing fullscreen image viewing throws error	closed	2015-05-11T07:40:31Z	2015-05-11T08:17:35Z	bug
220	Scrolling admin or campaign feedbacks too fast crashes app	closed	2015-05-08T12:50:39Z	2015-05-11T08:48:20Z	
153	Can't scroll down enough in side menu	closed	2015-03-18T17:41:03Z	2015-05-11T10:54:12Z	bug
224	News page: word-break	closed	2015-05-11T13:12:44Z	2015-05-11T18:41:15Z	
226	Unable to delete own feedback	closed	2015-08-10T07:04:32Z	2015-08-10T07:04:54Z	
227	Take new doesn't work	closed	2015-08-14T10:23:16Z	2015-08-14T10:57:34Z	Android,bug,iOS
225	Reading Tos clears registration.	closed	2015-07-02T06:02:13Z	2015-08-17T10:45:47Z	
230	iOS: Font is different from the rest.	closed	2015-08-18T10:19:25Z	2015-08-19T08:58:41Z	enhancement,iOS
234	Unable to select wallet if no campaign is selected	closed	2015-08-19T09:45:52Z	2015-08-20T06:28:59Z	enhancement
231	Android: Make notification icon to meet design guidelines.	closed	2015-08-18T19:07:55Z	2015-08-20T06:33:00Z	Android,enhancement
129	Hashtags	closed	2015-03-04T08:54:23Z	2015-08-22T17:32:52Z	invalid,wontfix,WTF
241	Capturing audio with android recorder requires back button to exit and causes pagechange	closed	2015-08-24T07:58:42Z	2015-08-24T07:59:10Z	Android,bug
237	Long challenge names overflow the challenge window	closed	2015-08-21T19:02:36Z	2015-08-24T08:18:14Z	
232	My feedback doesn't show delete button after sending new feedback	closed	2015-08-19T08:54:52Z	2015-08-25T08:58:54Z	bug
145	My Feedback shows multiple entries of a single feedback after sending new feedback.	closed	2015-03-16T12:20:21Z	2015-08-25T10:41:41Z	bug
240	Android: Translation issue in new photo feedback?	closed	2015-08-22T17:31:33Z	2015-08-25T11:24:53Z	Android,bug
243	Test issue for Slack integration test	closed	2015-09-08T13:54:21Z	2015-09-08T13:54:55Z	WTF
244	Error when sending a message through Jaxber admin panel	closed	2015-09-08T21:15:21Z	2015-09-09T09:30:57Z	
245	Changing the order of challenges: ascending	closed	2015-09-00T21:10:05Z	2015-09-09T09:31:30Z	
238	iOS: only targeting 8.1+ versions	closed	2015-08-21T19:03:14Z	2015-09-09T09:39:17Z	iOS
249	Critical problem: Windows Phone does not show campaigns	closed	2015-10-15T08:30:08Z	2015-10-15T10:03:26Z	
252	Challenge type "nothing" has strange behavior.	closed	2015-10-15T19:52:09Z	2015-10-15T22:30:56Z	bug
251	Clicking on a link in challenge description doesnt function properly.	closed	2015-10-15T19:50:05Z	2015-10-15T22:31:15Z	bug
246	Ignore uncompiled .LESS and JS libs from actual build version	closed	2015-09-10T08:43:05Z	2015-10-26T12:30:02Z	enhancement
254	Layout problem with smaller screens	closed	2015-10-27T13:18:36Z	2015-10-27T20:56:48Z	
3	Video feedback image quality low	open	2015-01-14T11:06:49Z		bug,enhancement
50	[redacted]	open	2015-02-04T15:29:57Z		enhancement
51	[redacted]	open	2015-02-04T15:30:13Z		enhancement
69	Interface is laggy and/or slow	open	2015-03-04T08:28:26Z		enhancement
87	After previewing image it might rotate 90 degrees	open	2015-03-04T08:40:34Z		bug,WTF
92	No horizontal viewing of full screen video	open	2015-03-04T08:40:59Z		enhancement
99	Video not playing but you can hear the audio	open	2015-03-04T08:41:34Z		bug
103	GPS is not always working	open	2015-03-04T08:41:53Z		question
105	UI problems on older phones (for example, contrast)	open	2015-03-04T08:42:02Z		enhancement
121	[redacted]	open	2015-03-04T08:53:34Z		enhancement
125	[redacted]	open	2015-03-04T08:53:59Z		enhancement
126	[redacted]	open	2015-03-04T08:54:06Z		enhancement
127	[redacted]	open	2015-03-04T08:54:12Z		enhancement
128	[redacted]	open	2015-03-04T08:54:17Z		enhancement
132	[redacted]	open	2015-03-04T08:54:37Z		enhancement
133	Autofill on searching the campaigns	open	2015-03-04T08:54:43Z		enhancement
134	[redacted]	open	2015-03-04T08:54:49Z		enhancement
140	Comment count isn't accurate	open	2015-03-16T12:00:10Z		enhancement,Fix later / not important
142	When writing on Windows Phone cursor is in wrong place.	open	2015-03-16T12:10:26Z		enhancement,WP8
148	My Feedback is empty on login	open	2015-03-16T12:26:14Z		bug,WP8
149	Feedback type selection UI is not placed properly on iOS	open	2015-03-16T12:30:48Z		enhancement,iOS
161	WP8.1 black screen on video capture after a few seconds	open	2015-04-03T09:56:09Z		bug,WP8
162	WP8.1: Can't preview captured videos from filesystem	open	2015-04-03T10:00:38Z		bug,WP8
163	WP8.1: Can't exit from image preview	open	2015-04-03T10:02:15Z		bug,WP8
178	[redacted]	open	2015-04-29T09:05:22Z		enhancement
195	[redacted]	open	2015-05-04T09:45:43Z		
228	[redacted]	open	2015-08-15T19:46:03Z		bug,enhancement,iOS
233	iOS 8: splash screen hide causes memory errors	open	2015-08-19T09:29:48Z		iOS,question
235	Licences and about	open	2015-08-20T11:15:49Z		enhancement,help wanted
236	Browse feedback icon align	open	2015-08-21T12:25:24Z		enhancement
242	Application icon transparency	open	2015-09-08T13:49:22Z		Android,enhancement
247	[redacted]	open	2015-09-10T21:12:08Z		enhancement
248	[redacted]	open	2015-10-15T07:27:38Z		
250	App "closes" after taking a picture	open	2015-10-15T11:06:17Z		
253	[redacted]	open	2015-10-27T09:32:24Z		

