Quality of Service Framework for Retail Fixed-Line Broadband Internet Access Services (ADSL / Cable Broadband Services)

This is applicable to **Broadband Access Service Providers (BASPs) providing fixed-line ADSL / cable broadband services** to residential and/or business end users, and whose ADSL / cable broadband subscriptions form more than 10% of the individual BASP's total fixed broadband service subscriptions.

- Affected BASPs who offer higher or equivalent Service Level Agreements or Guarantees to their end users can request for an exemption from complying with the QoS framework. A BASP can also request for an exemption if it can demonstrate that its end users have agreed to accept a lower QoS standard.
- Where the BASP is not subject to IMDA's minimum quality of service standards or is exempted from compliance, the BASP has the responsibility to inform the end user of the service level it will be providing and the fact that it does not comply with IMDA's minimum quality of service standards.

(A)	Performance Indicators (For Compliance[1])	QoS Standards
(1)	**Network Availlability**[2]	> 99.9%
(2)	**Network Latency (for round-trip) [see *]** In cases where more than one network latency figure is available for either the local or international network, BASPs must also submit one weighted average network latency figure for the relevant segment of the broadband network.	
(a)	Local Network Latency[3]	≤ 50 msec
(b)	International Network Latency[4]	≤ 300 msec
(3)	**Bandwidth Utilisation[5] [see *]** (for connections within the local network) For any one segment of the broadband network with more than 1 link, the BASP will be required to submit bandwidth utilisation figures for each individual link in that segment. In addition, in these cases, the BASP must also submit one weighted average peak bandwidth utilisation figure for the relevant segment of the broadband network. [see Appendix 1]	
	Segment between A-B	
	Segment between B1-E1	≤ 90%
	Segment between B2-C	[not to exceed 90% for 3 or
	Segment between D-E2	more consecutive months]
	Segment between F-G	

(B)	Performance Indicators (For Monitoring)	IMDA's Comment
(1)	**Service Activation Time[6]**	For Monitoring
(a)	% of service accounts activated within 5 working days or on date agreed/specified by customers	
(b)	Total no. of applications received for the period (to be removed with effect from 1 June 2017)	
(2)	**Customer Service Support**	For Monitoring
	No. of customer complaints received per 1000 subscribers[7]	
(B)	Performance Indicators (For Monitoring)	IMDA's Comment
(3)	Multiple TCP Throughput[8]	For Monitoring
(a)	Local[9] for Residential and Business	
(b)	International[10] for Residential and Business	
(4)	Single TCP Throughput[11]	For Monitoring
(a)	Local[9] for Residential and Business	
(b)	International[10] for Residential and Business	
(5)	**International Bandwidth Utilisation**	For Monitoring
	[only for Internet Exchange Service Providers (IXSP) to provide on the behalf of BASPs]	

* Frequency of Measurement: BASPs are required to make "test-calls" at 5-minute intervals during the 3 busiest consecutive hours for broadband Internet usage everyday. The "busiest hours" (or "peak hours") refer to the 3 busiest hours of a working week, excluding Sundays and public holidays. BASPs must inform IMDA of their 3 busiest hours when submitting their first QoS report – IMDA reserves the right to review the 3 busiest hours to determine if they should be changed, based on the MRTG Graphs and any other supporting documents.

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[1] For each instance of non-compliance, a financial penalty of S$5,000 per standard per month may be imposed.

[2] Network Availability is the measure of the degree to which the access network is operable and not in a state of failure or outage at any point of time. It measures the total downtime of the network, including the ATM switches, multiplexers, routers, e-mail facilities (if provided) and connection to 1-NET and Internet backbone over a month. All scheduled downtime for the purposes of maintenance and upgrading of the network system will be excluded from the calculation. However, all access network operators must keep their users informed of such maintenance times. Please note that reported downtime should include any downtime caused by upstream service providers.

$$\text{Network Availability} = \frac{(\text{Total operational minutes} - \text{Total minutes of service downtime})}{\text{Total operational minutes}} \times 100\%$$

[3] BASPs are required to send a PING packet from its test point to a router at the IX, i.e. from point A to point G (see Appendix 1). For the avoidance of doubt, PING packets are ICMP echo requests, which are 32 bytes in size for MS DOS and 56 data bytes for UNIX/MAC. The data for each month should be arranged in an ascending order and the 95th-percentile reading must be taken. The measurement, in "x msec", represents the maximum network latency (for round-trip) experienced by end-users for 95% of the time during peak hours and it should be less than 50msec in order to meet IMDA's QoS standard.

