**Consultation Paper No. 7/2006**

# Telecom Regulatory Authority of India

**Consultation Paper**

**on**

**fixing the Benchmarks**

**pertaining to**

**Quality of Service**

**for**

**Broadband**

**New Delhi**

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# Chapter-1

# Introduction

**Need for QOS Standards for Broadband:**

1.1 Recognising the potential role of ubiquitous Broadband service in growth of GDP and enhancement in quality of life through societal applications including tele-education, tele-medicine, e-governance, entertainment as well as employment generation by way of high speed access to information and web-based communication, Government issued national policy on recommendations of TRAI to accelerate the growth of Broadband services, in October, 2004.

1.2 At the time of issue of the Boadband Policy the total number of Broadband subscribers in India was of the order of 50,000 only. Now this has increased to more than 14 lakhs by the end of April, 2006. Alongwith the increase in the number of customers the number of consumer complaints pertaining to Broadband Services are also increasing. A need is, therefore, felt for addressing the quality of service issues for broadband service. As a first step in this regard, TRAI proposes to lay down the quality of service standards for broadband service, based on the international practice and also in consultation with major stakeholders.

1.3 The policy defines broadband as **"An 'always-on' data connection that is able to support interactive services including Internet access and has the capability of the minimum download speed of 256 kilo bits per second (kbps) to an individual subscriber from the Point Of Presence (POP) of the service provider intending to provide Broadband service where multiple such individual Broadband connections are aggregated and the subscriber is able to access these interactive services including the Internet through this POP. The interactive services will exclude any services for which a separate licence is specifically required, for example, real-time voice transmission,**

**except to the extent that it is presently permitted under ISP licence with Internet Telephony."**

1.4 On Quality of Service the Broadband Policy provides that **"As per TRAI Act, 1997, TRAI has to prescribe QoS parameters. Government recognises that QoS parameters are extremely important and have an impact on investment and roll-out decisions of operators. TRAI would be requested to prescribe QoS parameters for provisioning of broadband service using various access technologies at an early date".**

1.5 Subsequent Chapters of this Paper deal with various related issues, international practice and the proposed Benchmarks for parameters.

# Chapter –2

## Issues relating to Quality of Service for Broadband Service

**Technology:**

2.1 The Broadband Policy Framework visualises creation of suitable telecom infrastructure through various access technologies which can contribute to growth and can mutually coexist. Spread of such infrastructure is a must for healthy competition and therefore it has been the endeavor of the Government that the telecommunication infrastructure growth in the country is not compromised in any manner. The Government has adopted a technology-neutral approach in the Broadband Policy to facilitate usage of all types of technologies for Broadband. The salient features of various access technologies, discussed in the Broadband Policy are enclosed at Annex 'A'.

2.2 In the broadband access network the service providers could use different technologies in line with the Broadband policy framework. However, irrespective of the medium for access network, QOS expected by the consumer or mandated by the regulator has to be delivered. Generally, the major parameters affecting the end user QOS for broadband service are the following:

(i) Network latency
(ii) Packet loss
(iii) Bandwidth utilization/throughput
(iv) Service provision/ activation time
(v) Service availability/uptime
(vi) Fault repair/ restoration time
(vii) Static IP address allocation

These are described below:

**(i) Network latency:**

The transmission of broadband traffic involves the handing over of data packets over different operators' network (also known as hops). Latency is the measure of duration of a round trip for a data packet between

specific source and destination CPE's. There could be round trip delay for traffic within the local broadband network and also in international portion of the broadband network. The local broadband network includes connection from the end user to the ISP node and from there to the International Gateway. The international portion of the broadband network is from the International Gateway to the First Point of Presence (NAP) abroad. It may have to be considered whether the ISP providing broadband services should be responsible for the latency on both the local and the international leg. Being responsible to the customer for end to end Quality of Service, it is his responsibility to see that QOS is maintained on all the hops. For this purpose he should negotiate commercially with the upstream service providers i.e. leased line providers (NLD/UASP/BSO/IP-II) and IGSP/ILDO. There is also a need for mechanism for measuring the latency at different points.

**(ii) Packet loss:**

Packet loss is the percentage of packets lost to the total packets transmitted between two designated points (routers). Packet Loss is measured by averaging sample measurements for a month. This parameter indicates the quality of leased line resources used as well as the equipment at the ISP Node.

