Hybrid technology in mobile applications

Different ways of developing mobile applications

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Abstract

In this paper we shall introduce our readers for “Hybrid application” , what it is, how it work and also how it can be used. We will explain the term and give a fundamental ground for our readers how they can get started in a more simple hybrid project. We will also write about “native application” and “web application” to have some data to compare to, HTML 5 is also being written about in this paper since it´s the technology that made “hybrid application” possible. Our goal is to catch the reader's interest for this fairly new technique and give a deeper insight in what hybrid application means, give a hunch about which project the technique is applicable in and also less applicable. Hopefully we inspire our readers to begin develop hybrid applications or at least get them to open their eyes for it.

Content

Introduction

The demand on mobile applications have increased radically since the first release of Iphone. The mobile app development keeps increase due of more and more people use their mobile device. Due to the increase, companies are utilizing the mobile market to make new applications to reach people all over the world.

A fairly new technology that developers is starting to use to build mobile applications is with web technologies like HTML5, CSS and JavaScript. Hybrid mobile application makes it possible to create applications that will act, work and look like an native application, using only web technologies to develop it. As a web developer you can use your current knowledge and skills within web technology to make mobile applications. You do not need to learn how you make native application in programming languages like Swift(iOS) or Java(Android). What makes the hybrid and web applications so great is that you access the mobile device native functionality, for example the camera.

Developing a mobile application for a specific platform is something you do and still does. But with new appearing technology, mobile application development can also be done with hybrid technology that works for multiple platforms on the market. This makes the development of mobile applications faster and there is no need to hire developers to create the same application for other platforms.

Research Questions

These are the questions that we will proceed from and also try to get as good answer on as possible.

1. How does it come web technologies are used “outside” web development?
    - We want to know the reasons why web technologies are used to build other things than just websites, for example mobile applications.
2. How does hybrid technology work?
    - We want to get a grasp on how hybrid technology work. Since hybrid technology is something new for us both and we would like to know how it works and be able to use it in the future.
3. Will hybrid development stay for long?
    - The hybrid technology is relatively new and by this question we would like to know if it's going to stay for long and is it profitable to start learning this new technique?
4. What is the difference between native, hybrid and web application?
    - We would like to know the differences between native, hybrid and web applications . What are the pros and cons of the different way to develop an mobile application and which way of development is more profitable for each technique and why.
5. How do you start with hybrid application developments?
    - For the last question we would like to know how to start a simple application with hybrid technique, since we (and hopefully our readers) want to be able to develop hybrid applications.

Method

We started this report by collecting around ten to twelve articles related to our subject “Hybrid application”, “Native application”, “Web application” and “HTML5”. We chose these starting articles by reading thru them roughly and discuss them if they were relevant for our work and trustworthy, we stamped them as trustworthy by comparing it with different sources. By doing this we had enough to start gather information and start writing this paper, as the time passed we searched and added additional articles. As we had this information we tried to explain it as simple and concise as possible for our readers, because we do not want the reader to need years experience in software development to understand our paper.

We studied the pros and cons of the three ways of making a mobile application so we can give our own opinion stated on the facts/data we have collected under the process of this paper. These data was also used to answer our research question as stated above.

The final activity of this paper is to create a simple “Hello World” hybrid application. In this application we used “Phonegap” as our framework, this was chosen based on no special reasons more than it was recommended by some articles we read.

Search criteria

At the start of this paper our search terms were more non specific. So we could get a more broad view of our subject as possible. As we dug deeper in the subject we made more specific search terms for more specific results. Those more specific search terms will not be included here.

So the following search terms were:

- Hybrid application
- Native application
- Web application
- HTML5
- Hybrid vs Native application vs Web application
- Features of HTML5

Literature review

In this part we will go through what HTML is, what the new version of HTML brings to the table and present some new features that shows what web technologies can do nowadays. We will also go thru how a native, hybrid and web application works and describe their codebase, testing, maintenance and performance.

HTML

HyperText Markup Language also known as HTML, is a programming language used to build and defined the structure of the website. HTML latest version called HTML5 is the fifth edition of HTML. With the new version of HTML, a whole lot of new features are included. As said in the article "Introduction to HTML5", where they write that "creating web applications that interact with users, their local data, and servers more easily and effectively than was previously possible"[4]. With the recent development from HTML5, the developers have more possibilities to bring the web technologies outside of it's main area, the world wide web. [1]

New features from HTML5

Semantic

A semantic HTML element is used to separate the element from all of the other elements in a HTML document. The point is to give all the elements a structural part of the document, which will also give the web browser and developer a more clear view of what every element contains. An example can be the element, which is a non-semantic element and from a developer's view doesn't explain what it will contain. But if we would use the <nav> element, the developer and web browser will know it contains navigation links.[2] [3]

Offline and storage

HTML5 creates an easy for developers when it comes to storage or if a unit got no connection to the browser. The new features involves local storage, session storage, application cache, indexedDB, file system and online/offline-events which makes it possible for units to access the website with or without internet connection. [2] [4]

Connectivity

The new features of connectivity makes it possible for a client and server sides to communicate with a new and innovative way. What HTML5 is offering is Websockets, Server-sent events and webRTC.

