

Mobile Infrastructure to analyze Page Download Time/speed/size over multiple Network Service Providers

Fundamental of Computer Network- Term project

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Problem Statement

- ❖ Same Web page has different download times under various network signal strength.
- ❖ Low signal might considerably reduce the performance of the web browsing.
- ❖ Why certain web sites do perform well and load fast even under the poor network signal strength.
- ❖ Even with the improvements in the Page rendering technology and application layer improvements, web experience mightn't improve a lot.

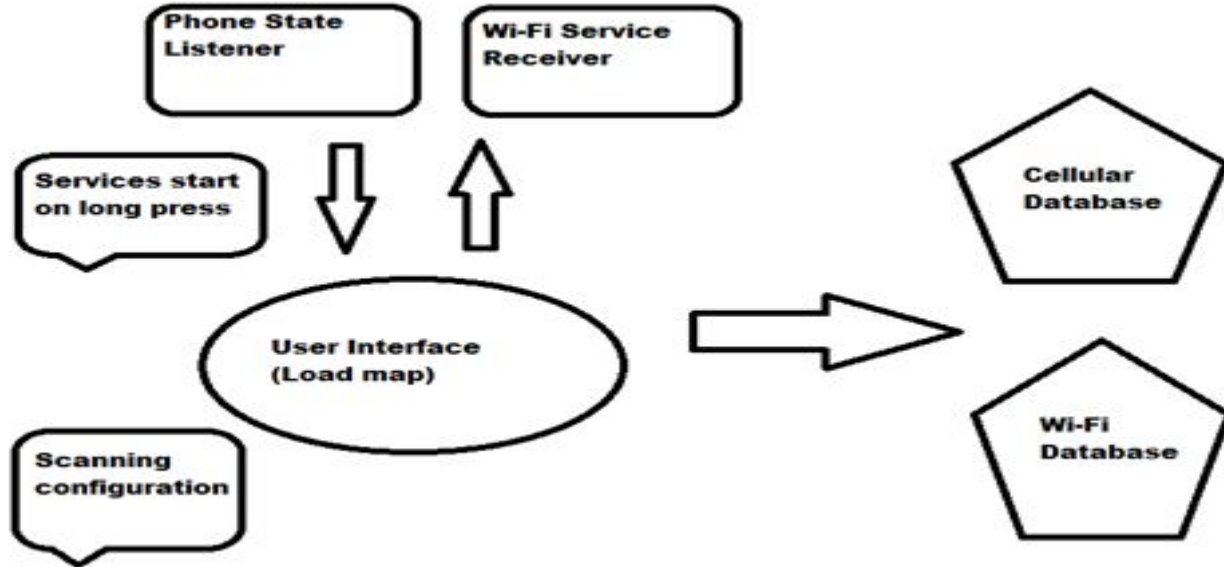
Motivation

- ❖ Key Performance Metrics for Web Page viewing:
 - Page Load Time (PLT) :- Application Layer
 - **Page Download Time (PDT)** :- Physical Layer
- ❖ Important for user experience and business revenues.
- ❖ Network Signal Strength, a key factor for page download time.

