

A Study of 4G Network Performance in Thailand Referring to Download Speed

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Abstract—One of the key performance indexes for mobile communication networks is the download speed of mobile Internet. Higher speed means better performance. In addition, different tools or methodologies to measure this key performance might show different results. This paper presents the comparison of 4G average download speed in Thailand, from the Opensignal application provided by the analytics company, and MIQ, the local mobile Internet quality measurement tool. Opensignal reported that Thailand has been ranked as the 77th place with an average speed of 5.7 Mbps, after analyzing the Q1/2019 data. Our results demonstrated by using the Q1/2019 data retrieved from MIQ server, it was found that the result from MIQ had an average download speed of 10.7 Mbps which is inconsistent with Opensignal. However, it is still lower than the global average download speed of 17.6 Mbps.

Keywords-4G; average download speed; global download speed; Opensignal

I. INTRODUCTION

Telecommunications industry is very important as it is widely used as the infrastructure for many other industries, particularly after the emergence of the modern mobile communications system (e.g., 3G and 4G) and the Internet. According to the timeline of the International Telecommunications Union (ITU), 5G or IMT-2020, which stands for the International Mobile Telecommunications-2020, is imminent. [1]. It is currently in the trial phase in several countries [2]. Currently, the world is now being dominated by 4G technology, 95 % of the lands worldwide have been covered by 4G signals [3]. Nevertheless, the performances of 4G in any one country would be different when compared to most other countries. Particularly, in term of download speed, South Korea has been reported to be in the first place with an average speed of about 52 Mbps, while Canada, Norway and Netherlands have been ranked from second to the fourth place respectively with speeds of more than 40 Mbps [4].

According to the same report, Thailand has been ranked in the seventy-seventh place with an average download speed of only 5.7 Mbps, which is extremely low, when compared to the speed of first place holder, [4]. Therefore, this study has been conducted to investigate this issue by using other methodology

to check if the result is consistent with the report published by Opensignal.

II. BACKGROUND

A. 4G Communication Network and the Brief History of 4G in Thailand

4G stands for the fourth generation of mobile communications technology, which is actually the International Mobile Telecommunications-Advanced (IMT-Advanced) standard proposed by ITU [5-6]. It also covers two other standards: Long Term Evolution (LTE) and Worldwide Interoperability for Microwave Access (WiMax). 4G technology supports mobility and all-Internet Protocol (allIP) based, packet-switched communications, including multimedia applications/services [7]. Therefore, beyond 3G, it supports high mobility on vehicles and supports additional services such as video streaming and video calling via mobile applications. As presented in [6], 4G has several interesting key features, for example, enhanced peak data rates with speeds of 100 Mbps for high mobility and 1 Gbps for low mobility, flexibility to support a wide range of services and applications with cost effectiveness, compatibility of services within 3G, capability of interworking with other radio access systems, high-quality mobile services, and worldwide roaming capability. In Thailand, after 3G was being used widely, 4G was operated as a pilot phase in some areas of Bangkok in 2012-2013 [8]. Then, it was commercially launched around the end of 2015 after the frequency spectrum auction [7][9]. It was delayed by 6-7 years from the first official 4G deployment in Finland in late 2009 [10].

B. Factors Affecting the Speed of Internet Connection

There are several factors that affect the speed of Mobile Internet connection [11]. For example, network technology and terminal device: the connection speed in mobile communication networks usually depends on the network technologies available in the area (e.g., 3G and 4G) and the features of the user's terminal device (e.g., CPU of the devices). Besides, the number of users who share the connection may

also affect the speed because the mobile network capacity is shared between all the users in the area using the same network. That means if there are many users, the connection speed would slow down. Furthermore, in case the user changes locations, the speed may change because the signal strength would vary depending on the coverage area.

C. Opensignal Application and Report

Opensignal, the mobile analytics company, created an application that has been installed in more than 10 million Android devices (there is no information about iOS devices) [12]. This application can capture real user measurements and developed innovative techniques to implement the system to analyze the data by collecting user data from around the world [4][12]. Of course, those data were measured from the point of view of daily users. On May 2019, Opensignal issued the report called the state of mobile network experience. In this report, it shows that the global average download speed is 17.6 Mbps, between January 2018 to March 2019 from 87 countries around the world. South Korea is in the first place with an average download speed of 52.4 Mbps, whereas Iraq is in the last place with a speed of only 1.6 Mbps [4]. As for Thailand, Opensignal reported that it is the 77th place with an average download speed of 5.7 Mbps, which implied that the data have been gathered from about 5.9 million devices and 896,000,000 measurements [4][13]. This speed rate is sharply lower than the other 76 countries in the report, including several countries in the same region; such as, Singapore, Vietnam, Malaysia, Philippines and Indonesia [4].

