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**Recommendations by LIRNE*asia* on Internet Quality of Service (QoS) Measurement Methodology for the MC on minimum speed of broadband connections**
**Submitted to the National Telecommunications Commission (NTC), Philippines on the 25th May 2015**



LIRNE*asia* appreciates the opportunity to offer further recommendations on broadband quality of service (QoS) measures. We have been engaged in related research and other broadband service issues since 2007. In the Philippines, we conducted studies on broadband QoS experience from 2011 to 2014. We trust that our research and experience in carrying out such tests, not only in the Philippine but in several other countries in South and Southeast Asia, can help contribute to the discussion on methodology. The recommendations put forward in this document are in support of, and complementary to, two previous LIRNE*asia* submissions to NTC, namely: (i) "Comments by LIRNE*asia* on the minimum speed of broadband services and related broadband quality measures" (3 November 2014) and (ii) "LIRNE*asia*'s response to the points raised by PCTO at the National Telecommunications Commission (NTC) Technical Working Group (TWG) on MO 07-07-2011 on Minimum Speed of Broadband Connection (16 April 2015).

**Summary of Recommendations:**

LIRNE*asia* has five (5) major recommendations:

1. **ISP performance metrics**. Identify two sets of internet performance metrics: *for fixed* (wired and wireless) and *for mobile broadband* service; *for compliance* (download and upload speeds, latency) and *for monitoring* (data volume, packet loss, jitter).

2. **Testing methodology**. NTC to measure performance metrics during:
    a. multiple times of the day (to account for peak and off-peak times);
    b. multiple days of the week (to account for changes in data traffic during week days and weekends);
    c. 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]);
    d. in multiple locations in the Philippines (to account for service areas of varying levels of congestion), both known and unknown to ISPs; and
    e. on a quarterly basis, in the least.

3. **Typical speed**. Require Internet service providers (ISPs) to measure and publish *typical* or *average* download speeds per location (e.g., city level) using an NTC-approved measurement tool.

4. **Roles and responsibility.** NTC to independently measure ISP performance and officially analyze and publish results, but software or web-based tool to be made available to the public.

5. **Publication.** NTC to publish results two weeks after the quarterly tests are completed.

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**Detailed Recommendations:**

## 1) ISP performance metrics

***Recommendation***: NTC to identify two sets of broadband performance metrics: *for fixed* (wired and wireless) and *for mobile* broadband service; *for compliance* and *for monitoring* only.



***Fixed and mobile broadband services:***

The new guidelines should clearly differentiate between fixed (wired and wireless) and mobile broadband services given the difference in service reliability in those two modes of connection. 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.

***For compliance and for monitoring:***

As such, LIRNE*asia* recommends two sets of QoS metrics that would take into consideration the telcos' issues about "being penalized for irrelevant standards" and "setting standards that would negatively affect the smaller players," while also addressing the main concern of subscribers about poor internet service. The NTC may choose to identify Internet service performance metrics **for compliance** and those that are **for monitoring** only.

In identifying the metrics *for compliance*, it is critical to consider which are most relevant to the subscribers, as also pointed out by the ISPs and stakeholders in the NTC technical working group.

**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). Further, with cloud services gaining prominence, download speed is no longer the single most important parameter to consider (Figure 1). The increase in the use of offline storage, file sharing, and back-up services significantly change the way **upload speed** is perceived. As such multiple parameters ought to be considered.

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| 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 1: The relevance of broadband quality parameters on services[1]**

### *Benchmarks for Compliance*

In performance metrics **for compliance**, NTC will measure performance and set minimum acceptable service standards for compliance by all ISPs.

| Parameter | Definition | Benchmark |
|---|---|---|
| Throughput | "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*:<br>Advertised speed achieved 80% of the time<br><br>*Mobile Broadband*:<br>Advertised speed achieved 70% of the time |
| Latency | "Delays when voice packets transverse the network". It is measured in milliseconds by using the **round trip time (RTT)**. | Ideally, latency is:<br>< 50 ms for local<br>< 300 ms for international |

### *Benchmarks for Monitoring*

In performance metrics **for monitoring**, NTC will measure performance but not necessarily set a minimum standard. Below are the recommended metrics for monitoring only:

| Parameter | Definition | Benchmark (for illustration purposes) |
|---|---|---|
| Volume | Amount of data that subscriber download from/upload through the ISP's network. | Based on data plan and daily cap |

[1] Gonsalves, T. A. & Bharadwaj, A. (2009). See http://lirneasia.net/wp-content/uploads/2009/09/AT-TesterComparison.pdf

| | | |
|---|---|---|
| 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% |



Test results for ALL metrics will be published on NTC's website.

## 2) Testing Methodology

***Recommendation***: The above metrics should be tested:

- 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), both and unknown to the ISPs
- On a quarterly basis, in the least

| | |
|---|---|
| **Multiple times** | Peak and off-peak hours (e.g., 8:00; 11:00; 15:00; 18:00; 20:00; 23:00) |
| **Multiple days of the week** | Two weekdays and two weekends |
| **Multiple domains** | 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 are also critical elements. Metrics should be measured in three domains based on content hosting:<br>• Local: Within ISP<br>• National: Within country but on a different ISP server<br>• International: In another country |
| **Multiple locations** | National Capital Region + select cities per region. For example:<br>• Luzon: Baguio City; Tarlac City<br>• Visayas: Cebu City; Bohol City<br>• Mindanao: Davao City, Cagayan de Oro City<br><br>Tests will be done in locations (origin and termination) both *known* and *unknown* to ISPs. |
| **Frequency in a year** | Tests must be done and results published every quarter (March, June, September, December) |

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### 3) Roles and Responsibilities

***Recommendation***: NTC to independently measure broadband performance, but software or web-based tool to be made available to the public.

