

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Consumer Information and Disclosure)	CG Docket No. 09-158
)	
Truth-in-Billing and Billing Format)	CC Docket No. 98-170
)	
IP-Enabled Services)	WC Docket No. 04-36
)	

COMMENTS OF GOOGLE – MOBILE BROADBAND MEASUREMENT

Google Inc. (“Google”) hereby responds to the Federal Communications Commission’s *Public Notice*¹ seeking comment on whether and how to establish a measurement program to obtain accurate and comprehensive data on actual performance of mobile broadband services in the United States.

I. USER ACCESS TO CLEAR AND COMPLETE INFORMATION ABOUT MOBILE BROADBAND SERVICE OFFERINGS IS ESSENTIAL TO ENABLING ROBUST ACCESS TO A FREE AND OPEN INTERNET

As the Commission has noted, “[t]he use of wireless broadband is growing rapidly” with “3G network services ... in full bloom.”² Google strongly supports the Commission’s efforts to obtain accurate and transparent broadband performance data for American consumers in furtherance of the *National Broadband Plan*’s goals.³ Google

¹ See *Comment Sought on Measurement of Mobile Broadband Network Performance and Coverage, Public Notice*, DA 10-988 (June 1, 2010) (“*Public Notice*”).

² Federal Communications Commission, *Connecting America: The National Broadband Plan*, at 76, GN Dkt. 09-51 (rel. Mar. 16, 2010) (“*National Broadband Plan*”).

³ *National Broadband Plan*, at 47 (“The FCC should develop broadband performance standards for mobile services . . .”); *id.* at 35 (“Increased transparency will likely drive service providers to deliver better value to consumers through better services.”).

agrees that “[p]erformance of mobile broadband networks is becoming more important as mobile broadband plays an increasingly important role in our lives and in our economy.”⁴

Markets rely on information to function properly. As the *National Broadband Plan* notes, “[i]f customers make well-informed choices, companies will likely invest in new products, services and business models to compete more aggressively and offer greater value.”⁵ Google has long believed that transparency is vital to a free and open Internet.

Despite the importance of broadband access to our nation, there is a lack of reliable, up-to-date, and readily-accessible information about actual performance of broadband service offerings available in the marketplace today.⁶ This is especially true with respect to mobile networks.⁷ Furthermore, by their very nature, network management practices occurring within broadband providers’ physical and logical networks may affect application and content performance in ways that are difficult for users to discern and understand.

Broadband measurement is essential to fill this information gap. Accurate information empowers users to make optimal selections and choices for their broadband needs. Mobile broadband measurement is vital to advance network research and to

⁴ *Public Notice* at 2.

⁵ *National Broadband Plan* at 44.

⁶ For instance, very little robust data is available about actual – as opposed to advertised – broadband speeds. *See, e.g.*, BERKMAN CENTER FOR INTERNET & SOCIETY, NEXT GENERATION CONNECTIVITY: A REVIEW OF BROADBAND INTERNET TRANSITIONS AND POLICY FROM AROUND THE WORLD, 54-62 (Feb. 2010), *available at* http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report_15Feb2010.pdf (reviewing available data in the U.S. and elsewhere).

⁷ *See id.* at 46-49 (discussing relative lack of data regarding mobile broadband offerings).

facilitate the Internet's continuing evolution and development. Mobile broadband measurement also is a critically important input for the policymaking process. Consistent with the FCC's obligations pursuant to Section 706(b) of the Telecommunications Act of 1996, data generated regarding mobile broadband offerings will help the Commission to evaluate the robustness of mobile advanced services offered to the American public.⁸ Furthermore, reliable data on mobile broadband offerings will allow policymakers to evaluate how offerings to American consumers compare *vis-à-vis* those offered to users in other countries.

II. THE COMMISSION SHOULD COLLECT A DIVERSE RANGE OF METRICS FOR MOBILE BROADBAND SERVICES

The Commission should collect data on a range of metrics, including peak and average throughput for both upload and download speeds, latency, jitter, diurnal patterns, signal strength, and network accessibility.

