Comments by LIRNE*asia* on the minimum speed of broadband services and related broadband quality measures
Submitted to the National Telecommunications Commission (NTC), Philippines on the 3rd November 2014

LIRNE*asia* appreciates the opportunity to offer recommendations on Broadband Quality of Service (QoS) measures. LIRNE*asia* has been engaged in related research since 2007. Our objectives have been to provide research-based input to relevant policy discourse, achieve truth in advertising, and to ensure that users have access to adequate broadband QoS. Our research findings have been extensively shared with the likes of the Economic and Social Commission for Asia and the Pacific (ESCAP), South Asian Telecommunication Regulators' Council (SATRC), training courses offered by the Ford Foundation, engagements with multiple national regulatory authorities (NRAs) for example, the Telecom Regulatory Authority of India (TRAI), Communications Authority of Maldives (CAM), Bhutan InfoComm and Media Authority (BICMA), Information and Communication Technologies Authority of Mauritius (ICTA), and the Telecommunications Regulatory Commission of Sri Lanka (TRCSL), to name a few. We trust our research based comments will contribute to the improvement of broadband QoS levels in the Philippines.

Recommendation 1 on Service Reliability: Differentiating between fixed and mobile broadband services

In wireline and fixed wireless networks, there is a static relation between the number of users and the exchange/base station, and this relationship is within the control of the service provider, i.e., the operator can relatively control how many users share the bandwidth." In contrast, in cellular networks (used for mobile broadband services), the number of users served by a Base Transceiver Station (BTS) is not under the control of the operator, nor is it under the control of any user. Therefore, the load on a BTS can vary within a very short span of time, resulting in variation on the QoS experienced by the user. Based on operator configurations, such occurrences may cause the cell to dynamically resize (the cell breathing phenomenon in 3G networks) thereby affecting changes to the user experience, including, in some cases, disruption of service.

Therefore, in the first instance, it is recommended that the guidelines clearly differentiate between fixed and mobile broadband services. Recognizing the volatility of the mobile network, the latter should realistically have a different threshold for 'acceptable service offerings.' For example, the broadband monitoring unit of the Telecommunication Regulatory Commission of Sri Lanka (TRCSL) measures and publishes download speeds from international servers on a monthly basis. In their analysis, they provide two thresholds for fixed and mobile broadband. For example, for fixed broadband services advertising speed of up to 10 Mbps the download speed received by the user is expected to be 70 percent of the advertised speed and *should not* drop below 40 percent of the advertised (Figure 1). In the case of mobile broadband, TRCSL recognizes the volatile nature of the network impacted by factors such as signal propagation and weather, inter alia, that affect the last mile. They are also aware that service providers advertise the theoretical maximum (based on the capability of the USB dongle device). As such, the benchmark is set for the lower threshold only; i.e., the download speed received by the user should not go below 30 percent of the advertised.
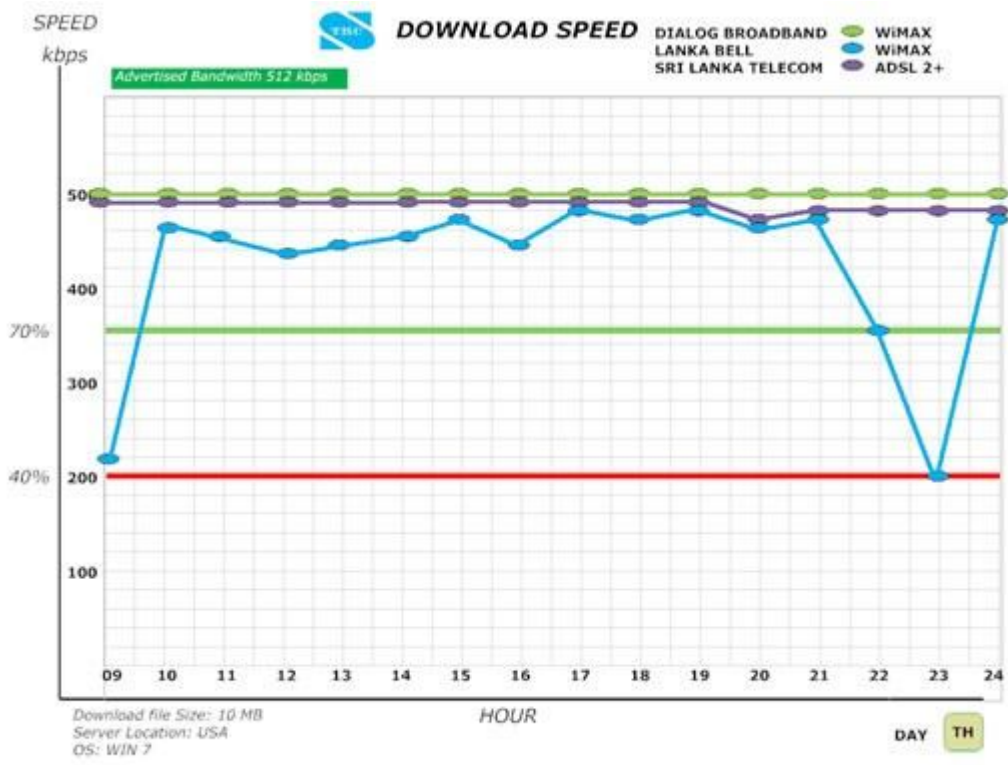
Figure 1: Fixed broadband download speeds collected and reported by TRCSL[1]

