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LAB 04-NETWORK SPEED, LATENCY & JITTER TESTS (2G,3G & 4G)

Monday, February 24, 20251.0 INTRODUCTION

Network speed testing applications are used to test the speed of a stable network connection. Internet Service providers (ISP's) promise "up to" a certain speed in optimal conditions, but a speed test will confirm how fast—or slow—your connection is. A speed test measures your download and upload speeds, latency and jitter. Measuring the latter two is essential because most ISPs make separate promises for download and upload speeds.

Speed Test

An internet speed test is the best way to get an idea of how fast your connection is. The service you connect to often limits your download and upload speeds based on the plan you chose, local congestion, any throttling rules it has, and so on. Many speed test Apps exist including OpenSignal and SpeedTest. Speedtest.net is perhaps the most well-known broadband speed testing tool around. It was developed by Ookla and has been around since 2006.

Ping /Latency

Latency is the time taken for a single packet of data to pass along its route. Latency can be defined as one-way latency and round-trip latency. The lower the latency, the more users are satisfied with the perceived QoS.

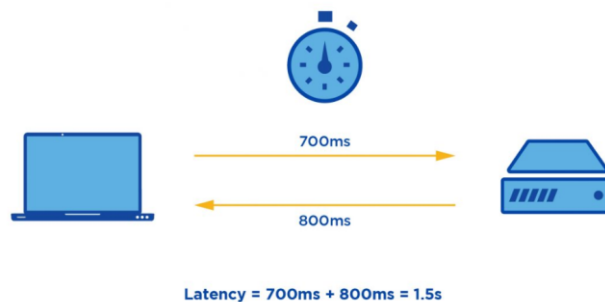


Figure 01. Round-trip latency

Jitter

Since IP networks don't guarantee the delivery time of data packets, the data can arrive at inconsistent rates. The variation in inter-packet arrival rate is known as jitter and is introduced by variable transmission delays over the network. Removing jitter requires collecting packets and storing in a buffer them long enough to permit the slowest packets to arrive in time to be played in the correct sequence. Each jitter buffer contributes to the end-to-end delay. High jitter impacts sound quality of VoIP telephone calls. And in extreme cases, that can mean that a call is difficult to understand. Parts of the conversation may 'drop out'

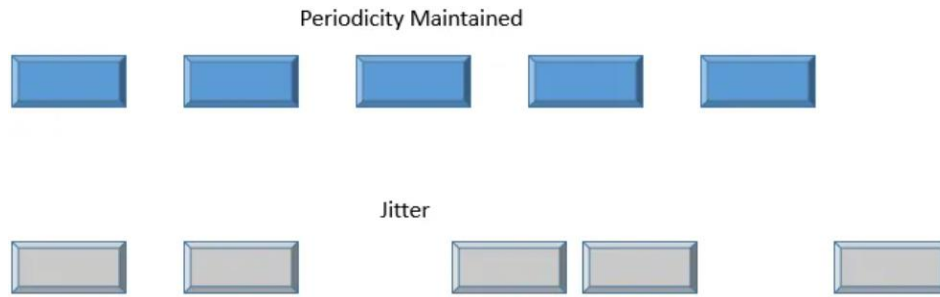


Figure 02. Effect of jitter on data streams

Speed Test Servers

The accuracy and high-quality performance of Speed-test is made possible through the 12,000+ servers around the world that host our Speedtest server daemon. This robust network of servers enables us to ensure that our users get local readings wherever they are on the planet.

The following Internet service providers have OOKLA speed test servers. Safaricom Limited, Airtel Kenya, Orange Cellular Kenya, Wananchi, Safaricom Business, Jamii Telecommunications Limited, Wananchi Online Limited and Zuku.

Speedtest automatically selects a server to test to based on ping, but you can also select a server to test to as shown in the figure below.

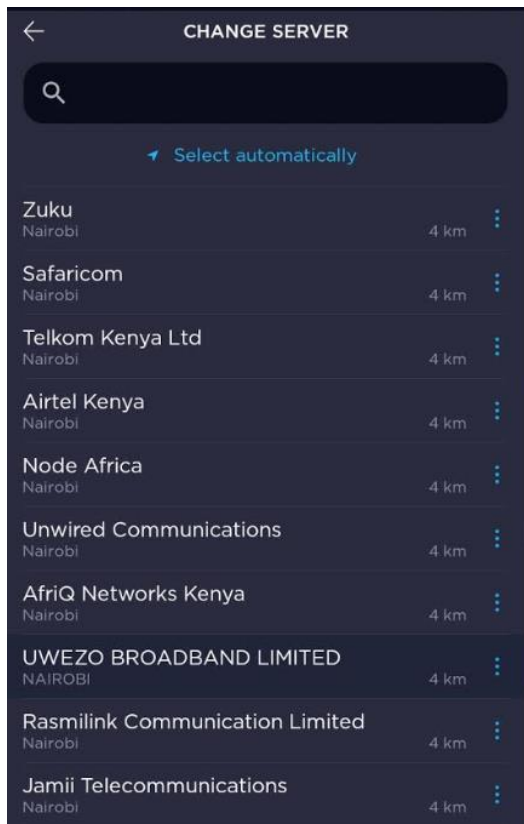
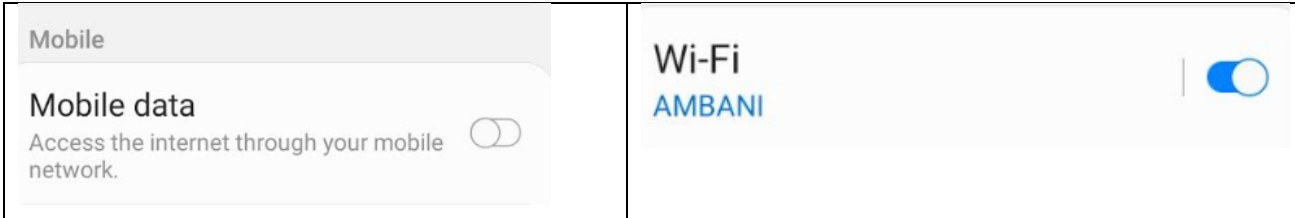


