

Native or Web or Hybrid which is better for Mobile Application

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Abstract: Mobile application technologies developing rapidly. There are numerous OS and system available in today's market. There are three types of main development methods in mobile application, which are Native, Web and Hybrid. These Hybrid mobile app technologies make easy to develop sound mobile application comparable to Native mobile application. These Hybrid mobile app technologies perform better compared to these native mobile app technologies. Hybrid mobile application technology provides flexibility for cross-platform as well as any mobile OS.

Key Words: Native Apps, Hybrid Apps, Web Apps, Mobile Apps, Mobile Application Development, HTML5

1. Introduction

Usage of mobile devices is rising rapidly day by day. And selling mobile devices such as like smartphones and tablets are increasing day by day. Therefore users are always trying to do their daily task through these devices. Thus the developer also developing apps accordingly. There are many types of mobile applications and the same, methods of developing the application, those too available in the current market. Currently, there are four types of platforms, such as Android, Apple iOS, Blackberry and Windows. So the developers need to build apps which is compatible with all these OS or else need to develop apps individually. Yet most of them are not successful steps to follow. Through this paper, we will discuss the best approach to develop a mobile app. When developing an app we need to select a development method. Native, web (HTML5) or hybrid are the popular methods for developing an app. Each of these methods has benefits as well as limitations.

2. Native Apps

There are roughly 1.4 million native apps available in the current market. 90% of the native apps are for android OS. Native apps are always executable only on named device, which will be downloadable from locally or originally, such as downloading from Android market place, apple apps store, etc. The native app interfaces are always connected with the mobile OS. It is not working alone or with any other apps. These apps are permitted to access all types of APIs which origin with OS vendor and, these apps are always unique. To develop a native app you may require different sets of skills and technologies. To develop a Native app, most developers use Kotlin, JAVA and C++ languages. Apart from that there are several tool kits available for different mobile OS. Such as like Android SDK, Android Jetpack use for Android OS, iOS SDK, XCode use for Apple iOS, etc.

3. Web HTML5 Apps

HTML is the basic language which we use to build a website or web-based application. It is a text-based markup language that makes it easy to learn for any kind of device/s as well as for browsers. HTML5 is the latest version which released a few years ago. HTML5 language is supportive with multimedia and server communication elements, which make much easier for a web developer to do their job perfectly. HTML5 provides modern techniques which contain a designing ability, therefore developers need to add fewer plug-ins to make beautiful the website or application.

There are roughly 80,000 HTML apps that we can see in the current mobile app market. The largest HTML5 app in the market is the Facebook app. These HTML5 apps are consist of advanced UI components, geo-location services and offline availability and many more. These apps can run in any OS. These apps are built the user interface with JavaScript toolkits and jQuery, which makes UI comparable in look and feel to native apps. And also developers use the newest JavaScript, CSS and HTML5 languages to add features to look and feel modern.

4. Web as mobile App platform

Web is a user-friendly medium when discussing with the application, where it can run on cross platforms. When looking through the view from the service provider of the application, it is easier for them to gather data about the users. Most of the Google apps are integrated with this system. Social media applications and games are some of the other apps that already integrated into this system. Yet apps distribution are still controlled by the vendor of the OS of the certain mobile. Web apps always run in the sandbox. Accordingly, all the input functions are held by the web browser and then send it to the Web app. This functionality only works when the web browser does not catch the signal itself. By default, Web apps have no access to the mobile phone's hardware. Such as GPS, NFC, camera, etc. Therefore it is much safer than Native apps.

Web apps develop with HTML5 runs with APIs, which have been enlightening with the client-server communications system. Moreover, it has enabled peer-to-peer communication between web browsers. These API are listed as WebRTC [3] and WebSockets [4]. The objective of the WebRTC is to enable real-time communications directly from browser to browser via the web. Cookies are the well-known traditional way to store data on a web client. When comes to HTML5, it makes easy rather than cookie method. In HTML5 it uses the Web-Storage interface method. Here it uses two attributes, which are Local Storage and Session Storage. Web Storage system much like cookies. The objects of this method are much simple than the cookie system. Here, they use key-value pairs for getting and setting a key-value and removing a key [5].

