RESPONSE TO CONSULTATION
BY THE INFOCOMM DEVELOPMENT AUTHORITY OF SINGAPORE (IDA)
ON NET NEUTRALITY

SUBMISSION BY GOOGLE ASIA PACIFIC PTE LTD

1. Statement of Interest

Google's innovative search technologies connect millions of people around the world with information every day. With the mission to organise the world's information, and make it universally accessible and useful, Google touches people's lives in many ways.

When you visit www.google.com or one of more than 150 other Google domains including www.google.com.sg, you can find information in many different languages and translate between them. You can also find images, videos, maps and much more. In addition, we build web applications, or "apps," to make it simpler for people to share information and collaborate more easily. The information is stored securely online, accessible from any device with a web connection.

We are also working hard to find better ways to help people get information they need when they are on the go. In this regard, we co-developed Android, the world's first fully open platform that any mobile developer can use and any hardware manufacturer can install on a device. Android was built with the web in mind, and we believe that it will help drive innovation so that more people can use better and cheaper mobile devices to access the Internet.

As a leading provider of data services, as well as host of numerous apps and platforms, Google has a strong interest in the effective regulation of Singapore's broadband service providers, and welcomes the opportunity to make a submission in response to the consultation paper issued by the IDA on its Policy Framework for Net Neutrality on 11 November 2010.

2. Google's Comments

A. An Open Internet

Google has always been a strong supporter of the open Internet. After all, we are a product of that very environment, and our relatively brief history has been inextricably linked to the rise and success of the Internet.

The Internet was designed to maximise user choice and innovation. Its open, neutral architecture has proven to be an enormous engine for market innovation, economic growth, social discourse, and the free flow of ideas. The remarkable success of the Internet can be traced to a few simple network principles – layered architecture, end-to-end design, and open standards like the Internet Protocol – which together give consumers choice and control over their online activities.

This open network has spawned an explosion of innovation at the edges of the network, and the growth of companies like Google, Yahoo, eBay, Amazon, Facebook, and many others. Because the network is designed to be decentralised, the creators of new Internet content and services need not seek permission, from carriers or governments, to be seen online. As a result, we have seen an array of unanticipated innovations evolve, from VoIP to search to social networks and "the cloud."

Broadband can do many things, and serve many purposes, from conveying communications to entertainment to information. As a matter of public policy, though, we care most about broadband as an optimal platform for users to access and interact with the Internet. Broadband infrastructure plays a unique role as an essential and scarce resource, deployed by relatively few providers, and utilising valuable government-granted rights and advantages. With the rise of broadband networks as the new consumer "on ramps" to the Internet, all stakeholders in the Net's future have an interest in preserving the essential "open" qualities of the Internet and ensuring continued investment in network infrastructure. There are a number of ways to attain that objective. The key question is how best to promote in a light-touch manner those vital elements of openness that long have been part of the Internet's DNA.

B. The IDA's Current Policy Approach

The right solution will depend on the specific existing regulatory and market context, which will vary in different places. We believe market solutions – driven by competition, transparency, and industry norms – are preferable here. That said, the government can help the market work well, and where the market demonstrably fails, regulators can act as a backstop.

Currently, the IDA has a policy framework in place that provides some basic protections. Importantly, the framework provides a "no blocking" rule which we agree with, as there appear to be no good reasons – outside of managing networks to prevent DOS attacks, spam, and other malware – for a broadband provider to block lawful Internet traffic. This rule is also in line with existing consumer protection and competition laws in most countries, where broadband providers are not allowed to favour their own services over others' in anti-competitive ways. We encourage the continued development of this framework as the market evolves.

C. The IDA's Proposed Enhancements to Transparency

Markets rely on information to function properly, and greater transparency can empower policy-makers, consumers and companies to make well-informed decisions and hold market actors accountable. In this regard, we believe that the proposed policy enhancements are sensible improvements, by providing the public with greater information about actual (as opposed to advertised) broadband speeds.

