**Consultation Paper No. : 09/2010**

# TELECOM REGULATORY AUTHORITY OF INDIA

## Consultation Paper

## on

## National Broadband Plan

10th June, 2010

Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg
New Delhi-110002.

# Contents

# Preface

Although the National Broadband Policy, enunciated in the year 2004, envisaged coverage of 20 million broadband connections by the year 2010, the performance so far has not been up to the expectations. In order to ensure continued economic growth of the country, rapid spread of broadband both in the urban and rural areas is an imperative. The need of the hour is to evolve a National Broadband Plan, covering various aspects right from the definition of broadband to spread of infrastructure and various regulatory and other issues.

The present consultation paper is an effort in this direction. All stakeholders are requested to send their comments preferably in electronic form on the issues raised in the consultation paper by 7th July 2010. Comments will be posted on TRAI's website as and when they are received. Counter comments, if any, to the comments may be sent to TRAI by 15th July 2010. The consultation paper has already been placed on TRAI's website (www.trai.gov.in). For any clarification/information, Sh.S.K.Gupta, Advisor (CN), TRAI, may be contacted at Tel.No. +91-11-23217914, Fax: +91-11-23211998 or email at advcn@trai.gov.in or cn@trai.gov.in.

(Dr.J.S.Sarma)
Chairman, TRAI

# Introduction

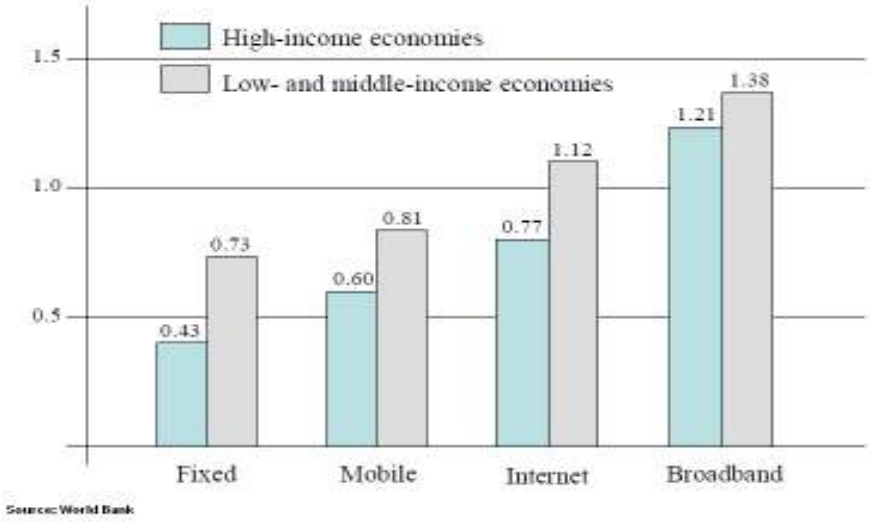
i) The power of Internet has brought greater awareness, skills and resources, helping markets reach to a diverse global audience. Broadband provides the opportunity to do things differently, to achieve better outcome for people, countries and to ensure continuous growth of economy and social development. The proliferation of the broadband enables growth of Information and Communication Technologies (ICT), content, applications and services which may help India to become a truly competitive knowledge based economy and leverage citizens to become healthier, better educated and more engaged in their community & society.

ii) Telecom Regulatory Authority of India has received a reference from Department of Telecommunications (DoT), vide letter No. 813-07/1/2010-DS dated 01/04/2010 (Annexure-I), seeking recommendations of the Authority on the review of definition of Broadband connectivity. It is anticipated that future growth in internet/ broadband will primarily be driven by wireless technologies. In that perspective, the word like "Always On" to define broadband may restrict wireless based high speed internet connection to qualify as broadband. It is therefore, necessary to relook at the definition of broadband. This issue is discussed elaborately in chapter 5.

iii) Internet and Broadband access are widely recognized as catalysts for economic and social development of a country. Availability of broadband services at affordable price can contribute to higher GDP for growth rates, provide for a larger & more qualified labor force and increased working efficiency. There is a correlation between the broadband adoption rate and the Gross Domestic Product (GDP) for various countries. Providing broadband access to citizens,

communities and public institutions is one of the strategic objectives for governments worldwide. As per the report of World Bank[1], a 10 percentage increase in broadband penetration accounted for 1.38 percentage increase in per capita GDP growth in developing economies (Figure 1). This is much higher than the impact of mobile telephony growth on GDP. The report also indicates that across all telecom services, the positive effect on GDP is higher in developing countries than in developed countries. In case of broadband this impact is about 15% more in developing countries than in developed countries.

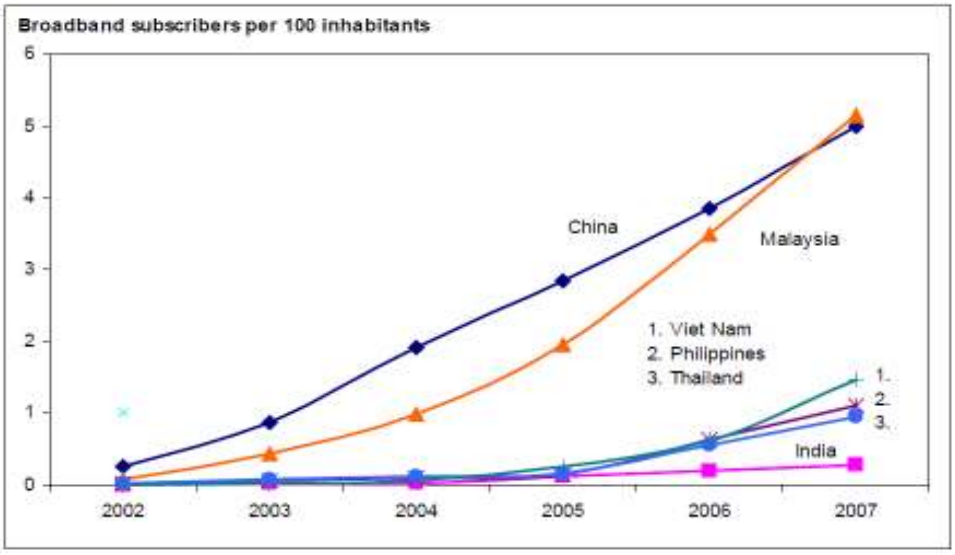
**Figure 1: Growth effects of ICTs: Percentage point increase in GDP per capita for every ten percentage point increase in ICT penetration, 1980-2006**




iv) It is of concern to note that we have just 8.75 million Broadband connections in the country at the end of March 2010 as against the target of 20 million broadband subscribers by 2010, set by the Broadband Policy 2004. Figure 2 shows the broadband penetration per 100 inhabitants in some developing Asian countries. This clearly indicates that India is lagging behind in terms of broadband penetration.

[1] *IC4D 2009: Extending Reach and Increasing Impact*

**Figure 2: Broadband penetration rates, per 100 inhabitants, in selected developing Asian economies, 2002-2007**




*Source:* ITU World Telecommunication Indicators Database.

v) Broadband penetration in India is low despite the fact that 104 service providers are providing broadband services. The net broadband addition per month is just 0.1 to 0.2 million in contrast to 18 million mobile connections per month. The broadband penetration is just 0.74% when compared with teledensity of 52.74%. A need is being felt to address the impediments and create an environment to encourage broadband growth.

vi) Table 1 gives the comparison of broadband and wireline subscribers as on March 2010. The most preferred technology for broadband access in India is Digital Subscriber Line (DSL) as about 86% of total broadband connections i.e. 7.93 million are using this DSL technology. Presently most of the broadband proliferation is taking place in the urban areas. There are 36.96 million wireline connections at the end of March 2010, out of which about 26.87 million connections are in urban areas. This indicates that just 21.45% of wireline connections are having DSL broadband activated.

There is a need to enhance utilisation of existing wireline infrastructure for providing broadband services.

**Table 1: Comparison of Broadband & Wireline connections (March 2010)**

| Month | Broadband Connections in Million | DSL Broadband Connections in Million | Wireline Connections in Million | % of wireline Connections having DSL Broadband |
|---|---|---|---|---|
| March-2010 | 8.75 | 7.93 | 36.96 | 21.45% |

vii) The Indian demographic pattern indicates that almost 70% of its population lives in rural areas. The rural areas have poor infrastructure availability for electricity, road connectivity, educational support, medical facilities, employment opportunity etc. Lack of opportunity in villages is one of the main causes of migration of villagers to urban areas. The need of the hour is to provide all urban facilities/ opportunities to villagers without actually urbanizing them. Broadband can significantly contribute to this endeavor by providing access to enormous information, employment generation, better medical facilities and business opportunities to the rural population.

viii) Broadband has been termed as a transforming technology and is now widely available in many countries. However, broadband availability is not the same as broadband adoption. If the socio-economic benefits of broadband are to be realized, then adoption needs to be both understood and encouraged. In rural and remote areas, the primary reason for low broadband penetration in villages is lack of support infrastructure, backhaul capable of providing high bandwidth, low penetration of fixed line services, high cost of service

roll out and unviable business model. In addition to key infrastructural issues availability of relevant content and high cost of CPE will also be crucial for broadband growth. The broadband in rural areas will initially be for community use and will proliferate for individual utilization subsequently.

ix) Convergence and popularity of IP networks is leading to Next Generation Networks (NGN) worldwide. Provision of various services over IP network reduces capex and opex and provides competitive advantage in highly competitive market. A robust broadband network will be necessary to support all types of services; especially bandwidth intensive applications. As the bandwidth requirement is inversely proportional to the literacy level of user, the rural areas will require much higher bandwidth than their urban counterparts. In UK, British Telecom (BT) who pioneered NGN implementation realized that success of NGN implementation is dependent on availability of high speed access network. Accordingly, it has reviewed its plan for implementation of its project 21CN and higher emphasis is being given for upgradation of copper access network to fibre network to support growing demand for super-fast broadband services.

x) The Authority realized the importance of broadband and took number of steps from time to time for increasing growth of broadband:

- TRAI recommended use of any media (including fibre, radio and copper cable) by ISPs for establishing last mile.
- TRAI revised tariff ceiling for Domestic Leased Line and International Private Leased Circuits (IPLC) in order to reduce Internet bandwidth cost.

- TRAI recommended allocation of Spectrum for Broadband Wireless Access to enhance broadband penetration.
- TRAI issued regulations to facilitate access to essential facilities at cable landing stations to enhance competition and reduce international bandwidth charges.

xi) In spite of above, the growth of broadband in the country is far below the expectations. It seems that broadband sector still lacks required impetus. In order to identify various issues impeding growth of broadband in the country and for facilitating deployment of robust & scalable broadband infrastructure, there is a need to chalk out a national strategy that provides a long-term vision and detailed plan for the growth of broadband in the country.

xii) DoT has made a reference for "Review of the definition of broadband connectivity". However considering the importance of changing trends and low penetration of broadband, TRAI *suo-motu* intends to enlarge the scope and have comprehensive consultation on various issues besides review of broadband definition. In order to focus on relevant issues required to spur broadband growth in the country and to provide necessary platform for discussions, the Authority has initiated this consultation process to seek the views of stakeholders. The focus of this consultation paper is:

A. To review the definition of broadband;
B. To address regulatory and licensing bottlenecks, if any, for speedy growth of broadband;
C. To identify infrastructural bottlenecks impeding growth of broadband in urban & rural areas and suggest corrective measures;

D. To identify opportunities to develop synergy to boost broadband penetration including financial support for broadband development from USOF;

E. To identify the need for "National Optical Fibre Network".

xiii) The consultation process may result in:

- Recommendations to the government on different issues;
- Issuing new regulations or modify existing regulation;
- Any other action, which may be felt necessary during the course of deliberation with stakeholders to boost the broadband penetration and to improve QoS of Broadband.

xiv) The paper is divided into six chapters. Chapter 1 deals with "Present Status of Broadband" giving overview of the existing broadband scenario. Chapter 2 is on "Broadband – Supply and demand" elaborating future broadband demand and network required to support such demands. Chapter 3 deals with "National Broadband Network". Chapter 4 deals with "Regulatory challenges & Future Approach" for growth of broadband. Chapter 5 summarizes all issues for consultation.

# CHAPTER 1: Present Status of Broadband

1.1 Broadband is perceived as a tool for improving the life of the people by providing affordable & equitable access to information and knowledge and contributing for making them eco-friendly. For individuals, broadband has direct impact on their day to day life style & behavior. For the state, it enormously contributes towards trade and generation of employment. Governments find it as a powerful tool to manage municipal services, provide improved governance, increase participation of common masses in e-democracy, and effectively monitor implementation of projects.