[4] BASPs are required to send a PING packet from its test point to a router at the first U.S Point-of-Presence, i.e. from point A to point I (see Appendix 1). However, BASPs should only take the readings from point H to point I (see Appendix 1) along the trace routes for international network latency computation. The data for each month should be arranged in an ascending order and the 95th-percentile reading must be taken. The measurement, in "y msec", represents

the maximum network latency (for round-trip) experienced by end-users for 95% of the time during peak hours and it should be less than 300 msec in order to meet IMDA's QoS standard.

[5] Highest Bandwidth Utilisation = (peak utilisation level in each segment) / (total bandwidth available for that segment). BASPs are required to run "Daily" MRTG Graphs at 5 minute average during peak hours. The highest bandwidth utilisation is the peak utilisation level in each segment (Appendix 1) for each month. BASPs are required to run "Monthly" MRTG Graphs to obtain average bandwidth utilisation for each month for every segment. The Monthly Graphs are to be submitted to IMDA.

BASPs should closely monitor their links when the loading level exceeds 75%. However, BASPs will only be required by IMDA to purchase additional bandwidth if the bandwidth utilisation of the terrestrial links exceeds the 90% loading level for a period of at least 3 months and if there is no better alternative plan to maintain the QoS.

Should a BASP have more than one link within one segment of the broadband network (see Appendix 1), it will be required to submit bandwidth utilisation figures for each individual link in that segment. For example, if a BASP has 3 separate links to its IXs (i.e. 3 separate links within the F-G segment), it should submit separate bandwidth utilisation returns for each of the 3 links. In addition, in these cases, the BASP must also submit one weighted average peak bandwidth utilisation figure for the relevant segment of the broadband network. For instance, in the above example, the BASP must also submit one weighted average peak bandwidth utilisation figure for the F-G segment, taking into account the peak bandwidth utilisation of each of its 3 separate links to its IXs.

[6] Service Activation Time should be computed from the date of application to date of service activation.

[7] A "complaint" is defined as any expression of dissatisfaction with the service provider's service, product, advertisement or policy via oral or written communication, that requires some action by the service provider beyond the initial contact.