Along with collecting such data, the Commission should attempt to measure and understand what factors contribute to a certain level of performance. That is, the Commission should seek to understand not simply *what* speed a user achieves, for example, but also *why* they achieved that speed and the operative bottlenecks to performance on the network or the device. This can be done in a number of ways, including, for example, using tools like the Network Diagnostic Tool (NDT), which the Commission used for its Consumer Broadband Test. Recently, computer scientists at MIT completed a study of several broadband speed tests, including NDT, and noted:

⁸ Section 706(b) of the Telecommunications Act of 1996 requires the Commission to regularly examine and report on the "availability of advanced telecommunications capabilities to all Americans . . ." 47 U.S.C. § 1302(b).

[NDT] is an excellent testing tool and infrastructure. The insights to draw from this data, however, are not simple averages of the upload and download speeds from different user populations.... Rather the value of the NDT data is in understanding the sources of the performance bottlenecks for today's network users. Analyzing the publically available data from this test has been very helpful in advancing our own understanding of the performance bottlenecks on today's broadband networks.⁹

Understanding performance bottlenecks and other factors contributing to the user's experience of broadband would bring important insights for policymakers, broadband providers, and users.

The Commission also should analyze how network management practices affect application and content performance, and consider measuring performance of different protocols and applications, such as HTTP and VoIP traffic. These measurements would serve a critical role in understanding how networks impact actual performance experienced by users.

III. THE COMMISSION SHOULD USE MULTIPLE COMPLEMENTARY METHODOLOGIES, INCLUDING BUT NOT LIMITED TO "CROWDSOURCING"

The *Public Notice* seeks comment on mobile broadband data collection methodology. First, as in the wireline broadband context, the Commission should build on existing measurement efforts in addition to developing its own techniques. Researchers and businesses have focused on the challenges and opportunities in this area for some time, and a wide array of tools already exists that may assist the Commission.

⁹ *Understanding Broadband Speed Measurements*, Massachusetts Institute of Technology, available [at http://mitas.csail.mit.edu/papers/Bauer_Clark_Lehr_Broadband_Speed_Measurements.pdf](http://mitas.csail.mit.edu/papers/Bauer_Clark_Lehr_Broadband_Speed_Measurements.pdf) ("*MIT Measurements Study*").

For example, the Commission can utilize the open, distributed Measurement Lab (M-Lab) platform and tools already deployed on it.¹⁰ M-Lab also can accommodate mobile broadband tests. NDT, for example, has been converted for use on the Android platform,¹¹ and researchers at Northwestern University recently released “WindRider” (currently available for Windows Mobile devices) which “attempts to detect whether your mobile broadband provider is performing application or service specific differentiation, i.e. prioritizing or slowing traffic to certain websites, applications, or content.”¹²

Second, rather than selecting a single methodology or tool, Google believes the Commission should consider complementary ways to rely on multiple data sources and methodologies. Because there are trade-offs with different techniques, the Commission should attempt to combine different measurements to best empower users and inform policymaking. For example, the Commission can “crowdsource” data through user-initiated, self-selected tests. To effectuate this, the Commission should build upon its beta-version release of the Consumer Broadband Test and continue to encourage deployment and use of independent user-run mobile broadband performance tests.

While self-selected, software-based tests yield useful data, they also have limitations, and the resulting data are not adequate to fully understand the state of the

¹⁰ M-Lab Home Page, <http://www.measurementlab.net>.

¹¹ See NDT Source Code for Android Platform, <http://code.google.com/p/ndt/source/browse/branches/android/Android/>.