Recommendation 2 on Advertised Speed

In the least and based on the ITU definition of broadband, the minimum download speed of 256 Kbps must be met, at the onset, at least 80 percent of the time. Figure 2 illustrates this further. It consists of results obtained by LIRNE*asia* for three mobile broadband plans in Manila, Philippines and one in Jakarta, Indonesia. The Globe Tattoo Prepaid stick and SmartBro Starter Plug-it fail to provide the minimum speed, let alone providing 80 percent of the advertised speed.

City, Country	Manila, PH			Jakarta, IND
Package	Globe Tattoo Prepaid (3.6 Mbps)	SmartBro Starter Plug-it (7.2 Mbps)	Sun Broadband Plan 799 (3.6Mbps)	Telkomsel Flash Ultima (3.6Mbps)
8:00 AM	375.4	339.6	798.75	847.6
11:00 AM	**75**	**188.4**	**198.75**	849.2
3:00 PM	**108.2**	273.4	465.25	952.8
6:00 PM	**221.2**	**216.2**	282	1173.6
8:00 PM	**97.6**	**252**	500.5	787.6

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[1] Fixed broadband plans with advertised speeds of 512 Kbps. The graph illustrates the download speeds achieved while downloading a 10 MB file from a server in the US, September 2014.

| 11:00 PM | | 131 | 124 | 174 | 838.6 |
| Average | | 168 | 232.3 | 403.2 | 908.2 |

Figure 2: Download speeds of select broadband plans, LIRNE*asia* 2014[2]

Note: These diagnostics are carried out as per LIRNE*asia*'s methodology[3][4] developed in collaboration with Prof. T Gonsalves, Director, Indian Institute of of Technology (IIT)-Mandi.

Another way of assessing service reliability is, as MO 07-07-2011 defines, to mandate the advertised speed is achieved at least 80 percent of the time. However, if performance is assessed against advertised speeds, all plans severely fall short (Figure 3). Unfortunately LIRNE*asia* could not carry out its diagnostics on fixed broadband services in the Philippines due to considerable investment and long contractual requirements by the service providers[5]; however, there are many examples from other South Asian and South East Asian economies where this same trend is seen (please refer to Figure 2 on the LIRNE*asia* 2014 report). The disparity is perhaps highlighted more in the case of mobile broadband because service providers tend to advertise the capabilities of the device (USB dongle) or the theoretical maximum as opposed to reporting re realistic / average speeds that can be expected. Especially in the case of mobile broadband, it is recommended that service providers measure and publish *typical* or *average* download speeds.

