CHALLENGE OF CREATING CROSS - PLATFORM MOBILE APPLICATIONS

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ABSTRACT

The computer world slowly but surely steps in the new era, the era of the mobile phones and tablet computers. The problem that arises is how to produce high quality mobile and tablet applications for the most popular mobile platforms. The main goal of the paper is to show the easiest way to create a single - code mobile applications that are ready to compile for all the platforms, with attention paid on tools and technology needed for the application submission process. Afterwards, plenty of tools and techniques are presented in order to deploy an iOS mobile application on MS Windows computer. The very special part of the paper is the demonstration of the possibilities for cross platform game development using native gestures.

Keywords: Action Script, Flash, iOS, MXML, Flex

I. INTRODUCTION

The challenge to make functional application with less funding, which at the same time will be high quality and simple to use is huge for any modern IT company. Every day we see the major online application stores rising their potential. Undoubtedly the need is imposed to make an effort to become part of these stores in order to make a succesfull business. The online stores and markets are giving huge amount of possibilities so that every company can find their way to make some more money. Special store programs like ads are bait for developers, representing an easy way to make money.My recent review of the literature reveals many different ways of creating native applications on native platforms using the native code (for example Objective C with XCode for iOS developers). But, the achievement will be complete when we broke down the barriers and start building single-code native tablet and mobile applications. Technology that will be described below in detail describes this process together with all the support activities for the process of distribution to the online stores.

The main achievement of this paper is the development of a new programming view, directed towards developers. There is plenty of materials for PhD students and young researchers about this technology, in this paper you can find a description for many of them. The mobile phone software development is an active research area with lots of obstacles that should be eliminated. First of all one very important thing to mention is the approach of creating mobile software. Anyone who has tried to create a desktop application for PC knows that the thing is not that easy to do [3]. For this case you need to know that the work is complicating twice because of the limited working environment which is dictated by the characteristics of mobile devices. The next big problem we will try to solve are the different screen sizes of the devices and the different DPI (Dots Per Inch) for every device. When you sit and try to develop a desktop software you do not have to really care about the size of the button, or the color of the menu because the PC has a mouse and a keyboard that makes the things a lot easier. On the other hand you have many different devices, with different screen sizes, lots of configuration differences and all this stuff combined with different mobile platforms like Google Android and Apple iOS. Really, it is a very big success if the developers overcome those barriers and build a mobile or tablet application for both platforms (Android and iOS) with a single code, targeting all the mobile devices [2].

Third major thing we will try to review below are the device permissions. The implementation of the device permissions could be a very big problem, especially when packaging for Google Android platform, for example Internet connection requires special permissions. Very big trouble for developers are making the local files, for example, if you need to display a local pdf file inside your mobile application, you won`t have problem running it on iOS device, but if you try to compile the same code for an Android device, the application running on the Android device will not show the local pdf file, and that is a major problem that developers are facing with, and needs to be fixed as soon as possible. For the purposes of this study we will use the Adobe products and their technology, we will review below all the aspects of the FLEX mobile development and we will try to fix the issues that we mentioned, in order to create a quality cross platform mobile/tablet application.

Flex SDK (Software development kit) is a technology for development and deployment of cross platform rich internet applications based on the Adobe Flash platform that initially was developed by Macromedia.

Parts of this paper could be very useful especially for small companies that don`t have sufficient funds to purchase licenses or pay professional developers for each platform. The paper is also useful for undergraduate students who wish to improve their knowledge and follow the current trends in science. Basically, this article might be a good reason to start your own business as an individual cross-platform mobile developer. The last chapter of this paper gives us the conclusions and answers to all previous questions we opened in order to try to fix the main issues that hinder our way. Section number two presents the phases and activities to support the process of cross-platform mobile development with all the tools we`ll discuss later. As we mentioned before this process could be extremely useful for game development because is based on the Adobe Flash platform which is a very popular platform used for animation, flash web sites and other things. We all know that developing games for mobile phones is a complicated process that requires a lot of effort and a lot of creativity, this technology supports all these activities.

