Analysis of Quality of Service Ranking for Radio Network Optimization in Shah Alam

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Abstract – **Cellular technology is emerging rapidly. Based on the demand of the users, next generation cellular system is being able to provide a variety of applications for user's satisfaction. The Universal Mobile Telecommunication System (UTMS) is a 3rd generation telecommunication system which provides various multimedia applications along with conventional telephony service. The Quality of Service (QoS) is the major concern for real time application such as voice and video telephony. Thus to fulfill the user demand, it is necessary to improve the QoS. The immediate objective of this project is to identify and rank the QoS provided by three mobile network operators; Celcom, Digi and Maxis. The QoS measured focused on an interactive class of service and based on the end-user perspective. The QoS are measure based on three parameter which are accessibility, retainability and connection or time delay. The data were collected using the Nemo Handy-A installed in a HTC Sensation Z710e smartphone. The drive tests were performed in Shah Alam. The results indicated that Maxis has the best QoS for interactive class of service in Shah Alam followed by Celcom and Digi.**

Keywords – Accessibility, retainability, connect time, end-user QoS, drive test

I. INTRODUCTION

Telecommunication industry has experienced rapid growth due to the advancements in the semiconductor technology industry. The demands in this industry increase rapidly to meet the needs of human lifestyle and new technology can be seen being launch which indicate the latest technology in this field. In the mobile communication network, the main objective of radio network optimization is to achieve the optimal network design of the best possible grade of services (GoS) and quality of services (QoS) within budgets and constraints of cell configurations. The Gos and QoS are measured by a succession of technology-specific key performance indicators (KPIs)[1] such as coverage and user rejection percentage. The QoS is very important to the mobile provider to provide the best service to the mobile subscriber. The term QoS is used for different strategies and techniques designed to provide end users with a predefined and predictable level of service from the network and other components associated with the network[2].

The 3G network in Malaysia is based on the Universal Mobile Telecommunication System(UMTS) standard which is created and revised by the 3rd Generation Partnership Project(3GPP). There are four different classes of traffic in UMTS as defined by 3GPP and therefore the QoS of UMTS based 3G network must also be in accordance with these four classes of traffic.

This study will focus on the interactive class of QoS. Interactive traffic is one of the classical data communication modes that at an overall level are characterized by the request response pattern of the end-user. At the message destination there is an entity expecting

the message (response) within a certain time. Round trip delay time is therefore one of the key attributes. Another characteristic is that the content of the packets shall be transparently transferred. Different data application services are examined such as web browsing and e-mail application services. For example web browsing; this category refers to retrieving and viewing the HTML component of a Web page and other components such as images or audio/video clips. From the user point of view, the main performance factor is how fast a page appears after it has been requested. A value of 2-4 seconds per page is proposed, however improvement on these figures to a target figure of 0.5 seconds would be desirable[7].

However, this study will not focus on the technical parameters of QoS stated in, instead the QoS assessment view point is from the end-user based on drive test measurement. The parameters that were measured are accessibility, retainability and connection time or delay. The data for the parameter stated were collected using drive test and ranked the best network provider based on the parameter.

II. METHODLOGY

A. User Equipment

The type of hardware used in this study is HTC Sensation Z710e smartphone. The smartphone can only use one Subscriber Identity Module (SIM) card at a time; therefore the SIM card had to change into the respective operator's card each time data collection for a particular network took place.

The smartphone is installed with software called The Nemo Handy-A. It offers smart and discreet solutions for thorough and advanced measurements on the wireless air interface and mobile application quality of service. This version only supports the measurement of Global System for Mobile Communication (GSM) and UMTS system.

From this study, the term User Equipment (UE) carries the meaning of a hardware which is the HTC Sensation Z710e smartphone that installed with the Nemo Handy-A version 1.30.075.

B. Data collection

Three mobile network operators were chosen in this study. The three operators is Celcom Axiata Berhad (Celcom), Digi telecommunication Sdn. Bhd.(Digi), Maxis Communication Berhad (Maxis). Data were collected using drive test in Shah Alam. The drive test that was performed is categorized as benchmarking and therefore the conditions during drive testing needs to be constant.

The UE in this study can only connect to one mobile network at one time, thus the data collection were done in a period of five day working hour. In addition, constant weather when the data were collected is fixed as follows: clear day without rain.

Drive test started from 9.00am until 1.00pm each day. The sets of data were taken each day (Monday – Friday) and all the measurement was made using the HTTP data transfer feature. The data for each session is logged using the software's logging feature and a screenshot of the HTTP statistics screen is taken after each session. All the data from each session were then tabulated and average measurement is calculated for each day.

The route taken to collect the data is shown in Figure 1. The route was also kept constants for the whole duration of data collection.

Figure 1: The drive test route.

C. Drive test setup

The drive test setup for this study consists of the UE that is connected to the UMTS network which is connected to the internet.