If required as a benchmark, the Infocomm Development Authority (IDA) of Singapore implemented the same in 2011.[6]
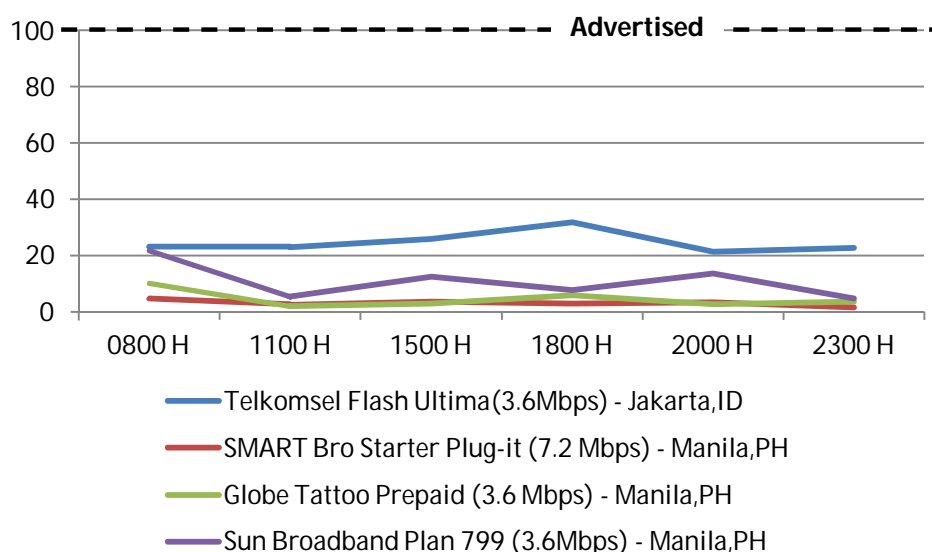
Figure 3: Download speed as a percentage of what was advertised, LIRNE*asia* 2014

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[2] LIRNEasia QoSE Indicators Report 2014 available at: http://lirneasia.net/wp-content/uploads/2014/09/BBQoSE-Report_Final.pdf

[3] The methodology is available at http://lirneasia.net/wp-content/uploads/2010/10/Methodology_FixedQoS1.pdf

[4] http://www.lirneasia.net/wp-content/uploads/2008/03/broadband-quality-test-plan1.pdf

[5] Fixed broadband service providers require subscribers to be under a two-year lock-in period.

[6] See https://www.ida.gov.sg/About-Us/Newsroom/Media-Releases/2011/IDAs-New-Regulations-for-Mobile-and-Broadband-Services-Empower-Consumers-to-Make-Informed-Choices.

Recommendation 3 on Measuring Broadband Quality of Service:

3.1 Roles and Responsibilities

Adequate measurement of broadband performance is in the interest of all stakeholders. Regulators mandated to act in the best interest of consumers conduct broadband tests to enable them to set standards, define policies and resolve disputes based on evidence. Consumers need the data to make informed decisions when selecting service providers and broadband plans, as well as for lodging complaints.[7]

Several factors should be considered when deciding who is best positioned to take on the responsibility of measuring broadband performance (Figure 4).

- Independent consumer measurements typically lack uniformity in the methodology adopted, making comparability an issue. The risk of inaccurate results is significant as a number of factors—such as the operating system, the browser, virus-infected machine etc.—can affect the results. Nonetheless, consumer-centric initiatives are important not least to hold operators accountable.

- While network operators usually have various diagnostics for internal quality monitoring purposes, they usually consider the segments of the network with the best connectivity that does not accurately emulate the access network. As a result, the diagnostics will often differ from what consumers actually experience.

- Therefore, from a consumer perspective, and given the nature and mandate of national regulatory authorities (NRAs), a regulator is often well positioned to measure broadband performance. The challenge is to adopt a sound methodology and present the data transparently, in a manner that can be easily understood by the general public.

Ideally, many broadband users will generate diagnostics that can be centrally analyzed to better inform policy. Also, the large number of user generated data will normalize potential anomalies. However, LIRNE*asia*'s past experience shows that in developing economies crowd-sourcing or volunteer-based methods pose a challenge. Lack of incentives and the lack of positive outcomes, i.e., operator or regulator actions based on generated results, are some reasons as to why this approach does not work.

	Regulatory approaches			
	Self-regulation by operators	Direct monitoring by regulator	User-satisfaction surveys	Demand-side (user) testing
Intrusiveness on the network	None	High	None	Negligible
Regulator participation	Medium to Low	High	Depends on survey	None
Operator participation	High	High	Depends on survey	None

[7]Epitiro. 2011. Regulatory Challenges for Measuring National Broadband.
http://www.epitiro.com/assets/files/Challenges%20for%20Regulators%2020-102-1008.001.pdf

User participation	None	None	High	High
Subjectivity of results	Medium to Low	Medium to Low	High	Low

Figure 4: Different approaches to broadband QoS regulation[8]

3.2 Methodology

When defining the minimum download speed, it is also important to ensure that the speeds reported by the various service providers are comparable. In order to do this, a common test methodology should be followed.

