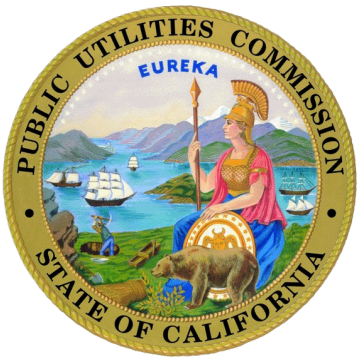
Analysis of Open-Source Web-Based Speed Measurement Tools



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Abstract

This report details our project for CSUMB's Spring 2018 CST 499 Capstone class. Since 2012, the California Public Utilities Commission (CPUC) has gathered mobile performance data in 6 month intervals across 2000 locations in California. In addition to this, the CPUC has also developed a desktop application called CalSPEED which collects broadband data and stores it for comparison purposes. However, CalSPEED cannot be installed on secure computers, so the data that can be collected is limited. To address this limitation, we researched sixteen open-source web-based network metric tools in order to recommend CPUC a tool for adoption. Based on our research, we have concluded that Federico Dossena's HTML5 Speedtest and M-Lab's Google Speed Test are both excellent tools that meet the CPUC's needs.

1. Introduction

In order to gather information about broadband internet in California, the CPUC developed the CalSPEED desktop application in collaboration with CSUMB. Although CalSPEED is a quality tool that collects data on download/upload speeds, latency, and jitter metrics, it cannot be installed on organizations' computers for security reasons. Despite this, even if one does not have administrative privileges to install programs, web-based testers written

in HTML and JavaScript run perfectly fine. To increase their user base and obtain more data, the CPUC would like to be recommended some of these web tools.

2. Initial Tool Selection

The first step we took was to define the criteria of the tool we wanted to recommend. We decided that the ideal tool would be accurate, open-source, easy to install, and collected data based on the same metrics as CalSPEED. Based on this, we looked into sixteen speed testers and defined them based on our criteria. Following that, we chose the three tools that seemed the most promising for further research: SpeedtestJS by Comcast, HTML5 Speedtest by Federico Dossena (GitHub: adolfintel), and Google Speed Test by M-Lab. We chose these tools because they the code was clean, documentation was complete, and examples were available. The resulting table of this process can be seen in Figure 2.1 below.

Name	Provider	Open Sourced	Jitter	Download Speed	Upload	Latency	Platform Compat.
pingdom	Solarwinds	Y/N	N	N	N	N	Y
SpeedtestJS	Comcast	Y	?	Y	Y	Y	Y
HTML5 Speedtest	adolfintel	Y	Y	Y	Y	Y	Y
Test your speed	Cute-Apps	N	N	Y	Y	Y	Y
Bandwidth place	?	N	N	Y	Y	Y	Y
SpeedofMe	SpeedofMe	Y	N	Y	Y	Y	Y
speed	PCWelt	N	Y	Y	Y	Y	Y
testmynet	TestMy Net	N	N	Y	Y	N	Y
Google Speed Test	M-lab	Y	NO: Jitter Yes: RTT	Y	Y	Y	Y
Speedtest	Ookla	Y	N	Y	Y	Y	Y
Fast	Netflix	N	N	Y	N	N	Y
Speed Test	Xfinity	N	N	Y	Y	Y	Y
Speed Test	AT&T	N	N	Y	Y	Y	Y
Speed Test	Verizon	N	N	Y	Y	N	Y
wow speed test	Wowway	N	Y	Y	Y	N	Y
Bing Speed Test	Bing	N	N	Y	Y	N	Y

Figure 2.1: Web Tool Table

3. Tool Analysis

In order to analyze our chosen tools, we downloaded the source code and set up each application on our own server. Although there were already servers set up for two of the three tools, using the same server made comparisons more accurate and minimized external factors. We also conducted every test at the same location on the same network, which was the second floor of CSUMB's BIT building. In total, we conducted 225 tests in the same time blocks on different days. These tests were done from 11:30am-12:00pm and 1:00pm-1:30pm on Wednesdays and Fridays.

The results of these tests were compiled into a spreadsheet, an example of which can be seen in Figure 3.1 below. Each team member ran the tests on different major browsers to control for compatibility issues. After all the values were recorded, a spreadsheet function was used to obtain the averages of each individual's download/upload speeds, ping, and jitter. Following that, we took the average of our individual averages to get an overall average, which was the point of comparison used between different speed testers.