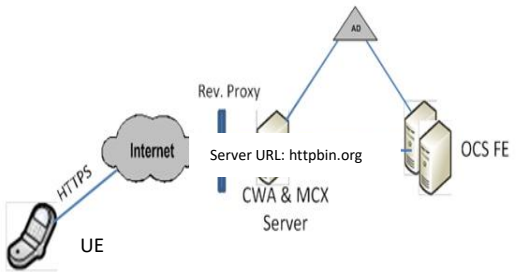

Figure 2: The drive test setup

III. RESULTS AND DISCUSSCION

Table 1: Average measurement of data for Monday

Network provider	Celcom	Digi	Maxis
Accessibility	10.3333	10.1667	11.2500
Retainability	5.3333	5.3333	5.6667
Connection time(s)	2.6875	4.7458	1.7458

Table 2: Average measurement of data for Tuesday

Network provider	Celcom	Digi	Maxis
Accessibility	10.3333	10.3333	10.8333
Retainability	5.3333	5.3333	5.6667
Connection time(s)	2.7792	4.6833	1.8125

Table 3: Average measurement of data for Wednesday

Network provider	Celcom	Digi	Maxis
Accessibility	10.3333	10.5000	10.4167
Retainability	5.2917	5.1667	5.3333
Connection time(s)	2.7583	4.7792	1.7625

Table 4: Average measurement of data for Thursday

Network provider	Celcom	Digi	Maxis
Accessibility	10.3333	10.1667	10.8333
Retainability	5.5000	5.1667	6.7917
Connection time(s)	2.2658	4.4567	1.6567

Table 5: Average measurement of data for Friday

Network provider	Celcom	Digi	Maxis
Accessibility	10.3333	10.1667	12.7917
Retainability	5.5000	5.1667	6.0500
Connection time(s)	2.2958	4.5000	1.7105

Table 6: Average measurement of data to rank by day

Network provider	Maxis	Celcom	Digi
Accessibility	11.2250	10.3333	10.2667
Retainability	6.7917	5.3917	5.233
Connection time(s)	1.5750	2.5573	4.6330

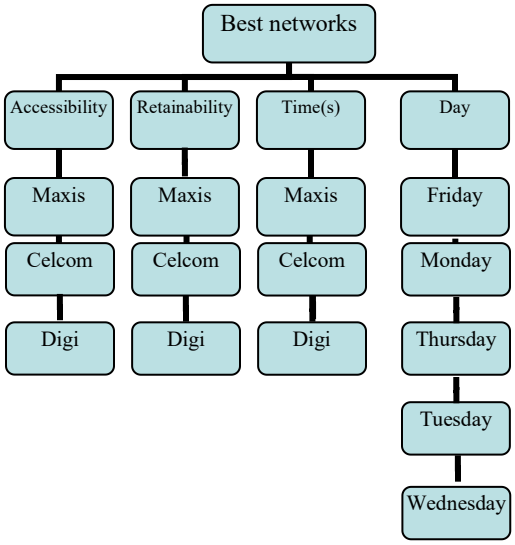

Figure 2: The hierarchy for this research

From the table, the raw data were collected from drive test. Measurement set was taken from 9.00am until 1.00pm each day. A pattern can be seen from the set of data in table by observing the data set for five measurements. It can be seen that for each network provider, there is a large variance in the data.

Based on the data, Maxis has the highest of accessibility and retainability compared to the other two networks, therefore Maxis has the stable connection in the sense that it is easy to connect to the network and maintain to be in the network until data transfer is completed. Whereas, the lowest accessibility is found in Digi provider which means Digi subscriber has the lowest chance of successful connection and easy to disconnect.

Concerning the influence of connection time (seconds), Maxis has the fastest connection data compared to Celcom and Digi. It shows that Maxis has a good coverage and good received signal strength in that particular area.

According to the data tabulated, it can be concluded that Maxis 3G network is the best provider in terms of

interactive service QoS in Shah Alam followed by Celcom and Digi.

Celcom and Digi can improve the receive signal strength by provide cell coverage through a network of strategically placed cellular tower. The ideas, whenever you are within this network, your mobile device will automatically connect with the closest tower, and as you move, will continue hopping to the next closest tower. Other than the tuning process, mobile provider should add another antenna or repeater to increase the coverage in that particular area. Besides antenna locations other possibilities to reduce interference between mobile providers are the proper selection of the antenna direction and the correct tilting of the antenna. Antennas with too wide coverage will cause too much interference to adjacent sectors.

IV. CONCLUSION

From the experimental results, it can be concluded that the QoS value served as the important measurement to determine the performance of the radio network. The objective of this study is to provide information regarding the QoS of the interactive service of the three networks provider from the end user perspective. The data obtain from the drive test clearly show the QoS of the three networks provider.

As a conclusion, it can be said that Maxis has a good network provider compared to other network. Improvement for future services can be done by introduced 4G or long term evolution (LTE) to subscribers that can reach and send data easily.

Future recommendation works that can be done is to rank the QoS of the three mobile network operator in other classes of service, which is conversational, streaming and background. Other than that, study to find out the QoS of another operator in Malaysia which is U Mobile and beneficial study that can be conducted is a novel business model based on user demand for mobile network Qos in a particular area.

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