We have done a research on this matter. We have found that HTML5 fail to cover all the features in WebRTC. Table – 1 below indicate the results.

Table – 1. HTML5 with Mobile App

Features	Android	Opera	Firefox	iSO
HTML5 Canvas	Yes	Yes	Yes	Yes
A/V	Yes	Yes	Yes	Yes
Offline App run	Yes	Yes	Yes	Yes
Location(GPS)	Yes	Yes	Yes	Partially
Web Storage API	Yes	Yes	Yes	Yes
Camera	No	Yes	No	No
API Files	No	No	No	No

5. Hybrid Apps

Hybrid apps are the combination of both Native and Web apps. These apps also cross-platform apps such as Web apps. Hybrid app developers write major parts for their app using web technologies such as HTML5 Javascript, etc., and rest with native APIs as required. These apps consist of customizable plug-ins that can be accessed to native features whenever available on mobile device/s. Hybrid apps are 3 times faster than native apps and it can save around 80% developing costs compared to Native. The common framework developers used to develop a Hybrid app with Adobe PhoneGap. It is open-source and connects with Javascript, which is helpful to make the app run in cross-platform. In hybrid apps, the Native part can be developed independently while the web part can be connected with servers or can develop with HTML5, Javascript and CSS. Hybrid apps are matched with cross-platform requirements. For instance, it is using the same HTML content which can be retrieved from a different platform. Nevertheless, native features of the platform are still can be accessed through these hybrid apps.

Hybrid app developers are applying web technologies to develop hybrid apps. The well-known platforms, such as iOS, Android, and Windows OS, allow users to embed web views when viewing website through their native apps. To make it well-performed, developers add open-source frameworks to these hybrid apps. PhoneGap is a well-known example of these frameworks. PhoneGap is an open-source framework, which targets to empower native app development linked with web technologies. This method commonly uses for mobile platforms. These plugins allow the Web application to perform well and connect with the native code

written by developers. To develop a proper hybrid app it is required to select a suitable framework. Then only app developer can develop a proper Hybrid app with a countable performance. There are numerous frameworks available in the market which is suitable for Hybrid apps. We have made a comparison of frameworks available in the market to make sure that these frameworks are necessarily suitable for developing Hybrid apps. The table below shows the above-discussed frameworks and 0 - 10 (10 is considering best, 0 is bad).

Table – 2. Comparison of different frameworks for Hybrid Apps

Framework	Performance	Communication	Documentation
Iconic	7	8	8
PhoneGap	10	6	6
Famous/Angular	10	6	7
OnSenUI	6	5	7

6. Compare the differences

We have researched a study in this regards. From this research, the eventual study is to determine which method is best to develop mobile apps compared to each of the three methods discussed above. For this experiment, we have considered the following requirements;

1. Firstly need to fill the technical requirement to develop a proper mobile application. Such as like GUI, device sensority, speed, touchpad requirement, etc.
2. Need to check the performance level of the applications, whether it is Native or web or Hybrid app, it must function smoothly.
3. When running these apps inside the device, it should not ruin the device performance. For example, slowing down the device, or freezing the device, etc.
4. As battery life is a significant part of a mobile device, these apps should not consume high power and drain the mobile device's battery life.

To evaluate we have developed three apps in three different developing methods as discussed above. All these apps have similar functionalities as well as features. Then we have test user experience, performance, and finally energy consumption when running said three apps. For this test, we have used two different phones with two different OS: Android &iOS. The following Figure - 1 shows the results.

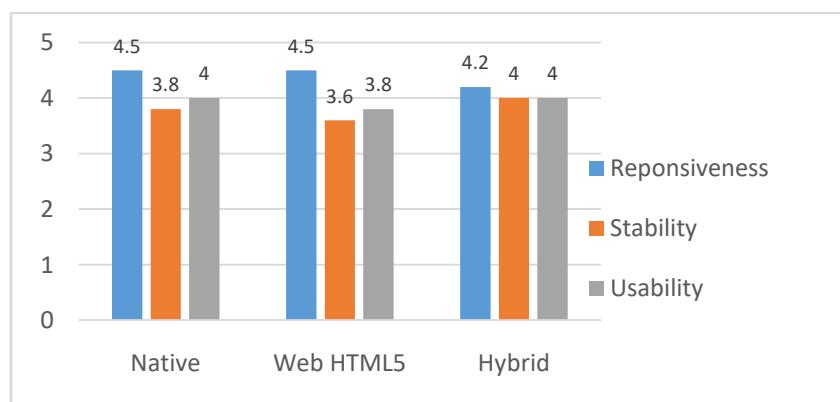


Figure – 1. Android - User Experience

User experience test for Android results shows that the Hybrid app is considerably well functional compared to Native &Web apps. However, both Native and Web app's responsiveness is higher than the hybrid app, and

