Network Quality Comparison 4g LTE X And Y in Campus UMSU

by Faisal Irsan

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Network Quality Comparison 4g LTE X And Y in Campus UMSU

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Abstract. Long Term Evolution (LTE) the fourth generation (4G) cellular network technology. This LTE speed in data transfer speed reaching 100 Mbps on the side downlink and 50 Mbps on the uplink side. Growth in the number of service users telecommunication in Medan City causes a decrease in network quality, especially 4G LTE technology. By doing a driving test, the area can be found where a system's signal strength aims to increase the signal quality. Benchmark (comparison) of operator service quality 4G LTE is done by measuring, comparing, and analyzing network quality (performance) of two 4G LTE operators around Muhammadiyah University of North Sumatra. Total operator throughput value X is only $0 > 3$ Mbps while the Y operator is $0 > 30$ Mbps. The low throughput value is caused by high user traffic during the day. The incidence of low throughput on the Muhammadiyah University of North Sumatra campus coincides with active learning with many students using data services.

1. Introduction

Long Term Evolution (LTE) is a fourth-generation (4G) cellular network technology standardized by 3GPP (Third Generation Partnership Project). LTE is a continuation of 3G and 3.5G technology from previous technological developments, namely the Universal Mobile Telecommunication System (UMTS) and High-Speed Downlink Packet Access (HSPA). At UMTS, the maximum data transfer rate is 2 Mbps. At HSPA, the data transfer rate reaches 14.4 Mbps on the downlink and 5.6. Mbps on the uplink side, while LTE provides data transfer speeds of up to 100 Mbps on the downlink side and 50 Mbps on the uplink side. Benchmarking 4G LTE operators' service quality is done by measuring, comparing, and analyzing the network quality (performance) of two 4G LTE operators (XL Axiata and Telkomsel) around the Muhammadiyah University of North Sumatra campus.

The service quality benchmark for this data is obtained from the results of the Engineering Test Drive Irefers to the KPI (Key Performance Indicator), namely Serving PCI, RSRP (dBm), SINR (dB), Throughput Downlink, and Uplink (Mbps). From the benchmark results obtained, it can be seen which operator service quality (network performance) has the best signal quality for the Medan area, especially the area around the Muhammadiyah University of North Sumatra campus. Besides, it can also be seen that network performance problems are felt directly from the customer side. [1]

The background revealed several problems, including how the 4G LTE Drive Test Engineering process uses the Genex Probe by Huawei program to find out actual data in the field and compare the three 4G LTE operators. KPI measures 4 G LTE performance. The comparative analysis of

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the two 4G LTE operators' service quality is based on the Drive Test Engineering results. You can find out the comparison of the 4G LTE network's rate from 2 different operators. 4G LTE telecommunication technology has become a standard in cellular service in Indonesia in 2017. All cellular operators in the country have implemented a technology that provides data transfer speeds of up to 300 Mbps to its users [2].

Multimedia communication has become a necessity, and this is possible because of the convergence of several services such as voice, data, images, and video. Any telecommunication service applications have many users enjoy due to the junction of services.

Telecommunication service applications, which originally been only fixed services, are now being required to be enjoyed using mobile devices such as PDAs or laptops. Some multimedia service applications currently being appreciated include m-learning, m-banking, m-shopping, and others [3] [4].

LTE allows users and subscribers to enjoy various media (multimedia), such as music, the internet, movies, and games, in one connected device. A method of collecting radio-frequency field information in real terms is needed to analyze and collect signal strength data. The most suitable method for collecting accurate signal strength data in the field is a driving test. Improving the quality of the Long Term Evolution (LTE) network can be done by analyzing the performance of one of the operators in Indonesia. Drive Test is a job that aims to collect data by measuring the signal quality of a network. Drive Test is part of the optimization process that improves a network's quality and develops network capacity. In the drive test process, the Genex Probe by Huawei software is used, which is a software to measure the parameters and performance of a telecommunications network, be it GSM, CDMA, or W-CDMA networks [5]

7 Preliminary

Communication technology is hardware equipment (hardware) in an organizational structure that contains social values that allow each individual to collect, process, and exchange information with other individuals. The technology of communicating data can spread, spread, and deliver to the information technology location that is more precise on the data obtained results. Information technology develops, communication rapidly with computers' development with supporting devices and products in existing technology. Communication technology is overgrowing with the development of technology, transmission systems, and system modulation so that that information can be conveyed quickly and precisely.