II. Definition of the main aspects of the process

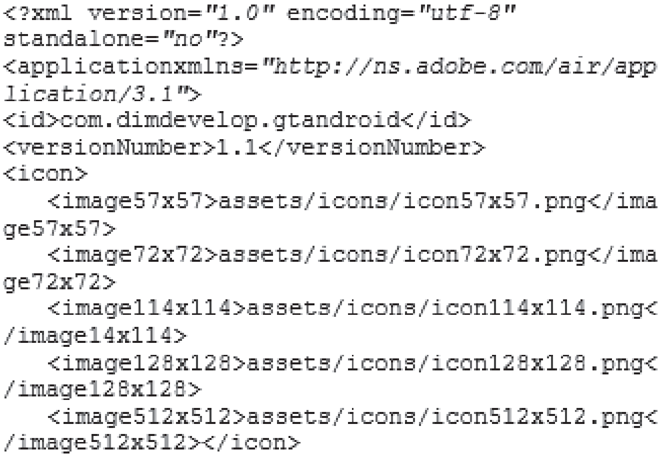
A. Introduction to Flex

First of all we need to explain what is FLEX? Most people use Adobe Flash as a framework for creating flash animations and in some cases flash web applications with animated content inside. Flex framework is dedicated to the programmers and is used for creating flash content. Two things are very important for the Flex Framework, the first is MXML and the second is ActionScript. The primary application installation file is an XML file. This file is called "The application descriptor file", here is where you define all the important aspects for the installation of the application on the targeted device. Here the story begins. Descriptor file is the (.xml) file where you define which devices will be targeted [5].

The OOP (Object – Oriented Programming) concept will be used to explain the process of cross-platform mobile development. ActionScript is an object-oriented programming language that is designed specifically for Web site animation. Originally released with Macromedia Flash 4 and enhanced for Flash 5, Action Script is a sophisticated version of the script language introduced in Flash 3. ActionScript was modeled on ECMA (European Computer Manufacturers Association), an international standard for JavaScript. In the Flash 5 version, new ActionScript syntax, conventions, and features were introduced that make it similar to JavaScript, which in turn makes the language automatically familiar to most web developers. If you have some experience creating web pages, the concepts behind Flex won't be totally foreign to you. The new flex framework created new series of components called Spark. The Spark series defines new collection of components that were missing before. During 2011 Adobe decided to donate Flex for flash-based framework to the Apache Software Foundation as an independent project. You can create Flex-based applications using any text editor or Integrated Development Environment (IDE), we will review the tools later below. Flex provides open possibilities for creating and using a variety of classes and libraries as well as the finished code which saves time and effort.

B. Creating mobile applications

There are many tools for creating mobile applications, the tool which we will use is a product of Adobe and is called Flash Builder. The Flash Builder is the best tool for designing cross-platform mobile applications with integrated flex SDK inside. At the beginning I would like to pay more attention on the XML descriptor file which is integrated in every FLEX mobile project you create with Flash Builder. Good thing to mention for flash builder IDE is that Flash Builder does a lot of work for you by giving you code snippet suggestions, it really saves a lot of time. As I mentioned before, when you start building a mobile application you need to have a special approach. First and very important thing is the definition of the project. To make a good project definition you use the application descriptor file. Here you define things like application ID, which is very important for the installation process on the device and the signing of the applications. The device recognizes the application through it`s identification value and checks the validity of the signature and certificate. Later on we will review the deployment process and we`ll give some more explanation about this things which are very important at the same time. Here is an example code from application descriptor file. As I said before this is a file with XML extension. Inside the application descriptor file we will set the name of the application, the version number, and one very important thing, the tags for the application icons. When you build a cross-platform mobile application u need to set the property tags for all the icons. If you want the application to work correctly you have to take care about the size of the icons to correspond with the intended platform [18].



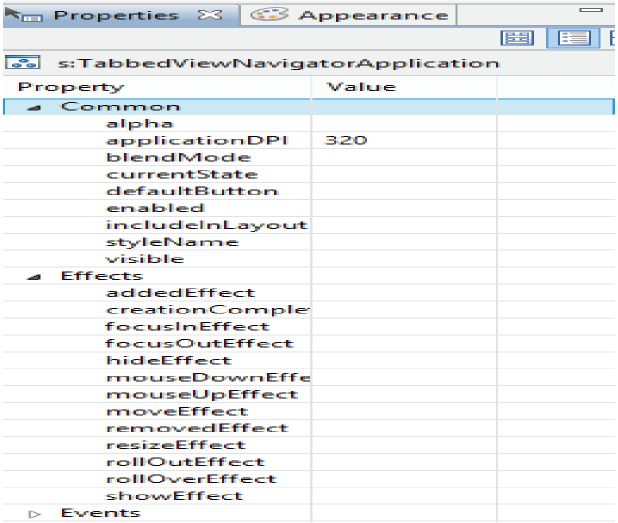
```
<?xml version="1.0" encoding="utf-8"
standalone="no"?>
<applicationxmlns="http://ns.adobe.com/air/app
lication/3.1">
<id>com.dimdevelop.gtandroid</id>
<versionNumber>1.1</versionNumber>
<icon>
    <image57x57>assets/icons/icon57x57.png</ima
ge57x57>
    <image72x72>assets/icons/icon72x72.png</ima
ge72x72>
    <image114x114>assets/icons/icon114x114.png<
/image14x114>
    <image128x128>assets/icons/icon128x128.png<
/image128x128>
    <image512x512>assets/icons/icon512x512.png<
/image512x512></icon>
```