## A- Present status of Broadband

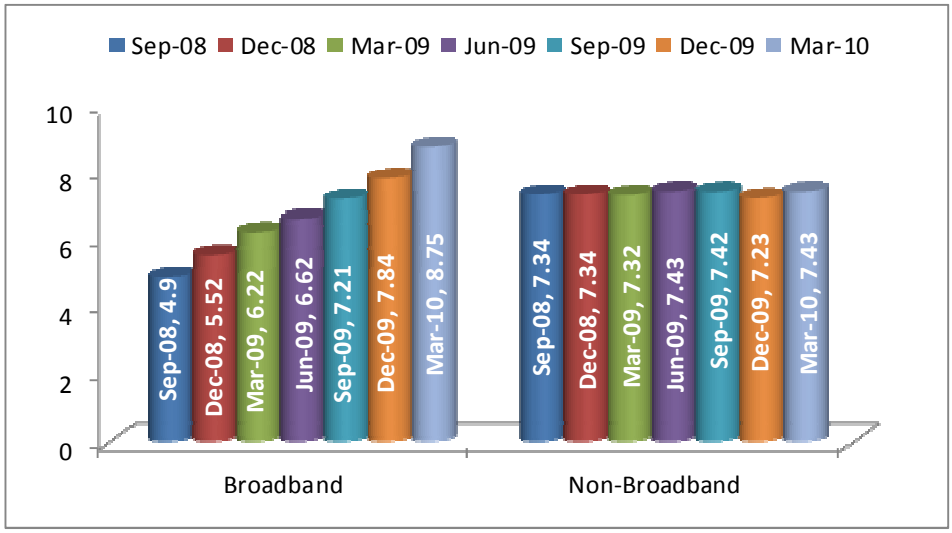
1.2 Broadband Policy, 2004 had fixed the target of 9 million broadband connections by the end of year 2007 and 20 million connections by the end of year 2010 in the country (refer table 1.1).

**Table 1.1: Broadband targets**

| Year Ending | Internet Connections | Broadband Connections |
|---|---|---|
| 2007 | 18 Million | 9 Million |
| 2010 | 40 Million | 20 Million |

1.3 The broadband connections at the end of March, 2005 stood at 0.18 million and in five years it grew to 8.75 million at the end of March 2010. Figure 1.1 shows the growth of broadband connections during last five quarters. Apart from dial-up connections, there are about 1.7 million internet connections having speed less than 256 kbps.

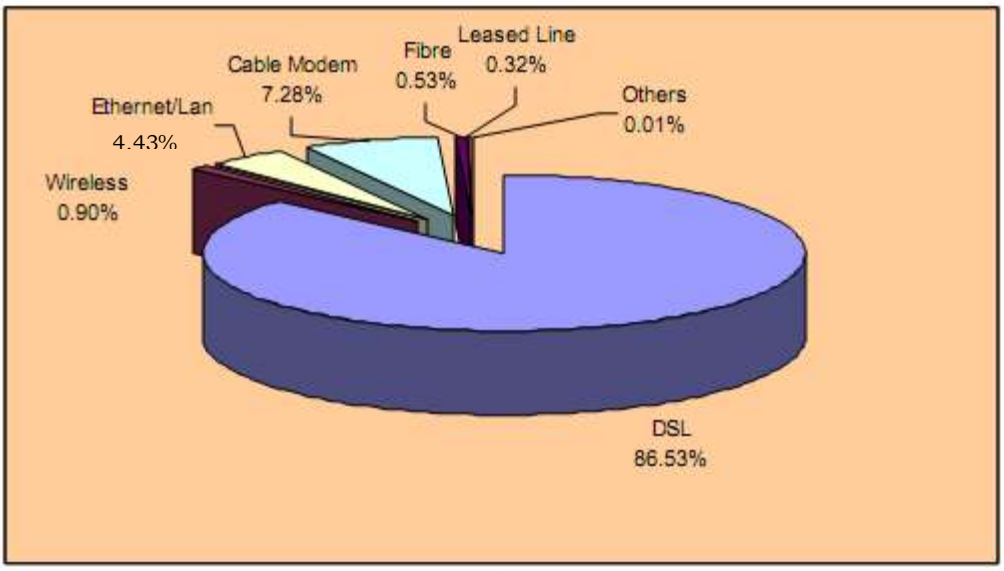
**Figure 1.1: Internet & Broadband Connections in Millions**




From the above figure it is clear that though the broadband connection base rose steadily, it is still way behind the target set by the Government. It is unlikely to achieve this target by end of 2010.

1.4 Many broadband technologies such as Cable Modem, xDSL etc. have evolved and being used by existing subscriber as connection as a medium for communication. Provisioning of Broadband using DSL technology is predominant in India as the connection to the subscriber's premises can be easily provided using the existing copper wire connected to subscriber's premises. Figure 1.2 provides the breakup of broadband provided using various technologies. It is evident from figure 1.2 that 86% of total broadband connections are using DSL technology. Majority of DSL technologies available on ground are able to support maximum download speed upto 2 Mbps, only, if copper loop length is less than 3 Km from the exchange. As such it can cater to only low bandwidth needs of subscribers accessing Internet. Any further up-gradation to support higher Internet speed would require up-gradation of network.

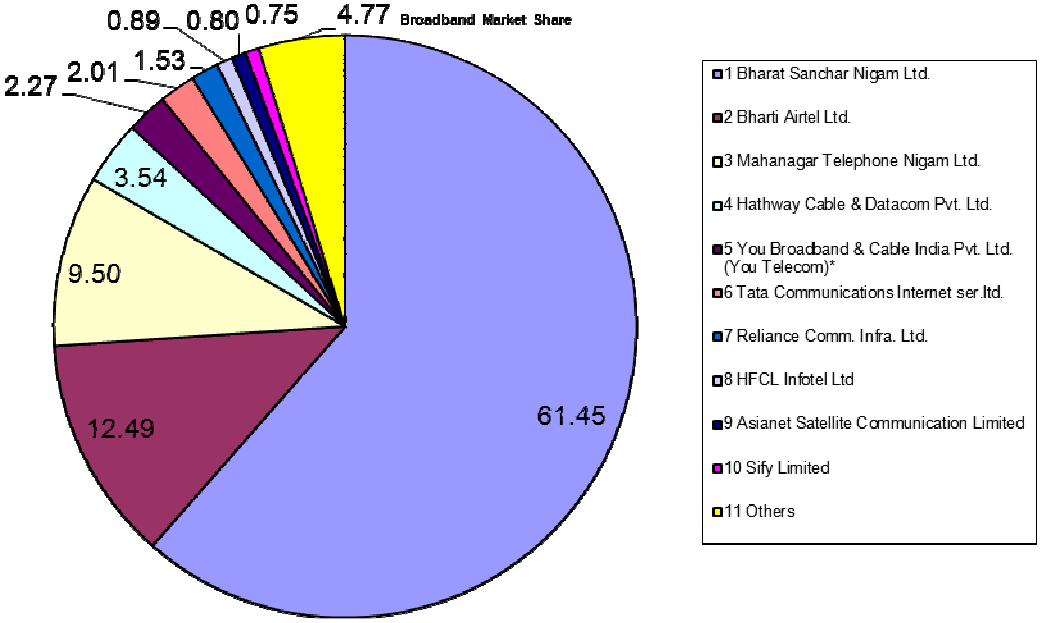
**Figure 1.2: Technology wise broadband connections**




Source: TRAI

1.5 Presently apart from Internet Service Providers (ISPs), Unified Access Service Licensees (UASLs), Cellular Mobile Service Providers (CMSPs) and Basic Service Operators (BSOs) are also permitted to provide broadband access under the existing licensing framework. There are 104 service providers who are providing broadband at present. However, top ten service providers have occupied more than 95% of market. Out of this 95% market 70% market is occupied by the state owned companies BSNL and MTNL. More than 89% market share belongs to 5 service providers only (Refer figure 1.3). This clearly indicates that majority of the connections are provided by 4-5 service providers though there are 104 service providers providing broadband. The only common thing in these top 4-5 service providers is that they have their own nationwide network. This indicates that despite of having license for provisioning of broadband services, majority of service providers are unable to penetrate into the market and market is still dominated by few players only.

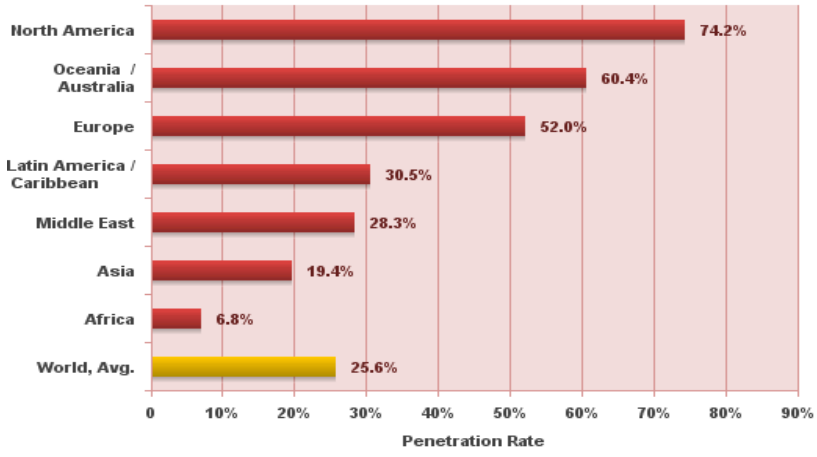
**Figure 1.3: Market Share of Broadband**




Source: TRAI

1.6 Region wise international internet penetration is given in figure 1.4. India is having penetration far below from world's average penetration. India does not stand even in top 10 countries in terms of total broadband connections.

**Figure 1.4: World Internet Penetration Rate**




Source: Internet World Stats - www.internetworldststs.com/stats.htm

Source: Point Topic

1.7 India stands at 22nd position (out of 27 countries) in ICT development index of Asia pacific region (refer table 1.2).

**Table 1.2: ICT Development Index (IDI) (2002 and 2007), Asia and the Pacific**

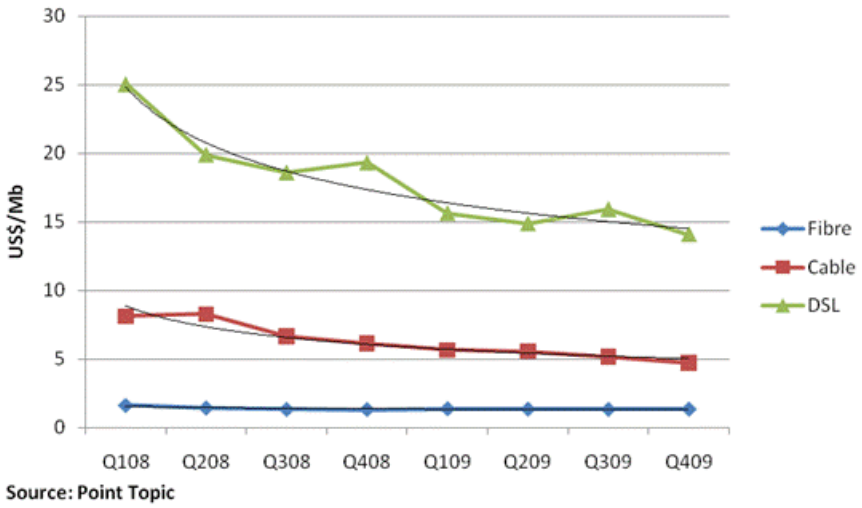
| Country | Rank 2007 | IDI 2007 | Rank 2002 | IDI 2002 | Rank change 2002-2007 | IDI change 2002-2007 |
|---|---|---|---|---|---|---|
| Korea(Rep.) | 1 | 7.26 | 1 | 5.83 | 0 | 1.43 |
| Hong Kong, China | 2 | 6.70 | 2 | 5.10 | 0 | 1.60 |
| Japan | 3 | 6.64 | 5 | 4.82 | 2 | 1.82 |
| Australia | 4 | 6.58 | 3 | 5.02 | -1 | 1.55 |
| Singapore | 5 | 6.57 | 4 | 4.83 | -1 | 1.74 |
| New Zealand | 6 | 6.44 | 6 | 4.79 | 0 | 1.65 |
| Macao, China | 7 | 6.25 | 7 | 4.41 | 0 | 1.85 |
| Brunei Darussalam | 8 | 4.80 | 8 | 3.27 | 0 | 1.53 |
| Malaysia | 9 | 3.79 | 9 | 2.74 | 0 | 1.04 |
| Thailand | 10 | 3.44 | 10 | 2.17 | 0 | 1.27 |
| Maldives | 11 | 3.16 | 14 | 1.96 | 3 | 1.20 |
| China | 12 | 3.11 | 15 | 1.95 | 3 | 1.16 |
| Iran(I.R.) | 13 | 2.94 | 16 | 1.93 | 3 | 1.02 |
| Fiji | 14 | 2.73 | 12 | 2.00 | -2 | 0.73 |
| Mongolia | 15 | 2.67 | 13 | 1.97 | -2 | 0.70 |
| Philippines | 16 | 2.63 | 11 | 2.07 | -5 | 0.57 |
| Viet Nam | 17 | 2.61 | 18 | 1.59 | 1 | 1.02 |
| Sri Lanka | 18 | 2.38 | 17 | 1.75 | -1 | 0.63 |
| Indonesia | 19 | 2.13 | 19 | 1.54 | 0 | 0.59 |
| Bhutan | 20 | 1.63 | 21 | 1.17 | 1 | 0.46 |
| Lao P.D.R. | 21 | 1.60 | 22 | 1.08 | 1 | 0.52 |
| India | 22 | 1.59 | 20 | 1.19 | -2 | 0.40 |
| Cambodia | 23 | 1.53 | 23 | 1.07 | 0 | 0.45 |
| Pakistan | 24 | 1.46 | 27 | 0.89 | 3 | 0.56 |
| Bangladesh | 25 | 1.26 | 25 | 1.02 | 0 | 0.24 |
| Nepal | 26 | 1.23 | 26 | 1.01 | 0 | 0.21 |
| Papua New Guinea | 27 | 1.14 | 24 | 1.05 | -3 | 0.09 |

Source: ITU Information Society Statistical Profiles 2009 -Asia and the Pacific

1.8 Although broadband penetration is low in India, the entry level tariff for broadband services has come down drastically from Rs.1500/- per month in 2004 to Rs. 200/- a month in 2007. Most of the service

providers are charging broadband monthly rental between Rs 200/- to Rs. 1600/- and providing various options for data transfer. Some service providers even provide unlimited download packages. Some of the service providers are already offering broadband services having zero rental schemes. However, in such schemes per MB download charges are comparatively high ranging from Rs.1.00/- to Rs.2/- per MB. Figure 1.5 illustrates the international average entry level price per megabit for different broadband technologies.