1		Joseph - Firefox	Average	Michael - Safari	Average	Israel - Chrome	Average	Tristan - IE	Average	Tristan - Edge	Average
2	Download	96.26	66.7716	149.74	130.35	145.61	145.5172	120.65	153.3124	131.47	119.25
3	Upload	10.13	46.5156	97.41	263.7836	97.09	248.464	24.99	47.388	22.78	47.4212
4	Ping	215.35	109.9128	175.9	93.782	174.8	93.448	185.13	100.0256	179.81	111.6424
5	Jitter	91.56	24.186	2.01	7.6832	8.54	8.7856	12.67	21.9652	13.28	102.024
6											
7	Download	102.56		147.73		94.26		46.56		46.09	
8	Upload	11.28		103.63		80.3		24.26		23.22	
9	Ping	207.46		176.05		175.37		192.42		195.3	
10	Jitter	41.44		5.03		5.37		16.77		28.73	
11											
12	Download	83.27		147.36		75.6		80.23		62.35	
13	Upload	21.26		114.71		141.14		27.96		23.36	
14	Ping	220.31		175.17		174.28		186.22		177.25	
15	Jitter	106.8		1.87		1.85		10.31		2.03	
16											
17	Download	79.35		146.59		127.81		132.85		125.14	
18	Upload	9.93		112.23		131.72		21.59		27.65	
19	Ping	204.49		175.71		178.18		179.45		178.09	
20	Jitter	29.41		1		7.14		4.61		7.91	
21											
22	Download	56.83		143.81		145.54		130.01		102.92	
23	Upload	4.37		105.03		118.86		24.4		24.7	
24	Ping	218.28		177.68		174.87		180.38		32.3	
25	Jitter	50.33		22.82		2.34		3.73		201.45	

Figure 3.1: Tool Spreadsheet Data

SpeedtestJS

SpeedtestJS is a JavaScript application developed by Comcast. Unfortunately after following the installation directions in their readme, the application failed to run and only displayed “Test Failed” as shown in Figure 3.2. Upon examining the source code it appears there is a bug when the results are returned to the user; no data is actually returned and “Test Failed” is shown. Tracking down a fix for this is beyond the scope of our project, but if code to fix this bug ever gets pushed, this application is worth doing further research into.

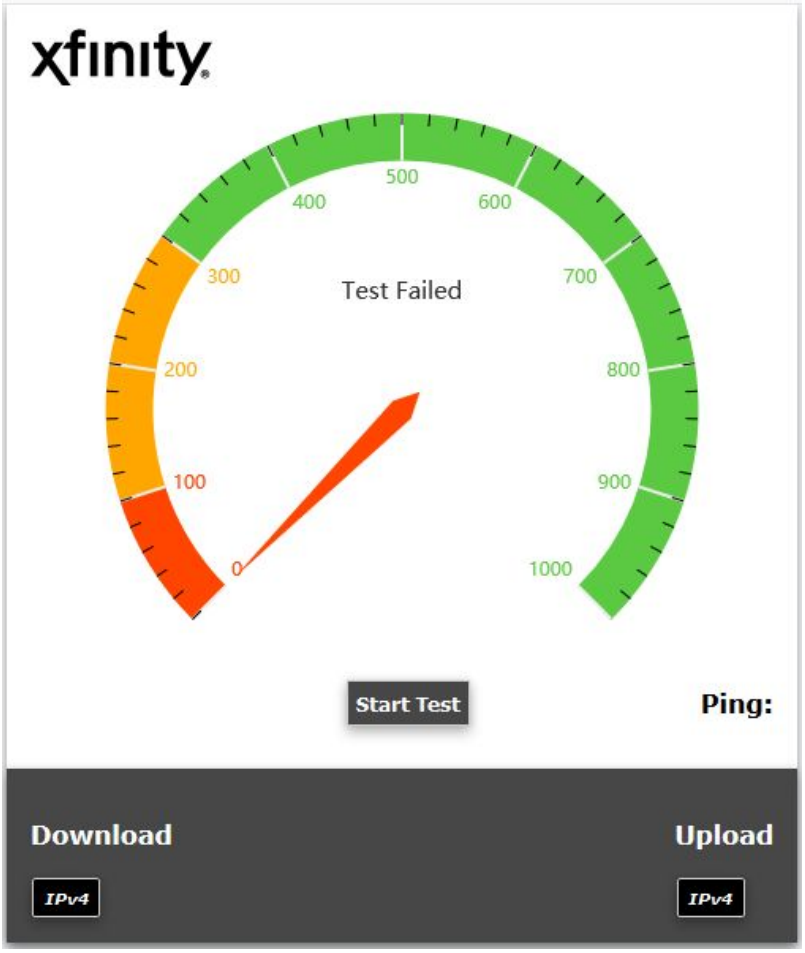

Figure 3.2: SpeedtestJS Error

HTML5 Speedtest

HTML5 Speedtest is a lightweight JavaScript application developed by Federico Dossena, known as adolfintel on GitHub. Setting up HTML5 Speedtest was simple, and the website itself is responsive and friendly to mobile devices. It is also highly configurable, comes with multiple example pages, has support for MySQL and PostgreSQL out of the box, and is well-documented. Figure 3.3 shows an example HTML5 Speedtest webpage.

