

Evaluation and Identification of Android Networking Libraries

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Abstract - Every single person in our population has mobile and most of the work doing through mobile phone. Now expansion of internet, mobile technology becomes more popular. For this android development has really charm for us. This research is study of different networking libraries used in mobile for network communication. Therefore, there are lots of open source network libraries that app developers use on a daily basis for development. In Old days, networking in android was a frightening. At this time the problem is find out which solution fits for better android app projects development necessities. Thus, android developers face the tendentiousness of selecting an appropriate network library for their specific mobile application. To reduce the challenge, this paper proposes an empirical method for benchmarking, which includes a comprehensive study of selected libraries and a selection of representative metrics. This paper has four android networking libraries Http Client, Volley, Retrofit and Fast Android Networking are selected for study analysis. This research examines these libraries and find which library is suitable for developers as their necessities so that they provide better experience to mobile app users.

Keywords- Network Library, REST API, Client-Server Communication, Services, APK.

I. INTRODUCTION

The world is run on internet and mobile apps is best use case of the internet. Now networking is a very important topic in android app development which never ignored. In which such functions like loading images, requesting data from an API server or downloading media files or getting a single byte from your server through internet, these can be done through networking.

In open source world i.e. over internet there are a lot of good libraries out there and we don't need to reinvented, but given libraries how complex and omnipresent networking is on Android, every Android developers has one common question, face when they start researching about networking libraries is which libraries should I use? which supports mostly cover all features?

what's the difference between them? what do I actually need? On one side developers have a bunch of openly small libraries available on internet, they only focused on solving one specific problem that you can stack on top of each other and needs combine to achieve your need of project. Other side you have some libraries which look more like handle a lot of different scenarios related and Swiss knife and can with networking root of so many great networking libraries is that the offered options in the Android framework are not great and they were a mess to

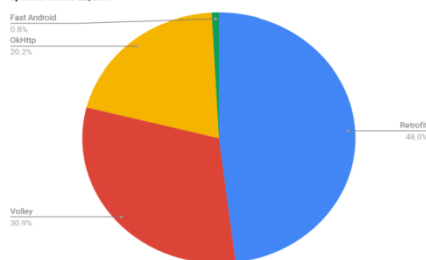
deal with in the old days. Developers had to write a lot of code each time when you request an API data, and probably you'll be doing a sub-optimal job. This was the objective scenario to solve above discussed problem so a lot of libraries started to appear and evolve.

II. LIBRARIES FOR NETWORK COMMUNICATION

Network libraries main work is that it allow communication between Android mobile apps to other devices, online services and to calling of asynchronous network requests. For this research paper we research top 500 play store available apps. This works on networking for server communication. We get results which last updated on June 22, 2019.

The result was found that Retrofit most of the application uses then other networking libraries. Current time we seeing continuous advancement changes in the mobile technology is in the market, the users of these latest libraries are also increasing. Currently available most popular android networking libraries are with no doubt Fast Android Networking Library, Retrofit, Volley and Ok Http. Recently, Fast Android Networking Library is reaching more popularity.

Fig. 1 Android Apps percentage available on playstore uses Different Networking Libraries last updated on June 22, 2019



These are the list of all networking libraries in android. Retrofit, Volley, Ok Http, Fast Android Networking, Jus, Net Request, Iris, Robo Spice, Simple Http, Thunder, android-http-client, Http Buster, Perfecto, Web Service Connect, Smash etc.

Retrofit [12] is a clean, simple, and light library for Android by Square, Inc. Retrofit is a REST client for Android, through which you can use its easy interfaces which can work on any android app. Retrofit can perform asynchronous and synchronous requests as well. It has a feature with that is automatic JSON parsing without any effort. This feature alone makes it powerful enough from other networking libraries. So it to make a competitor for others. Although it has more useful features.

- As compared to other libraries its REST API code is brief. I also provides excellent API documentation.
 - Retrofit very easy to integrate into the projects.
 - Headers are easy to add into request types.
 - Customization is easy, you can manually convert request data into Gson, Jackson, Moshi, Protobuf, XML etc. We can also customize it to add different interceptors and cache.
 - It provides an easy way to file uploading.
- Volley [13] is a networking library which is now adopted by Google. Volley uses by the developers because of its is fast responsive and easy to implement into project. It has some features like request scheduling, request prioritization, etc that can be automatically or manually. Request cancellation is also a main feature present in Volley as well. Volley can also be used to download images. API response data can be cached. It can be stored data in disks as well as in memory. It provide the functionality of image downloading.
- Main thread or UI thread not blocking while request going or if it takes long time to responded.
 - Performance. This work won't evaluate this claim, but they've clearly taken some care to be judicious in their memory usage patterns.
 - Volley work great in compressed image with hi quality or resolution.
 - Works on Http.
 - Activity lifecycle work well with volley

- In volley caching mechanism is a very great feature. This is one of the best features of volley.