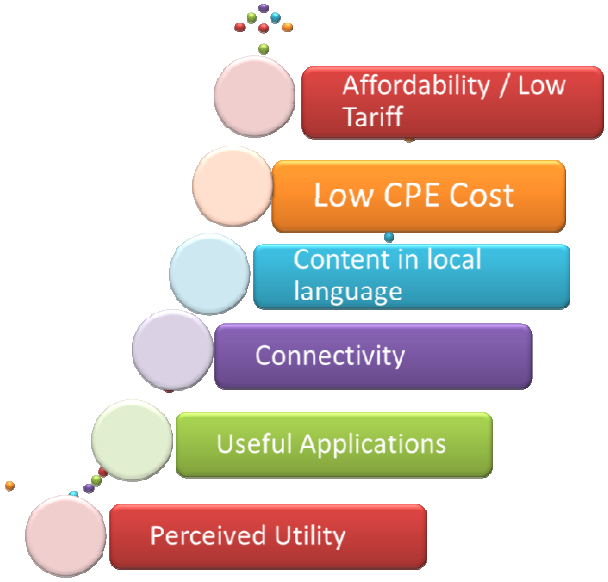
**Figure 1.5: Entry level price per megabit by technology (in USD)**




## B- Factors affecting the Growth of Broadband

1.9 Broadband is advantageous for socio economic growth, employment generation, increase in living standards, e-commerce, reliable & faster communication etc. This has been broadly accepted and proven internationally. Broadband growth depends on perceived utility, useful applications/ usage, affordability and availability etc. as depicted in figure 1.6:

**Figure 1.6: Factors affecting the Growth of Broadband**



# CHAPTER 2: Broadband - Demand & Supply

## A- Demand Factors

2.1 Broadband is generally considered as 'always on' high speed internet connection providing ubiquitous coverage. Broadband utilization scenarios can particularly be categorized in three major heads:

- Fixed utilization scenario
- Mobile utilization scenario
- Portable utilization scenario

2.2 While fixed scenario is used to provide broadband through DSL or cable modem or optical fibre, the mobile scenario is referred to use of broadband while on the move. The real usage of broadband at present in India in mobile scenario is limited as it is generally used for receiving emails or some capsules of information. Mostly people are using broadband in portable mode where location of user is not fixed but usage is done while user is stationary. The scenario is likely to change with introduction of high speed wireless broadband and increasing popularity of various applications including entertainment.

2.3 India has 8.75 Million broadband connections as of March 2010 with quarterly growth of one million. The increasing popularity of smart phones, killer applications and launch of 3G and BWA services will boost broadband demand. Though Broadband policy 2004 set a target of 20 million broadband connections by 2010, it is expected that we can achieve a target of about 11 million broadband connections extrapolating present growth rate.

2.4 Hon'ble President of India set a target of 100 Million connections by 2014. The growth of broadband will increase with launch of 3G and BWA services. Considering increasing broadband demand, a

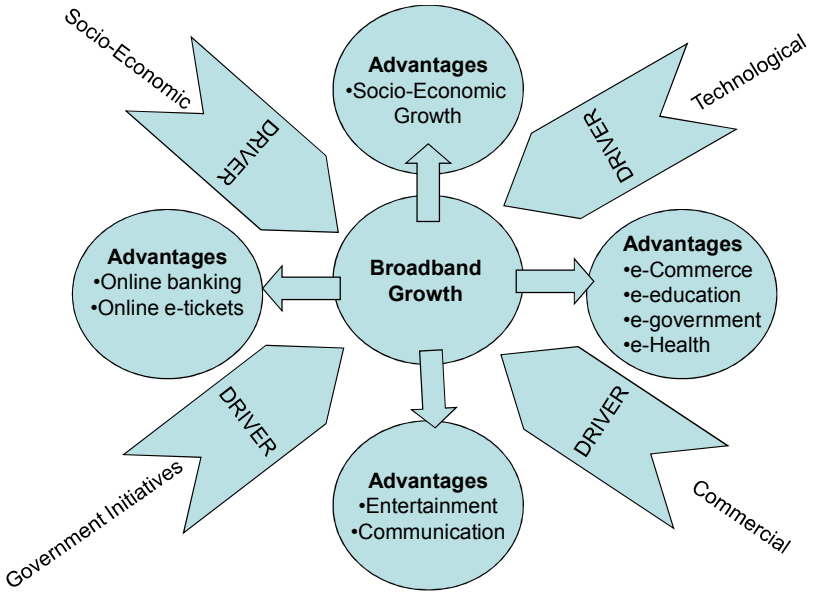
conservative estimate will project 5%, 20% and 40% households having broadband connections by 2010, 2012 and 2014 respectively, (refer table 2.1).

**Table 2.1: Desirable Targets**

| Year | No of Households | % of Households to be covered for broadband | Number of Broadband Connections |
|---|---|---|---|
| 2010 | 236 Millions | 5% | 11.5 Million |
| 2012 | 241 Millions | 20% | 48 Million |
| 2014 | 250 Million | 40% | 100 Million |

2.5 Broadband bridges distances, increases automation, improves quality of life and enhances user's participation in social and democratic life. There are several factors driving broadband growth. Figure 2.1 indicates various drivers and advantages of broadband.

**Figure 2.1: Drivers and Advantages of Broadband**




2.6 Broadband growth drivers can be categorized as follows:

- Technological Drivers

- Economic Drivers
- Social and behavioral Drivers
- Government initiatives

**Technological Drivers**

2.7 Liberalization and competition in the telecommunications market have brought new and innovative technologies in the market. The convergence of technologies and ubiquitous use of IP networks will increase broadband use. The distinction of medium for existing services such as voice, data or video, will blur with increased adoption of convergence. The move towards IP based services will make broadband technology integral part of our life as users will try to reap the full benefits of convergence.

2.8 The capabilities of smart phones bundled with pre loaded features and inbuilt applications permit access to new domains using Internet access. Data cards and Wireless Broadband CPEs facilitate availability of broadband anytime, anywhere further fueling wireless broadband demand.

2.9 Technological innovation permits new ways of creating, distributing, preserving, sharing and accessing digital content. As economies move to become more knowledge-intensive, information-rich activities will increase; new content will be created, collected, managed, processed, stored, delivered, and accessed. This spread will contribute to further innovation, growth and enhanced utilization of broadband.

**Economic Drivers**

2.10 Service Providers are continuously developing their network to introduce new services (Value Added services & killer applications) in order to meet the diverse demands of users. They have to cut down

the operational cost and maximize the profit. The convergence of networks (IP network to provide all services) helps in reducing operational cost to the service providers and support different applications irrespective of platform or format for their transmission. Various studies world over have indicated competitive advantages in providing bundled services considering its economic viability. Service providers get better return on investment as well as increased subscribers' patronage. The convergence of telecom, IT, broadcasting and entertainment verticals increases business volumes with no significant increase in network cost due to use of converged carrier network (IP network). As a result, provision of bundled services including broadband to end user makes economic sense to the service providers and likely to enhance broadband demand.

2.11 Broadband also supports online communication and processing. It enables businesses to effectively communicate with clients, capture more business, reduce inventory cost, efficiently handle available resources and collect valuable data online. Broadband allows households to access advanced online applications such as e-ticketing, net banking etc.

**Social and behavioral Drivers**

2.12 Busy life style, technological innovations, and desire to keep in touch have added various new requirements in day to day life. The priority of entertainment, device convergence and need to be always connected has enormously boosted popularity of broadband. Young generation is fascinated to use new applications and innovative services generally supported on broadband.

2.13 The lifestyle and social norms are fast changing. People prefer to be in touch with each other through e-mail, telephone, Internet, chat/

instant messaging etc. There are several social networking sites like Orkut, Facebook on Internet and millions of users use them for exchanging information. This generates requirement for high speed Internet.

2.14 The concept of entertainment is changing. Users want entertainment such as music, video etc. anytime, anywhere with enormous choice. The convergence of communication and entertainment has been on rise. This also generates broadband requirement for support of triple play / quad play services.

**Demand driven by Government Initiatives**

**e-Governance**

2.15 Broadband technology can be used to deliver government services directly to citizens. Such applications can reduce the cost of providing government services to citizens with much ease. Such services can range from information services, administration documentation, renewal of a range of licenses, tax submissions, etc. In geographic areas where no government offices are available such services allow real-time dialogue between citizens and administrative officials at low cost.

**National e-Governance Plan**

2.16 Department of Information Technology (DIT) has drawn up National e-Governance Plan (NeGP) for delivering Government and private services at the doorstep of the citizens. The plan has been drawn up covering 27 Mission Mode Projects and 8 support components to be implemented at the Central, State and Local Government Levels. Planning Commission has allocated funds as Additional Central Assistance (ACA) to all the States for taking up capacity building measures as a first step towards NeGP. Three core infrastructure

components are identified under the plan i.e. State Wide Area Networks, State Data Centres, Common Services Centres and Electronic Service Delivery Gateways. This will enable provision of civic services to masses enhancing broadband requirement.

**Potential Sectors for Broadband Growth**

2.17 There are drivers projecting high broadband requirements but still current demand is low. Low literacy is major concern to improve the broadband utilization. As per National Readership Survey, India is having 818 Million population with 12 years age and above. Total English literate population is only 91 Million and total computer literate are only 87 Million. Nearly 25% of Indian population stay in cities, out of which, 32% are computer literate[2]. Therefore, it is necessary to improve computer literacy and bring in user friendly applications so that broadband can be used without having good knowledge of computers. Similarly, there is a need to develop software which are language agnostic and can be used with Graphical User Interface (GUI) to help common masses to use such devices. This will be the fundamental requirement to increase broadband penetration. Once a common user is exposed to broadband, there can be numerous applications to encourage masses to adopt broadband.

2.18 Government of India has issued "Right to Education Act", which describes the modalities for provision of compulsory education for children aged between 6 years and 14 years in India. The act came into force on 1 April 2010. There is acute shortage of schools and trained teachers to provide educations to eligible children especially in rural areas. The broadband can very easily help in bridging this gap to provide effective education at affordable cost.

[2] I Cube 2009-10 Survey, IAMAI & IMRB

2.19 Another sector which can be benefited from broadband penetration is healthcare. A significant problem plaguing the nation's health care system is the fact that there are health disparities between urban and rural areas. Rural India , for example, experiences the higher rates of mortality due to non-availability of expert advice and timely treatment. A lot of development is taking place in e-health field. Many gadgets are now available, which can assist in capturing vital parameters of the body and seek expert advice of doctors available in any corner of the world. This will definitely drive broadband demand.

2.20 Broadband is also useful for various utility services like online Banking, bills payment, rail ticket booking, online application filing, and trading. Internet allows job seekers to search effectively for employment. New content creation and distribution systems have enabled millions of people to distribute their contributions online with least expenditure. There are significant benefits, both financial and social, that come from being able to shop online, getting the cheapest deal and saving time especially when using price comparison on the web. Broadband is capable to provide all these services.