Figure 1: Example code snippet. The image shows the configuration of the application icons inside the application descriptor file

In this few lines of example code you can see the functionality of the application descriptor file. The file is very big and defines almost everything.When you finish setting up the application with all the permissions for Android then you are ready to start working on the design. In the next few chapters I will try to explain how to fix the problems coming with the native extensions and the scaling problems which are the major problems in the process of creation of cross-platform mobile applications.

C. The Design View

What makes Flash Builder different from other IDE`s is the design view. This completly changes the things and makes the software creation process much easier. We have to explain this because it is very important especially when you are targeting a lot of devices with different screens. Graphics quality must remain the same for all devices and the design view helps a lot here. Design View provides a lot of visual tools for composing an application layout, you can put a button by just dragging and dropping the button component, with just one click you can give an action to the button or create a function method. That saves a lot of time and effort [4]. Flash Builder works with **views**, for each part of the application you can create a different view and set it property to suit your needs, the navigation between the **views** is very easy and works pretty well on all devices. What is really interesting for designers is that you can create your own themes using CSS, and again that is very important for cross-platform development because you have the opportunity to create your own application theme that will work on every mobile device using CSS. For this purpose you can use standard Adobe products like Photoshop or Flash Catalyst to create a library files or components for your application, we`ll review the tools later. Editor pane always shows the file name of the opened file, if more than one file is opened then multiple tabs will appear. Design View provides standard components like button, Callout Button, CheckBox, DateSpinner, RadioButton, Image and Data Binding tools. If you want to make a client – server application you have a good environment to use PHP. Flash Builder offers simulation for every supported device, functionality of the application can be tested by simulation to the desktop or directly on the device.



Property	Value
◢ Common	
alpha	
applicationDPI	320
blendMode	
currentState	
defaultButton	
enabled	
includeInLayout	
styleName	
visible	
◢ Effects	
addedEffect	
creationComple	
focusInEffect	
focusOutEffect	
hideEffect	
mouseDownEffe	
mouseUpEffect	
moveEffect	
removedEffect	
resizeEffect	
rollOutEffect	
rollOverEffect	
showEffect	
▷ Events	

Figure 2: Flash Builder Properties tab while running in design view mode. The image shows the ability that Flash Builder offers to add functions and effects directly to the selected objects on the stage.

Flex has three native namespaces: Spark (s:), Halo (mx:), and the Language (fx:) namespace. The namespace is a unique pointer that refers to a specific package. Flex also provides several nonvisual components like formatters, various service components like HTTPService class and data objects. Very impressive here is the ability to create custom components and import them to the components pane or create action script class components and use the functions inside the source code. Later below we`ll provide some examples in order to explain this process. As we mentioned before, this makes the process of game development much easier and creative. The properties pane is docked on the right and offers properties relevant to the component class. Properties are divided into three segments, standard view, alphabetical view and category view. These three segments offer many opportunities for modification of the components and adding special features [7].

D. *Working with collaboration tools and libraries*

This technology offers a lot of possibilities. The main advantage is working with so-called libraries. Flash builder offers to add (.swc) files into the project folder of the applications. You can create a SWC file and import it. An Adobe SWC file is a package of precompiled Flash symbols and ActionScript code that allows a Flash or Flex developer to distribute classes and assets [14].This means that you can create an action script class or flash movie and export it as an SWC class and then use it inside your application project as a package. Flash Builder offers the possibility to import projects from other Adobe products like Flash Catalyst and Adobe Flash.