However, despite the importance of broadband to Singapore, there is still a lack of information about many aspects of broadband service offerings, including information about actual speeds and the impact of network management practices. By their very nature, network management practices occurring within the broadband providers' physical and logical networks may have effects on application and content performance that are difficult for a user to discern and understand.

3. Suggestions for Further Improvement

The IDA asks specifically for comments on how it can improve transparency of the performance of broadband Internet access offerings, and we offer some specific suggestions below.

A. Consumer Transparency Regarding Broadband Services

The IDA may want to evaluate whether consumers have sufficient information available to them about all pertinent terms of their service offerings before they purchase broadband Internet access, including information about the average and minimum speeds; the average and maximum intra-network latency; and information on diurnal patterns in actual speeds. Currently, the IDA only publishes QoS reports for network availability, local and international network latency, and customer service support. Going beyond these metrics can help users make informed decisions.

The IDA may also want to consider collecting and publishing information concerning network management practices that will (1) directly impact the performance of particular applications, content, or protocols; or (2) reduce the speed or quality of the connection below the provider's advertised measures for the service offering. Relevant network management practices include traffic prioritisation, traffic blocking or throttling, processes to address traffic congestion such as usage download or upload restrictions, content/message examination processes (e.g. deep packet inspection), and traffic routing processes that are based on sender/receiver, or type of traffic. Because such practices likely will affect broadband availability, adoption, and competition, the IDA should have access to clear, accurate, and useful information about them. Application developers, content providers, and other Internet users should also have access to this data, as such practices impact their ability to design and invest in their offerings.

Such data collection and disclosure requirements need not be unduly burdensome and should be commercially feasible. In fact, ISPs like Singnet and Starhub already make such information available.[1] Most ordinary network adjustments would not fall into the two categories above. For those that do, a broadband provider should be required to disclose the consequences of the network management, but not highly specific details about particular technologies used. For example, consider a practice that prioritises traffic from a particular application. A broadband provider should disclose what application is being prioritised and how that will impact performance (e.g., this application will have a guaranteed low latency, even at times of

[1] See http://www.singnet.com.sg/technical/broadband/qns/adsltech.html#Q10 and http://www.starhub.com/networkmgmt

congestion). A provider would not, however, have to disclose the exact networking equipment, router configurations, or algorithms that achieve this impact.

The IDA may then want to consider how to make this data easily accessible in the form of a functional, easy-to-use web-based "dashboard." This would enable consumers to have access to clear, accurate, and useful information about broadband access offerings, and better understand the parameters of the services to which they subscribe or could potentially subscribe. This data could also be published in user-friendly, machine-processable formats, so as to make it easy for researchers to access and re-use in "raw" form. Indeed, some of the most useful insights often come from network researchers engaging in deep analysis of the data, as well as examination and comparison of different data sets.

B. Measurement of Broadband Services

Broadband measurement is a necessary, complementary part of improving broadband transparency. As such, in addition to collecting data from providers, it is important that the IDA independently determines the level of service that is actually being delivered to users, and verifies data collected from the ISPs themselves.

Measurement can serve other important roles as well. For instance, it can advance network research, and empower users to diagnose problems with their Internet connections and take steps to address them, to the extent that is within their control. Therefore, the IDA should also consider developing its own measurement efforts as well as building on existing ones. The research community, along with businesses, have long focused on both the challenges and opportunities in this area, and a wide array of network measurement tools already exist that may assist the IDA.

For example, Measurement Lab (M-Lab)[2] is an open, distributed server platform that allows researchers to deploy Internet measurement tools as the server back-end for its tests. Users can run M-Lab tools to measure their own broadband connections and test speed and latency. They can also determine whether certain applications may be throttled or blocked, and diagnose certain problems that inhibit broadband performance. M-Lab is a collaborative effort led by academic researchers, with the support of a broad range of organisations and companies, including Google Inc.,

[2] http://www.measurementlab.net

New America Foundation's Open Technology Initiative, the PlanetLab Consortium, Amazon Web Services, Internet2, and SamKnows. Today, 48 servers are currently operational across 16 sites in the US, Europe, and Australia, and 7 tools, including two mobile measurement tests, have been deployed. All M-Lab data is publicly available and open to re-use. To date, there have been 47 million tests run since launch, with over 200,000 tests run daily, and more than 170 terabytes of data are available publicly[3].