2.21 There is dramatic increase in consumer behavior towards real-time applications i.e. "experience now". Share of real-time entertainment traffic (video and audio streaming, Flash media, peer casting, place shifting) is increasing. Thus, entertainment seems to be key driver for generating huge demand of broadband specially in rural and computer literate population.

2.22 Provisioning of broadband facility to all panchyat may be a class service in initial phase. However, it will facilitate the villagers to experience the utility of broadband in their daily life and after

realizing the usefulness and convenience, it will be a catalyst for mass adaptation of broadband.

2.23 **Issues for Consultation:**

- **What should be done to increase broadband demand?**
- **What, according to you, will improve the perceived utility of broadband among the masses?**
- **What measures should be taken to enhance the availability of useful applications for broadband?**
- **How can broadband be made more consumer friendly especially to those having limited knowledge of English and computer?**

**B- Supply Factors**

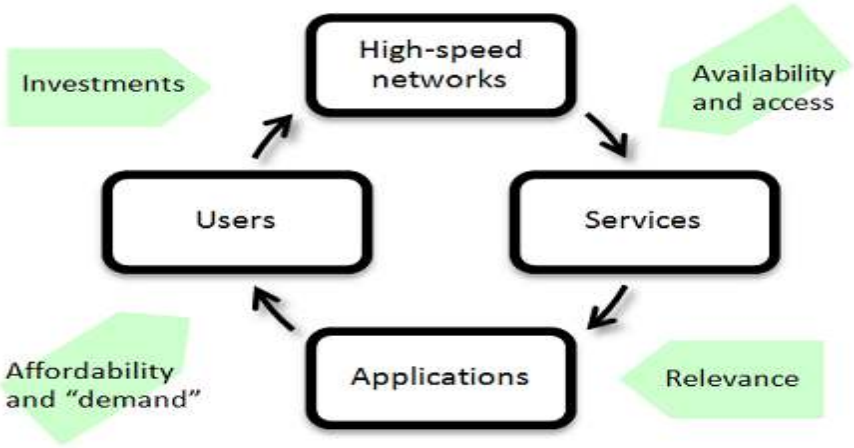
2.24 Despite high utility and considerable demand, broadband services are not available to many citizens due to non availability of required infrastructure. Operators have created networks only in big cities. Due to high initial investment and expected low returns, operators are hesitating to invest in small cities/ villages or remote areas. Ultimately, citizens of these areas do not get access to broadband services. Considering the enormous power of broadband, it is essential to concentrate on availability of the broadband to every citizen. Most of the developed countries like US, Europe, China are deliberating whether to enhance expenditure on creation of infrastructure like roads or to provide high speed broadband connectivity facilitating access to well connected world.

2.25 Now Broadband is being considered as an "ecosystem" that comprises different elements such as high-speed connectivity to interact in different ways (see Figure 2.2)[3]. Broadband users have the ability to

[3]InfoDev/OECD workshop on "Policy Coherence in ICT for Development" Sept 2009

create and share multimedia content in a variety of formats. This interactivity is an important factor that differentiates the broadband ecosystem from other high-bandwidth, but essentially passive networks such as multi-channel TV. It also creates many new opportunities for value creation and innovation.

**Figure 2.2 : The virtuous circle for broadband: Connecting the elements**

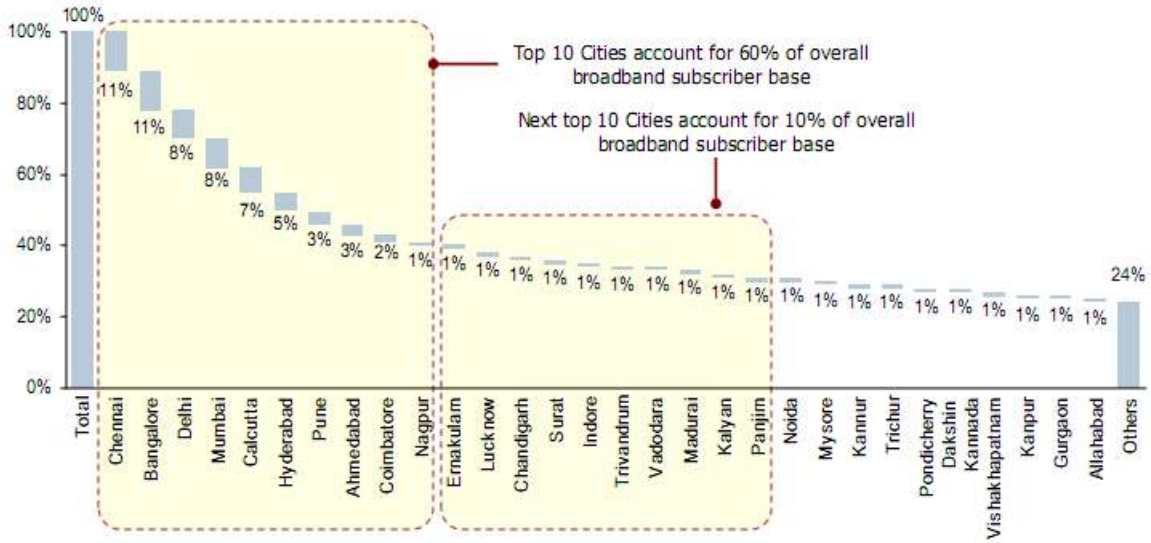



2.26 The growth of Web 2.0 services and applications that are dynamic and collaborative in nature depends on the ability of users to interact with each other. For instance, older networks were asymmetric and upload speeds were low. Users of today's two-way interactive multimedia services demand high-speeds in both directions. The global Internet seems robust in terms of scalability to larger number of users, more demanding applications and higher speeds. Hence, network is part of an ecosystem that is evolving and includes users and applications that are more demanding. Users creating and sharing more content will require more bandwidth and drive broadband requirement. This virtuous cycle forms the basis of what we refer to as the broadband "ecosystem."

2.27 The networked applications in India are very limited due to lack of guaranteed network connectivity. Common masses have to be promised basic access to broadband, if fruits for government

initiatives in terms of e-Governance, e-Health, e-Education have to be passed on to them. Presently, more than 60% broadband subscribers belongs to top ten metros / tier-I cities and more than 75% connections belongs to top 30 cities. More than 86% of existing broadband connections have been provided using DSL technologies. Figure 2.3 indicates that most of the DSL broadband users are concentrated in metros or A1 class cities and availability of broadband to common masses in smaller cities and villages is very limited. Apart from the crucial role of broadband in development, it is important to provide guaranteed connectivity to common masses for effective disaster management during national calamities. Many of the countries have deployed various applications using broadband for ensuring personnel securities also. As such government has to consider broadband requirement for all to ensure all-round growth of country.

**Figure 2.3: Broadband DSL Connections by Cities**




Source: Analysys Mason (Illustrative)

2.28 As already discussed in para 1.5 that market is dominated by only 4-5 service providers having their own infrastructure. Broadband is

primarily provided using cupper cable networks (DSL connections) in India. The 3G and BWA technologies have to pick up as spectrum for launch of such services is being allocated. Satellite connectivity is costly and availability of transponders is limited.

2.29 In 2004, when initially broadband was defined, it was mainly used for various elementary applications like e-Mail, voice chatting and text information. At that time, speed of 256 kbps was considered sufficient to support applications popularly used by subscribers. The availability and type of popular contents evolve with time and so their bandwidth requirement. Table 2.2 summarizes various applications in present scenario and bandwidth required to support such applications.

**Table 2.2: Bandwidth requirement for various applications**

| Application | Min. Bandwidth Required |
|---|---|
| **Internet Surfing** | Upto 256 Kbps |
| **E-mail** | 64 Kbps |
| **Voice Chatting** | 64 Kbps |
| **Video Clips** | 256-512 Kbps |
| **Tele-education** | 256-512 Kbps |
| **Tele-medicine** | 256 Kbps to 4 Mbps |
| **Video streaming per Channel** | 2 Mbps (Approx.) |
| **Video gaming** | 256-512 Kbps (high precision games may required higher bandwidth) |
| **High Definition Video per Channel** | 4-8 Mbps |

Source: TRAI Status paper on Broadband Speed, January 2008

2.30 Increasing digitalization and expansion of network capabilities are enabling network convergence which facilitates provisioning of telecom, broadcasting & IT enabled services over the same network. This trend is leading towards higher bandwidth requirement. Extrapolating this trend and considering that a household connection is generally used by 3 to 4 persons, the bandwidth requirement per connection is expected to be minimum 3 to 4 Mbps per household by the end of 2010 to support emerging applications. There will be huge increase in the bandwidth requirement due to increase in demand of bandwidth intensive services. Considering the bandwidth requirement of 3 Mbps per household with a high contention ratio of 1:50, and 5%, 20% & 40% households having broadband by 2010, 2012 & 2014 respectively, the estimated core bandwidth requirement will be gigantic 750 Gbps, 3000 Gbps and 6000 Gbps respectively (refer table 2.3).

**Table 2.3: Bandwidth Requirement Forecast**

| **Year** | **Estimated No. of Households** | **Forecast** (number of connections) | **Number of connections with Contention Ratio (1:50)** | **Core Bandwidth Requirement (@3mbps per user)** |
|---|---|---|---|---|
| 2010 | 236 Millions | 11.5 Million | ≈ 0.25 Million | 750 Gbps |
| 2012 | 241 Millions | 48 Million | ≈ 1.0 Million | 3000 Gbps |
| 2014 | 250 Millions | 100 Million | ≈ 2.0 Million | 6000 Gbps |

2.31 Though there are multiple wireline and wireless technologies that can support bandwidth requirement in core network, considering the projected core bandwidth requirement a suitable option need to be promoted which may be cost effective, resilient, robust, provides low latency, easily upgradable and support huge bandwidth for core networks. Optical fibre is one of the options being perceived as long term solution to carry enormous bandwidth in core network.

2.32 Internationally, most of the developed countries have either already created nationwide optical fibre network or are in process of doing so. United States created rural utilities service broadband loan program and given USD 111.4 billion in 2005 and USD 329.4 billion in 2006 to deploy fibre to home infrastructure in rural areas. Korea and Japan have already upgraded their network and in most cases optical fibre is available upto the subscriber's home, providing average broadband speeds of 20 Mbps. British Telecom (BT) has also foreseen high bandwidth requirements and successfully deployed a new DWDM core network (Optical Fibre Network). They are now using this core network to roll out new Ethernet services to many places in UK. BT has recently observed that success of Next generation network depends on next generation (very high speed access network) access network upto subscriber premises and accorded high priority for up-gradation of access network by optical fibre upto subscriber premises. Australia has recently decided to develop a National Broadband Network (NBN) (an optical fibre network) and has provided funding of $4.7 Billion. NBN will be open access, high speed, fibre based national network that will provide access speeds of at least 12 Mbps to 98% of Australian homes and business.

2.33 Apart from governments, service providers are also recognizing higher bandwidth demand in core network and upgrading their networks accordingly. In USA, Google is planning to build fibre optics network for as many as 500,000 people with minimum connections speed of 1 Gbps. The FCC hopes to have 100 million U.S. homes equipped with 100 Mbps Internet access by 2020, while the Internet adoption rate is expected to increase from its current 65% to about 90% during this period.

2.34 ITU has released ICT Development Index (IDI) constructed around three sub components, access, use and skills. A breakdown of index results by these sub components allows the user (for example, Government policy makers) to assess ICT performance and identify those areas which need to be addressed. In ICT Access Sub-Index there are five indicators: fixed line penetration, mobile cellular penetration, international Internet bandwidth per Internet user, the proportion of households with computers and the proportion of households with Internet access. The sub-index 'ICT use' includes three indicators, Internet user penetration, fixed broadband penetration, and mobile broadband penetration. The three indicators included in the 'IDI sub-index skills' (adult literacy, secondary and tertiary enrolment) are proxy measures, in the absence of comparable data for a large number of countries that would measure more specific ICT-related skills. India is ranked very low in all these sub-indices. Out of 154 countries, rank of India is given in Table 2.4 for these sub indices:

**Table 2.4: Rank of India in IDI sub indices**

| **Sub-Index** | **Rank of India** |
|---|---|
| IDI Access | 129 |
| IDI Use | 106 |
| IDI Skill | 118 |

Above ranks clearly indicate lack of access, use and ICT skills in India affecting internet and broadband penetration. There is an urgent need to create appropriate infrastructure for supporting broadband growth.