Ok Http [14] is used from long time ago. In stating Ok Http is the way of making network communication application. By doing HTTP call you can save your time and bandwidth. Ok Http uses HTTP client that is efficient in request calls to the same host. It can distinguish between same IP address, Connection pooling reduces our request latency with using Http/2. It reduces the download size via transparent GZIP. Repeat request are less or overrides. OkHttp hang on when the network is troublesome: it will internally handled common connection problems. Some time service request call has multiple IP addresses then OkHttp have responsibility to attend the alternate addresses if the first connect fails. Ok Http can be implemented in fall back for broad connectivity.

- Gzipping for reducing download file size
- Connection pooling from IP address
- Recovers network problems
- Redirects of API URL
- Retries works with override request
- Synchronous and asynchronous call feature

Fast Android Networking Library [15] also is a latest popular library. It uses for doing any type of network request calls in Android applications. This feature made it on top of OkHttp Networking libraries. This library handles every type of request after retrofit. So by using it we don't have to do any type of efforts, only make request and wait for its response from server.

- downloading any type of file
 - upload any type of file
 - Cancelling Request supports
 - setting priority to any request
- Jus [18] is a flexible and easy HTTP/REST client library for Java and Android.

- It is like Volley but much easier
- It is like Retrofit but infinitely more flexible
- Just is inspired by the flexibility, modularity and transparency of Google's Volley Library and the extreme simplicity of declarative API mapping of Retrofit.
- Like google volleys the main thing where request calls are executed is the Request Queue.

Robo Spice[19] is a modular mobile android library. That makes writing asynchronous network requests easy. Some features like :

- It executes network requests asynchronously in background
- It supports REST API call like retrofit, volley etc.
- It is strongly typed
- In request execution it provides multi-threading
- Robust exception handling
- It designed to respect android philosophy, stable and efficient
- Provide request cancellation, prioritization, and request aggregation

- It notifies our activities when its result of request comes with using lifecycle.
- Difference over other Networking Library :
- We can customize Http Client the network request using prioritizing and time out also
- Using OkHttp and Okio, it is faster than other libraries.
- Single library for each type of request with small size.
- By knowing bandwidth and quality of connection we can change our code and as well change timeout time of request.
- We can make interface of this network request so that we can reflect out main thread and other background thread.
- All request done like GET, PUT, POST, DELETE.
- Immediate Request possible.
- Uses catch for saving response data so that if request fails then it provide data from catch.
- Request cancelling functionality.
- It avoid cancelling of request if it crosses the minimum threshold value.
- Easy interface which access any type of request.

III. RELATED STUDY

This section provides the contributions and study around the different network libraries developed for network operations in different environments. Generally in modern application development data lies in web Server so for retrieve the data communication with web services are necessary. Web service [11] is the way of communication that allows two parties to exchange the data. Anand, Varun, et al , in his paper[12] they did analysis through a Java optimization framework called Soot [7], and analyzed various types of networking libraries used by different 1300 free apps.

From that 3.52% applications use HTTP Client library exclusively, 19.6% apps use retrofit and 22.03% apps use volley. To verify analyze http usage, they analyze the http library used by third party libraries like Volley, Retrofit, freewheel, convivial, com Score, crash analytics and adobe pass. There are many popular mobile applications take benefit of third party networking libraries to manage multiple request, prioritization, catching, bug reporting and others.

Android networking libraries[8][9] HTTP Url Connection with Async Task, Volley, Retrofit[3] and Fast Android networking which supports request sending in background and they support post requests and multipart file uploads. Table 1 – list out the different features supported by these libraries for network communications which shows that Volley, third-party libraries have advantages like catching, prioritization, multiple requests, Image loading and many more[4][5][6]. Features / Functionalities HTTP Url Connection with AsyncTask Volley Retrofit Post

Request Multipart Uploads Multiple Request Types JSON Request etc.