Policymakers have already been taking advantage of M-Lab. For example, in March 2010, the U.S. Federal Communications Commission incorporated the Network Diagnostic Tool (NDT) running on M-Lab as part of their Consumer Broadband Test[4]. In April 2009, Greece's telecommunications regulator (EETT) deployed M-Lab servers in Athens, in collaboration with the Greek Research and Technology Network (GRNet), in order to improve the Greek user experience with the tools.

Whichever way the IDA decides to pursue broadband measurement, open data and methodologies are crucial to enabling robust measurement. To use a common engineering trope, open code means that all bugs are shallow. Making it easy for myriad people to analyse both the tools and data will make it easy to identify flaws, shortcomings, and confounding variables.

Indeed, the only way to properly evaluate data's utility is if measurement tools are as open and accessible as possible, so that many people can analyse them. Measurement tools need not be perfect before they are used. The IDA can still rely on several complementary methodologies, combining insights to get a more fulsome picture of the broadband environment, and iterating its methodology as measurement improves. Subsequently, third parties should then be enabled to "look under the hood" of the measurement tools and techniques on which the IDA relies, so that researchers and others can independently verify the data and provide feedback on their methods and analysis. Good network research – like any other scientific field – requires experimentation and improvement over time.

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[3] MIT computer scientist Dave Clark has done one of the first analyses of M-Lab data, and noted that the NDT tool on M-Lab 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... This is an impressive amount [of data]." See: http://mitas.csail.mit.edu/papers/Bauer_Clark_Lehr_Broadband_Speed_Measurements.pdf

[4] http://www.broadband.gov/qualitytest/about/

Because there are trade-offs with different techniques, the IDA may also wish to consider taking advantage of multiple, complementary data sources and methodologies, rather than selecting a single methodology or tool. This can be done by "crowdsourcing" data through user-initiated, self-selected tests.

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. That said, they also have limitations, and the resulting data can often be inadequate to fully understand the state of the broadband marketplace. Selection bias and other confounding factors may also limit the usefulness of the aggregate data.

In this regard, the IDA could also incorporate complementary options, including software- and hardware-based testing through well-designed customer panels across a representative sample of users. The SamKnows testing approach used to obtain comprehensive data measuring actual performance of broadband services in the U.K.[5] and U.S.[6] provides a useful model. SamKnows embeds its software-based tests in wireless routers, and the devices perform speed, latency, jitter, and other measurements at regular intervals. In this way, SamKnows can better control for certain factors that might affect test validity, such as the impact of a user's PC or other users on the broadband connection. SamKnows is planning to use the M-Lab platform, and, as with all M-Lab tools, raw data from its collections will be available to researchers.

The IDA could also 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 analyses actual network activity without introducing new traffic into the network. Both types of tools provide opportunities for the collection and analysis of useful data.

Ultimately, the IDA should investigate tools that attempt to measure and analyse what factors contribute to a certain level of performance, and provide possible fixes. For example, the IDA should seek to understand not simply what speed a user

[5] http://www.ofcom.org.uk/research/telecoms/reports/broadband_speeds/broadband_speeds/
[6] http://www.testmyisp.com/index.php

achieves, but why that speed was achieved and the operative bottlenecks to performance on the network or the device. This would help users to improve their performance, to the extent that improvements are within their control.

4. Conclusion

Google believes that the availability of clear and accurate information is essential for a free and open Internet. Therefore, we urge the IDA to continue looking at ways to improve transparency, to require broadband providers to supply consumers, other users, and the IDA with more details about their service offerings, and to engage in measurement techniques that will enable the IDA and broader community to study the performance of broadband service offerings in Singapore.