2.35 **Issues for Consultation:**

- **Do you agree with projected broadband growth pattern and futuristic bandwidth requirements?**

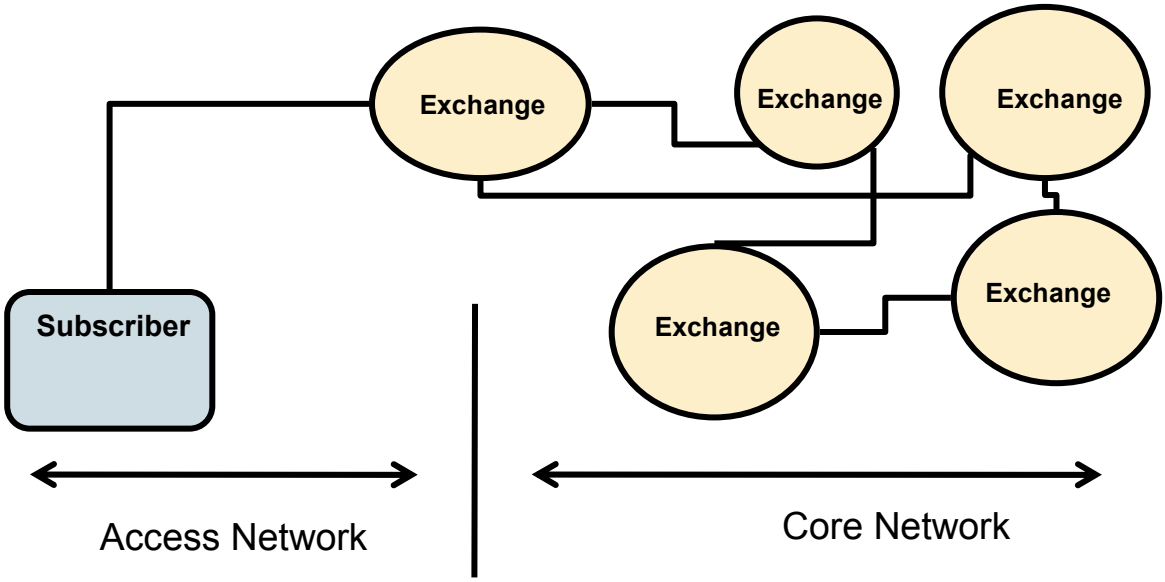
- **Do you agree that existing telecom infrastructure is inadequate to support broadband demand? If so what actions has to be taken to create an infrastructure capable to support futuristic broadband?**

## CHAPTER 3: National Broadband Network

3.1 Predictive demand of broadband in near future and required infrastructure for this purpose necessitates deployment of nation wide broadband network.

3.2 A broadband network can be divided in two parts namely Access network & Core network as shown in figure 3.1.

**Figure 3.1: Schematics of Broadband network**

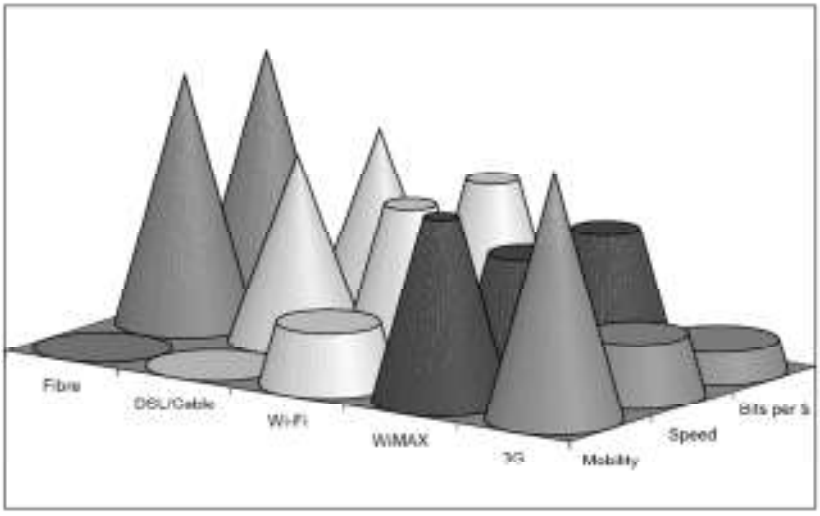



3.3 Access network provides last mile connectivity between subscriber premises and nearest exchange of the service provider or point of presence (POP), whereas the core network connects all exchanges of the service provider for carrying aggregated traffic of subscribers to other service providers and international gateway. Different technologies both wireline and wireless are available for access and core networks to provide broadband. Some of the technologies can be used both in access and core networks.

### A- Access Network:

3.1 The popular technologies used to provide broadband in access network are DSL, Wireless, Cable TV, Satellite and optical Fibre. Figure 3.2 indicates that different technology options have different advantages and limitations and are best suited to different requirements. For example, 3G provides highest mobility but speed supported on such networks is comparatively low. Similarly optical fibre supports highest speed but no mobility. We will discuss these access technologies in subsequent paras to explore their strength and potential to boost broadband penetration.

**Figure 3.2: Access Technologies vs. Price, Speed and Mobility**




Source: OECD

### DSL in Access Network:

3.2 At present, 86% of broadband connections are provided using DSL technologies. DSL connections are provided using copper cable of fixed line network. As already discussed in para 2.4 that more than 60% broadband subscribers belongs to top ten metros / tier-I cities and more than 75% connections belongs to top 30 cities.

3.3 Table 3.1 indicates number of fixed line connections and broadband connections in 4 metros as on March 2010.

**Table 3.1 : No of fixed line and Broadband Connection in Metros**

| Name of Metro | No. of fixed lines | No. of Broadband connections | Broadband as a Percentage of fixed line connections |
|---|---|---|---|
| Delhi | 2,710,835 | 785,564 | 28.97% |
| Mumbai | 2,945,525 | 467,692 | 15.87% |
| Chennai* | 1,420,342 | 366,539 | 25.80% |
| Kolkata* | 1,463,442 | 248,510 | 16.98% |

*Broadband subscriber figures are approximate.

Though fixed line copper cables are used to provide broadband connections, number of broadband connections is small as compared to fixed line telephones. Even in metros where maximum DSL connections are working, only 15% to 29% of fixed line connections are used to broadband connection. This clearly indicates that existing copper network for providing fixed lines have not been optimally used. There is a scope to increase the broadband penetration through these potential fixed line connections.

3.4 Presently there is no growth of copper cable network resulting in limited copper cables availability. DSL connections presently being provided supports maximum speed upto 2 Mbps within a limited distance of 3 Kms from the exchange. Even if we consider that about 50% of available copper loop is capable to deliver broadband services and only 50% of these capable connections exist within 3 Km range from the exchange, we can provide broadband capable to support upto 2 Mbps to 25 - 30% of fixed line connections through DSL (9-10 million). DSL will not be able to satisfy futuristic subscribers' bandwidth demand which is 3-4 Mbps per household. There is an urgent need to create a suitable and robust network capable to meet growing bandwidth demand.

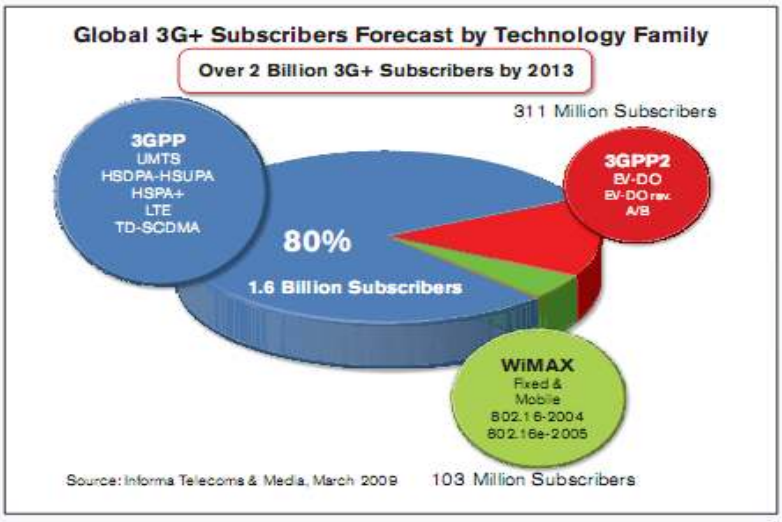
**Wireless in Access Network**

3.5 Wireless technologies provide different alternatives to provide Internet/ Broadband.

3.6 At present in India, majority of wireless internet connection is working on 2G EDGE technology which can support maximum speed up to 144 kbps. With the allocation of spectrum for 3G and BWA services, high speed wireless access will soon be a reality. Existing 3G wireless technologies are capable of providing broadband speed upto 14.4 Mbps per cell site with 5 MHz carrier. With the evolution of 4G technologies like LTE, we can achieve maximum bandwidth upto 140 Mbps per cell site with 20 MHz carrier. Since wireless broadband can be deployed very quickly, it is likely to be handy to increase broadband penetration; however spectrum is limited. Authority has already dealt various issues related to spectrum in its recommendation on "Spectrum Management and Licensing Framework" sent to government on 11th May, 2010. Wireless in access network seems to be promising but for supporting growing bandwidth demand, frequent reuse of spectrum is necessary. The spectrum reuse require well laid robust feeder network upto tower. Therefore, even after availability of capable wireless technologies for high speed broadband, robust feeder network will be necessary.

3.7 A lot of developments have taken place in wireless technology and comparatively large bandwidth can be supported over wireless networks. It is estimated that there will be more than 2 billion wireless broadband connections worldwide by 2013. (refer figure 3.3)

**Figure 3.3: Global 3G subscriber forecast**




3.8 It is also expected that data services from mobile will grow at rapid speed and demand for mobile broadband will also increase (refer figure 3.4). Development of suitable eco-system for sustained broadband growth is necessary.

**Figure 3.4: Prediction of Mobile data traffic and broadband**

**Cable TV Networks**

3.9 There were 451.94 million broadband connections worldwide as per the World Broadband Statistics[4] for quarter ending December 2009. Out of these 20.32 percent are Cable modem connections. Majority of Cable modem connections are in North America (52.37%). Some European countries like UK, Netherlands, Germany, Spain & Belgium also have good number of cable modem connections. (Refer figures 3.5 & 3.6).

**Figure 3.5: Total Broadband by Technology in Q3 2009**

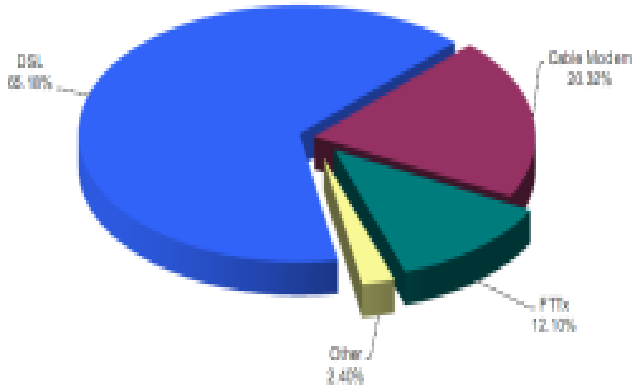
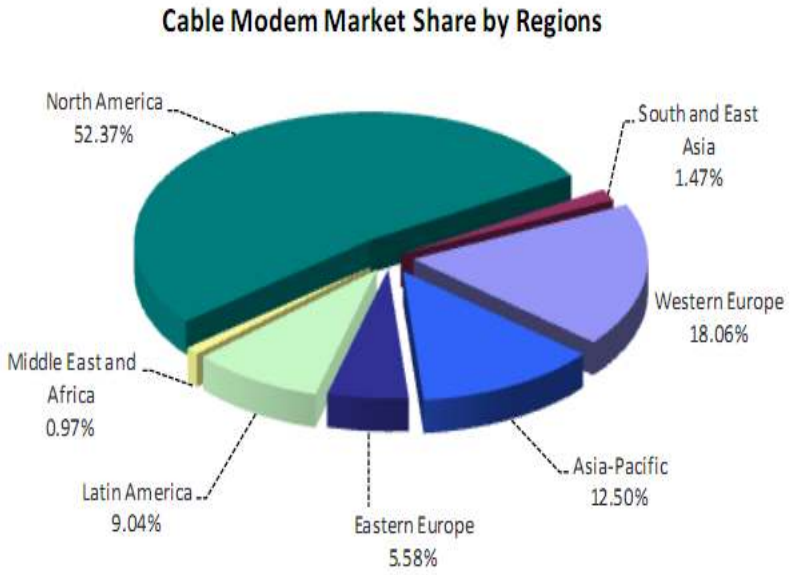



**Figure 3.6: Cable Modem Market Share Q3 2009**




[4]World Broadband Statistics: Q3 2009 by Point Topic

3.10 Cable TV networks has the capability to become a cheaper and convenient source of providing broadband to households as cable TV networks already have access to large number of households. Presently there are 85 million Cable TV households in India. By and large cable TV networks are analog and one way. These networks require upgradation for providing broadband. The highly fragmented existing cable TV networks in some cases may not be upgradeable and may require total replacement. But, there are instances where existing network has been upgraded by many of the existing cable operators to provide broadband services. The competition from DTH sector and digitization of video content is encouraging cable operators to upgrade their networks. Upgradation of cable TV network per line requires significant cost and seems to be one of the reasons for slow upgradation of Cable TV networks to provide broadband. There are different models possible:

- Using Bi-directional amplifiers in existing network
- Combination of Optical fibre/ cat 5/ cat 6 cables
- Passive Optical network (OF upto subscriber premises)

3.11 The use of bidirectional system to provide two way connectivity and broadband is the simplest and requires app Rs 800/- per subscriber for a network of about 1000 subscribers. This system is prone to noise in the return path effecting QoS of broadband provided using such systems.