**(iii) Bandwidth utilization/ Throughput:**

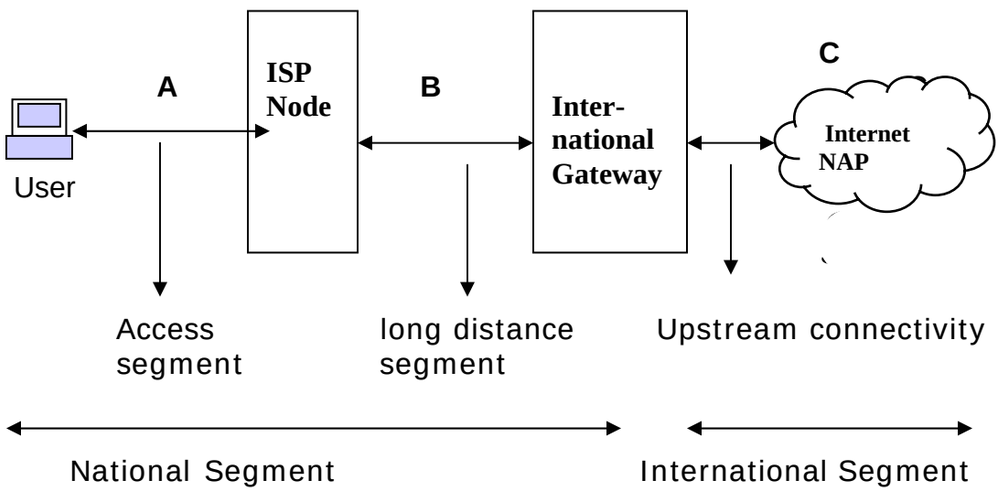


**Fig 1**

As may be seen from figure 1 that there are three bandwidth segments involved in the Broadband network. The first segment is from the customer premises to the ISP node known as access segment. The second segment is from the ISP node to the IGSP's International Gateway known as long distance segment. The third segment is from the IGSP's International Gateway to the Overseas NAP (Network Access Point), from where it connects to the public Internet cloud. The first and second segment comprise the national portion of the Broadband connectivity while the third segment is international portion of the Broadband connectivity. The first segment is entirely managed and operated by the ISP. This could be through DSL, Cable, TV Network, OFC, Wireless, VSAT etc. The second segment is usually taken on lease from NLDOs, UASPs, IP-IIs. The third segment is generally provided by ILDO in the form of International Private Leased Circuit (IPLC) or Internet Leased Line (ILL). The ISP could offer a good quality to the customer only if there is enough bandwidth available in all the three segments. Since the ISP is responsible for the end-to-end quality of the service to the customer, it should have service level agreement (SLA) with the bandwidth provider of long distance segment and IGSP/ILDO for International segment for ensuring that enough bandwidth is available for usage.

**(iv) Service availability/ Uptime:**

Service availability means the total operational hours of the service less the total transmission down time or disruption to the service due to service failure divided by the total operation hours over a period of one month or quarter whichever is the monitoring cycle. Downtime for the purposes of upgrading or routine maintenance of the network system is generally excluded from the calculation of the network service availability provided that users shall have been informed in advance of any such upgrading or maintenance action. Since broadband is an always on connection the downtime should be minimal. The issue here is that in case of downtime of long distance segment and international segment the broadband service provider could take the plea that these segments are not under his control.

It is felt that since the broadband service provider is entirely responsible to the customer such a plea is not acceptable. Hence, it is important that the broadband service provider should have service level agreement with the bandwidth provider of the segments concerned.

**(v) Service provision/ activation**

The service provision/ activation time means the time taken from the date of receipt of valid application to the date when the service is activated. The issues that could arise in this regard is as to whether the following situations should be excluded from the service activation time benchmark or not:

a) Wrong address/incomplete information.
b) Damage to network facility due to force majeure.
c) Damage to network facility by third party.
d) Customer premises inaccessible.
e) Customer canceling or defering agreed appointment

The above factors do impact the service activation time and on these factors the service provider has not much control.

**(vi) Fault Repair/ Network restoration time:**

Fault Repair time means the time taken to restore a service from the time the fault was reported by the customer to the time of restoration. Since broadband is an always on connection there should be minimal disruption of service and the fault should be attended immediately and repaired within a reasonable time period. In this case also factors not within the control of the service provider may have to be considered for exclusion.