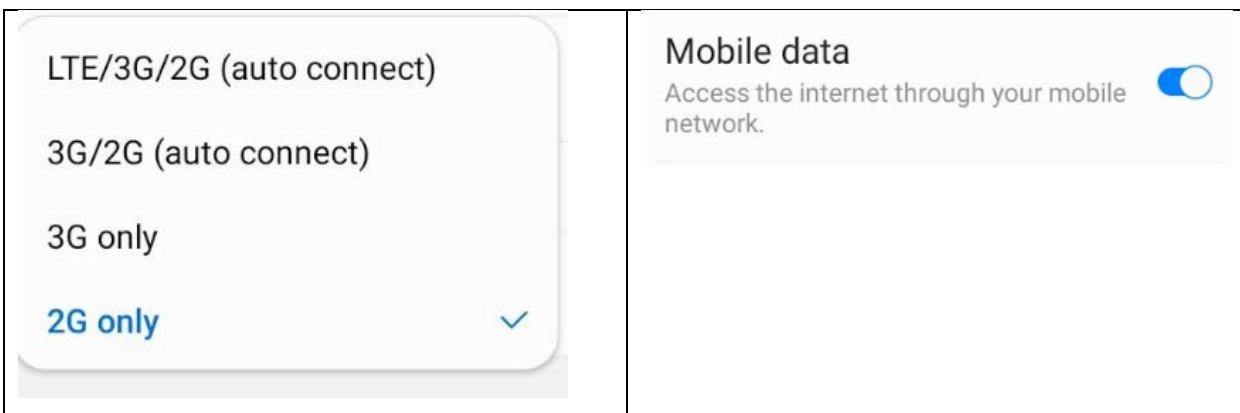
Figure 03. Speed test servers

2.0. EXPERIMENT 1

1. Load your credit to over 500 MB and download the speed test App from this link:
<https://www.speedtest.net/apps/android>
2. Turn off the data Service and ensure that WiFi is **ON** as shown below



2. While indoors, go to the settings of set your network mode to **2G**. Turn Mobile Data to **ON** as shown below.



3. Set the test server to be local but different from your operator, i.e If your network operator is Safaricom, select the speed test server to be Airtel.
4. Run the speed test and record the following (i) Download speed (ii) Upload speed (iii) Ping (latency), and (iii) Jitter.
5. Go back to settings and change the network mode to **3G** and record (i) Download speed (ii) Upload speed (iii) Ping (latency), and (iii) Jitter.
6. Go back to settings and change the network mode to **LTE** and record (i) Download speed (ii) Upload speed (iii) Ping (latency), and (iii) Jitter.
7. Repeat steps 2-6 while outdoors.
8. Change the Speed test server to be outside the country, e.g Liquid Telecom-Kigali. Repeat the LTE speed test and compare the results with those when the server is located in Nairobi.

Results and Analysis

1. Compare the downlink and uplink speeds with the 3GPP recommendations for 2G+, 3G, 3G+, 4G and 4G+
2. Discuss any differences that you may find between indoor and outdoor measurements.
3. Discuss the reasons why there are discrepancies in Jitter and latency between 2G, 3G and LTE.
4. Discuss the cause of discrepancies in the observed download speeds, latency and jitter between a local server and a distant server. i.e located in another country.

2.0 EXPERIMENT 2 – DURNAL VARIATION OF SPEED TEST OF LTE CONNECTIONS

1. Disable WiFi and Set the Network mode to LTE
2. Start Speed Test
3. Set the server to be different from your service provider but local, i.e Safaricom, Airtel, Telkom, etc.
2. Carry out speed test in early in the morning (7.00am), Late in the morning (10.00am), Lunch time (13.30 am), Afternoon (15.00pm), and Evening (18.00pm). In each case record download speed, upload speed, ping and jitter.

Results and Analysis

1. Briefly explain why there are variations download and upload speeds at different times of the day.
2. What time of the day would you expect peak download speeds

EXPERIMENT 3 – ESTIMATING TRAFFIC IN LTE NETWORKS

1. Disable WiFi and Set the Network mode to LTE
2. Start Speed Test from 2, 3, 4, 5 mobiles.
3. Set the server to be different from your service provider but local, i.e Safaricom, Airtel, Telkom, etc.
2. Carry out speed test, ping and jitter simultaneously.

Results and Analysis

1. Derive the expression for the traffic in the LTE network. Discuss any assumptions you make.
2. Briefly discuss the differences between bandwidth and throughput with specific reference to network speed tests.