Table 1 Different features supports by Android networking libraries

Features	Http Client	Volley	Retrofit	Fast Android Networking
POST	Yes	Yes	Yes	Yes
Multipart	Yes	Yes	Yes	Yes
Different Request Types	No	Yes	Yes	Yes
JSON Request	No	Yes	Yes	Yes
Priorities	No	Yes	No	Yes
Multiple requests	No	Yes	No	Yes
Caching	No	Yes	No	No
Image Loading	No	Yes	No	Yes

Retry Mechanism	No	Yes	Manual	No
Manual Request Cancellation	No	Yes	Yes	Yes

IV. CHALLENGES IN NETWORK LIBRARIES

There are a number of networking libraries in open internet which I have implemented and evaluated earlier but none of them provide the best solution in all required aspects. Generally for the developers need of network communication for data exchanges in which information passing, image download-upload, media files like audio, video, and other type of files. So a developer has to select a challenge to find such type of library which can provide all type of support which discussed. The comparative performances of these libraries are features, request type supported. Therefore there is a strong need to find out library which fulfil all the aspects of the projects needs. Among several networking libraries, problem occurs in

presented libraries such as Http Client, Volley, Retrofit and the Fast Android Networking Library are described. Therefore in this section, in this study discuss shortcoming of these selected libraries.

This section provides a brief description of challenges arise in response data parsing and use other library for parsing data as well, during the dissertation work.

1. Issues in Library Selection

For the android developers has many option for adopting the library from open source platform for working there functionality. So while choosing network library mobile app developers has not much idea about all libraries which has functionalities for their projects need. Now Developers use different network library for their basic works like image downloading uses Glide, Picasso etc, by adding this third library its direct impact on the APK side of the android application. So issue is that developers use multiple libraries in mobile app, although it increases the APK size.

2. Issues in Response Data Parsing

Response of the network service or other third party library is typical to parse in old times. Now there are different available network library which can easily parse data. For these functionality developers also need to add other dependency library, and also its impact on APK size.

3. Issues in Response Time

There are many android network libraries available on open source environment where we can pick and add into our project. But issue is that which library provides fast result in less time so that user has not to wait long time for the result data. If response takes too much time then users time are wasted in waiting. So this is the major issue that many of the application available on play store which uses old libraries which has slow response time and less featured.

4. OkHttp Client is a pure HTTP client library. It is responsible for any type of network operation, caching and response handling many more. If your service URL contains multiple IP network addresses then OkHttp will attempt alternate network addresses if the first connect fails. OkHttp can be configured to broad connectivity medium. OkHttp Client supports both asynchronous calls with callbacks and synchronous blocking calls. Recently from Marshm allow(Android M, SDK version 23) Http Client features removed. So this news made good opportunities for other networking lending libraries. This library has some unavoidable shortcomings. Lack of this algorithm is listed below:

- It gives slow response as compare to other networking libraries.
- Its Interface tricky as other library gives us.
- It not easy integrate for image, audio, video or files upload to server.

So after knowing some lack of Http Client we have to find a library which provides us easy and who fulfil developers project requirements.

Volley library also work on Http. It internally uses image loader and REST helper. It handles request calling, threading, synchronization all queued requests, loading status, caching for fast response and some more stuff. Volley always ready to deal with JSON response, Json Array request response, image request response, raw text response and allow some customization. Volley designed with help of RPC connection operations that populate the UI. Volley performs on network layer. But volley has some shortcomings which are directly effect on the response of the service request. Some issues which are as follows

- Multipart Requests, lots of code write to perform this request.
- Media files downloading not easily.
- Files upload to server are hard to implement.
- Response data parsing in specific type of object.

Some request type supported by different network libraries are present or not is in below table.

Table 2 different network libraries are present or not

Volley	Retrofit	Fast Android Networking
Json Object Request	String	Object
Json Array Request	Object	Object
String Request	Collection	Collection
Image Request	Boolean	Boolean

-	Integer	Integer
-	Date	Date
-	-	Image
-	-	File

V. CONCLUSION

This research paper presented different network libraries for network communication in android. Today's time mobile app almost uses in all areas for doing their work. So this is necessary to find such a libraries which provide better server communication in mobile app. This study is reduce the efforts of android developers for making network communication in mobile app. This paper has information about different libraries and their different features, challenges, merits and demerits etc. So that mobile app developers by using good libraries they provide better user experience to user. In future work can add more network libraries, which provide much better response time to user. So that it will help android app developers to overcome their efforts to identify networking library for their application.

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