**(vii) Static IP Address Allocation:**

For a Broadband connection permanent IP address is not a ‘must’ requirement though it is desirable for some applications. On the other hand, a permanent IP address allocation may lead to increased privacy risk for the users as once its address is intercepted it will remain exposed. In the Recommendations of TRAI on issues relating to transition from Ipv4 to Ipv6 in India, TRAI had recommended that there is no need of mandating allocation of a permanent IP address to a Broadband subscriber and this

option is to be left to the user. Another connected issue is the availability of static IP address and charges for such static IP address. Considering the number of IP addresses available in India with service providers today, it would not be feasible to expect them to give each subscriber a static public IP as subscriber numbers grow. This is a service that even in very developed countries is a value-added service, and typically has an additional charge. Therefore, every time the user were to reinitiate a connection (either on booting-up a computer, or on re-authentication for security purposes), a new external or even internal to the ISP, IP address can be assigned to the subscriber. That IP address is likely to remain consistent until the user actively disconnects the session. But this pool of IP addresses could be shared amongst the subscribers of the ISP. But in case a Broadband customer desires to have one or more static IP address on payment, it is expected to be made available.

2.3 **Issues for consultations:**

(i) What are your views on the various parameters related to Quality of Service for Broadband?

(ii) Which of these should be considered for inclusion in the QOS Regulation?

**(iii)** Can you suggest some additional parameters to be considered?

# Chapter-3

# International Experience

3.1 It is seen that most of the countries do not regulate QOS of Broadband and this is left to the market forces due to excessive competition in this segment. Only the Singapore Regulator IDA and Malaysian Regulator MCMC are known to be regulating quality of service for Broadband Internet access among the Asia Pacific region. The QOS parameters prescribed by these Regulators are given below:

**3.2 IDA Singapore** (Source www.ida.gov.sg)

| **Qos Indicator** | **Benchmark** |
|---|---|
| Network availability | > 99% |
| Service Activation Time (from date of receipt of application) | 5 working days or less |
| Network Latency (connection within the local Network)* | =< 85 msec |
| Network Latency (for the international portion of the network)** | =< 300 msec |
| Bandwidth Utilisation (for connections within the local network) | =<90% |

* This latency figure extends from the broadband user to the broadband service provider's Internet Exchange (IX).

** The international portion of the broadband network extends from beyond the domestic broadband local network up to the network provider's first point-of-presence in the U.S., or the first point of entry in the U.S.

3.3 **Malaysian Communication and Multimedia Commission**
(Source: http://www.cmc.gov.my/what_we_do/qos/index.asp)

3.3.1 **Standards on fulfillment of installation orders**

(i) Installation orders shall be fulfilled in the following time frames:

(a) 80% of all installation orders shall be fulfilled within 24 hours of receipt of the order;

(b) 90% of all installation orders shall be fulfilled within 48 hours of receipt of the order; and

(c) 100% of all installation orders shall be fulfilled within 7 business days.

(ii) The measurement of the standard is described by the ratio:

$$\frac{\text{Total number of installation orders met within a 12 month period} \times 100}{\text{Total number of installation orders for the 12-month period}}$$

(iii) When measuring the time taken to fulfill installation orders, installation orders not fulfilled within the requisite time due to the following reasons may be excluded from the total number of installation orders for the 12-month period:

(a) Wrong address given by the customer;

(b) Damage to network facility due to force majeure;

(c) Damage to network facility by third parties;

(d) Customer premises inaccessible;

(e) Customer premises internal wiring not ready at the committed or agreed time;

(f) Customer cancels or defers agreed appointment; or

(g) Network facility not available.

(iv) Complete and accurate records of installation orders shall be maintained by the relevant Service Providers. Such reprots shall be in the form and format as may be prescribed by the Commission from time to time. Each report shall be accompanied by a declaration signed by an officer of the Service Provider duly authorised by the board of directors, stating that the report is true and accurate. These reports shall be submitted to the Commission not later six weeks after 30 June for reporting period January to June, and 31 December for reporting period July to December respectively.

3.3.2 **Standard on service restoration performance**

(i) Service restoration performance means the time taken to restore a service from the time the fault was reported by the customer to the time of restoration. The restoration time is calculated from the time of report to the time of restoration, including weekends and public holidays.

(ii) Service restoration shall be effected within the following time frames:

(a) 80% of all service restoration requests shall be fulfilled within 24 hours of receipt of request; and

(b) 90% of all service restoration requests shall be fulfilled within 48 hours of receipt of request.

(iii) The measurement of the standard is described by the ratio:

$$\frac{\text{Total number of service requests fulfilled within the time frame} \times 100}{\text{Total number of service requests received over a 12 month period}}$$

(iv) When measuring the time taken to restore service, service not restored within the requisite time due to the following reasons may be excluded from the total number of service restoration requests received over the 12 month period:

(a) Faulty customer equipment;
(b) Network facility damage due to third parties;
(c) Fault due to other service providers;
(d) Customer premises inaccessible;
(e) Damage to network facility due to force majeure;
(f) Faulty customer infrastructure or internal wiring; and
(g) Deferment of service restoration request by customers.