[8] Throughput refers to the amount of data that is successfully transferred from one point of the network to another over a specified period of time. It is usually expressed in terms of kbps or Mbps. To run the Multiple TCP throughput tests, the BASP will be required to run multiple concurrent TCP sessions to fill up the access pipes. The Multiple TCP throughput tests will only apply to the top four most heavily subscribed broadband plans.
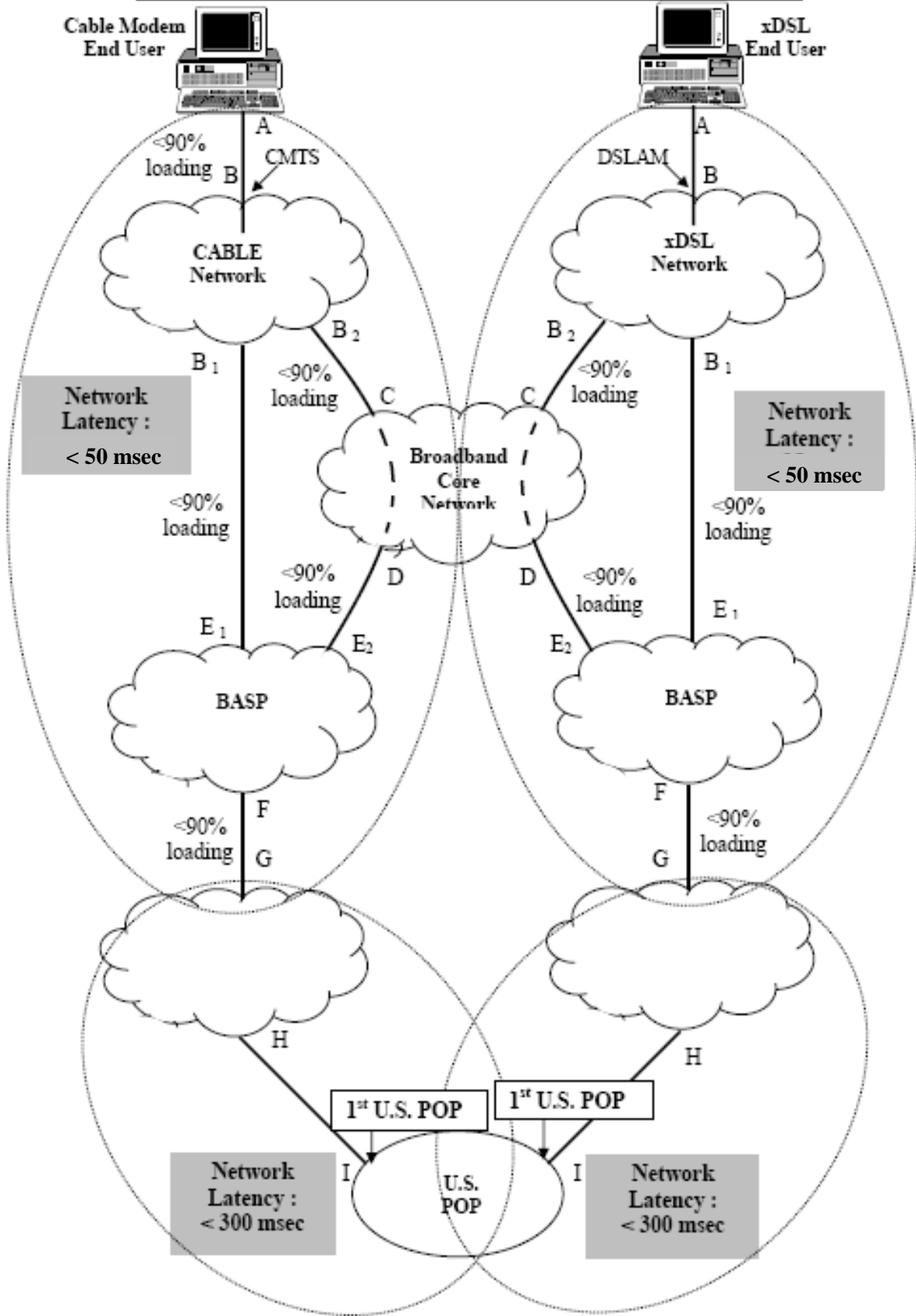
[9] BASPs are required to run six-hourly throughput tests over a 7-day testing period for each of the broadband plans it is required to test, from its test point to a test server in its local Internet Data Centre, i.e. from point X to point Y (see Appendix 2). For quarterly reporting purposes, BASPs should report the throughput result recorded over a testing period for each broadband plan it tests.

[10] BASPs are required to run six-hourly throughput tests over a 7-day testing period for each of the broadband plans it is required to test, from its test point to a test server at the first U.S. Point-of-Presence, i.e. from point X to point Z (see Appendix 2). For quarterly reporting purposes, BASPs should report the throughput result recorded over a testing period for each broadband plan it tests.

[11] Single TCP throughput measures the throughput provided by the respective broadband service plans for a single TCP session. The Single TCP throughput tests will only apply to the top four most heavily subscribed plans.

BROADBAND ACCESS NETWORK

Cable Modem
End User

<90% loading

CMTS

CABLE Network

Network Latency : **< 50 msec**

<90% loading

<90% loading

BASP

<90% loading

Broadband Core Network

xDSL End User

DSLAM

xDSL Network

Network Latency : **< 50 msec**

<90% loading

<90% loading

BASP

<90% loading

1st U.S. POP

1st U.S. POP

Network Latency : < 300 msec

U.S. POP

Network Latency : < 300 msec

Appendix 2

Point X

Test Client – Each BASP will install at least 2 test clients for each service plan to be tested

Local Throughput

For Monitoring

International Throughput

For Monitoring

BASP's Network

Dedicated Link (provided by BASP)

Point Y Test Server at BASP's IDC

Submarine Landing Point/ International Gateway

1st U.S. PoP

Point Z Dedicated Link (provided by BASP)

U.S. Point-of-Presence (PoP)

Test Server at BASP's first U.S. PoP