Mobile network technology is divided into 2, namely GSM and CDMA. The two networks play different frequencies. With the more development of cellphone technology, the internet via cellphone technology is also growing. All cellphone vendors are competing to improve their flagship products, especially in their mobile internet access network. We are familiar with creating mobile internet networks starting from GPRS, EDGE, UMTS, HDSPA [6].

2.1. Fourth Generation (4G) Technology

4G is the fourth generation introduced in 2009. The inventor of LTE technology is Khoirul Anwar from Indonesia, who has lived in Japan for 12 years and has been a researcher at JAIST (Japan Advanced Institute of Science and Technology School of Information Science). This cellular technology is called LTE (Long Term Evolution) and LTE-A (Long Term Evolution Advance). This LTE technology has DL speeds of up to 100 Mbps and UL up to 50 Mbps. That speed can still be much faster according to the release of the category used by the operator. 4G stands for a term in English: fourth-generation technology [7]. The official name of this 4G technology, according to IEEE (Institute of Electrical and Electronics Engineers), is "3G and beyond". Before 4G, High-Speed Downlink Packet Access (HSDPA) is sometimes referred to as technology 3.5G has been developed by WCDMA just as EV-DO developed CDMA 2000.

HSDPA is a mobile phone protocol that provides an evolutionary path for Universal Mobile Telecommunications System (UMTS) networks to give a more extensive data capacity [8].

2.2. LTE Frequency Band in Indonesia

The use of LTE frequencies has different frequencies such as Indosat Ooredeoo in the Bandung, Jakarta, Denpasar, and Yogyakarta areas using dual carriers B8 FDD LTE with 900 MHz frequency and B3 FDD LTE frequency of 1,800 MHz. Then, 4G Plus Indosat Ooredeoo for the Surabaya, Surakarta, Sukabumi, Semarang, Malang, Makassar, Balikpapan, Pati, Pontianak, Padang, Bogor, Banyumas, Lampung, Tasikmalaya, Rembang, Kudus, and Jepara single carriers uses a single carrier B3 FDD LTE with a frequency of 1,800 MHz [9] [10]. The following is a list of LTE frequency bands in Indonesia, namely:

(i) Telkomsel: B8 FDD LTE frequency 900 MHz / B3 FDD LTE frequency1,800 MHz.
(ii) Indosat Ooredoo: B8 FDD LTE 900 MHz frequency / B3 FDD LTE frequency 1,800 MHz.
(iii) XL Aksiata: B8 FDD LTE frequency 900 MHz / B3 FDD LTE frequency 1,800 MHz.
(iv) Tri Indonesia: B3 FDD LTE 1,800 MHz frequency.
(v) Smartfren: B5 FDD LTE frequency 850 Mhz / B40 TDD LTE frequency 2,300 MHz.

2.3. Frequency Division Duplex (FDD)

FDD (Frequency Division Duplexing) FDD has a way of delivering data by using two different channels between transmit and accept. This method is used by 4G operators in Indonesia and Southeast Asian countries. In Indonesia, Only Bolt! Only those who do not use FDD technology. This technology also has several advantages such as less interference and good reception. The way FDD works itself is classified as a full-duplex system. This means that both uploads and downloads are always available. FDD uses two different channels, namely for downloading and uploading data. In FDD, separate uplink and downlink are used, which allows a device to send and receive data simultaneously. The distance between the uplink and downlink channels is referred to as the duplex distance. The uplink channel is at a lower frequency. This is done because higher frequencies experience more significant attenuation than lower frequencies [11] [12].