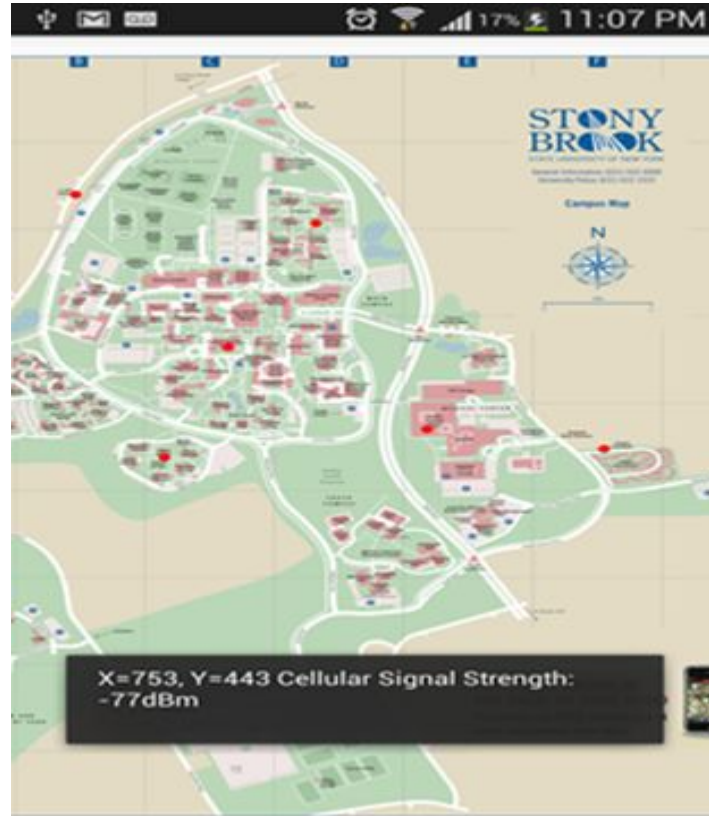
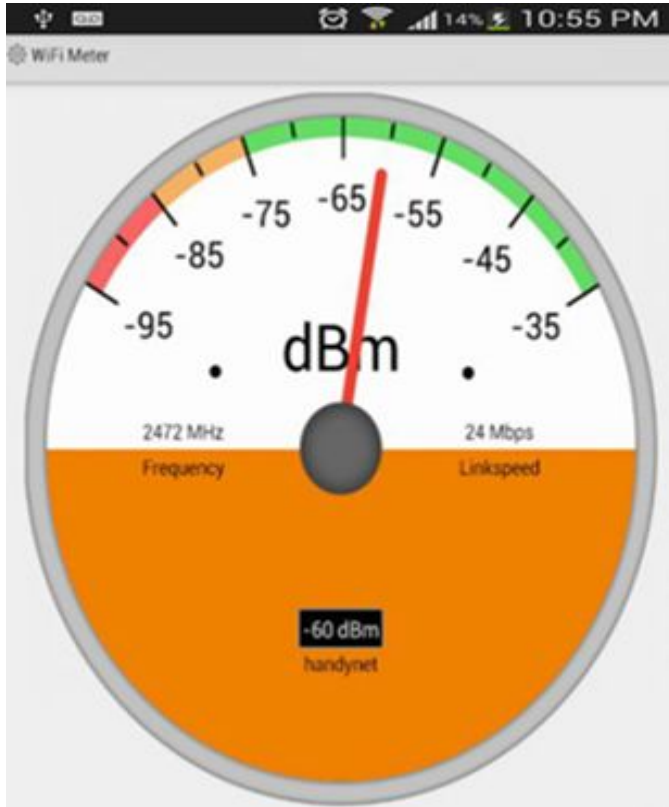
Methodology

Network Signal Analyzer

Designed and developed a location agnostic Android application platform to measure network signal strengths (Cellular & Wi-Fi).