Appendix 2.   jQuery Mobile 1.4 Browser Support (jQuery Foundation 2015)

A-grade - Full enhanced experience with Ajax-based animated page transitions.

- **Apple iOS 4-8.1** – Tested on the original iPad (4.3 / 5.0), iPad 2 (7.2 / 8.1 / 6.1), iPad 3 (5.1 / 6.0), iPad Mini (7.1), iPad Retina (7.0), iPhone 3GS (4.3), iPhone 4 (4.3 / 5.1), iPhone 4S (5.1 / 6.0), iPhone 5 (6.0), iPhone 5S (7.0), iPhone 6 (8.1)
- **Android 5.0 (Lollipop)** – Tested on a Nexus 6
- **Android 4.4 (KitKat)** – Tested on a Nexus 5
- **Android 4.1-4.3 (Jelly Bean)** – Tested on a Galaxy Nexus and Galaxy 7
- **Android 4.0 (ICS)** – Tested on a Galaxy Nexus. Note: transition performance can be poor on *upgraded* devices
- **Android 3.2 (Honeycomb)** – Tested on the Samsung Galaxy Tab 10.1 and Motorola XOOM
- **Android 2.1-2.3** – Tested on the HTC Incredible (2.2), original Droid (2.2), HTC Aria (2.1), Google Nexus S (2.3). Functional on 1.5 & 1.6 but performance may be sluggish, tested on Google G1 (1.5)
- **Windows Phone 7.5-8.1** – Tested on the HTC Surround (7.5), HTC Trophy (7.5), LG-E900 (7.5), Nokia 800 (7.8), HTC Mazaa (7.8), Nokia Lumia 520 (8), Nokia Lumia 920 (8), HTC 8x (8.1),
- **Blackberry 6-10** – Tested on the Torch 9800 (6) and Style 9670 (6), BlackBerry® Torch 9810 (7), BlackBerry Z10 (10)
- **Blackberry Playbook (1.0-2.0)** – Tested on PlayBook
- **Palm WebOS (1.4-3.0)** – Tested on the Palm Pixi (1.4), Pre (1.4), Pre 2 (2.0), HP TouchPad (3.0)
- **Firefox Mobile 18** – Tested on Android 2.3 and 4.1 devices
- **Chrome for Android 18** – Tested on Android 4.0 and 4.1 devices
- **Skyfire 4.1** – Tested on Android 2.3 device
- **Opera Mobile 11.5-12** – Tested on Android 2.3
- **Meego 1.2** – Tested on Nokia 950 and N9
- **Tizen** (pre-release) – Tested on early hardware
- **Samsung Bada 2.0** – Tested on a Samsung Wave 3, Dolphin browser
- **UC Browser** – Tested on Android 2.3 device
- **Kindle 3, Fire, and Fire HD** – Tested on the built-in WebKit browser for each
- **Nook Color 1.4.1** – Tested on original Nook Color, not Nook Tablet
- **Chrome Desktop 16-43** – Tested on OS X 10.10 and Windows 7, ThinkPad Yoga Windows 8.1
- **Safari Desktop 5-8** – Tested on OS X (10.7 / 10.8 / 10.9 / 10.10)
- **Firefox Desktop 10-38** – Tested on OS X 10.10 and Windows 7, ThinkPad Yoga Windows 8.1
- **Internet Explorer 8-11** – Tested on Windows XP, Vista and 7, Windows Surface RT, ThinkPad Yoga Windows 8.1
- **Opera Desktop 10-25** – Tested on OS X 10.10 and Windows 7