Websockets is a feature that makes it possible to create an interactive connection between the users web browser and a server. What makes websockets good is that you can send a message to a server and then get an answer back without asking for an answer. [5]

Server-sent events is quite like the websockets feature. It requires an interactive connection between uses web browser and a server. When the connection is done, the server has the possibility to send messages to the web browser at any time. These messages are called events. [6]

Web Real-Time Communications also called WebRTC makes it possible for websites to send and receive streams of real-time communications like video, sound or data, directly without having the need of a intermediator. This feature enables sharing data with peer-to-peer technology without installing a third-party software. To make this work according to the article "WebRTC API", they say that "WebRTC consists of several interrelated APIs and protocols which work together to achieve this". [7]

Multimedia

For a longer time developers have been wanting to include video and audio on their web sites, but there were no support for embedding video and audio. That's why we have third-party plugins as Flash or Silverlight that makes it possible to have video and audio. The new feature that supports multimedia is two elements called <video>, <audio> and a JavaScript API to handle multimedia. Developers can now use this feature instead of requiring the user of the website to have a third-party plugin to see the video or audio. [2] [8]

Performance & integration

To increase the performance of websites, a new feature called Web Workers have been introduced. With Web Workers the browser can run scripts in the background on another thread without being canceled by another script for example to answer a interaction of the user. The scripts can now run longer "tasks" and the website is still interactive to the user. This makes the build of the website more faster and robust. [2] [10]

Device Access

HTML5 brings great features that can turn a website into being like a mobile application. With access to the camera of a mobile unit, a website can use that access to ask a user if they want to use the camera and upload the picture to the website. Mobile units now days have a touch screen and with the new feature touch events a website can intercept touch activities from the user. With the touch events API a website can also support multi-touch interactions, so the user can use multiple fingers. Website have also the possibility to access the users position and get updates when the user moves around with the feature geolocation. The position is retrieved from the units GPS or from the network the user is connected to. Another feature is detection device orientation and with that feature a website can know when the user of the mobile unit is rotating the unit. With this information a developer can adapt the website's content to a wider view when the unit is rotating. [1][2]

Web application

Mobile web applications is an website that is written once and is meant to be able to be used on many different units. Development of an web application is done by web technologies like HTML5, CSS3 and JavaScript. From the article "Understanding HTML5 mobile application development" by Robert Sheldon he writes "All major browsers support these technologies" [11]. Today's web browsers that is available on our mobile units is extremely powerful and have built-in support for the new "HTML5 capabilities, Cascading Style Sheet 3(CSS3) and advanced JavaScript" [12]. The technologies and functionalities of HTML5 have started a new developing standard to create mobile web applications.

Codebase

There is two ways to make mobile web applications and they are either a mobile friendly website that you can reach thru your browser. The sites are structured by HTML which detects when a mobile device connects to the page and adapts the page to get a design that fits the slim screen. But there is another way where you can go deeper and create a mobile website that looks like a native application and can be open from your homescreen from the mobile unit. Both have in common that the code behind the page is executed in the browser of the mobile unit that uses the latest HTML5, CSS3 and JavaScript that is currently available in the modern browsers. [12]

Testing

Like hybrid application you only have one codebase in web apps, which make it easier/faster than native(if the native application supports multiple platforms) to test. There is a exclusiv testing technique for web application that´s named "Web application testing". [13][14]

Maintenance

Maintenance of web apps are relatively simple when you have a web application that supports multi platforms. To have support for multiple platforms with a common codebase makes the maintenance of the product a lot easier. To include new functionality or make changes to the web application is only required once and user doesn't need to download or update the web application again, since the web application is not installed on the unit. [26]

Performance

Mobile web applications have different factors that play a role in performance. The performance of a web application is that you always depend on an internet connection. Something who sometimes can be difficult to have if you are in places where the connection is bad, which means that the time to load the page is increased. Another factor is that web applications have no directly connection to the hardware to the mobile unit but instead uses a bridge that makes it go slower and if the applications uses too many animations and 3D graphics on the web application, the web application will be slower. [15]

Native application

Native applications is developed to be used for a specific platform or unit. The application is installed directly on the mobile device and all information and data is collected and saved on the unit. An native application have the possibility to access all functionality that the operating system of the mobile unit is offering. “Those services are exposed via a dedicated Application Programming Interface (API) with methods related to communication and messaging, graphics, location, security, etc”. Communication with the API can only be done with the same programming language that is used on the unit(e.g Swift/Objective-c for iOS or Java for Android). [12][16][17]