D. MIQ: the Mobile Internet Quality Measurement Tool

Similar to Opensignal and nPerf, MIQ is the Mobile Internet Quality measurement tool which has been funded by the Broadcasting and Telecommunications Research and Development Fund for the Public Interest (BTFR), which is under the umbrella of the National Broadcasting and Telecommunications Commission (NBTC) of Thailand. MIQ application has been developed using the API provided by Ookla, which also provides a very popular speed test application [14][15] (More than 100 million downloads). MIQ application has been distributed to Thai users who use mobile

devices with iOS and Android operating systems and are interested in mobile Internet quality evaluation with more than 50,000 downloads (The most downloaded Internet quality measurement tool from NBTC.). The main feature of MIQ that makes it different from other applications is presenting the objective mean opinion score (MOS) score for mobile Internet quality, while other basic features (e.g., download speed, upload speed, delay and location) are certainly included.

III. METHODOLOGY AND RESULT

MIQ system was designed and developed according to Fig. 1, while the sample of MIQ speed test screen showed in Fig. 2. MIQ was designed for collecting data in 3 aspects: Speed Test, MOS and Video Quality. Then, the test result has been calculated before presenting as in Fig. 3. However, only the speed test issue is focused and discussed hereafter.

In order to investigate the reported low 4G download speed tested by OpenSignal in Thailand, and shown in Opensignal's report, the MIQ data (from about 9,300 measurements) between January 1st 2019 to March 31st 2019, (corresponding to the same time period for Opensignal's data gathering), were retrieved from the MIQ main server. These data were gathered from the whole country (see Fig. 4), although majority of them were from Bangkok metropolitan region. However, the data associated with 2G, 3G and WiFi has been discarded, and then the 4G data have been used to calculate for the average download speed. After obtaining the result, it is compared, (apples to apples), to the result from Opensignal, and then presented in Table 1 and Fig. 5.

IV. DISCUSSION

From this study, there are few issues that should be discussed. For the first issue, Opensignal mentioned about gathering the data from almost 5.9 million devices and almost 900 million measurements. We might question the veracity of Opensignal's assertion that their application was downloaded into 5.9 million iOS & Android devices in Thailand, given it seems disproportionately large when compared to its total worldwide download count, (see Table 1) [16].