(v) Complete and accurate records of all service restoration requests shall be maintained by the relevant Service Providers. Such reports shall be in the form and format as may be prescribed by the

Commission from time to time. Each report shall be accompanied by a declaration signed by an officer of the Service Provider duly authorised by the board of directors, stating that the report is true and accurate. These reprots shall be submitted to the Commission not later than six weeks after 30 June for reporting period January to June, and 31 December for reporting period July to December respectively.

### 3.3.3 **Standard on Network Performance**

The standard for Network Performance shall be measured based on the following criteria:

(a) **Network latency** - Network latency from the broadband user to all connections within the local broadband network shall be no more than 85 ms, 95% of the time during busy hours;

(b) **Throughput or bandwidth utilisation** - Throughput or bandwidth utilisation between the user and the nearest service local ISP node shall be no less than 70% of the subscribed level for 95% of the time during busy hours; both for the purposes of uploading and downloading;

(c) **Packet loss** - Packet loss shall not exceed 1 %. Packet loss is measured by averaging sample measurements over the reporting period; and

(d) **Annual network service availability**

(i) Annual network service availability must be 99.99% for all users and the measurement of the standard is described by the ratio:

$$\frac{\text{(Total operational hours over a 12 months period- Total downtime over the 12 month period x 100\%}}{\text{Total operational hours over the 12 months period}}$$

(ii) The NSP shall have a test server to monitor, record and report on the criteria as stated above. The standard end user

equipment configuration is a personal computer with the equivalent of at least a 1GHz Pentium IV processor with 256 Mb memory running only a standard browser application. The test server shall be placed at the node or anywhere on the core network of the ISP. Sampling tests maybe initiated either by the end user from any point in the network or by the ISP. A minimum sample size for any of the tests shall be at least 30 samples per user. A minimum of 10 user locations per node shall be tested for this purpose.

(iii) Complete and accurate records of the Network Performance shall be maintained by the relevant ISP. Such reports shall be in the form and format as may be prescribed by the Commission from time to time. Each report shall be accompanied by a declaration signed by an officer of the ISP duly authorised by the board of directors, stating that the report is true and accurate. These reports shall be submitted to the Commission not later than six weeks after 30 June for reporting period January to June, and 31 December for the reporting period July to December respectively.

3.3.4 **Audit and Verification**

The Commission may from time to time conduct an audit on the report(s) submitted, perform test call sampling and/or service observation to verify compliance with these mandatory standards.

# Chapter-4
# Proposed benchmarks for parameters

4.1 In the developed countries the QOS aspects of broadband service are generally addressed through competition. In India the service has just taken off and considering the rapid growth of the service, insufficient competition in this segment throughout the country and the increased number of consumer complaints it does not appear to be proper to leave the Quality of Service aspects to be addressed through market forces. For this purpose international best practices specially from developing countries in the region are very important factors to be considered while fixing the quality of service standards for any service. Keeping these in view, the following benchmarks are proposed to be mandated:

4.2 **Network latency**

(a) The network latency within the local network i.e. from the Broadband customer to the IGSP Gateway < 90 msec.

(b) The network latency for the International segment - < 300 msec for OFC based and <800 msec for satellite based connection.

4.3 **Bandwidth utilization/ Throughput**

The bandwidth utilization between the user and the nearest serving ISP node during download shall not be less than 70% of the subscribed level for 95% of the time. To ensure this, the broadband service provider accordingly has to provision enough bandwidth for the upstream connectivity by having service level agreements (SLA) with the domestic service providers and IGSPs/ ILDOs.

4.4 **Service availability/ Uptime**

The service availability – 90% for all users upto 3103.08 and 99% for all users w..e.f. 1.4.08, calculated on a monthly basis. There will be provision of rebate in the monthly charges for the excessive downtime beyond what is permitted.

4.5 **Packet loss**

The packet loss should not be more than 1% over a period of one month.

4.6 **Fault restoration time**

The service should be restored with the following time limit:

(a) 80% of all service restoration requests should be attended to and restored within 24 hours of report of fault.

**(b)** 90% of all service restoration requests should be attended to and restored within 48 hours of report of fault.

**(c)** 100% of all service restoration requests is expected to be attended to and restored within 72 hours of report of fault.