By using FDD, it is possible to send and receive signals simultaneously with different frequencies. With this technique, a guard frequency is needed to determine the frequency of sending and receiving simultaneously, and a frequency screening process that must be accurate is required. The operating bands are shown in the following Table 1:

Table 1: FDD Operation Band Table for 3500 MHz Frequency

FDD LTE BANDS & FREQUENCIES					
LTE BAND NUMBER	UPLINK (MHZ)	DOWNLINK (MHZ)	WIDTH OF BAND (MHZ)	DUPLEX SPACING (MHZ)	BAND GAP (MHZ)
22	3410 - 3500	3510 - 3600	90	100	10

2.4. Benchmarks

Benchmark is a testing technique using an expected value. A program or work compares various work capabilities from several providers to improve a new product's quality. Testing is done by comparing the network quality of two or three operators with the same experiment. Benchmark itself aims to determine and compare one operator's quality with another to see which operator has the best network quality. Benchmarks are usually carried out routinely by each operator to

determine the quality of its competitors' networks. That way, they can find solutions to improve network quality in areas experiencing problems. [13]

3. Research methodology

This type of research is a Comparative Analysis of Operator X and Operator Y on 4G Networks Using the Drive Test Method in the Medan Region of North Sumatra, especially at the University of Muhammadiyah Sumatra Utara.

3.1. Test Drive Equipment Configuration

The steps that need to be taken to apply the application Genex Probe v3.17 by Huawei is as follows: First, prepare the tools (laptop, MS / UE / Handset, GPS) and materials (Probe v3.17 and Assistant v3.17 applications, as well as drivers for both MS and GPS, as well as Microsoft Network Monitor).

(i) Tools required

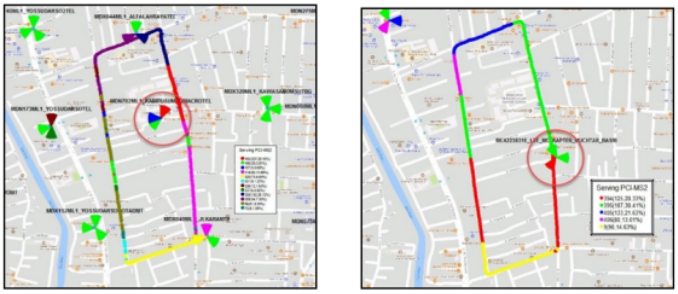
(a) Laptops with Minimum Spec Core i3, Minimum RAM 4 GB, etc.Handset
(b) MS (Mobile Station), UE (User Equipment), Samsung S5
(c) GPS Receiver

(ii) Necessary materials

(a) Genex Probe v3.17 application
(b) Genex Assistant v3.17 application Samsung Driver and Microsoft Network Monitor
(c) EU Driver

To display the parameters needed for DT with a 4G system, on the Menu (VIEW - LTE) - a,b,c,d,e,f,g

(i) Radio Parameters
(ii) Serving and Neighboring Cells c. Throughput
(iii) Event List
(iv) Test Plan Control f. Device Configure g. UE State



(a) Operator X (b) Operator Y

Figure 1: Drive Test Comparison Results

4. Results and discussion

The data collection process for the driving test was conducted in the area around the Muhammadiyah University of North Sumatra.

4.1. PCI (Physical Cell ID)

(i) MDN702ML1_KAMPUSUMSUMACROTEL
(ii) MDX044ML1_ALFALAHRAYATEL
(iii) MDN173ML1_YOSSUDARSOTEL
(iv) MDX152ML1_YOSSUDARSOKOTADMT
(v) MDX040ML1_JLKARANTINA2TEL

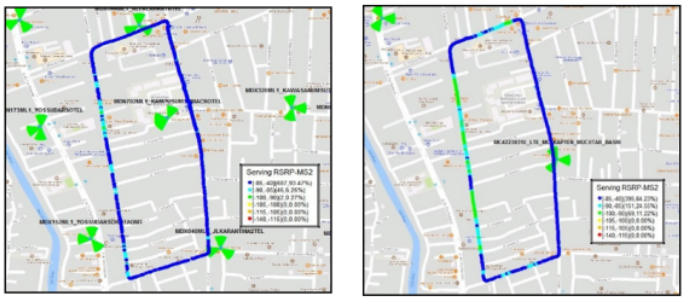
The measurement results in Figure 1 - 3 are the Drive Test results in the Muhammadiyah University of North Sumatra Campus Area, predominantly covered by the MDN702MM_KAMPUSUMSUMACROTEL site belonging to operator X. The results of these measurements can be seen from the research that has been done. This can be seen from the effects of measures that have been made. Namely, this site is more dominant than other locations near the area.