Codebase

When working with native applications you will need to have different codebases for each platform you want your application to support, e.g an Android application will not run on an iOS platform. Most of today's developers is specialized for example Android or iOS which means if the application should support on both platforms it will need two separate developers. This will result in increase time cost and so on cost of the development. [15]

Testing

Because native applications is build for a specific platform, a testing of an native application will require a lot of testing. If a native application is going to be used on different platforms, there will be more than one codebase which will result in more testing. The point of a test case can be the same, but the code behind these test cases will be different for each platform. [17]

Maintenance

Native applications will require more maintenance if the application is built for more than one platform. If the application is only for one platform, then the maintenance and updates will be easier. It is often an application is build for more than one platform and that will increase the cost of maintaining the application. [18]

Performance

Because a native application got a direct connection to the API of the mobile units operating system and hardware], the performance of the application will be fast since there is no intermediator to take care of the communication between the application and the API. [18]

Hybrid application

A hybrid application is a combination of a native application and a web application. In order for this to work, developers can either create their own "bridge" (embedded HTML renderings engine) between a webview that contains a browser and the platform API or use an open-source library or framework that provides the developer with a complete JavaScript interface for the mobile platform's API, regardless of which system [12].[19]

Having a native wrapper that contains web technologies like HTML5, CSS and Javascript also a generic “bridge” that takes care of all of the functionality between the application and the mobile units platform. The developer can reach out to all mobile units. The use of a native wrapper allows a hybrid application to be packaged and placed on the market that is available for various platforms (e.g., Apple Store or Google Play) [12][19]

[20]

Codebase

There are several reasons for using web technologies and using it as a hybrid applications, Matt Netkow says in his article "Hybrid Mobile Apps are Overtaking Native," which mentions the following: "A key advantage of hybrid app is the ability to build for all major app platforms using a single codebase "[21]. As Matt himself says, you only need one codebase even if you want the software to be supported on several platforms.

Testing

When it comes to testing an hybrid application with today's web technologies, you don't need several unique scripts for testing. The infrastructure within testing will decrease radically because you will only be testing one codebase and not several. So out of pure testing perspective you have the possibility to save much valuable time in this process. [21]

Maintenance

Given that hybrid applications are built on web technologies, it's simple to maintain the application, as it's just one codebase that needs maintenance and changes for new functionality. As the application is already installed on the users mobile unit then they will not need to update the application if the changes have not changed how the application works e.g to the native container. Using the webview the pages of the application is loaded from a server then the user navigates around on the site and then you can see the updates directly. [22][23]

Performance

When starting to develop an hybrid application, the developer should have thought of what the purpose of the application is. When it comes to performance of an hybrid application, making an application that uses a lot of 3D graphics and animations is not a great idea. Since the application is using a intermediator to communicate with the API of the mobile units operating system and hardware, the performance will take a betting. Another thing that affects the performance is the hybrid framework you can use to build an hybrid application. The framework provides a lot of plugins to access all of the different functionality that is available from the API. If the hybrid application is using a lot of plugins for different functionality, the performance of the hybrid application will be slower. [24]

Analysis and discussion

HTML5

The features of HTML5 brings a new way for developers to expand their uses from just developing websites to making mobile applications with web technologies. All of the new features makes it easier for web developers to develop websites and bring new solutions to make the experience for users better. One example could be that the user doesn't need to use third-party plugins to see video or audio when visiting a website. That is a huge step and is mainly because the browsers have increased their performance and HTML5 can then support more advanced features. From all the information gathered about HTML5, we believe that the web development will change and that the use of web technologies will be more popular in a near future.

HTML5 requires support from the browser to be able to use the new features. And when it comes to mobile devices, almost every mobile device is equipped with the latest browser. Since the browser on a mobile devices is a native application, browsers can access the functionality of the mobile device and pass on the access to HTML5. Developers then have access to use some of the functionality that is supported and make websites feel more like an native application even though it's just a website.

Native vs Hybrid vs Web applications

While native have more performance oriented perks, hybrid and web applications have more cost oriented perks like development cost and speed, maintenance cost and testing cost. This could differ depending on what platforms should be supportive by the native application.

When it comes to "Skills needed" hybrid and web application is more gentle when it comes to that front, this is more like a matter of taste but for a new programme web technology would be easier according to us.

When it comes to developing mobile applications, we believe that the native way of development will be replaced by applications developed with web technologies in a near future. HTML5 can almost provide the same functionality as an native application[25]. With mobile devices getting more powerful for each release and the browser is also getting better and increase performance. The difference between an native application and an application made by web technologies is getting slimmer by the day.

Results

How does it come web technologies are used “outside” web development?