B-grade - Enhanced experience except without Ajax navigation features.

- **Opera Mini 7** – Tested on iOS 6.1 and Android 4.1
- **Nokia Symbian^3** – Tested on Nokia N8 (Symbian^3), C7 (Symbian^3), also works on N97 (Symbian^1)

C-grade - Basic, non-enhanced HTML experience that is still functional.

- **Internet Explorer 7 and older** – Tested on Windows XP
- **Apple iOS 3.x and older** – Tested on original iPhone (3.1), iPhone 3 (3.2)
- **Blackberry 4-5** – Tested on the Curve 8330 (4), Storm 2 9550 (5), and Bold 9770 (5)
- **Windows Mobile** – Tested on the HTC Leo (WinMo 5.2)
- **All older smartphone platforms and featurephones** – Any device that doesn't support media queries will receive the basic, C grade experience

Appendix 3.   List of PhoneGap plugins used in Jaxber

```
1   phonegap plugin add cordova-plugin-device
2   phonegap plugin add cordova-plugin-dialogs
3   phonegap plugin add cordova-plugin-camera
4   phonegap plugin add cordova-plugin-media-capture
5   phonegap plugin add cordova-plugin-console
6   phonegap plugin add cordova-plugin-file
7   phonegap plugin add cordova-plugin-file-transfer
8   phonegap plugin add cordova-plugin-media
9   phonegap plugin add cordova-plugin-network-information
10  phonegap plugin add cordova-plugin-vibration
11  phonegap plugin add cordova-plugin-geolocation
12  phonegap plugin add cordova-plugin-inappbrowser
13  phonegap plugin add cordova-plugin-globalization
14  phonegap plugin add cordova-plugin-x-toast
15  phonegap plugin add phonegap-plugin-barcodescanner
16  phonegap plugin add phonegap-plugin-push
17  phonegap plugin add cordova-plugin-whitelist
18  phonegap plugin add https://github.com/whiteoctober/cordova-plugin-app-version.git
```

Appendix 4.   Document management plan for Jaxber

Documentation

- All documentation should be centralized here on the Github wiki if possible. You can link from Planbox to this wiki if necessary.
- After every weekly meetup, a short writeup should be available for later browsing here.
- Git commit messages should be actually readable (no aaaaaaaaaaaaaaaaaaaaaaaaaaaasdsssssssssssd).

Coding style

- Name variables and functions in a clear and concise manner. It's better to be too verbose than to be too ambiguous.
- nameFunctionsLikeThis()
- variablesLikeThis
- ClassesLikeThis
- methodsLikeThis()
- CONSTANTS_LIKE_THIS
- filenameslikethis.js
- Use ";"'s after every line.
- Spaces instead of tabs.
- Use ' instead of " for strings.
- Always use triple evaluation (===, !== and so on).
- In logic loops/functions put brackets on their own lines.
- Comments should be always written with `/* This is a comment! */` notation, even one-liners.
- Being consistent is more important than following these guidelines 100%!