4.2. Drive Test Comparison Results

After data collection is carried out on the driving test in the field and data analysis has also been carried out, the data will be compared. The comparison is as follows:

Table 2: PCI Comparison Table

Operator *X*			Operator *Y*		
S	PCI	Sample	S	PCI	sample
ADA	165	207	DAA	93	0
	166	28		394	125
	167	5		395	187
ADA = MDN702MM_KAMPUS_UMSUMARCROTEL DAA = MC2223831_Kapten_Muchtar_Basri					



(a) Operator X (b) Operator Y

Figure 2: Comparison of RSRP

Table 2 shows that the North Sumatra Muhammadiyah University campus is covered by the MDN702MM_KAMPUSUMSUMACROTEL site owned by operator X and the MC2223831_Kapten_Muchtar_Basri site owned by operator Y. That way, we can find out the places surrounding the campus of the Muhammadiyah University of North Sumatra.

Table 3: Comparison of RSRP

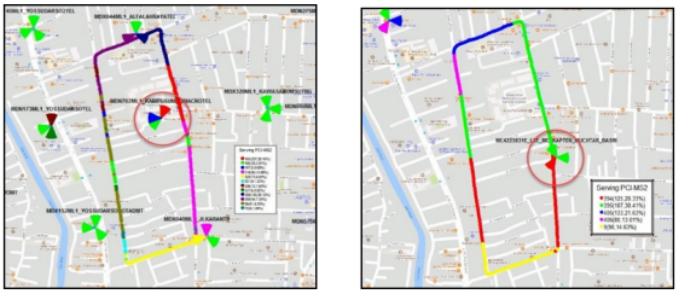
Operator X			Operator Y		
RSRP (dbm)	Sample	Percentage	RSRP (dbm)	Sample	Percentage
-85 to -45	687	93,47 %	-85 to -45	395	64,2%
-90 to -85	46	6,26%	-90 to -85	151	24,55%
Total	733	99,73%	Total	546	88,78%

The distribution of RSRP Operator X in the Muhammadiyah University of North Sumatra's campus area has a percentage of 99.73% with a sample of 733. In contrast, Operator Y has a rate of 88.78% with a model of 546: the more models that are obtained, the greater the percentage.

Table 4: Comparison of SINR

Operator X			Operator Y		
RSRP (dbm)	Sample	Percentage	RSRP (dbm)	Sample	Percentage
20 to 50	37	5,03 %	20 to 50	26	4,23%
10 to 20	350	47,26 %	10 to 20	149	24,23%
Total	387	52,65%	Total	175	29,26%

The SINR Operator X level is more dominant, with 52.65% and 387 samples from the table above. While Operator Y has a portion of 29.26% and 175 representatives. Because SINR itself significantly affect



(a) Operator X (b) Operator Y

Figure 3: Comparison of SINR

5. Conclusion

From the results of the comparative analysis, it can be concluded that the Muhammadiyah University of North Sumatra Campus Area is covered by the operator site X

MDN702MM_KAMPUSUMSUMACROTEL and the operator site MC2223831_Kapten_Muchtar_Basri Y. Operator signal X with RSRP parameter has a frequency width of -90> -45 dBm with a range of 99.73% in sample 733. In contrast, Operator Y has a proportion of 88.78% with a sample size of 546. Quality of 4G LTE operator network in the Campus Area of the Muhammadiyah University of North Sumatra We take operator Y's overall value on the SINR parameter with a range of values. 10> 50 dBm, with a proportion of 52.65% and 387 samples. At the same time, Operator Y has a balance of 29.26% and 175 models. And the more sampling, the bigger the presentation. Operator X's total throughput value is only 0> 3 Mbps, while operator Y is 0> 30 Mbps. The performance level of 2 (two) 4G LTE operators in the UMSU Main Campus area is based on data that has been taken and analyzed. The shallow throughput value is due to the high user traffic during the day.

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