¹² See “WindRider Mobile Traffic Test,” available at <http://www.measurementlab.net/measurement-lab-tools#tool6>; see also “WindRider, a Mobile Network Neutrality Monitoring System,” available at <http://www.cs.northwestern.edu/~ict992/mobile.htm>.

broadband market. Because these tests can be designed to run relatively easily – often requiring just a single click from a user – they can facilitate testing across a large number of users and provide indicators of actual conditions. However, selection bias and other confounding factors limit the usefulness of the aggregate data. The Commission, therefore, should incorporate additional options, including software- and hardware-based testing through well-designed customer panels across a representative sample of users. As in the wireline broadband context, SamKnows provides a helpful model.¹³

Third, the Commission should consider both active and passive measurement techniques. Active measurement involves generating traffic in a pre-determined way in order to measure the results, whereas passive measurement analyzes actual network activity without introducing new traffic into the network. Both types of tools can generate useful data.¹⁴

Finally, the *Public Notice* seeks comments on how to perform measurement “with minimal impact on the network itself.” Active measurement has the potential to influence congestion, although that effect that can be mitigated. Passive measurement, on the other hand, does not add additional traffic to the network. Thus, passive measurement could prove an ideal means to achieve the Commission’s objectives.¹⁵

¹³ See *Comment Sought on Residential Fixed Broadband Services Testing and Measurement Solution*, Public Notice, 25 FCC Rcd. 3836 (2010) (describing SamKnows’ methodology).

¹⁴ See, e.g., kc claffy, et. al, *Community-Oriented Network Measurement Infrastructure (CONMI) Workshop Report*, ACM SIGCOMM COMPUTER COMMUNICATION REVIEW, Vol. 36, Issue 2 (Apr. 2006), available at <http://portal.acm.org/citation.cfm?id=1129582.1129594> (discussing opportunities for and challenges to development of user-initiated passive and active measurement tools).

¹⁵ Of course, passive measurement should be pursued in way that respects users’ privacy.

IV. THE COMMISSION SHOULD MAXIMIZE THE OPENNESS OF ITS MEASUREMENT AND DATA, AND DEVELOP WAYS TO MAKE THE DATA INTELLIGIBLE TO USERS

The data collected will provide powerful and useful insights into mobile broadband services offered to the American public. The Commission should make data easily accessible by consumers, researchers, and industry by providing a functional web-based “dashboard” to evaluate and compare mobile broadband offerings and make better-informed decisions. In particular, consumers should have access to clear, accurate, and useful information about broadband Internet access offerings to understand the parameters of the services to which they subscribe or could potentially subscribe.

The Commission also should maximize the openness of its data by making it easily available for others to access and re-use in “raw” form. Some of the most useful insights may come from network researchers engaging in deep analysis of the data, as well as examination and comparison of different data sets. For example, the MIT study discussed above reported that the rich logs of NDT allow them to “track the evolution of the connection state over time” and to identify how the receiver window set by a user’s operating system affects broadband speed.¹⁶ Such logs might not initially lend themselves to a “dashboard,” but through deeper analysis they can yield insights that are useful on a much broader basis.

More generally, the Commission should adopt policies that maximize the openness and transparency of its broadband measurement techniques. Along with maximizing access to data, the Commission should enable third parties to effectively

¹⁶ *MIT Measurements Study* at 30, 33-34.

“look under the hood” of its measurement tools and techniques. In that way, researchers and others can verify independently and provide feedback on the Commission’s methods, as well as analyze and build upon the results. This will help the Commission foster the development of robust, reliable broadband measurement tools, which will ultimately enhance the Commission’s own iterative processes. The degree of transparency may differ depending on the particular data collected,¹⁷ but the Commission should initiate a measurement process that is as open as possible.

V. CONCLUSION

Clear and accurate information on performance of mobile broadband Internet access service offerings is essential for a free and open Internet. Google urges the Commission to engage in measurement techniques to study the performance of mobile broadband service offerings and to supply consumers and other users with information necessary to make intelligent broadband choices.

¹⁷ For example, passively measured data may need to be anonymized first, with limits on appropriate data sharing, in order to protect user privacy.

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Respectfully submitted,



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