Performance Metrics for Evaluating Internet Speed Test in Symmetric Broadband

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Abstract—The internet has become more than a routine of everyone's life; it has become a necessity. This paper aims to use statistics to identify the different factors that affect many aspects of the internet such as its download speed, upload speed, and ping. The research looks at various factors for the causes and changes in the internet's performance such as the location of the household receiving the signal for their internet. With this research information, the researchers of the paper intend to determine which possible factors hamper the internet's performance metrics in order to leave the issue in the hands of organizations who have the capacity to combat these same hindrances. This data could also further improve the internet performance for the population, consequently improving a conventional part of urban societal life.

Index Terms—ping, download speed, upload speed, internet

I. RANDOM VARIABLES AND SOURCES OF DATA

1. **Location**: The location of the closest test server when the test was being conducted.
   Source: Data gathered from the Ookla Speedtest using Raspberry Pi 4.
2. **Download Speed**: How fast you can receive data from the internet to your device (measured in Mbps).
   Source: Data gathered from the Ookla Speedtest using Raspberry Pi 4.
3. **Upload Speed**: How fast you can send data from your device to the internet (measured in Mbps).
   Source: Data gathered from the Ookla Speedtest using Raspberry Pi 4.
4. **Ping**: A type of latency measurement that sends a small packet of data from your device to a server and back (measured in ms).
   Source: Data gathered from the Ookla Speedtest using Raspberry Pi 4.
5. **Jitter**: Variation in latency over time (measured in ms).
   Source: Data gathered from the Ookla Speedtest using Raspberry Pi 4.
6. **Latency**: Time it takes for data to travel from your device to a server and back (measured in ms).
   Source: Data gathered from the Ookla Speedtest using Raspberry Pi 4.

II. NORMALITY OF DATA

1. **Download Speed**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 1, p-value $< 2.2e\text{-}16$ (not normal)
2. **Upload Speed**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 1, p-value $< 2.2e\text{-}16$ (not normal)
3. **Ping**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 0.81376, p-value $< 2.2e\text{-}16$ (not normal)
4. **Download Jitter**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 0.60492, p-value $< 2.2e\text{-}16$ (not normal)
5. **Upload Jitter**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 0.78504, p-value $< 2.2e\text{-}16$ (not normal)
6. **Ping Jitter**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 0.50309, p-value $< 2.2e\text{-}16$ (not normal)
5. **Download Average Latency**:
   a) **Test**: Kolmogorov-Smirnov Test
   b) **Result**: D = 0.87014, p-value $< 2.2e\text{-}16$ (not normal)
6. **Upload Average Latency**:
   a) **Test**: Kolmogorov-Smirnov Test

b) **Result**: D = 0.88351, p-value < 2.2e-16 (not normal)
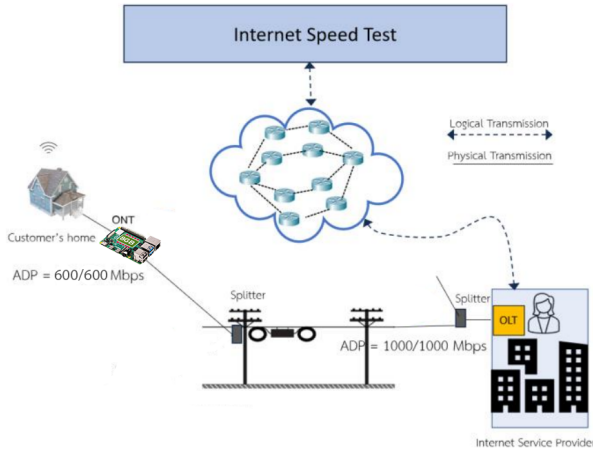
III. METHODOLOGY

Fig. 1. A scenario in evaluating internet speed test.

As shown in Fig. 1. The Methodology involve collecting data from the Ookla Speedtest using Raspberry Pi 4. The experiment was conducted from June 18 to June 30, 2024 amounting to 1116 data points. The dataset was cleaned by removing any test from Globe Telecom, any error that came with misconfigured network. Statistical analyses, including box plot, map graph, regression analysis, time series graph, was used to examined the relationship between download speed, upload speed, ping, jitter, and latency. MS Excel and R was used to analyze the data. The statistical analysis was done to determine the factors that affect the internet speed test.

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