The following events may be excluded in the above calculation:

(i) Network facility damage due to third parties.

(ii) Damage to network facility due to force majeure.

(iii) Deferment of service restoration request by customers.

(iv) Faulty customer equipment.

4.7 **Static IP address allocation**

At least on Static IP address to be allocated on demand by customer on payment basis. More than one IP address to be allocated on mutual discussion based on the demand and its justification.

4.8 **Billing performance**

- Billing complaints should not be more than 2% of the bills issued during the billing cycle.
- Billing complaints should be resolved within the following time-frame:
  (i) 95% within 15 working days of the receipt of the complaint
  (ii) 100% within 30 working days of the receipt of the complaint

4.9 **Issues for consultation:**

(i) What are your views on the proposed benchmarks?

(ii) What should be the extent of rebate to be given to the customer for excessive downtime for service?

(iii) Are these limits achievable?

(iv) If not, what you suggest to be the limits?

(v) Do you feel some more parameter to be specified? If so, please suggest the benchmarks.

Annex ‘A’

## Access Technologies for Broadband

### (a) Optical Fibre Technologies

The fibre optics technology can provide nearly unlimited bandwidth potential and is steadily replacing copper network specially in intra-city backbone networks. This is being deployed in commercial buildings and complexes and some metros / big cities having high-density potential broadband subscribers. Hybrid Fibre Coaxial (HFC), Fibre to the Curb (FTTC) and Fibre to the Home (FTTH) networks make use of fibre cabling into the last mile. The fibre based infrastructures are future proof as they are able to provide huge amounts of bandwidth in the last mile as well as provide a true IP and converged network that can deliver high quality voice, data and video together.

### (b) Digital Subscriber Lines(DSL) on copper loop :

DSL has proved to be an important technology for provisioning of Broadband services through the copper loops. Generally, the owners of copper loop have to be given a high priority because their role is critical as key drivers in the Broadband service market using DSL.

Bharat Sanchar Nigam Limited (BSNL) and Mahanagar Telephone Nigam Limited (MTNL) as well as other access providers are expected to aggressively use their copper loop infrastructure for providing Broadband services through this technology.

Recognising that last mile copper loop is not a ‘bottleneck facility' for broadband services, the policy provides that access providers shall be free to enter into mutually agreed commercial arrangements for utilization of available copper loop for expansion of broadband services**.**

In addition, the owners of copper loops are expected to make use of franchising option to market the broadband services speedily. However, all responsibilities for ensuring compliance of terms & conditions of the licence

shall vest with the Licensee. The terms of franchise agreement between Licensee and his franchisee shall be settled mutually by negotiation between the two parties involved.

**(c) Cable TV Network**

Cable TV connection as last mile infrastructure reaches more people than even the telephony copper infrastructure and can be leveraged in providing cable operators a new business model while giving a stimulus to Broadband penetration. Therefore, the Policy provides that Cable TV network can be used as franchisee network of the service provider for provisioning Broadband services.

**(d) Satellite Media**

Regarding Satellite Media, the Policy provides for Very Small Aperture Terminals (VSAT) and Direct-to-Home(DTH) services to be encouraged for penetration of Broadband and Internet services with the main objective to serve remote and inaccessible rural areas. The Policy permits commercial VSAT service providers having ISP licence the use of same hub station and remote station to provide Internet service directly to the subscribers. Further, this remote station is permitted to be used as a distribution point to provide Internet services to multiple independent subscribers.

The Policy also provides for permission to DTH service providers to provide Receive Only Internet Service after obtaining ISP licence. Also they are permitted to provide bidirectional Internet services after obtaining VSAT and ISP licence from DoT. Further, ISP licensees are permitted to allow customers for downloading data through DTH after obtaining necessary permission.

**(e) Terrestrial Wireless**

Recognising that terrestrial wireless is another upcoming technology platform for Broadband, 2.40-2.48 GHz band for low-power outdoor use on non-protection, non-interference, non-exclusive and technology neutral basis has been delicensed.

To further accelerate penetration of Broadband and Internet, the Policy provided for de-licensing of 5.15-5.35 GHz band for the indoor use of low power Wi-Fi systems. Alternative spectrum bands which are not in high usage and could be deployed for Broadband services, are also being explored and identified.

**(f) Future Technologies**

In the changing technology scenario, there is a possibility of innovative technology new options being used for provisioning of Broadband services. These technologies can also be utilised for provisioning of such services within the licensing framework of the service provider and the spectrum policy of DoT.