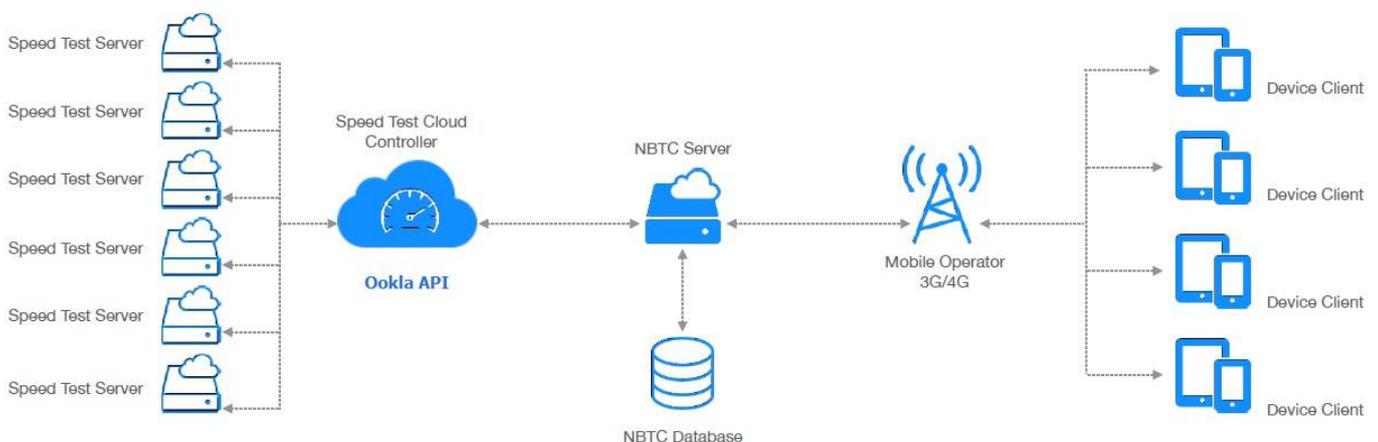


Fig. 1. System Design

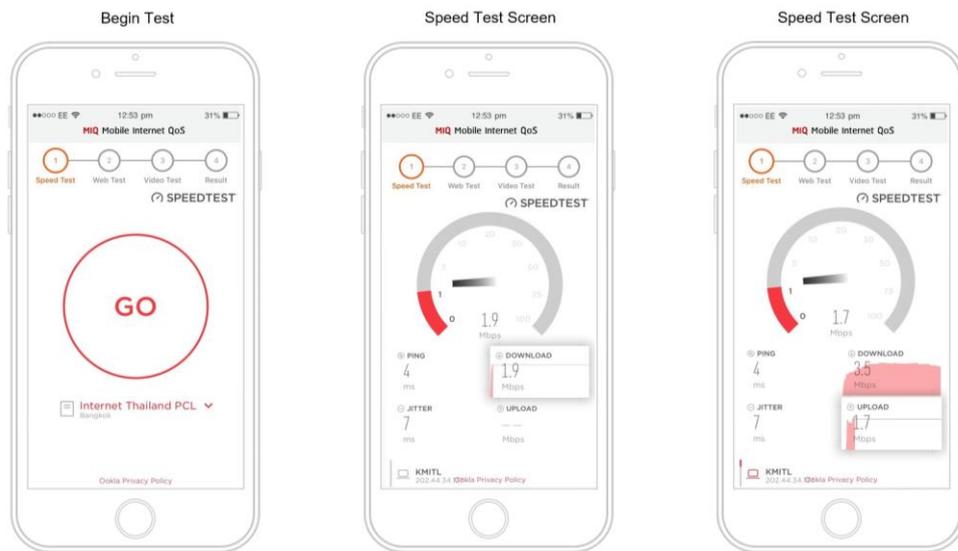


Fig. 2. MIQ Speed Test Screen



Fig. 3. Test Result Screen

Next, for MIQ, the data was gathered from about 3,900 devices and 9,000 measurements only, whereas it has been shown about 10 thousands for the total number of download from Google Play and Play Store worldwide (see Table 1) and this application might be downloaded to the iOS devices from App Store with the same number of maximum downloads, see Table 1. However, it might be acceptable because the data were gathered from the whole country (see Fig. 4) [15].

For the last issue, according to the download speed over 4G mobile network, as mentioned in [4], Thailand has been ranked as the 77th place with the speed of 5.7 Mbps when compared to other 86 countries (it was to be assumed Opensignal's information to be reliable). If the MIQ result in Fig. 5 is to be considered more reliable, Thailand should be ranked at the 62nd place with an average speed of 10.7 Mbps. In either case

mobile network operators in Thailand ought to see the need to greatly improve the quality of network.

V. CONCLUSION AND FUTURE WORK

After investigation by using the local official tool called MIQ, it has been found that the average download speed of the 4G mobile Internet in Thailand measured by MIQ (10.7 Mbps) is inconsistent with the speed measured by Opensignal (5.7 Mbps). Therefore, the difference between Opensignal and MIQ should be investigated in future work. Furthermore, this open issue should be considered and investigated for other countries. For futurework, the download speed data and the data for other key performance indexes of mobile Internet (e.g., average upload speed) within other period should be investigated as well.

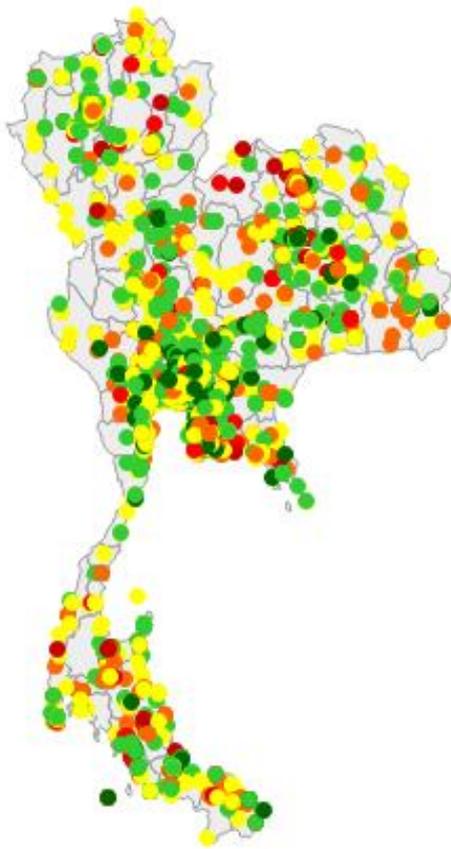


Fig. 4. Users' locations that conducted the test using MIQ, around Thailand in Q1/2019

TABLE I. INFORMATION ABOUT OPENSIGNAL AND MIQ

Application	No. of Devices	No. of Measurements
Opensignal	5,866,404	896,527,121
MIQ	3,868	9,291

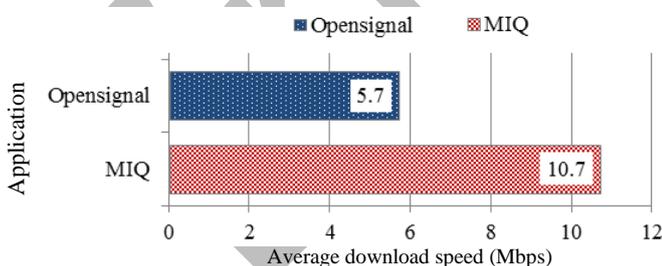


Fig. 5. Comparison between the average download speed from Opensignal and MIQ

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