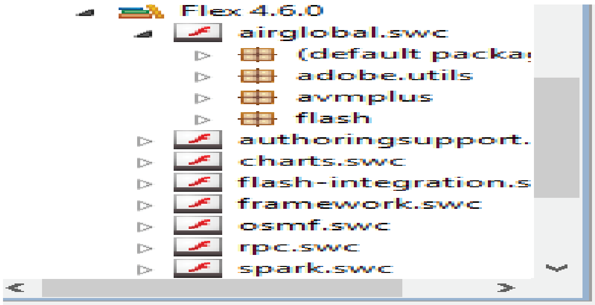


Figure 3: Flex SWC file libraries

The collaboration activities also supports creation of containers inside the application and then work with the flash containers in Adobe Flash, the process is automated and does not require programming. This is a great opportunity for flash developers to create iOS games using Flash. Adobe flash also gives a lot of code snippets that you can implement inside the flash containers like geolocation, navigation controls, swipe controls and lots of other native gestures that works great on both mobile platforms.

E. *Fix the application scale problems*

Our goal is to develop a cross platform mobile application that will work on every device regardless of the screen size of the device. Resolution is the number of pixels high by the number of pixels wide: that is the total number of pixels that a device supports. DPI is the number of dots per square inch: that is, the density of pixels on a device's screen. The term DPI is used interchangeably with PPI (pixels per inch).The default package of the project contains the main project file (filename.mxml), inside the source code of this file name you can set the default application settings like DPI (Dots Per Inch) settings and splash screen settings

You can choose from three DPI values, 160,240 and 320. Device DPI values do not always exactly match the DPIClassification constants (160, 240, or 320). Instead, they are mapped to those classifications, based on a range of target values.Flash Builder offers you to select bitmap assets based on DPI.

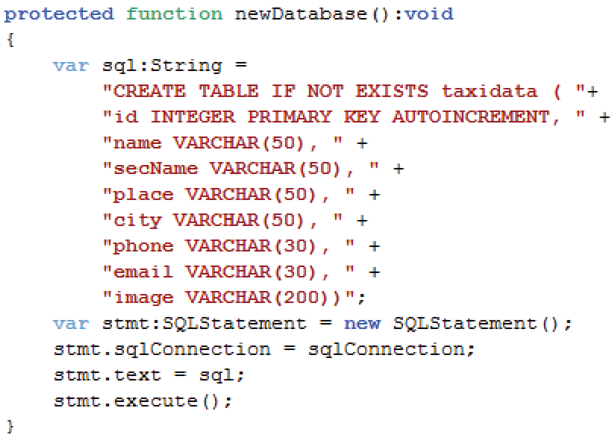
For providing exact fit you can set the values of width and height to 100% so that the SWF will fit the display. Else, you can use the Stage Scale Mode, it lets you control how your SWF will appear. It's also useful for creating AIR apps and full screen Web sites. We can conclude that Flash Builder provides amazing opportunities for creating a mobile application that will not depend on the screen size of the device and will operate with a high picture quality on all devices for which it is made.

F. StageWebView Class

The StageWebView class is maybe the most important class for this process of cross-platform development. This class offers a lot of possibilities like displaying local pdf content or displaying local video or html files. The class provides no interaction between ActionScript and the HTML content except through the methods and properties of the StageWebView class itself. When you use this class to display a video file for example, the device uses the native video player to play the video, the same happens when you try to open local pdf file or html file inside your application. The problem here is the Android platform. When you run the application on the simulator everything seems to work well, but on an Android device only white screen is displayed, this is not the case with the Apple`s iOS devices. On Android, the nativePath property of a file object pointing to the application directory is an empty string , the fastest solution is to put the files on web server and display them from there. Once again I will say that this is not a problem when you export an iOS application.

III. USING SQLITE

When creating an iOS or Android application on Windows, with FLEX mobile, you can use SQLite to store application data. You can create an XML data file and read the data from there and store in database using SQLite. Using SQLite databases, you can store your application data in a secure database and query your data.



```
protected function newDatabase():void
{
    var sql:String =
        "CREATE TABLE IF NOT EXISTS taxidata ( "+
        "id INTEGER PRIMARY KEY AUTOINCREMENT, " +
        "name VARCHAR(50), " +
        "secName VARCHAR(50), " +
        "place VARCHAR(50), " +
        "city VARCHAR(50), " +
        "phone VARCHAR(30), " +
        "email VARCHAR(30), " +
        "image VARCHAR(200))";
    var stmt:SQLStatement = new SQLStatement();
    stmt.sqlConnection = sqlConnection;
    stmt.text = sql;
    stmt.execute();
}
```

Figure 4: SQLite Database function

IV. CERTIFICATION

Flash Builder provides embedded compilers for both iOS and Android platform. When the project is finished, the last thing to do, is to compile for both platforms. At the beginning of this explanation we`ll have to say that the process is much easier to do for Google Android platform. In Flash Builder you have the option to create certificate fie (.p12) and you are ready to export the application for Google Android. The problem comes when you try to export your application for iOS platform. Later below we will review all the aspects of the process of signing of the applications.