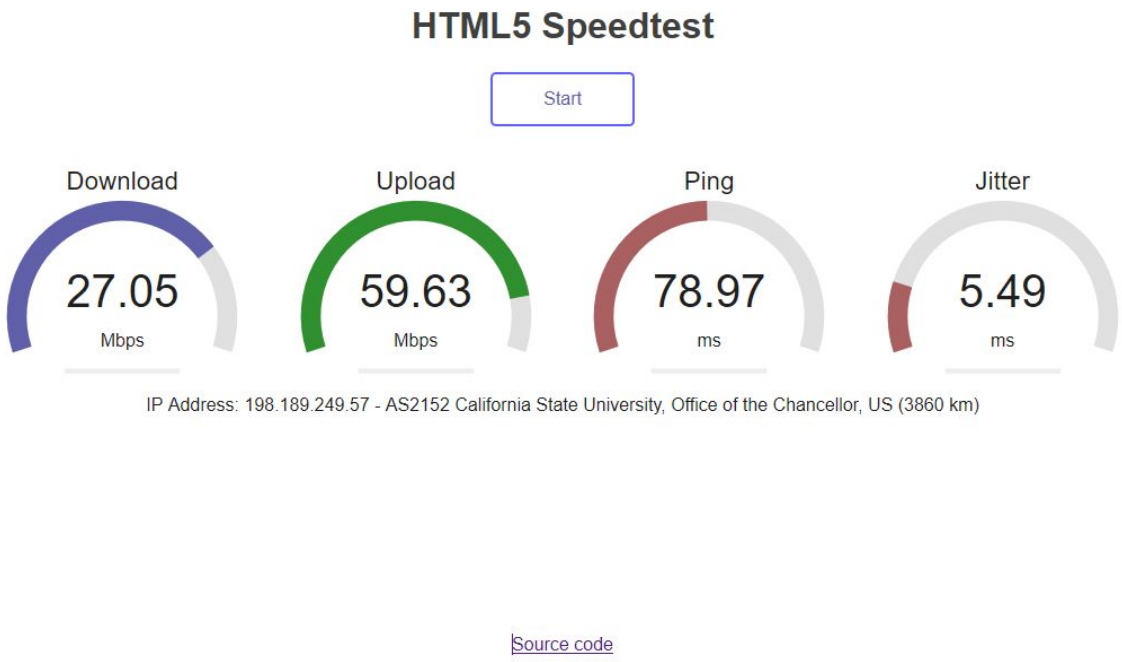

Figure 3.3: HTML5 Speedtest

Google Speed Test

Google Speed Test is hosted by M-Lab, which is a research organization that makes their data available for public use. All of M-Lab's tests, data, and tools are open-source, but configuration is more involved because there are a variety of tools with distinct uses. At the time of this report, there are 10 different measurement tools offered. Although M-Lab offers more complex tools, we feel the complexity might be something the CPUC is interested in. Additionally, M-Lab's open data could also be useful for CPUC studies. As seen in Figure 3.4 below, one quirk of the M-Lab tool we used is that there is no jitter displayed, but there are M-Lab tools that have that functionality.

Figure 3.4: Google Speed Test

4. Tool Comparison

The results of the tests we conducted show that both HTML5 Speedtest and Google Speed Test function well, giving results that are both consistent and expected. The metrics obtained for both tests at a certain time often matched each other, although Google Speed Test has the slight edge in consistency. However, Google Speed Test also has more complexity behind the scenes while HTML5 Speedtest is simpler. Neither complexity nor simplicity is necessarily a con; it all depends on what the CPUC desires in a tool.

5. Conclusion

Based on the tests we have conducted and the information above, we recommend both HTML5 Speedtest and Google Speed Test as excellent web application alternatives to CalSPEED's desktop application. Both testers are open-source, have great documentation, and will provide the CPUC with accurate data based on their desired metrics. HTML5 Speedtest is an easy-to-use and install tool that closely mirrors the current iteration of CalSPEED. At the same time, tests run in Google Speed Test contribute to a global public database that provides scientists and policymakers with important data. These differences should help guide the California Public Utilities Commission in choosing the web-based tool that most fits their goals.