Network Signal Analyzer

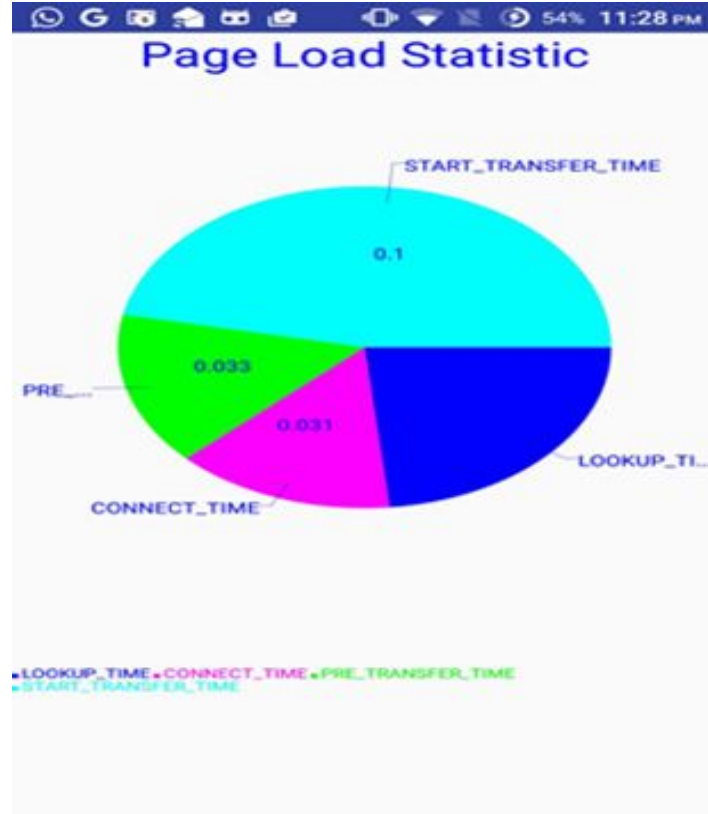


Interactive PDT Analyzer

Designed and developed a visual interactive android app which can help researchers in following ways:

- ❖ Quick and detailed user interface to calculate the page download time, bytes downloaded and network speed of Top 100 Alexa websites
- ❖ Graphical analysis (pie chart) of various page download time components (Using cUrl) along with network speed and bytes downloaded.

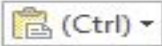
Interactive PDT Analyzer



PDT Dump Tool

- ❖ We wrote a robust and powerful shell script which automatically downloads the top 100 Alexa websites.
- ❖ Dumps detailed statistics for each.

```
www.youtube.com
-----
Lookup time: 0.015 sec
Connect time: 0.012 sec
Pretransfer time: 0.012 sec
Start transfer time: 0.053 sec
Size download: 0 Bytes
Speed download: 0.000 Bytes/sec
Total time: 0.051 sec
```



