

Cross-platform Solution for Development of Mobile Applications

Gatis Vitols¹, Ingus Smits² and Oleg Bogdanov³

¹*SLA "IT kompetences centrs", Lacplesa 41, Riga, Latvia*

²*Faculty of Information Technologies, Latvia University of Agriculture, Liela 2, Jelgava, Latvia*

³*Ecommerce Accelerator, Skanstes 54, Riga, Latvia*

Keywords: Mobile Applications, Development Frameworks, Styling Tools.

Abstract: Mobile devices are one of the most popular devices for access to web applications. Problems that arise in development process of mobile web applications are the same as with desktop applications. One of the fundamental problems in both cases is cross platform development. At the moment three mobile application development methods can be identified: web-based, native and hybrid. When developing business applications, hybrid application development framework can be most appropriate. From evaluated hybrid application development frameworks and styling tools *Adobe PhoneGap* with *JQuery Mobile* have the highest compliance to the criteria researched in this study.

1 INTRODUCTION

Smart phone market is growing rapidly and so does the count of different applications that can be executed on them. Companies targeting those markets must overcome different challenges such as integration into central application distribution models and ensurance of product correspondence to quality and content requirements.

Problems that arise in development process of such applications are the same as with desktop applications. One of the fundamental problems in both cases is cross platform development.

Typical solution for this matter is single codebases applications developed with web and mobile web technologies. Various application development researchers bring forward advantages and disadvantages of mobile web technologies. For example there is a statement (Na, 2011) that developing cross-platform mobile web applications with a single codebase is one strategy that allows organizations to stay ahead of the mobile curve.

When taking into consideration rapid mobile operation system development and principles of the mobile market that allow platform developers to change the rules of distribution of mobile applications, single codebase solutions that allow deploying applications on multiple platforms becomes an important matter. Use of mobile web technologies not always satisfies functionality

demands of developed application. For example developed applications cannot access all supported platform services and devices, such as contacts, messaging, compass and others. It is concluded that current versions of mobile browsers have some functional limitations, but rapid development of mobile technologies allow to overcome many of these limitations (Na, 2011).

It is already seen that advances in web technologies and device capabilities have created alternative application development technologies that are web-based, use proprietary middleware and clients, or are a hybrid of webkit and native applications. At the moment the hybrid approach provides the best trade-off (Myer, 2012).

At the moment three mobile application development methods can be identified: web-based native and hybrid (Fig. 1). As it can be seen from Figure 1, web-based applications are most restricted. Hybrid and native ones can provide access to almost all functionality of mobile operation system (Beckman, 2012). In practice, hybrid applications has still more restrictions compared to native ones. However, these restrictions can only be identified when developing certain type and requirement applications, such as gaming applications.

For example native applications still can have several features that are difficult to "imitate" by web applications and some hybrid applications, such as complex 3D graphics or the management of device

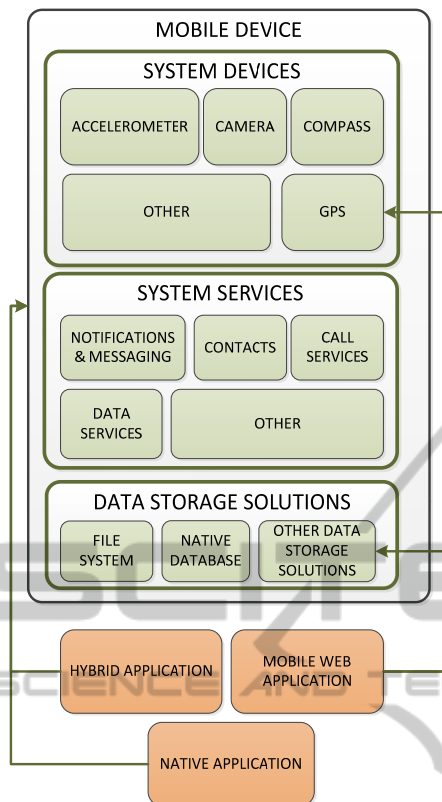


Figure 1: Mobile device functionality access possibilities with different application development methods.

hardware components such as sensors (Gossweiler et al., 2011).

While developing application developers must take in mind mobile device's limitations (resources, input possibilities, screen features, etc.), must realize marketing requirements for application deployment and modelling, as well as distributors, providers, technologies providers and end user relations (Corral, Janes, et al. 2012).