3.12 The combination of Optical fibre and Cat 5/ Cat 6 cable is costing app Rs 1300/- per subscriber for a network of 500 subscribers. The length of cat 5/ cat 6 cable cannot be more than 100 meters and switches in this network will require stable un-interrupted electric supply which may be a challenge.

3.13 The passive optical fibre will be ideal and long term option but cost per subscriber in this case is high. Apart from network cost of app Rs 1500/- per subscribers, each subscriber will have to pay app Rs

20,000/-(one time) for optical network unit (ONU). As such the solution becomes very costly.

3.14 There are apprehensions that providing only broadband services over cable TV network may not give commensurate rate of return on investments required for up gradation. The available data suggests that only 10% of existing cable TV network i.e. approximately 8 million cable TV connections are capable to provide broadband access at present. However, only about 7% i.e. 0.6 million broadband connections over cable TV network have been reported by March 2010. The main reason for this low utilisation of cable TV networks is non viability of business model. The cable operators feel that high cost of International Internet bandwidth; limited applications and high competition do not make a suitable business model.

3.15 Cable TV operators want permission to provide additional services to make viable business model by bundling different services. At present cable TV operators have option to provide different services by acquiring UASL license though limited services can also be provided by taking ISP license. There are huge financial barriers for obtaining UASL and therefore Cable TV networks are not emerging as one of the alternatives to provide broadband.

3.16 Another major concern of cable TV operators is that cable TV networks have not been included in infrastructure category. Therefore, they are not able to get the funding/financial support from various institutions for establishing/ upgrading their network. Stakeholder's views are invited on the issue.

**Satellite in Access Network**

3.17 Use of satellite technology for Broadband offers significant advantages in terms of ubiquitous coverage, simplicity in network design, reliability and rapid deployment and is very

effective to serve inaccessible hilly areas where wired access is difficult to lay. Provisioning of Broadband through satellite requires main hub and remote stations. The cost of a main hub and satellite bandwidth is high. As a result the broadband connections provided using satellite medium is costly. The low bandwidth support, higher cost of connectivity and limited availability of satellite transponders limit use of satellite connectivity to provide broadband for masses.

**Optical Fibre in Access Network**

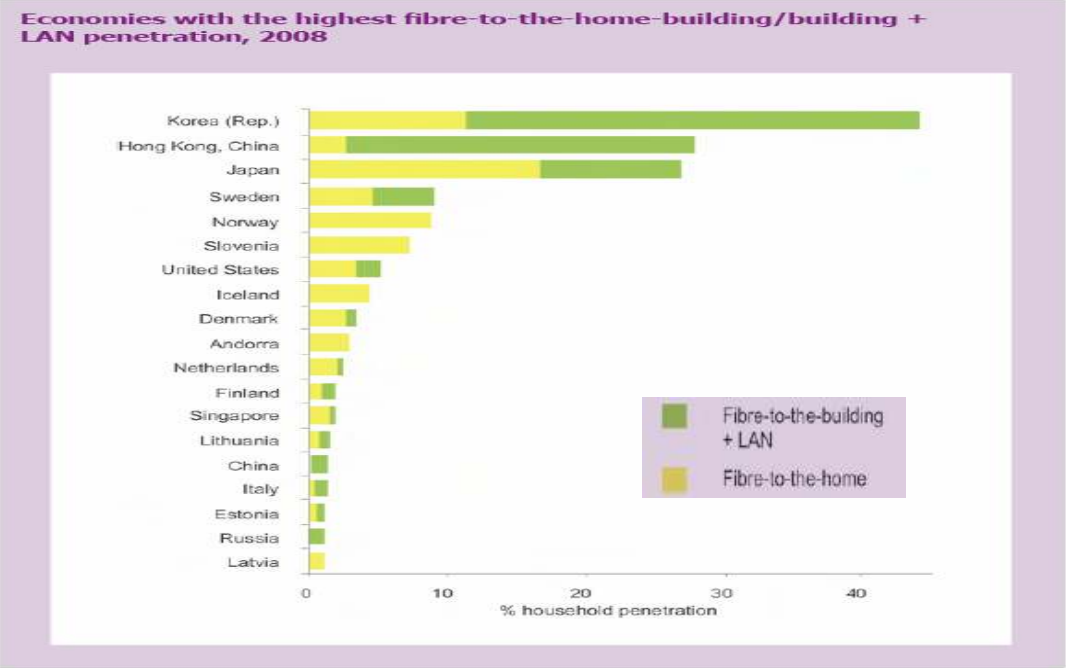
3.18 Optical Fibre in access network is capable to provide high bandwidth throughput for services (even upto 100 Mbps) such as high-definition IP Television (IPTV), video on demand (VoD) etc. The different technologies discussed earlier indicated that available technologies generally fail to support high speed futuristic broadband requirement and focus has to be shifted to creation of optical fibre.

3.19 Service providers have realized this fact and are in process of laying optical fibre upto customer premises/cabinet. The critical issue associated with laying of optical fibre in access network is Right of Way. Non availability of ROW is one of the impediments for creating Optical Fibre Infrastructure in access network. ROW issues are discussed in details in Para B of chapter 5. Operators are generally taking care of high initial investment and huge time lag before such infrastructure can be put to use.

3.20 Several advanced economies like US, UK, South Korea, Japan, France, Canada, Australia, Germany, Greece & Finland have either already created or in the process of deployment of nationwide optical fibre. In South Korea, the government has adopted a plan to upgrade national broadband infrastructure in order to enable speeds of 1Gbps to

broadband users by 2012. Fibre to the Home/ building penetration of top 20 countries is shown in figure 2.4. In India, at present provisioning of broadband connection through optical fibre network is low and only 0.53% broadband connections are working on optical fibre. India is having poor Fibre to the Building (FTTB) connectivity and even does not figure in top 20 countries (refer figure 3.7).

**Figure 3.7: Economies with the highest fibre-to-the-home-/building + LAN penetration, 2008**




Source: ITU adapted from Fibre-to-the-Home Council.

3.21 India has a unique demographic pattern where there is high population concentration in metros and cities though majority of population lives in rural areas. There is a need to create optical fibre access network in all major cities and metros to provide high speed broadband. There are only 42 cities having the population more than 1 million. These big cities are having optical fibre in core network but in access network optical fibre penetration is limited. In these cities, optical fibre to the home will be better option in case of individual dwelling units and optical fibre to the curb will do well for multiple dwelling units. In case of cities with population less than 1 million,

fibre to the curb may be desirable. Optical fibre up to the villages may do well to start with. There is an urgent need to focus attention on optical fibre so that most of the internet traffic is handled by optical fibre network and last mile is taken care by wireless/ Ethernet/ copper cable etc. Stakeholders are requested to give their comments how optical fibre penetration can be increased in access network in India.

3.22 **Issues for Consultation:**

- **What network topology do you perceive to support high speed broadband using evolving wireless technologies?**
- **What actions are required to ensure optimal utilization of existing copper network used to provide wireline telephone connections?**
- **Do you see prominent role for fibre based technologies in access network in providing high speed broadband in next 5 years? What should be done to encourage such optical fibre to facilitate high speed broadband penetration?**
- **What changes do you perceive in existing licensing and regulatory framework to encourage Cable TV operators to upgrade their networks to provide broadband?**

**A- Core Network**

**National Optical Fibre Network - connectivity to Rural Area**

3.23 Broadband penetration in rural areas has been low. Just 5% of the present broadband connections are in rural areas as compared to about 31% of total mobile telephone connections. The primary cause of low penetration of broadband in rural areas is non-availability of required transmission media connectivity upto villages, high cost of service roll out and lack of viable business model. Presently about 7,50,000 route Km of optical fibre network is available in India. It includes 5,00,000 Km optical fibre network of state owned BSNL.

3.24 Internationally, it is observed that there is a national level broadband plans to increase the reach of broadband upto rural and remote areas. All these national plans are initiated by government with a significant contribution. Majority of countries have created optical fibre network capable to support high speed bandwidth hungry applications. A brief of initiatives of some countries is given in table 3.2.

**Table 3.2: International Initiative for National Broadband Projects**

| Name of Country | Brief of National Broadband Project |
|---|---|
| Australia | • Government investment of USD 38 billion in national broadband plan.<br>• 90% of population shall be provided broadband access of 100 Mbps speed with fibre based network. |
| Singapore | • Next Generation Broadband plan started in 2006 with government subsidy of USD 0.7 million.<br>• Open Access wholesale to 95% population by 2012 with initial speed 100 Mbps rising to 1 Gbps using FTTH network. |
| Malaysia | • High speed broadband network to connect 1.3 million homes in major cities on FTTH/FTTC network by 2012.<br>• Government to invest USD 0.7 billion out of total cost 3.2 billion USD.<br>• Government to invest additional USD 250 million in rural areas. |
| Sweden | • Local municipals to invest more than 180 million USD to deploy 1.2 million km of fibre in and around Stockholm. |
| United Kingdom | • Government invested 1.6 billion USD for development of NGA in rural areas.<br>• Aim is to bring the superfast broadband to 90% of population. Private investment is expected to cover 70% of optical fibre cost by 2017.<br>• Part funded by proposed landline duty of USD 0.8 per month on all fixed line in country . |
| United States | • There is a national broadband plan to provide the nationwide broadband including rural areas. Government |

| | |
|---|---|
| | to provide USD 11.6 billion under various broadband programs.<br>• Further USD 2.5 billion is made available for grants loan and loan guarantees. |

3.25 Hon'ble President of India in her Address to joint session of the Parliament on 4th June 2009 had mentioned that every panchayat will be connected to broadband network within next three years and the scheme for CSC or e-kiosks will be suitably repositioned in order to create a broadband network of panchayats under Bharat Nirman Common Service Centers to provide government services to citizens in rural areas.

3.26 Service providers use access technologies (wireless, PSTN line, cable) to provide broadband services to villagers, consolidate the broadband traffic from different villages/rural areas at block/ cities/district level and route it to their switching center/destination. While access can be provided to villagers/subscribers using wireless/wireline access technologies, backhaul is the bottleneck.

3.27 Non availability of connectivity in rural areas has already impacted existing schemes to provide broadband in rural areas. Department of Information technology (DIT) in May 2006 planned to deploy Community Service Centers in rural areas all over the country under National e-Governance Plan (NeGP) in order to deliver e-governance services. Presently the project has targeted to deploy 123181 CSC all over the country. The project was started with an estimated cost of Rs. 5,742 crores to roll out these CSCs in 4 years i.e. by June 2010. However, till April 2010 only 77,338 CSCs have been provided. Connectivity to most of these CSCs has been provided by one service provider who has highest optical fibre presence in rural areas. The project has been delayed for want of transmission connectivity in the

rural and remote areas. As a result, DIT has now decided to utilize satellite connectivity for CSCs in the unconnected areas and so far approximately 7000 CSCs have been established using satellite connectivity. The low bandwidth support, higher cost of connectivity through satellite and limited availability of satellite transponders are some of the issues of concern.

3.28 The connectivity to villages and getting online information will be crucial for various e-governance services being delivered in rural areas. Non-availability of online information from rural areas is the major bottleneck in effective monitoring of progress and management of rural projects. This highlights urgency to provide a suitable connectivity upto village level on priority basis. Among the various available technologies, Optical fibre is robust, stable and scalable. However, creating countrywide optical fibre connectivity will require a lot of funds, efforts and planning. Presently, availability of optical fibre from major service providers is largely restricted up to the district headquarters and in some cases upto block headquarters. This necessitates exploring other options to provide optical fibre network upto village level as most of the service providers may not find such projects viable. Even developed countries have similar experiences. Federal Communication Commission (FCC) had observed "Relying on market forces only will not bring robust and affordable broadband services to all parts of rural America". The time has come when we have to work out alternative plans to lay optical fibre network upto villages on priority basis.

3.29 The copper cable network suitable for broadband is limited in rural areas. As discussed in para 3.4 DSL is not capable to support higher speeds ranging 3 to 4 Mbps fulfilling future bandwidth requirements. Optical fibre seems to the best available option even to meet future

requirements. The focus at this stage is to create a nationwide robust optical fibre network. Emphasis has to be given to provide optical fibre connectivity from districts/cities to the villages. Existing long distance bandwidth will be used for inter districts/cities traffic routing. Though such connectivity to all the villages may be desirable, but we will do well if all villages having population of more than 500 are provided with optical fibre connectivity in first stage. According to Census 2001, out of total 6.38 lakh villages, 3.74 lakh villages have population of 500 and above. It has been estimated by the National Rural Road Development Agency (NRRDA) (under the Ministry of Rural Development) that 11.46 lakh kilometers of road network is required to provide each of these habitations connectivity with one good all-weather road. Since optical fibre is best laid along the roads, this figure can be adopted as the length of optical fibre required to connect all the villages.

