

# CS CAPSTONE TECHONOLGY REVIEW

MAY 29, 2020

## MOBILE APPLICATION FOR FOREST ECOLOGY RESEARCH

PREPARED FOR  
PACIFIC NORTHWEST PERMANENT SAMPLE PLOT PROGRAM

PREPARED BY  
SERGEI POLIAKOV

TEAM

38

ROLE  
DATA MANAGEMENT

### Abstract

Our team is trying to help our client by building him an Android app which facilitates data collection while in the field at forestry research plots. Our client is currently using a relatively old electronic data collection system (by today's standards), which they are seeking to replace with something more modernized and less likely to cause problems. The devices they use now have small displays, are clunky to use, and are liable to crash and lose the contained data. This means regular syncing with a laptop on-site is necessary to prevent data loss. We plan on solving this issue by building new modernized software which will be deployed on new, state of the art, Samsung tablets. (<https://tobi.oetiker.ch/lshort/lshort.pdf>)

**CONTENTS**

<b>1</b>	<b>Introduction</b>	<b>2</b>
1.1	Role . . . . .	2
1.2	Tools . . . . .	2
<b>2</b>	<b>Alternate Technology Options</b>	<b>2</b>
2.1	Frameworks . . . . .	2
2.1.1	Xamarin . . . . .	2
2.1.2	Flutter . . . . .	3
2.2	Database Management Systems . . . . .	3
2.2.1	Oracle . . . . .	3
2.2.2	Realm DB . . . . .	4
	<b>References</b>	<b>5</b>

## 1 INTRODUCTION

### 1.1 Role

My primary role for this project is data management. Therefore the specific responsibilities of this project that I will be overseeing will be data collection and database management, which includes storing and fetching data from the database. For this project our client wants us to use the Open Data Kit(ODK) framework, which is an open source piece of software that specializes in data collection. The ODK software comes with a tool suite, which contains a number of different apps, which are all specifically task oriented.

### 1.2 Tools

The two particular apps, from the ODK tool suite, that I will be using are the survey and services apps. The survey tool uses HTML, JavaScript, and CSS to specify layout and facilitate data collection in the application. This is the specific tool which I will be using for fulfilling my data collection portion of the project. The services tool is a program that handles database access, file access, and data synchronization services. I will be using the SQL language alongside the SQLite3 database for managing and storing our data, as this is the specific database which our client is requiring us to use.

## 2 ALTERNATE TECHNOLOGY OPTIONS

Even though our client is pretty set on the particular technologies, which we will be using in this project, we will still explore other possibilities that are out there.

### 2.1 Frameworks

#### 2.1.1 Xamarin

One particular framework that is commonly used for mobile application development is Xamarin. Xamarin is an open source framework that was launched with an aim to solve the problem of disjointed native technology stacks, which made mobile app development difficult and an expensive affair[1]. Xamarin was launched back in 2011, but was eventually acquired by Microsoft in 2016. Xamarin is based on Microsoft's .NET framework, which means that most development is done in C#[2]. One of the greatest benefits of the Xamarin framework is that it supports cross-platform deployment. It allows for the capability to deploy applications in IOS, Android, and Windows mobile. According to a recent study performed by Datanyze, the current market share of Xamarin is 31%[1]. Although Xamarin has a lot of upsides to it, there are still a number of drawbacks involved. One of these being that Xamarin provides limited access to certain important libraries, that developers need for implementing key features into their applications. Another drawback with using Xamarin, is that the UI implementation is extremely time consuming. If we wanted to get our client to switch the project over to Xamarin, our main selling point would most likely be that Xamarin offers cross-platform deployment, other than that I do not see much benefit in switching over to Xamarin from ODK.

### 2.1.2 Flutter

Another mobile framework, which we might consider using for this project, is the Flutter framework. Flutter is a very new framework that was released by Google in 2017[1]. It is based on Dart, an object-oriented programming language that developers have found rather easy to acquire the skill for. It offers faster development time with hot reloading, meaning that it allows the developer to preview the results of changes in the code within the device or an emulator, or a simulator. It also allows a wrapping web view and a great native-like user interface. It also offers quick, adjustable gadgets within the framework on its superior rendering motor. The architecture, that Flutter is based upon, is reactive programming, something that is becoming more of preference these days[1]. Another one of the benefits of using the Flutter framework is that it offers cross-platform deployment. Alibaba, Google Ads, and a number of other companies are currently using Flutter for developing their mobile applications. One of the downsides to using Flutter, is that Google is still testing it and it is currently in its beta phase. This means that the framework is not stable and that there is a lack of support for it, at the moment. If our project group were to propose this framework to our client, our main selling point would most likely be that we would get to use the Dart programming language, which allows for extremely rapid development. Another selling point would be that the framework was developed by Google, and Google is a highly reputable company who is known for producing high quality products.

