Towards Benchmarking Android Networking Libraries

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Abstract – **This paper deal with fast network communication in android system. Although both industry and academia are using Android Networking Libraries, the performance of Android networking libraries has not been compared in-depth. Thus, users face the daunting challenge of selecting an appropriate library for their specific application. To alleviate this challenge, this paper proposes an empirical method for benchmarking, which includes a comprehensive study and a selection of representative metrics. In this process, focus on evaluating basic performance and datatype supports by different libraries. In this paper three Android networking libraries HTTPUrlConnection with AsyncTask, Volley and Retrofit are selected for experimental analysis.**

Keywords: Android, Networking Libraries, Volley, Retrofit, HTTPUrlConnection, Network Communication.

1. INTRODUCTION

Generally, Modern mobile application development have multiple network interfaces capable of having concurrent data connections. Generally in modern application development data lies in webserver [10] so for retrieve this content communication with webservices are required. Webservice [11] is the method of communication that allows two software system to exchange the data.

Anand, Varun, et al , in this paper[12] they did analysis through a Java optimization framework called Soot [7], and analysed type of networking libraries used by different 1300 free apps. From that 3.52% applications use HTTPUrlConnection library exclusively, 19.6% apps use retrofit and 22.03% apps use volley. To verify analyse http usage, they analyse the http library used by third party libraries like Volley, Retrofit, freewheel, conviva, comScore, crashlytics 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. For example Retrofit aims to make it easier to consume RESTful web services whereas the goal of Volley is to handle all your networking needs for Android specifically. Volley library helps to make networking for Android apps faster and easier. It is an open-source library written by Google and used in Android Open Source Platform. Volley library operates with both apache and HTTPUrlConnection libraries.

To communicate with webservices in android HTTPUrlConnection [12] with AsyncTask [1], volley [1] and retrofit [2] are the great networking mechanism for android apps. All of three has major difference in requesting, response time, response type, and network usage. First thing in android we can't send request in main thread [1], if we try to send request in main thread then it will raise exception, so for sending network request we must have to send request in background.

2. FUNCTIONALITIES AND BENCHMARKING FOR ANDROID NETWORKING LIBRARIES

In this paper we discussed android networking libraries[8][9] HTTPUrlConnection with AsyncTask, Volley and retrofit [3]which supports request sending in background and they supports post requests and multipart file uploads. Table 1 – list out the different features supports 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	HTTPUrl-Connection with AsyncTask	Volley	Retrofit
Post Request	✓	✓	✓
Multipart Uploads	✓	✓	✓
Multiple Request Types		✓	✓
JSON Request		✓	✓
Prioritization		✓	

multiple requests		✓	
Caching		✓	
Image Loading		✓	
Retry Mechanism		✓	Manual
Request Cancellation		✓	✓

Table -1: Different features supports by Android networking libraries

In Table 2 – list out the HTTP requests and read the responses Datatypes supports in volley and retrofit respectively. To develop mobile application for specific types of request it helpful to select appropriate third party library like Volley/Retrofit.

Volley	Retrofit
String Request	String
JsonObjectRequest	Object
JsonArrayRequest	Collections
ImageRequest	Date
-	Integer
-	Boolean

Table -2: HTTP requests and read the responses in volley and retrofit libraries

2.1 HTTPUrl Connection using AsyncTask: HTTPUrl Connection using AsyncTask is a built-in way to retrieve data from web services, but currently it's preferable to use third party libraries to get fast result. This is not allowed parallel requests, cancel request[13]. Once we make request no orientation support means when we go to horizontal from vertical mode it will again request to server and fetch data, by default AsyncTask run in serialized mode, it means one AsyncTask can run at a time, so it is not good approach to retrieve data from web services.

2.2 Volley: Volley is an open source library written by google, it makes networking easier for android apps [1]. Volley has some great features which are listed as follow:

Synchronous/ Asynchronous Request: It offers synchronous as well as asynchronous requests.
Prioritization: This third party library supports prioritization means we can give priority to our requests like if we need to load content with images then we should give low priority to images and high priority to content.
Making multiple requests: It supports to make multiple request at same time.
Request Cancellation: It allow to cancel request at any time, we can cancel single request or we can set block of request to cancel.
Caching: It supports transparent disk and memory response caching means when we request for data at that time volley first check in cache memory if there is already data then it will retrieve from cache, otherwise it will make request to get data.
Image Request: volley supports image request means this type of request's response will automatically converted to decoded bitmap and it has special class known as NetworkImageView that is used to load images automatically.