3.30 The cost of laying optical fibre cable consists primarily of digging the trenches, cost of the HDD pipe, cost of optical fibre cable and cost of the optical fibre equipments. Taking indicative cost of various components to lay 11.46 lakh kilometers of optical fibre cable and to provide all villages having more than 500 inhabitants with optical fibre connectivity, approximately Rs.32,295 crores will be required (refer table 3.3). This estimate does not include cost of Right of Way (ROW), generally paid to local government / agencies granting ROW permission. Currently when telecom service providers seek ROW permission, they pay ROW charges averaging approximately Rs.3.0 lakh per kilometer. The cost for obtaining Right of Way (ROW) itself would be of the order of Rs.34,380 crores for laying 11.46 lakh kilometers optical fibre. TRAI has considered various options to fund to build National optical fibre network. Telecom service providers are not actively engaged in such projects due to huge expenditure with

low rate of returns at present. As such the only viable funding option left is through government funding, at least to start with.

**Table 3.3 : Estimated cost to cover villages with Optical fibre cable**

| | |
|---|---|
| Total number of inhabited villages (Population >500) | 374552 |
| Total single connectivity roads to villages having population more than 500* | 1146000 Km |
| Total optical fibre requirement (in Km) for connecting villages having population more than 500 | 1146000 Km |
| Estimated cost of digging OF cable laying | Rs 18565 crores |
| Estimated cost of the material (OF cable, HDD pipe & end equipment) | Rs 13730 crores |
| Total estimated cost of covering all villages (population >500) with Optical fibre connectivity (Without Right of Way (ROW)) | Rs 32295 Crores |

*As per information given by National Rural Road Development Agency (NRRDA)

3.31 Here it is important to mention that governments in many of the developing economies are heavily investing to increase broadband penetration and create robust backbone as this is going to boost economic development. As discussed in chapter 1, concept of virtual office will reduce movement, video conferencing will bridge the distance gap, information availability will bridge the gap between classes of society and drive towards a civil society bridging the big gap of haves and have not's. Government has to initially fund the creation of optical fibre network upto the villages to boost broadband penetration.

3.32 Creation of optical fibre network involves digging of trenches, laying of HDD pipes (Plastic ducts), pulling the optical fibre cables in the said ducts, their jointing and finally connecting to the optical fibre terminal equipments. It is estimated that labour component for digging the trenches accounts for Rs.18,565 crores while other costs

including material would be of the order of Rs.13,730 crores. This also includes Rs. 5937 crores as cost of end equipments. Careful analysis of this proposal indicates that material cost accounts for just 42% of project cost and big portion of 58% is the unskilled labour cost.

3.33 Universal Services Obligation Fund (USOF) has been created to boost telecommunication penetration including broadband in rural areas. At the end of March 2010, Rs 10411 Crores balance is available with USOF[5]. However, fund collection position for year 2009-10 is not available. If we consider same fund collection towards USOF in 2009-10 as in previous year i.e. Rs. 5515 crores (though it will be higher), the USOF will have Rs 15926 crores by the end of 2009-10. With such amount the whole project can not be completed. Options for funding the project from other sources need to be explored.

3.34 Funding of project can easily be managed if labour cost can be linked up with some other ongoing project and taken care through different funding source. Since number of rural development projects are already in operation, TRAI study felt that supporting trenching activities through Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) will provide a viable solution. Here it is important to mention that Government has started the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) with an objective to provide at least 100 days of guaranteed wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. MGNREGS covers the entire country with the exception of districts that have a hundred percent urban population. Government has allocated fund of Rs 39100 crore for this scheme in the current financial year. If cost of

[5] http://www.usof.dot.in/

the digging for laying of optical fibre cable upto the villages can be funded through allocated resources for NREGS, only Rs 13,730 crores will be required to meet expenses of equipments, material and other activities, which can easily be funded through USOF.

3.35 The coordination of various agencies for smooth and timely implementation of project will be desirable. One option could be to setup an autonomous national level agency to manage and co-ordinate project on mission mode as well as to subsequently administer the optical fibre network. This agency would be self supportive organization and will be responsible to construct, own and lease the optical fibre network. The existing OFC network may be transferred to this agency. This agency would lease out OFC infrastructure/ bandwidth to all telecom service providers on non discriminatory terms and conditions.

3.36 Other option could be to form public private partnership to create national wide optical fibre network. USOF may invite the options for investment from various private agencies to be a partner in the project. Once the project is completed the PPP firm shall maintain the OFC under well defined framework. OFC may be leased out to service providers on demand on predetermined rates prescribed by the government/regulator. Revenue earned by this leasing operation may be shared between USOF and private partner.

3.37 Third option could be to create the optical fibre network by consortium of service providers having clearly laid down framework for its functioning. All the optical fibre network available today may be pooled for optimal utilization and is efficiently managed. The stake of individual company/ organization may be worked out depending on their contribution/ pool of optical fibre network.

3.38 Coordination among various agencies involved in execution of the project to properly lay optical fibre cables would be of prime importance for smooth and timely implementation of the project. It will be desirable to ensure implementation of this project in all respect in a time frame of 2-3 years.

3.39 **Issues for consultation**

- **Is non-availability of optical fibre from districts/cities to villages one of the bottlenecks for effective backhaul connectivity and impacts roll out of broadband services in rural areas?**
- **If so, is there a need to create national optical fibre network extending upto villages?**
- **In order to create National optical fibre core network extending upto villages, do you think a specialized agency can leverage on various government schemes as discussed in para B?**
- **Among the various options discussed in Para 3.35 to 3.37, what framework do you suggest for National Fibre Agency for creating optical fibre network extending upto village level and why?**
- **What precautions should be taken while planning and executing such optical fibre network extending upto villages so that such networks can be used as national resource in future? What is suitable time frame to rollout such project?**

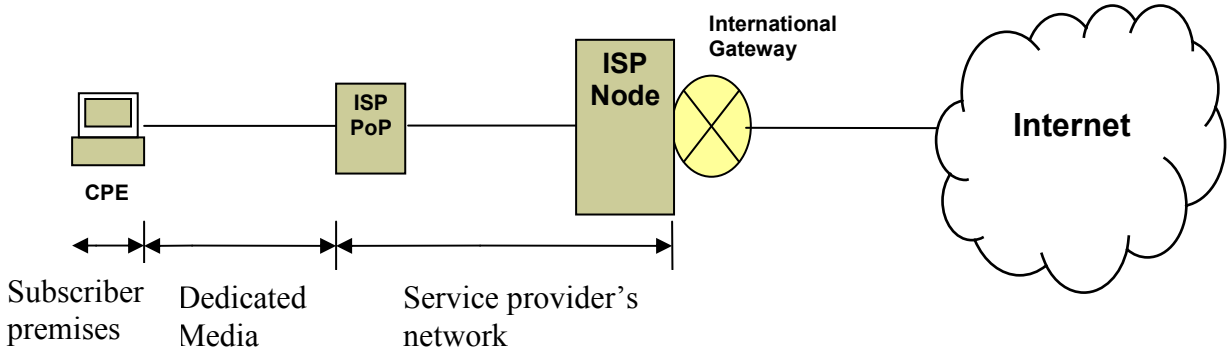
# CHAPTER 4: Regulatory Challenges and Future Approach

## A- Definition of Broadband

4.1 The classification of high speed Internet connection into Broadband became effective with the introduction of Broadband Policy, 2004 announced by the Government on 14th October 2004. The broadband was defined 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 license is specifically required, for example, real-time voice transmission, except to the extent that it is presently permitted under ISP license with Internet Telephony*". In short, all Internet connections having minimum download speed of 256 Kbps are classified as Broadband.

4.2 The above definition clearly lays emphasis on "an always on data connection" and having "minimum download speed of 256 Kbps" to an individual subscriber from the PoP of service provider. Figure 4.1 gives a schematic for fixed broadband access.

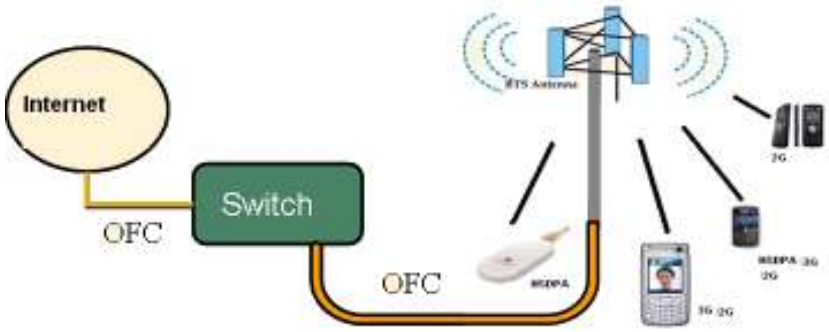
**Figure 4.1: Fixed Broadband Access**




4.3 In case of fixed broadband access, there is a dedicated resource (DSL, Cable, Fibre etc.) between service provider's PoP and customer premises, which can provide an always-on connectivity to the users. Use of dedicated resources can ensure any pre-defined guaranteed download speed from service provider's PoP to subscribers (presently defined speed is minimum 256 kbps for broadband). However, this definition does not hold well in case of BWA technologies and requires detailed deliberation.

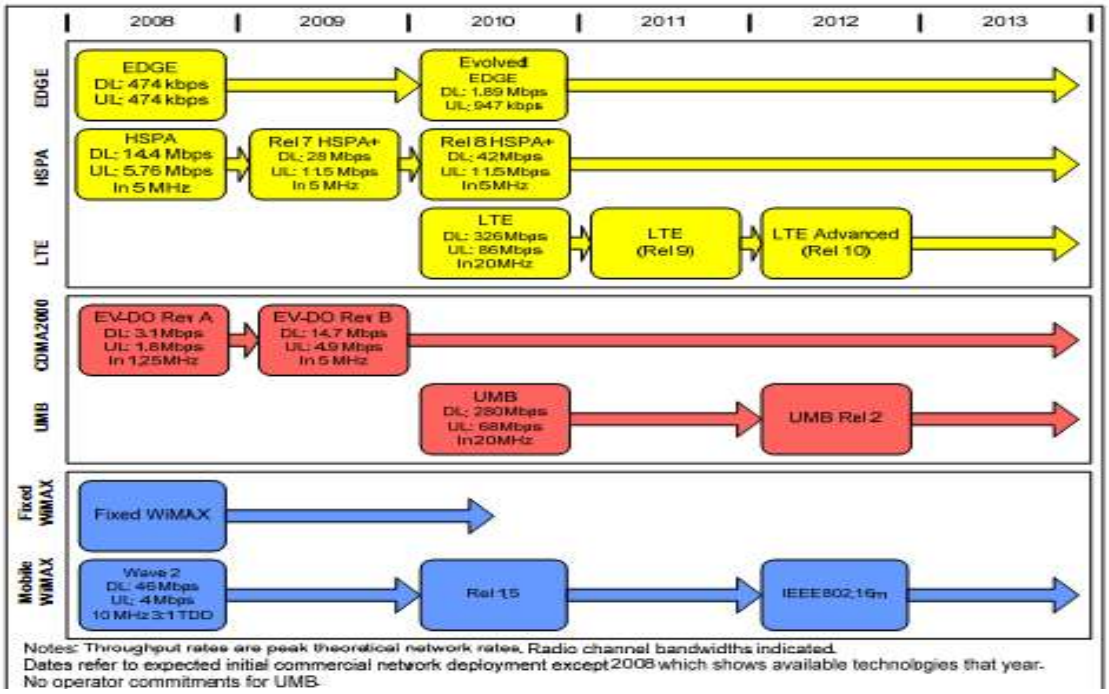
4.4 The technological innovations permit delivery of high speed data and access to Internet using mobile telephony networks. Figure 4.2 gives a schematic diagram of internet access through mobile network.

**Figure 4.2: Mobile Internet Access**




4.5 Various mobile technologies are now capable of providing high speed internet. Evolution of various wireless technologies which are capable of providing high speed internet are illustrated in figure 4.3 below:

**Figure 4.3: Evolution of Wireless Technologies with their network speed (theoretical)**




4.6 In case of wireless networks, a **broadband connection is not always-on,** as the resources like data channels using spectrum are allocated to a subscriber only on request and remains till the termination of data connection by the user. Once a connection is

terminated, the resource is free and available for allocation to another user. In addition, the speed of Internet access to ultimate end user is based on the design of the network and is shared among the subscribers present in a particular cell site. The location of subscriber in a cell area also impacts the available speed to an end user. Available speed is higher near to BTS but low towards cell edge. While maximum bandwidth which can be supported by a cell site is fixed by design, the number of subscribers at any given moment is variable. Therefore, in case of broadband provided using 3G & BWA technologies, it may not always be possible to ensure a minimum bandwidth of 256 kbps per user as bandwidth available to individual user depends on the number of subscribers being served by that cell site at any given point of time. If number of subscribers present in a particular cell site is low, users may get much higher speed than 256 kbps and vice-versa. As a result **mobile Internet access may not always fulfill the criteria of minimum bandwidth required for a broadband** connection as per the existing broadband definition.