## 2.2 Database Management Systems

### 2.2.1 Oracle

The Oracle database management system is the most used dbms in the world[3]. There are a number of reasons why the popularity of this dbms is so immense. The Oracle dbms was created in the late 70s, which makes it one of the oldest database management systems, still in use today[4]. Since the Oracle dbms has been around for a while, it has been able to establish a fairly good reputation with a very reputable track record. Because of this, many people gravitate towards it simply because of its reputation and reliability. Another one of Oracle's alluring features is its Big Data Mining capabilities[5]. Newer versions of Oracle provide users with the capability to search for indirect, secondary, and tertiary relationships in their data. This particular feature is especially useful, in terms of time efficiency, for users who are working with large data sets and are constantly needing to perform complex queries, which Oracle makes simple by providing abstractions in order to simplify the process[5]. Another one of the advantages to using the Oracle database is that it provides its users the ability to create customized database applications, and a wide variety of flexible tools[5]. This is in contrast to a number of other database management systems that only provide standardized tools and applications, with no capability for customization. Although there are a number of advantageous reasons for using Oracle, there are still some downsides. One of the most notable being that Oracle is not a free service and an individual licence is required for each device that it is installed on, which can get very expensive for large scale projects[5]. Another downside of using the Oracle database management system is that it is notably complex and sometimes even requires organizations to hire professionals, who are experts in the particular domain, in order to operate the software[5]. If our team were to persuade or client into switching our database to Oracle, our selling point would be primarily be based on Oracle's Data Mining capabilities. I believe that this particular feature would be extremely useful for our client,

since he is constantly working with large data sets and analyzing their behavior. Ultimately, I do not believe that Oracle would be a good fit for our project for two specific reasons. The first being that Oracle is proprietary software and our client only wants us to use open source tools. The second being that Oracle can be fairly complex to use. This could be problematic, since the majority of the people who will be using our software do not come from a technical background. So by implementing a complex database management system into our software, we would only be adding, extra, unnecessary hurdles and barriers to our users' projects

### 2.2.2 *Realm DB*

Another database management system that I will be evaluating is Realm DB. Realm DB is an open source database management system that is specially designed to run on mobile devices[6]. Realm DB emerged onto the tech scene in early 2017 and was acquired by MongoDB Inc. on April 24th, 2019[7]. Over the past few years Realm DB has gained immense attraction in the mobile development community due to a number of unique and superior features. Database implementation and manipulation, in Realm DB, is done using Java instead of SQL, which most database management systems use[8]. This feature is especially attractive to new mobile developers who have little to no experience in database development or management, and are likely not familiar with SQL. One of the most attractive features that Realm DB has to offer is its speed. A benchmark test performed by employees at Database Zone Inc. revealed a drastic difference in speed between Realm DB and a number of other popular mobile database management systems. In all of their test, Realm DB had the highest performance for query tests. On average Realm DB performed 10 times faster than SQLite, which had the second highest performance among the different database systems in all of the tests[8]. Although Realm DB offers very high performance for querying data, the speed comes at a cost. In order to maintain high performance, Realm DB has to impose limitations on certain aspects of data storage. Some of these include limiting the names of classes to 57 characters, field names only being allowed 63 characters, and string and byte arrays cannot be greater than 16 megabytes[8]. Another drawback of Realm DB is that it does not support auto-incrementing IDs and composite keys[8]. Although Realm DB does have a few drawbacks, overall I feel like they are fairly insignificant with respect to what Realm DB has to offer as a whole product. Overall I feel like Realm DB would be a great fit for our project especially since Realm DB has drastically higher performance for querying data, than SQLite, which is the database management system which we are using for our project. Even though Realm DB would be a great asset for our project, ultimately we cannot use it because the ODK framework does not offer support for it.

## REFERENCES

- 1     Manchanda, A. (2019). Where Do Cross-Platform App Frameworks Stand in 2019?. [online] Insights - Web and Mobile Development Services and Solutions. Available at: <https://www.netsolutions.com/insights/cross-platform-app-frameworks-in-2019/> [Accessed 3 Nov. 2019].
- 2     AltexSoft. (2019). The Good and The Bad of Xamarin Mobile Development. [online] Available at: <https://www.altexsoft.com/blog/the-good-and-bad-of-xamarin-vs-native/> [Accessed 8 Nov. 2019]. [Accessed 3 Nov. 2019].
- 3     DB-Engines. (2019). DB-Engines Ranking. [online] Available at: <https://db-engines.com/en/ranking> [Accessed 8 Nov. 2019].
- 4     Arsenault, C. (2019). The Pros and Cons of 8 Popular Databases - KeyCDN. [online] KeyCDN. Available at: <https://www.keycdn.com/blog/popular-databases> [Accessed 8 Nov. 2019].
- 5     It Consultants In Bay Area. (2019). Some Pros Cons of Selecting Oracle as your Database Platform — Diamond Technology. [online] Available at: <http://www.itconsultantsinbayarea.com/some-pros-cons-of-selecting-oracle-as-your-database-platform/> [Accessed 8 Nov. 2019].
- 6     Parihar, A. (2019). Five of the Most Popular Databases for Mobile Apps. [online] Trigent. Available at: <https://blog.trigent.com/five-of-the-most-popular-databases-for-mobile-apps> [Accessed 9 Nov. 2019].
- 7     Ratner, D. (2019). MongoDB to Acquire Realm - The Future is Bright. [online] Realm. Available at: <https://realm.io/blog/mongodb-to-acquire-realm-the-future-is-bright/> [Accessed 8 Nov. 2019].
- 8     Gupta, L. (2019). How Realm is Better Compared To SQLite - DZone Database. [online] Database Zone. Available at: <https://dzone.com/articles/how-realm-is-better-as-compared-to-sqlite> [Accessed 8 Nov. 2019].