usability is lower in Web app while both Native and Hybrid apps perform the same level. However, these results were changed with iOS. Figure – 2 shows the results.

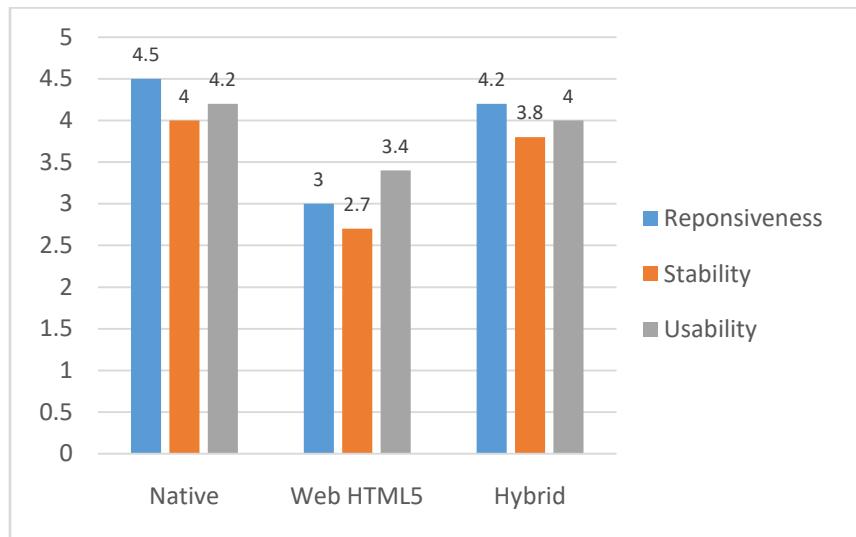


Figure – 2.iOS - User Experience

User experience test for iOS results show that the native app is considerably well functional comparing to Hybrid & Web apps. Unlike in Android OS, web HTML5 apps are poorly performing compared with Native and Hybrid apps.

We have checked Security, Process Speed, and Memory Usage in the performance test. Figure -3 shows the results from Android device and Figure -4 shows results from iOS devices.