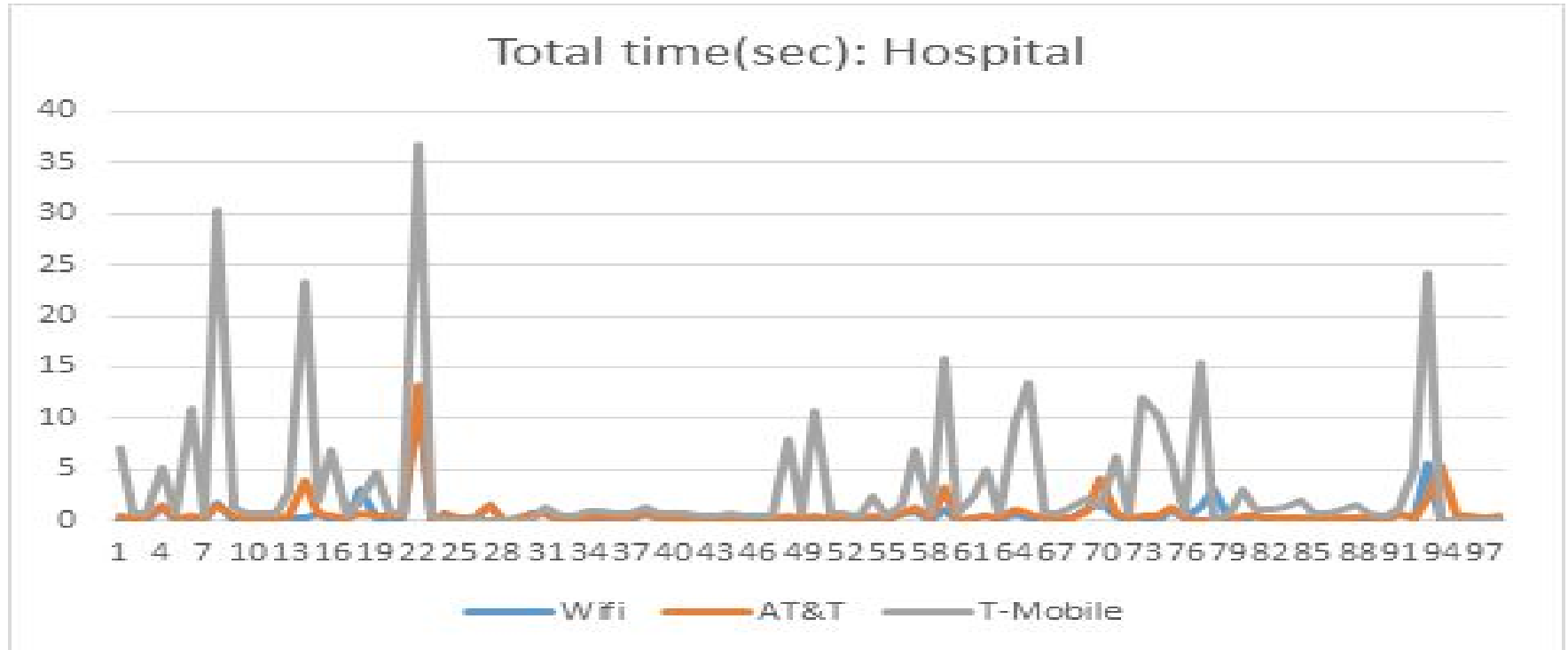
Evaluation & Results

Network Strength Survey Result

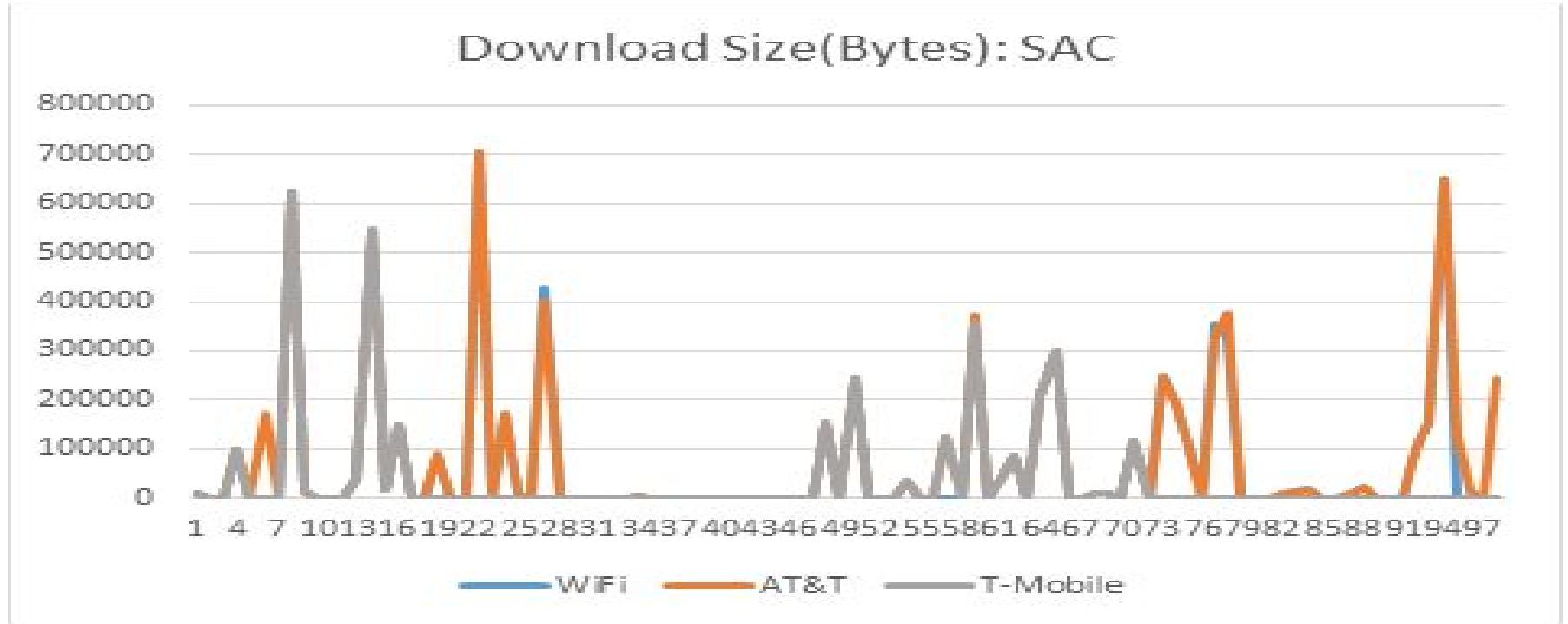
	Chapin Apartments, 700Health Science Drive, Stony Brook	Student Activity Center, Stony Brook University	Stony Brook Hospital, Main Entrance, Stony Brook	Stony LIRR Island Road)	Brook (Long Rail
AT&T	-97dBm	-85dBm	-95dBm	-85dBm	
T-Mobile	-109dBm	-87dBm	-67dBm	-81dBm	
Wi-Fi	-60dBm	-70dBm	-65dBm	NA	