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.[2] However, independent consumer measurements typically lack uniformity in the methodology adopted, making comparability an issue. Nonetheless, consumer-centric initiatives are important not least to hold operators accountable. **Network operators** usually have various diagnostics for internal quality monitoring purposes, but 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.

It is recommended that the NTC defines a clear methodology with appropriate benchmarks that is made publicly available. NTC should be responsible for measuring, analyzing and reporting the state of broadband quality in the Philippines. Ideally, a mechanism to run diagnostics will be provided to the public who can also contribute to the collection of broadband quality related data.

### 4) Typical or average broadband download speeds per location

***Recommendation***: NTC to require ISPs to publish their *typical* or *average* download speeds per location (e.g., city level) using NTC's measurement tool.

There are two ways to measure the quality of download speed. 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. However, this is not often the case. In a LIRNEasia study in Q1 2014, it was found that all major ISPs fail to provide the minimum speed, [3] let alone providing 80 percent of the advertised speed. The diagnostics were carried out as per LIRNE*asia*'s methodology[4][5] developed in collaboration with Prof. T Gonsalves, Director, Indian Institute of Technology (IIT)-Mandi. Another way of assessing service reliability is, as MO 07-07-2011 defines, to mandate that advertised speed is achieved at least 80 percent of the time. However, LIRNE*asia*'s QoSE studies reveal that all PH data plans tested severely fall short (Figure 2). 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.

[2]Epitiro. 2011. Regulatory Challenges for Measuring National Broadband. http://www.epitiro.com/assets/files/Challenges%20for%20Regulators%2020-102-1008.001.pdf
[3] LIRNEasia QoSE Indicators Report 2014 available at: http://lirneasia.net/wp-content/uploads/2014/09/BBQoSE-Report_Final.pdf
[4] The methodology is available at http://lirneasia.net/wp-content/uploads/2010/10/Methodology_FixedQoS1.pdf
[5]http://www.lirneasia.net/wp-content/uploads/2008/03/broadband-quality-test-plan1.pdf

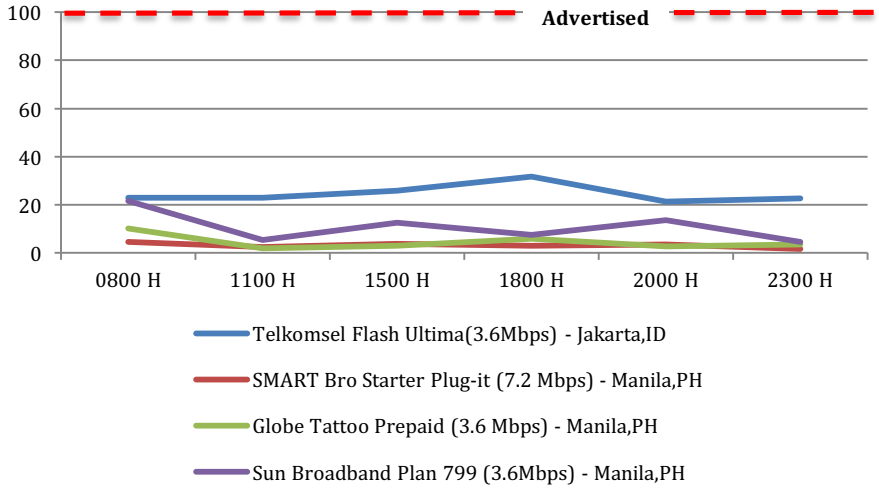


**Figure 2: Download speed as a percentage of what was advertised, LIRNE*asia* 2014**

Instead of requiring ISPs to publish minimum download speed—which telcos indicate at 12-48 Kbps across the board—it is recommended that service providers measure and publish *typical* or *average* download speeds per location (e.g., city level) using an NTC-approved measurement tool (vis-à-vis a specified domain [e.g., international server]). These average speeds must be published in all ads and websites to empower subscribers to make informed choices about the best performing ISP in their area.

## 6. Publication

***Recommendation***: NTC to publish the results of the internet QoS measurement within two weeks after each quarterly test is completed.

The report template of raw data may contain the following data (example):

| Date | Time | ISP | Service | Technology | Monthly Rental (in peso) | Monthly Data volume | Test location (City) | Domain | Metric [Download] |
|---|---|---|---|---|---|---|---|---|---|
| 01-06-15 | 08:00 | ISP 1 | Fixed | DSL | P1,000 | 1.5 GB | Quezon City | Local | 500 Kbps |
| 01-06-15 | 08:03 | ISP 1 | Fixed | DSL | P1,000 | 1.5 GB | Quezon City | National | 230 Kbps |
| 01-06-15 | 08:08 | ISP 1 | Fixed | DSL | P1,000 | 1.5 GB | Quezon City | International | 136 Kbps |

For the analysis report, here are some examples from other regulators:
IDA (Singapore): http://www.ida.gov.sg/applications/rbs/chart.html
TRC (Sri Lanka): http://www.trc.gov.lk/2014-05-12-13-25-54/broadband/454-broadband-speed-test-results-november-2014.html
FCC (U.S.): https://www.fcc.gov/reports/measuring-broadband-america-2014
OfCom (U.K.): http://stakeholders.ofcom.org.uk/market-data-research/other/telecoms-research/broadband-speeds/broadband-speeds-november2014

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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