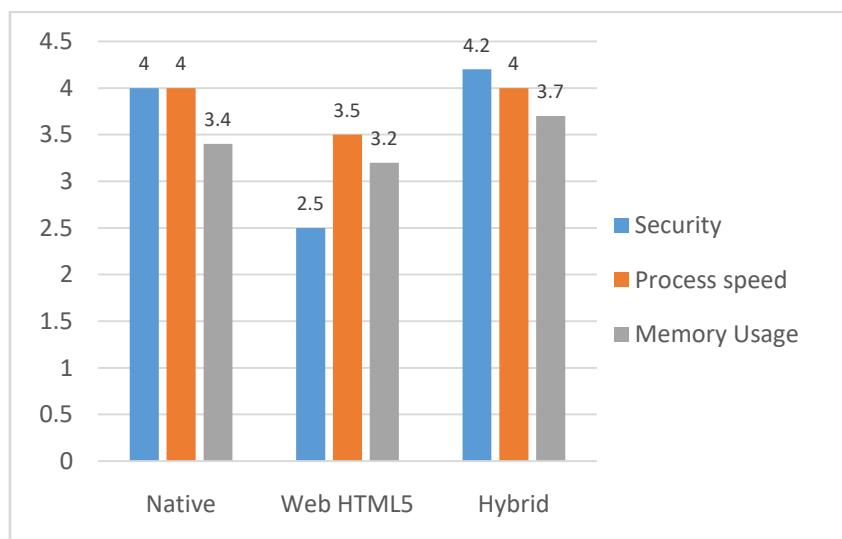
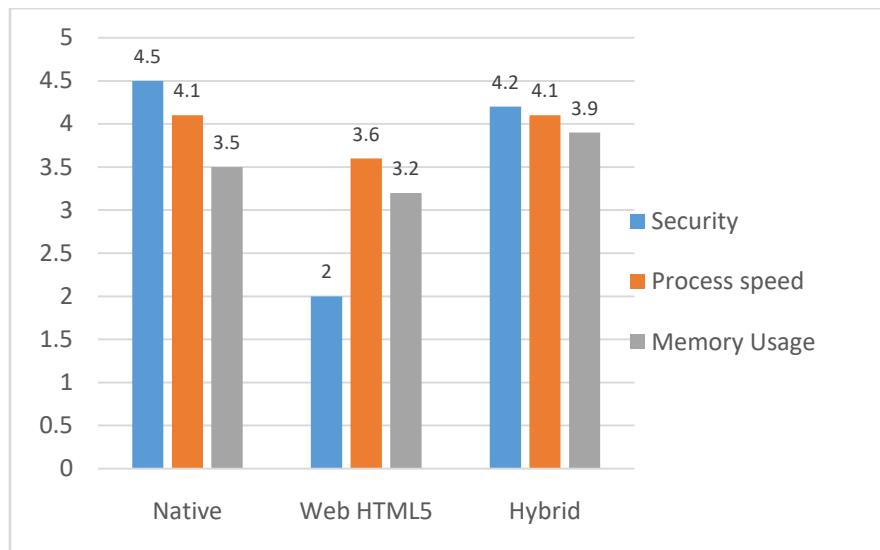


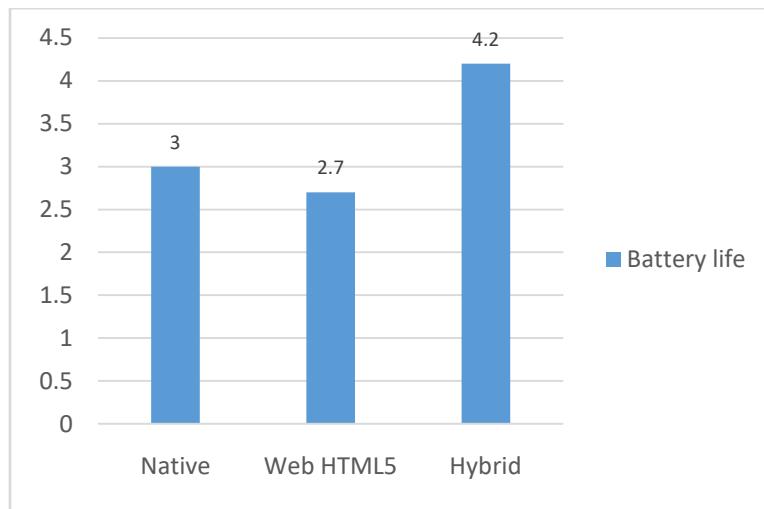
Figure – 3. Android – App Performance

App performance test for Android results shows that Hybrid apps perform well compared to Native and Web apps. Web apps show poor results in security and process speed compared to Native and Hybrid apps. Web app performance speed depends on the strength of the signals. Yet Native and Hybrid apps not that much consider the strength of the signals. The Native app shows poor performance in Memory usage compared to Hybrid apps. Usually, most of the Web apps in Android devices take lots of memory than Hybrid and Native apps.