Network Signal Strength statistics

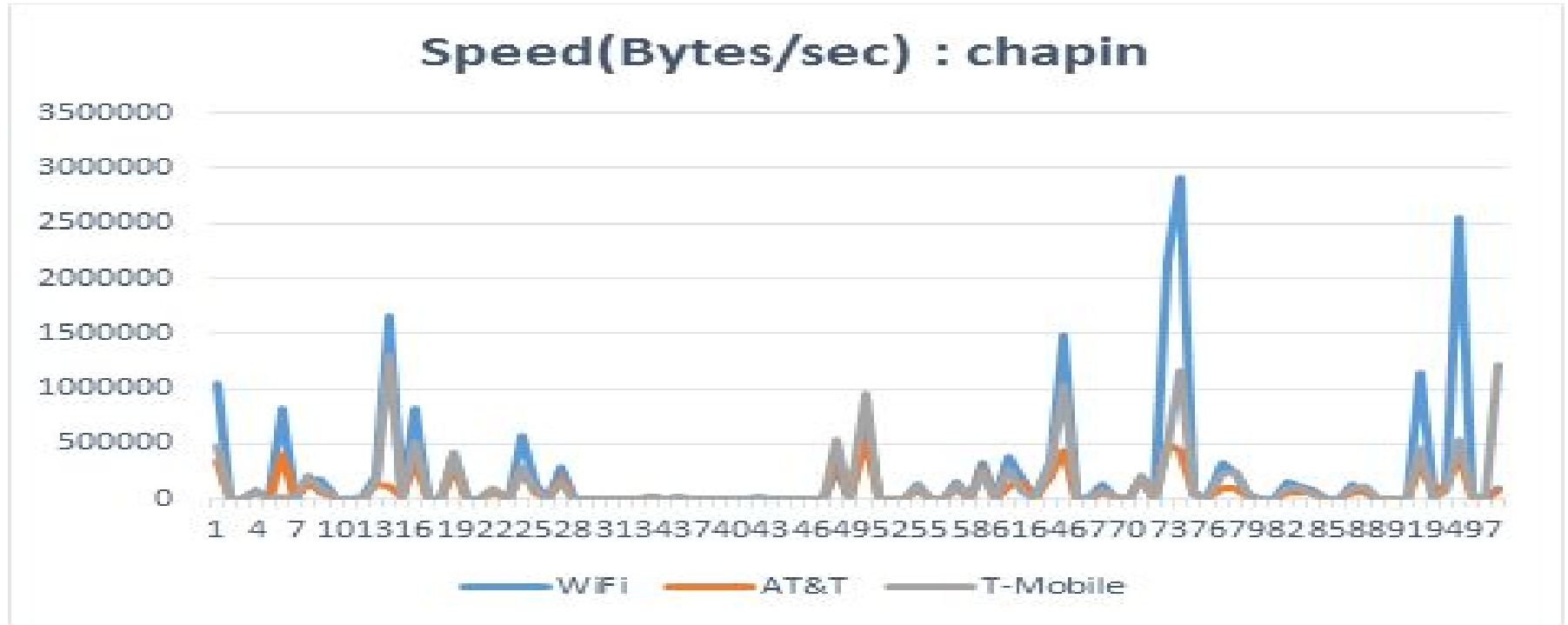
Total download time Vs Top 100 Alexa Websites