Network traffic is volatile. As such the method needs to take in to account these anomalies (peak and off-peak traffic variations) in a manner where they can be normalized. Therefore, it is important that typical speeds are advertised after having carried out tests over multiple time slots and over multiple days of the week including weekends.

Broadband quality is location specific. The quality at one location cannot possibly be used to assess the state of broadband of a country. Therefore, having a large number of data points where results can be aggregated at an urban agglomeration level will be ideal.

The various network domains (i.e., content hosted within ISP, within country but on a different ISP server, and internationally) are also critical elements. LIRNE*asia* research on broadband QoS includes analysis on multiple domains. The general trend has been better results when a servicer within the country is accessed than a server hosted internationally (Figure 5).[9] To avoid misleading information being published, it ought to be mandated that *typical download speeds* are measured while accessing an ***international server***, specifically if most of the content accessed is hosted out of the Philippines.

3.3 It is not just about download speed

Download speed is an important metric when downloading bandwidth-intensive media, such as music and video. The majority of users, however, access the Internet to browse websites. For browsing, latency is the more critical metric. Latency or round trip time (RTT) is the measure of how long a packet takes to reach the destination server and return to the client. So the less time it takes the faster the web page will load (in other words, the lower the RTT the better).
Figure 5 illustrates the RTT achieved during the March-2014 research carried out by LIRNE*asia*. 300 ms is the threshold recommended by the IDA (Singapore) for RTT to an international server, while 50 ms is their threshold for the local domain. The figure also helps reiterate the importance of carrying out multiple domain diagnostics.

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[8]Wattegama, C., and Kapugama, N. 2009. Prospects of Volunteer Computing model in performance data gathering for Broadband Policy Formulation: A Case study from South Asia. http://lirneasia.net/wp-content/uploads/2009/10/Broadband-Quality-of-Service-Experience_LIRNEasia.pdf
[9] However, there have been exceptions when the results have been the opposite, hinting of bandwidth limitations when accessing some servers in-country.
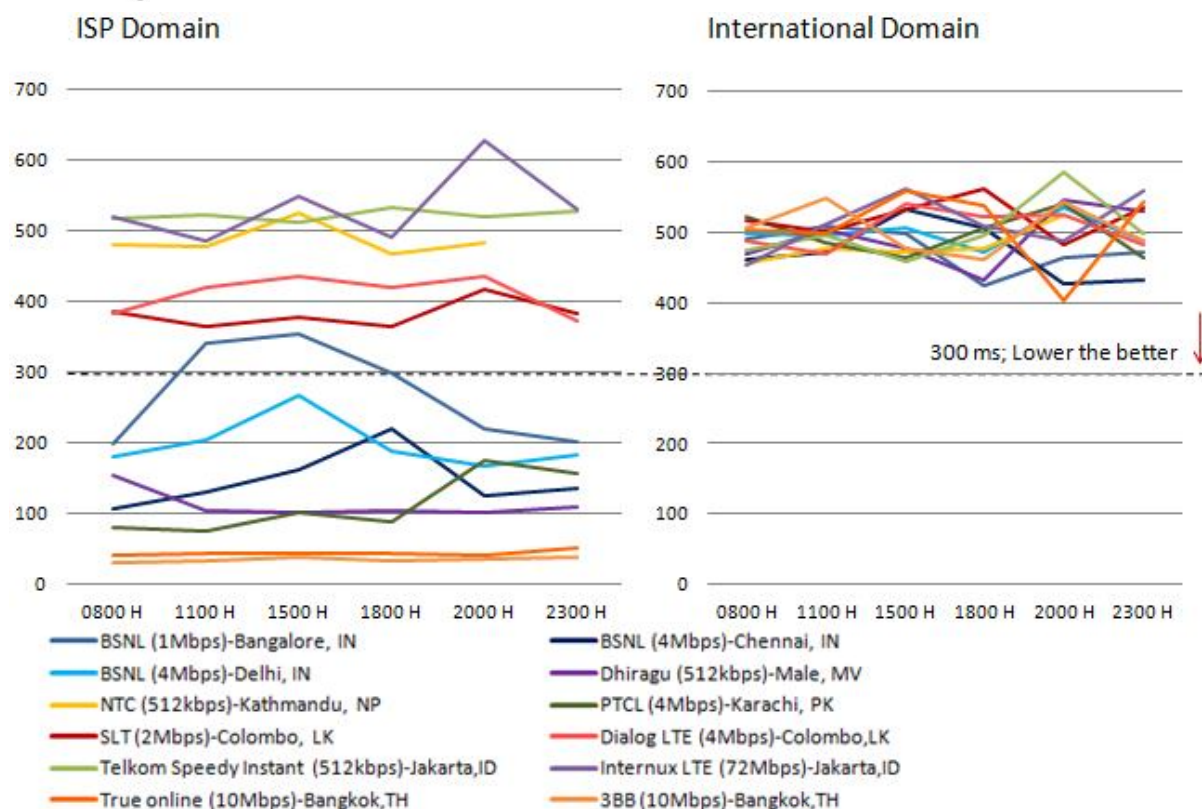
Figure 5: Latency, ISP Domain vs. International Doain, LIRNE*asia* 2014