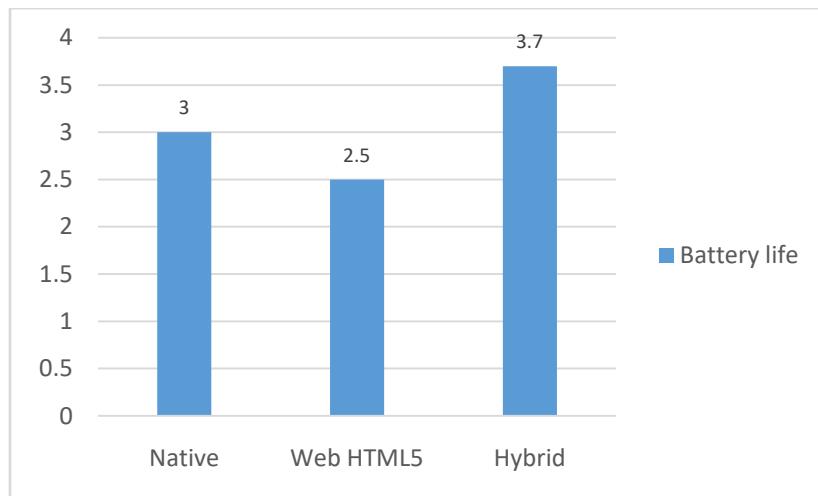
**Figure – 4.iOS – App Performance**

App performance test for iOS results shows that Native apps perform well in Security compared to Hybrid and Web apps. But in process speed-wise both Native and Hybrid apps perform well comparing to Web apps. Web apps show poor results in security and process speed compared to Native and Hybrid apps. Web app performance speed depends on the strength of the signals. Yet Native and Hybrid apps not that much consider the strength of the signals. Web apps show poor performance in Memory usage compared to Hybrid and Native apps.

Battery life is a significant part of a mobile device. If any app consumes more power until battery life drain in the mobile device, it is not a good app. From Figure – 5 it shows the results of Android devices and from Figure – 6 it shows iOS devices.

**Figure – 5.Android – Battery life**

In here Hybrid apps shows good results compared to Native and Web apps. Most of the time Native apps drain the mobile device's battery life as it may take more power to perform well. Web app drains somewhat battery life as it needs signals strength.

**Figure – 6.iOS – Battery life**

In here Hybrid apps shows good results compared to Native and Web apps. As I explain in the android Figure, the same theory applies to iOS.

Let's look at the summary of all Native, HTML5 and Hybrid development systems from the below table.

Features	Native apps	HTML5 Web apps	Hybrid Apps
Language	Native only	Web Languages	Native & Web Languages
Code Portability and Optimization	-	High	High
Access to Specific Features	Easy Access	Low	Low
GUI	High	Medium	High
Security	High	Low	Medium
Upgrading	Not easy (Via Native Apps Store)	Very easy	Very Easy
Installing	Easy	Easy	Easy

Table – 3. Comparison of Native, Web & Hybrid Apps

As to table – 3, we can see that no single method is beneficial at all times. Depends on the scenario either method will be the best. For example, if the person high considers security, it is best to develop with native. From this paper, we have discussed approaches to the three development methods for mobile apps. However, the cost and the time are the major issues that companies nowadays facing when developing an app. These challenges make them to select suitable development method to make it profitable.

As Android and iOS are the most commonly used mobile OS in Sri Lanka as well as globally, we have selected those two OS for this study. In general Native mobile apps provide a better user experience than Web HTML5 mobile apps. But Hybrid apps are equally performing with Native apps in usability, memory performance and security. Energy consumption of the mobile device depends on the mobile app and how it will be used. As to our research, we have noticed Web apps are considerably consuming energy of the mobile device when compared to Native and Hybrid apps. This applies to both Android and iOS. As per our research finding, Web app's memory usage is considerably higher than Native and Hybrid apps. When discussing the memory usage of apps, again Web apps use a high volume of memory compared to Native and Hybrid apps. Since these Web apps are based on browsers, it takes much capacity to load. However, this capacity won't increase after it is launched.

remains the same. In Native apps memory capacity function in a different way. Depend on the task of the user, it changes the memory capacity in order to function the app.

7. Conclusion

To conclude, based on our research findings, we suggest that it is advantageous to use Hybrid apps considering the advances of the technologies it uses to develop the Hybrid apps. And also these Hybrid apps are compatible across any platform and OS, either Android or iOS or any other OS available in the market. Native app technology is optimal. On the other hand, these native apps provide a better user experience similarly to Hybrid apps. Only minor differences that we can see in these two apps regarding user experiences. However, Web app with web technologies tells a different story as it is not that much friendly and considerably effective comparing to Hybrid and Native apps. As to the findings we suggest that performances, user experiences, technical capabilities of the Hybrid apps are closer enough to Native apps. Actually, these Hybrid apps are an advanced version of Native apps. We believe that the future of mobile application development is promising. The Hybrid app development technology already provides a viable alternative for the Native Mobile app technologies.

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