2 MATERIALS AND METHODS

To identify cross-platform mobile applications development solution it is important to determine target platform preference. Depending on the target devices, the application can be either cross-platform or developed for dedicated or native platform (Christ, 2011).

Basically most of existing platforms use different programming languages. For example, *Apple iOS* use *Objective-C*, *Android* and *RIM* use variations of *JAVA*, *Windows Phone 7* use *C#* and so on. To develop cross-platform applications there should be

either professional developer available who can work with these languages and have environment or solution for creation of mobile cross-platform applications.

Another important point is to develop use cases, which basically requires determination of potential users and functionality of application. Applications that are running on mobile devices involve vast range of types: communication, entertainment, business, media and others (Corral, Janes, et al. 2012). For example gaming application will have different functionality requirements than business application.

In practical development for creation of hybrid or mobile web applications basic web systems can be translated into mobile applications using:

- Framework, such as *Appcelerator*, *MoSync*, *KonyOne*, *PhoneGap*, *RhoMobile*, *Corona* and others.
- Styling tools, such as *JQTouch*, *DojoMobile*, *JQuery Mobile*, *DHTMLX Touch*, *SenchaTouch*, and others.

Multiple criteria can be brought forward for selection of frameworks and tools that would allow creating such cross-platform solution. We propose that one of the basic criteria should be extensibility of developed solution. Therefore tools that are chosen should satisfy basic extensibility matters and follow such criteria:

- Multiple platforms.
- Single codebase.
- Tools (plug-in) repositories.
- Main stream tool.
- Open source.
- Functionality.

Solutions should support multiple platforms. As minimum support for largest shareholders in the market (Christ, 2011): *Android*, *Apple iOS*, *RIM (BlackBerry)*, *Windows Phone 7* and *Symbian*. However *Symbian* will lose its share, because producer of this platform *Nokia* announced that they discontinue the mobile operation system (Islam 2013).

Solutions should be single codebase. It is considered that managing several code sets creates considerably extra work, which translates to increased development time and a greater probability of code errors (Myer, 2012).

Size and existence of tools (plug-in) repositories. This criteria also directly relates to extensibility of solutions as if there is no or low activity in production of tools (plug-ins) by owners or third party producers, it can be a sign of low extensibility.

Main stream tool. For example it can be evaluated with measuring size of community, count of bug fixes, count of updates, and count of responses to submitted problems.

Open Source is another criterion that may not be obligatory, but could be beneficial if the developed solution is based on open source tools and technologies. Open source solution also partly relate to satisfying demand for extensibility. A widely used and supported licence type is also beneficial, such as *GNU General Public License (GPL)* or *MIT license (MIT)*.

Functionality relates to which mobile device features are supported by selected tools. Typical mobile device features include contacts, accelerometer, camera, compass, files, geolocation, media, network, storage, barcode scanner, alert notifications, sound notifications, etc (Corral, Sillitti, et al. 2012).

3 SOLUTION IDENTIFICATION FOR BUSINESS APPLICATION

As for typical application profile we chose simple business applications that include catalogue of services, graphical details and functionality to perform simple monetary deals.

Criteria for framework:

1. Supported platforms: *Android, Apple iOS, RIM (BlackBerry), Windows Phone 7.*
2. Single code base solution.
3. Size of tools (plug-ins) repository. As count of published tools (up to February 1, 2013).
4. Count of updates (up to February 1, 2013).
5. Count of registered members in the community (up to February 1, 2013).
6. Open source solution.
7. Supported mobile device functions: accelerometer, contacts, camera, files, geolocation, media, network, storage, barcode scanner, alert notifications and sound notifications.

Leading and often mentioned (Christ, 2011; Corral, Janes, et al., 2012; Espada et al., 2012; Corral, Sillitti, et al. 2012; Newman, 2011) hybrid application development frameworks are *RhoMobile, Corona, Appcelerator* and *PhoneGap*. We performed evaluation of those frameworks compliance to criteria.

Based on performed analysis (see Table 1) it can be seen, that highest compliance to criteria reach *Adobe PhoneGap*.

Adobe PhoneGap other advantage are that applications are built using common web technologies such as *HTML* and *CSS* (Myer, 2012).

For example, *RhoMobile* requires knowledge of *Ruby* language. However, *Adobe PhoneGap* main disadvantages include, application is rendered using platform's web browser engine, not individual native user interface objects and each mobile platform requires installing appropriate *SDK*.