The technology and performance behind the browser is getting better for each day and from that HTML5 can provide more advanced features that wasn’t possible to provide before. HTML5 is mainly the reason for web technologies being used “outside” web development to create other things than just websites. The new technologies of web development have made it possible to create for example mobile applications combined with hybrid technology. Without the new features of HTML5, web technologies wouldn’t be used “outside” web development”.

How does hybrid technology work?

Hybrid technology are using a native wrapper that contains a webview with a browser. The webview is using web technologies like HTML5, CSS and JavaScript. To make this work, there is a generic “bridge” which is an embedded HTML renderings engine, between the webview and the native wrapper. This opens up the possibility for the “bridge” to access the platform API of the mobile device and provide it to the webview. With the use of a native wrapper, the application created with the hybrid technology can be packaged and used like an regular native application.

Will hybrid development stay for long?

After the research/analyse we have done thru this paper we think that the development of hybrid application will stay for a long time and might always be a option for developers when developing an application. Sure it have it’s back sides and isn't always the best option to use when developing an application considering the lack of performance versus native, but the technology is getting improved and the gap between native and hybrid is/will be decreasing.

What is the difference between native, hybrid and web application?

Attributes:	Native:	Hybrid:	Web application:
Codebase	Big/Medium/Small	Small	Small
Performance	Fast	Moderate	Moderate
Maintenance cost	High	Moderate	Low
Testing cost	High/Moderate	Moderate	Moderate
Development speed	Slow	Moderate	Fast
Development cost	High	Moderate	Low
Require installation	Yes	Yes	No
Skills needed	Objective-C, iOS SDK, JAVA, Android SDK	HTML, Javascript, CSS, Mobile development framework	HTML, Javascript, CSS
Graphical performance	High	Moderate	Moderate

As seen above all of the three ways to develop an application has it's pros and cons. Native will cost you more to produce, but have some crucial perks like “Performance” and “Graphical Performance” which companies often prioritize in their products. If the project doesn’t require a lot of performance, a hybrid or a web application is the way to go, based on the overall production cost, codebase and production speed.

How do you start with hybrid application developments?

As earlier mentioned we use “phonegap” as our framework to create a simple hybrid application. To get started visit https://phonegap.com/getstarted/ to download and install Phonegap desktop application to your computer. Also download and install the application on your mobile device. Through the desktop application start a new project and choose a template for this project or choose a blank template. To make this easier we choose the “Hello world” template. After you have started a project you now want to connect your mobile device to the web server that Phonegap have started for you when you create your new project. You can see on which address the server is running on at the bottom of the desktop application. Now you need to connect your mobile device, by doing that you open the mobile application of phonegap and write in the address available on the desktop application.

You have to be on the same network on your phone as your computer to be able to connect. The application will now appear on your phone and you are ready to develop your own hybrid application. When changes have been made to the files of your hybrid application, the application will be updated on your phone in only a matter of seconds.

Conclusion

The modern web is changing by the day and will probably become more popular in the future. Having read about what the new version of HTML can offer, web technologies can be used for other things than just a website meant for a computer. With this report we want to provide quick information about what HTML5 offers, how web technologies are used “outside” web development and how native, hybrid and web applications works.

With HTML5 and the modern browsers, developers can use this technology that is provided to expand the use of web technologies. There is three ways you can create an application for a mobile device and those are either an native, hybrid or web applications. With native being made for a specific platform and with different programming languages based on what platform. Compared to hybrid and web applications that uses web technologies like HTML5, CSS and JavaScript and is made for all platforms. Which gives hybrid and web applications an advantage when it comes to cost, speed and maintenance. Native application still have it's pros when it come to application that demands high performance, depending on what application you will develop you should consider the pros and cons(see table above) of the different technologies and from that choose a suitable approach. Faster browsers and new feature from HTML5 will change how we develop our mobile applications in the future.
This gives hybrid and web applications a huge advantage when it comes to cost, speed and maintenance of an mobile application

Future work

As we made this paper about how to develop a mobile application using different technologies, we have learned a lot in this area of development. As this knowledge was learned we have raised our eyes for the different technologies behind the different ways of developing mobile applications. For future work we would like to dive deeper into several different concept and technologies like HTML5 and more about all it´s available features and news. Since HTML5 made such a revolutionary step within development it have caught our interest to learn more.

Hybrid applications has caught our interest and definitely something that we would like to get more invested in and learn more about in a more deeper level, hopefully get the opportunity to develop it in the future.

A technology that we found while researching was “Progressive Web Application”. Which makes it possible for a website to offer a mobile device user to save the “website” as an icon on their phone as an regular native application. When opening this application, the browser will open the website and the address bar from the browser will no longer be shown and the website will now look and feel like an native application.

As seen we have some topics we would like to get more deeper into, with next opportunity to make a paper we will specify us to only one technology and analyze(probably one as seen above) it and make the whole paper about the chosen topic.

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