Further, with cloud services gaining prominence, download speed is no longer the single most important parameter to consider (
Figure 6). The increase in the use of offline storage, file sharing, and back-up services significantly change the way upload speeds are been perceived. As such multiple parameters ought to be considered.

Service	Download (kbps)	Upload (kbps)	Latency (or Round Trip Time, RTT) (ms)	Jitter (ms)	Packet Loss (%)
Browsing (Text)	++	-	++	-	-
Browsing (Media)	+++	-	++	+	+
Downloading	+++	-	-	-	-
Transactions	-	-	++	+	-
Streaming media	+++	-	++	++	++
VOIP	+	+	+++	+++	+++
Games	+	+	+++	++	++

+++ Highly relevant; ++ Very relevant; + Relevant; - Irrelevant

Figure 6: The relevance of broadband quality parameters on services[10]

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[10] http://lirneasia.net/wp-content/uploads/2009/09/AT-TesterComparison.pdf

3.4 Multi-stakeholder approach

It is recommended that the NTC defines a clear methodology with appropriate benchmarks that is made publicly available. As the regulator, it is recommended that <u>NTC is responsible for analysis and reporting the state of broadband quality in the Philippines</u>. But the fact that broadband quality is both location and time variant must be taken in to account. Ideally, <u>a mechanism to run diagnostics will be provided to the public who can also contribute to the collection of broadband quality related data</u>. As such, the NTC may consider several options:

- <u>Hire researchers</u> who are based in test locations (as done by LIRNE*asia*)
- <u>Enlist volunteers</u> to carry out diagnostics (as done by Research ICT Africa)
- <u>Publicize QoS diagnostic tool</u> on regulator's website (as done by the FCC, USA)
- <u>Host a diagnostic tool for public consumption</u> while testing and publicizing QoS results (as done by TRC, Sri Lanka)
- Define broadband quality benchmarks that must be adhered to and <u>request for service providers to report</u> on these parameters on a quarterly basis (as done by TRAI, India)
- <u>Collaborate with engineering colleges</u> nationwide (applicable only for software or web-based tools; tests can be conducted by faculty and students, but not in campus)

3.5 Recommended Benchmarks

Parameter	Definition	Benchmark
Throughput	Referred to as the "actual amount of useful data sent on a transmission". Defined by the ITU as "an amount of user information transferred in a period of time" (ITU-T X.641 (97), 6.3.3.16), more commonly referred to as download or upload speeds.	Fixed Broadband: Advertised speed achieve 80 percent of the time
Latency	Referred to as "delays when voice packets transverse the network". It is measured in milliseconds by using the Round Trip Time (RTT).	< 300 ms
Jitter	Referred to as "uneven latency and packet loss". It is the variation of end-to-end delay from one packet to the next within the same packet stream/connection/flow.	< 50 ms
Packet Loss	Referred to as the number of packets (as a percentage) that does not reach the destination.	< 3%

It is recommended that the above is captured;

- During multiple times of the day (to account for peak and off-peak times)
- During multiple days of the week (to account for changes in data traffic during week days and weekends)
- In multiple domains (at least two domains – local [a server located within the ISP network] and International [a server located at the first U.S. Point-of-Presence]).
- In multiple locations in the Philippines (to account for service areas of varying levels of congestion)

- On a quarterly basis, in the least

LIRNE*asia* is a regional information and communication technology (ICT) policy and regulation think tank active across the Asia Pacific. Its core focus is on conducting in-depth research and analysis of key policy issues, disseminating that research and analysis to policymakers, regulators, managers of the relevant firms, other stakeholders, and the media. Capacity building is a core element of our mission. We have a strong record of accomplishment in conducting policy relevant and successful training programs for a range of stakeholders, not limited to government, in several countries.

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