A. Creating certificate signing request and provisioning profile

The iOS application needs to be signed with distribution certificate. First thing is to create Certificate Signing Request file. Because our goal is to finish the full process on Windows PC, I recommend using OpenSSL for the creation of the Certificate Signing Request file. After that, you need to upload the file to the Apple`s Provisioning portal, then wait a few seconds and hit F5. The page will refresh and you will be able to download the certificate file. The next step is to create (.p12) file from the certificate file, for this step you can use OpenSSL again. First you need to convert the Certificate file you have downloaded from iOS Provisioning Portal into PEM file and after that you need to create the (.p12) file. Here is an example for creating (.p12) files using OpenSSL from command line on Windows PC.

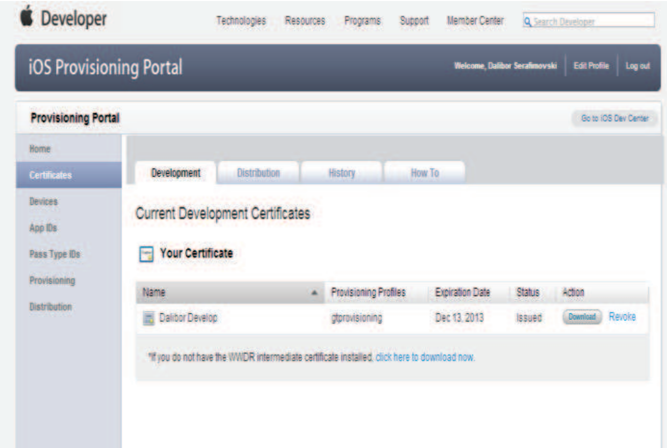
To convert certificate:

```
openssl x509 -in ios_distribution.cer -inform DER -out
ios_distribution.pem -outform PEM
```

To export p12 file :

```
openssl pkcs12 -export -inkey testkey.key -in
ios_distribution.pem -out iosdistributioncert.p12
```

The last step is to download the provisioning profile. This profile you can download from the Provisioning section in the iOS Provisioning Portal. The most common error that developer are making during this process is signing the application with development certificate. Remember that for distribution to the Apple official app store, the application needs to be signed with distribution certificate. Last thing to mention is that the value of the application ID in the descriptor file must match with the app ID you created on the iOS Provisioning Portal.



Name	Provisioning Profiles	Expiration Date	Status	Action
Dalibor Develop	gtprovisioning	Dec 13, 2013	Issued	Download Revoke

*If you do not have the WWDR intermediate certificate installed, click here to download now.

Figure 5: iOS Provisioning Portal. The image shows the development tab. Here are created the development certificates for testing the application on device

B. Distribution to Application Store

The last thing is to publish the finished application binary file to iTunes Connect website. This is not an easy process. For this process you need to have MAC OS operating system in order to install the Application Loader. The Application Loader is a software that Apple uses to upload the (.ipa) binary files to iTunes Connect. The problem here is that Application Loader runs only on MAC OS. Because we want to finish the complete process on Windows PC we need to find a solution. I recommend using Oracle VirtualBox to install virtual Mac OS machine and run Application Loader on it. Virtual machines are very helpful for this kind of problems and VirtualBox offers installation of Mac OS operating system on it. Other alternative is VMware Workstation that also will do the job.

V. CONSLUSIONS

Above we reviewed all the important aspects of the process of cross-platform mobile development on Windows PC. General conclusion is that this is an open environment for research and promotion. Windows operating system is used in the major European countries imposing the need of iOS development on Windows. Some great tools with great features are available for the process of iOS development on Windows. Flash developers can produce great iOS applications using their knowledge of Flash, MXML and Action Script. This method sourly saves time, money and effort. Special attention was paid to the small things like the ID of the applications that could cause a lot of trouble and you won`t find a warning of such problems in any book, that things you just learn in the process of creation. This solution allows full usage of the knowledge of Flash and Action Script technology.

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