Another part of typical development process is application styling. In a lot of cases it has same importance as functionality of developed application. There are several possible solutions available that contribute application development with hybrid development method. Popular and often mentioned ones are *JQTouch, JQuery Mobile, SenchaTouch, DojoMobile* (Corral, Sillitti, et al. 2012; Firtman, 2012).

In most cases these solutions physically are JavaScript libraries that have to be added to the developed application.

Table 1: Identification of hybrid framework for development of business applications.

Criterion No.	RhoMobile	Corona	Appcelerator	PhoneGap
1.	+	-	-	+
2.	+	+	+	+
3.	N/A	22	N/A	77
4.	6	N/A	10	16
5.	2716	N/A	N/A	15095
6.	-	-	-	+
7.	+	+	+	+

Criteria for styling solutions:

1. Size of tools (plug-ins) repository. As count of published tools (up to February 1, 2013).
2. Count of updates (up to February 1, 2013).
3. Count of registered member topics in the community (up to February 1, 2013).
4. Open source solution.
5. Footprint, which is the size in KB of script code. This criterion has importance on execution speed of particular solution as script is loaded into memory before starting to execute functions of the script.

Table 2 shows comparison of identified solutions.

Based on performed analysis of styling solutions (see Table 2) it can be seen, that highest compliance to criteria reach *JQuery Mobile*. Main benefits of this framework are the plug-in repository, longer

Table 2: Identification of styling solution for business application.

Criterion No.	JQTouch 1.0	JQuery Mobile 1.2.0	SenchaTouch 2.1.1	DojoMobile 1.8
1.	N/A	16	N/A	N/A
2.	N/A	33	11	8
3.	N/A	9648	62624	21532
4.	+	+	-	+
5.	10.9KB	110KB	94KB	152KB

update history and it's an open source solution. However it has larger footprint compared to *SenchaTouch* and *JQTouch*.

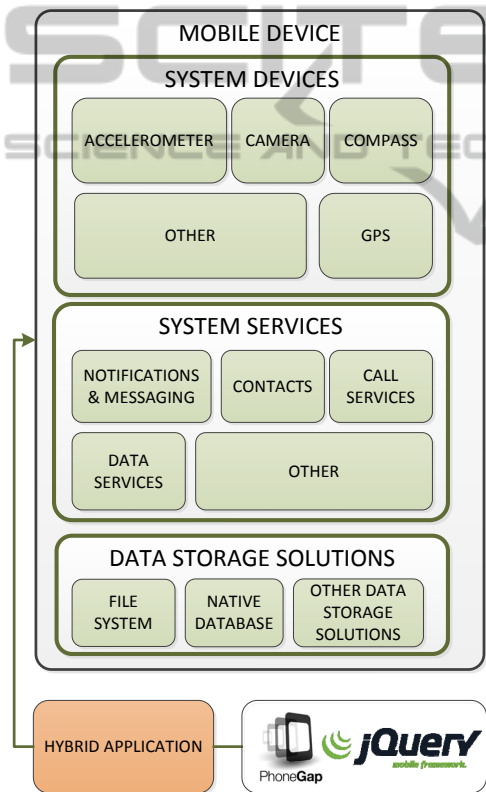


Figure 2: Proposed cross-platform solution for development of mobile applications.

SenchaTouch have also high compliance to the criteria, but one of the main drawbacks is unclear existence of plug-in repository and that it is mainly commercial solution.

From the analysis of solutions presented in Table 1 and Table 2 it is possible to propose cross-platform solution for development of mobile applications (see Fig. 2).

It is also mentioned that *Adobe PhoneGap* and very well can be integrated with *jQuery Mobile* (Firtman, 2012).

4 CONCLUSIONS

Hybrid and native applications can provide access to almost all functionality of mobile operation system. When developing business application, hybrid framework is most appropriate.

From compared hybrid application development frameworks, *Adobe PhoneGap* has highest compliance to criteria that is brought forward in this research.

Main benefits of *PhoneGap* include open source licence, wide mobile platform support and large repository of tools (plug-ins). However, as *PhoneGap* has been acquired by *Adobe*, there is a concern about possible licensing change from open source to commercial for this framework.

From compared hybrid application development styling tools, *JQuery Mobile* is most appropriate. Main benefits of this styling framework include existence of plug-in repository, longer update history and it's an open source solution.

For future research it is still an open discussion about hybrid solutions ability to produce cross-platform applications that feel and looks like native ones.

ACKNOWLEDGEMENTS

Research is part of project „Competence centre of information and communication Technologies” run by IT competence centre, contract No. L-KC-11-003, co financed by European Regional Development Fund.

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