Total Bytes downloaded Vs Top 100 Alexa Websites



Downloading speed Vs Top 100 Alexa Websites



Analysis & Findings

Q: Given a website, why do we see different page download time for different service providers?

- ❖ The type of service (network protocols/technologies) being provided at a particular location.
- ❖ The routing path that is taken by the service providers need not be the same.
- ❖ Customers and peer relationship might also affect.
- ❖ Other parameters like frequency of the band, network congestion, signal strength, provider introduced ads/scripts might also affect the page download time.

Q: Given a website, why different service providers have different bytes download?

- ❖ Different ads/ monitoring scripts embedded by the service provider.
- ❖ Extra custom information in the header/trailer specific to the provider.
- ❖ Loss incurred on the network.
- ❖ Difference in packet header sizes for different transmission protocols (2G/3G/LTE).

Q: Given a service provider, why download speed vary for different websites?

- ❖ Server network speed
- ❖ Server Load.
- ❖ Number of CDNs which host website's objects and their location.
- ❖ Present traffic on the network,
- ❖ Signal strength.

A million dollar question...

While choosing best channel for transmission/page download time, should we normally look for only signal strength?

No, Network speed can be high even with low signal strength.

- ❖ High network bandwidth.
- ❖ High bandwidth allocated for given user (premium/free)

Contrary, there are many cases where even though we have high signal strength but network speed is low.

- ❖ Reasons can be low bandwidth, network traffic, tower misconfiguration, tower deafness, signal interference, being too close to the tower, driving too fast between towers etc.

Other Components Affecting PDT

We performed further analysis by delving into other detailed time information obtained during our survey. They include:

- ❖ time_appconnect
- ❖ time_connect
- ❖ time_namelookup
- ❖ time_pretransfer
- ❖ time_redirect
- ❖ time_starttransfer

The results obtained matched with our previous analysis, So the details have been excluded here.

Conclusion...

- ❖ Given the importance of page download time/bytes/speed over different network service providers, we designed and developed a robust Mobile Infrastructure to collect and analyze the various network parameters.
- ❖ We performed real time experiments over multiple places and collected the ample amount of rich data.
- ❖ Our results show that page download time/speed/bytes depends not only on network signal strength but also to the bandwidth, protocol used, server capacity etc.

Future work

- ❖ Analyze non-landing pages for the websites.
- ❖ Comparison between PLT and PDT for web experience.
- ❖ Dependency on hardware(including radio antenna, NIC, memory r/w speed etc.)
- ❖ Analyze the result for other portable devices, like Laptops and tablets.

Code Repo & References

Code base & Survey data:

<https://github.com/waytoalpit/Mobile-Infrastructure-to-analyze-Page-Download-Time-speed-size-over-multiple-Network-Service-Provide>

Reference:

<http://www.ericmoble.net/measuring-performance-google-analytics/>

<https://en.wikipedia.org/wiki/CURL>

<http://developer.android.com/index.html>

<http://blog.livedrive.com/2012/08/why-is-an-internet-speed-of-125kbs-the-same-as-1mbps/#sthash.7A7Uixc6.dpuf>

<https://7labs.heypub.com/tips-tricks/download-speeds-explained.html>



Thank you!