2.3 Retry Mechanism: volley supports retry on request timeout, we can set retry policy with volley like timeout, number of retries and back off multiplier.
Retrofit: Retrofit is another open source third party library that is written by Square[2]. Retrofit performs asynchronous and synchronous with automatic JSON parsing. It is simple we need to create interface and Java class related to API[2]. Retrofit doesn't come with image loading from the network by itself. Retrofit doesn't support request prioritization, cancellation and retrying. Retrofit supports dynamic URL since version2. Retrofit also has some great features like Annotation. To work with retrofit need to use the annotation. If we want to send post request we need to use @POST annotation.

3. EXPERIMENTAL RESULTS

In this section we create a benchmarking set[14], by consuming Indian railway API(with required credentials like API key and so on) using a selected set of Android libraries. Table-1 summarizes our selected libraries. The complete results are represents in figure-1. We present here the result of the request respond time obtained for send request through selected libraries, in figure1. HTTPUrlConnection with AsyncTask always performs worse than Volley and Retrofit, mainly because using HTTPUrlConnection with AsyncTask we don't have to make HTTP calls in UI thread. We found that volley and

retrofit gives fast response compare to HTTPUrlConnection with AsyncTask. For single request Retrofit performs well than Volley. Though Volley supports multiple requests and catching due to that whenever we send multiple requests Volley performs good compare to Retrofit.
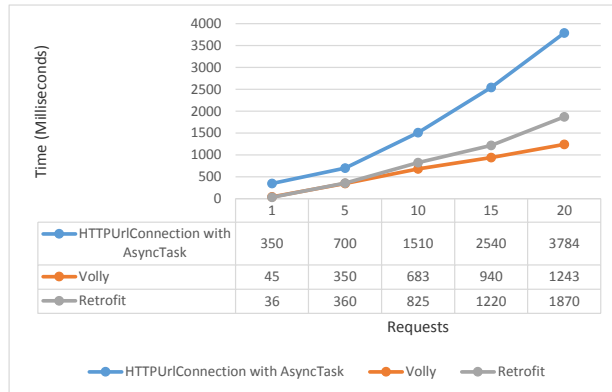

Figure 1: Respond time of requests send through various Android Networking Libraries.

CONCLUSION:

For Fast network communication in android system, both industry and academia, the performance of three selected Android networking libraries has compared in-depth.sThe method defines an empirical performance evaluation process and features of libraries, request and read respond data; thus, it act as a benchmarking set despite not covering all the methodological and practical aspects of a true benchmark. Using this method, we have experiment detailed, real work performance evaluation of three popular Android Networking Libraries. The results published in this paper, represents comparatively the highlights and weaknesses of the tested libraries.

REFERENCES:

[1] https://developer.android.com/

[2] http://square.github.io/retrofit/

[3] http://vickychijwani.me/retrofit-vs-volley/

[4] http://instructure.github.io/blog/2013/12/09/volley-vs-retrofit/

[5] https://www.quora.com/What-is-the-difference-between-retrofit-and-volley-in-Android

[6] http://www.truiton.com/2015/04/android-volley-vs-retrofit-better-approach/

[7] VALLEE´ -RAI, R., CO, P., GAGNON, E., HENDREN, L., LAM, P., AND SUNDARESAN, V. Soot - a Java bytecode Optimization Framework. In Proceedings of the 1999 Conference of the Centre for Advanced Studies on Collaborative Research (1999), CASCON '99

[8] https://medium.com/@ali.muzaffar/is-retrofit-faster-than-volley-the-answer-may-surprise-you-4379bc589d7c

[9] Kadam, A. J., et al. "Mobile Web Based Android Application for College Management Sysytem."

[10] Ganesh, Vishwakarma R. "Android College Management System." International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5 (2016).

[11] Alonso, Gustavo, et al. "Web services." Web Services. Springer Berlin Heidelberg, 2004. 123-149.

[12] Anand, Varun, et al. "MIC: Enabling Efficient Concurrent Use of Multiple Network Interfaces on Mobile Systems."

[13] http://stackoverflow.com/questions/19323573/android-http-request-on-main-thread-error

[14] Guo, Yong, et al. "Towards benchmarking graph-processing platforms." Poster at Supercomputing (2013).