4.7 Department of Telecommunications (DoT) vide its letter No. 813-07/1/2010-DS dated 01/04/2010 has sought recommendations of the Authority on the review of definition of Broadband connectivity anticipating future growth in internet / broadband driven by wireless technologies.

4.8 United Nations (UN) in their document "Revisions and additions to the core list of ICT indicators" in February 2009 has defined fixed and mobile broadband separately in view of technological advancements in wireless and increasing number of mobile broadband subscribers worldwide. As per the above report, definitions of fixed and mobile broadband are re-defined as follows:

*"**Fixed broadband** refers to technologies at speeds of at least 256 kbit/s, in one or both directions, such as DSL (Digital Subscriber Line), cable modem, high speed leased lines, fibre-to-the-home, powerline, satellite, fixed wireless, Wireless Local Area Network and WiMAX."*

*"**Mobile broadband** refers to technologies at speeds of atleast 256kbit/s, in one or both directions, such as Wideband CDMA (W-CDMA), known as Universal Mobile Telecommunications System (UMTS) in Europe; High-speed Downlink Packet Access (HSDPA), complemented by High-Speed Uplink Packet Access (HSUPA); CDMA2000 1xEV-DO and CDMA 2000 1xEVDV. Access can be via any device (handheld, computer, laptop or mobile cellular telephone etc.)."*

4.9 Above definitions do not emphasize on always on connectivity. This is more relevant in case of wireless environment due to technical constraint. In India, the spectrum for 3G and BWA technologies is being allocated soon. 3G & BWA technologies shall play crucial roll for increasing the penetration of broadband and their roll out time will be low. In view of above facts, it is for consideration whether present broadband definition requires modification.

4.10 Another issue of concern is whether present speed of broadband as defined in Broadband Policy 2004 is adequate to support popular applications and whether it should be modified to include futuristic requirements. TRAI has released "Status Paper on Broadband Speed" in January 2008 highlighting most widely used applications over broadband such as Internet surfing, e-mail, voice & video chatting, e-education etc. For these applications a broadband connection with an average download speed of 256 kbps was considered sufficient at that point of time. Broadband speed is deeply related to the

availability of Network access infrastructure, perceived utility of Internet applications, common applications in use, future demand and their availability to the subscribers. The increasing popularity of applications like cloud computing, IPTV, Video streaming, online gaming, education, high definition TV and health applications now require much higher bandwidth. The broadband definition was not modified earlier as at that time networks were not capable to deliver high speed Internet and up-gradation of networks to support high speed Internet was likely to take some time. Now there is urgent need to redefine minimum bandwidth which must be supported by a broadband connection to ensure adequate bandwidth to run bandwidth hungry applications.

4.11 Internationally, average advertised speed provides the benchmark for bandwidth requirement by users. From table 4.1 it is clear that average advertised broadband speed in various countries is much higher than the broadband speed defined by us at present. Some of the Asian countries like Korea have defined the wireline and wireless broadband separately. Korea for its broadband convergence network (BcN) has planned a speed between 50-100 mbps per household in wireline broadband segment and 1 mbps per subscriber for wireless networks.

**Table 4.1: National Broadband Speed Definition**

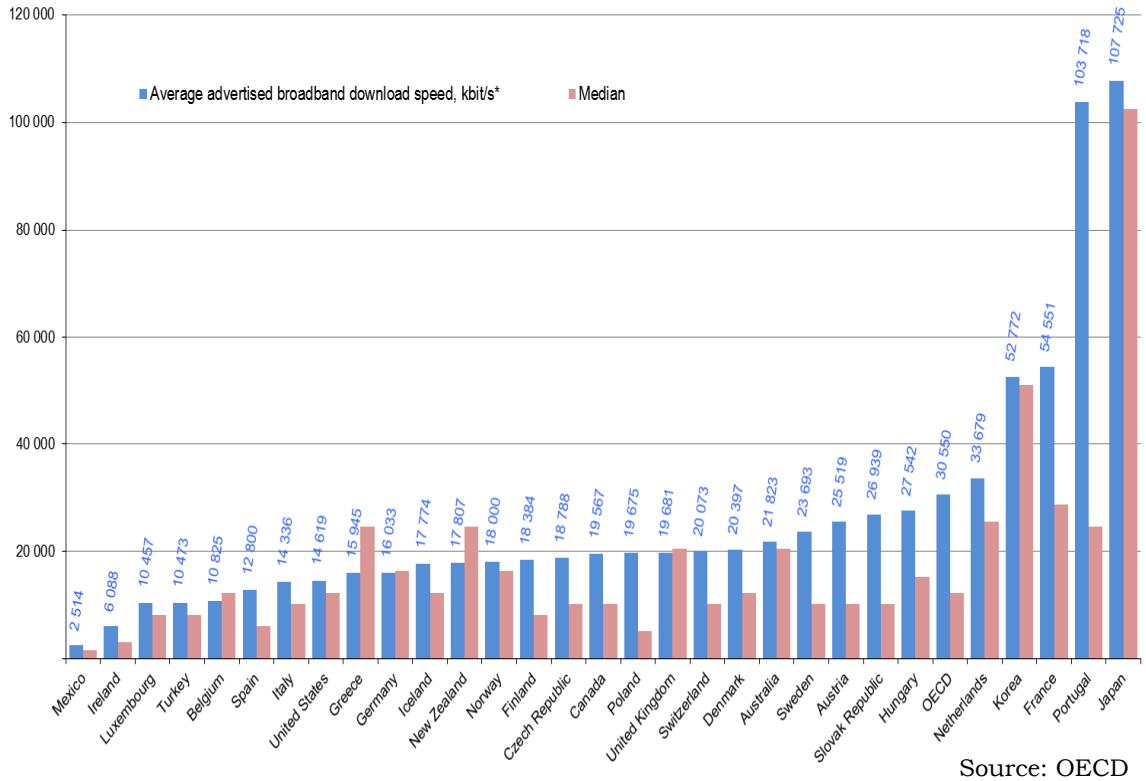
| Sl No | Country | Average advertised broadband download speed, kbit/s | Sl No | Country | Average advertised broadband download speed, kbit/s |
|---|---|---|---|---|---|
| 1 | Canada | 19567 | 17 | United States | 14619 |
| 2 | Germany | 16033 | 18 | OECD | 30550 |
| 3 | Mexico | 2514 | 19 | France | 54551 |
| 4 | Norway | 18000 | 20 | New Zealand | 17807 |
| 5 | Portugal | 103718 | 21 | Slovak Republic | 26939 |
| 6 | Turkey | 10473 | 22 | Finland | 18384 |

| | | | | | |
|---|---|---|---|---|---|
| 7 | United Kingdom | 19681 | 23 | Greece | 15945 |
| 8 | Australia | 21823 | 24 | Hungary | 27542 |
| 9 | Austria | 25519 | 25 | Italy | 14336 |
| 10 | Belgium | 10825 | 26 | Japan | 107725 |
| 11 | Czech Republic | 18788 | 27 | Korea | 52772 |
| 12 | Denmark | 20397 | 28 | Luxembourg | 10457 |
| 13 | Iceland | 17774 | 29 | Netherlands | 33679 |
| 14 | Ireland | 6088 | 30 | Spain | 12800 |
| 15 | Poland | 19675 | 31 | Sweden | 23693 |
| 16 | Switzerland | 20073 | | | |

Source: OECD broadband portal

4.12 Broadband survey conducted by Organisation for Economic Co-operation and Development (OECD) indicates that minimum advertised broadband download speed is greater than 2 Mbps while in some countries, it is as high as 107 Mbps. (refer figure 4.4)

**Figure 4.4: Average advertised broadband download speed by country in Kbps (Oct-2009)**




Source: OECD

4.13 The global average connection speed is increasing and as per Akmai's report "The State of the Internet" for 3rd quarter of 2009, global average connection speed is 1.7 Mbps. All top ten countries maintained positive yearly growth for broadband speed (refer table 4.2). It is of great concern that no modification for defined broadband speed has been done since announcement of Broadband Policy in 2004.

**Table 4.2: Average Connection Speed**

| Sl No | Country | Q3 09 Mbps | Y-o-Y Change |
|---|---|---|---|
| | Global | 1.7 | 13% |
| 1. | South Korea | 14.6 | 16% |
| 2. | Japan | 7.9 | 11% |
| 3. | Hong Kong | 7.6 | 13% |
| 4. | Romania | 6.2 | 12% |
| 5. | Sweden | 5.7 | 6.2% |
| 6. | Ireland | 5.3 | 73% |
| 7. | Netherlands | 5.2 | 18% |
| 8. | Switzerland | 5.0 | 1.0% |
| 9. | Denmark | 4.8 | 7.7% |
| 10. | Czech Republic | 4.8 | 23% |

Source: Akmai

4.14 The situation is changing rapidly. The volume of Internet traffic has been forecasted to increase four fold during the period 2008-2012. To get an idea of enormity, one may look at applications like YouTube, Blogosphere, Facebook and Twitter. Some of the growing trends can be seen by following statistics:

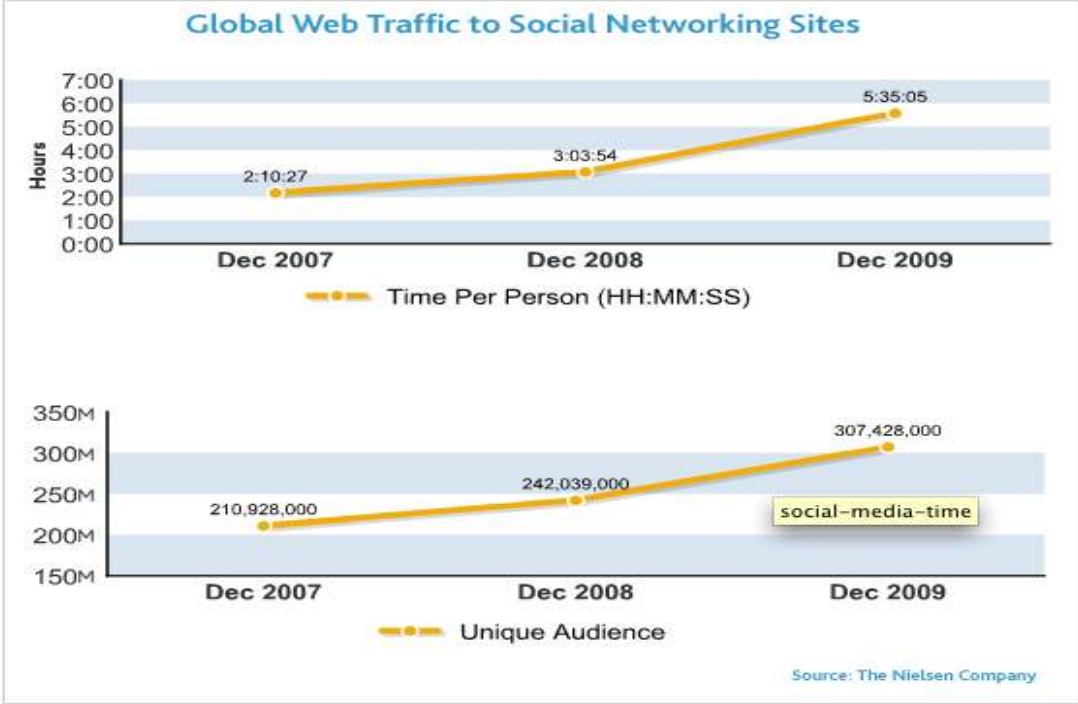
- There are more than 70 million videos on YouTube as on March, 2008 and YouTube is visited by more than 100 million views per day. It is streaming 1.2 billion streams per day.

- There are more than 400 million active users in Facebook as on 30th May, 2010. Six months ago, this was 250 million, indicating around 60% increase of users in six months.
- People spend over 500 billion minutes per month on Facebook.
- There are over 160 million objects that people interact with (pages, groups and events) on Facebook. More than 25 billion pieces of content (web links, news stories, blog posts, notes, photo albums, etc.) shared each month.
- More than 550,000 active applications currently on Facebook Platform. More than 250,000 websites have integrated with Facebook Platform.
- There are more than 100 million active users currently accessing Facebook through their mobile devices.
- Photo uploads to Facebook have increased by more than 100% in last six months (as on may 2010). There are around 2.5 bn uploads to the site each month.
- There are more than 70 translations available on Facebook indicating the trends to provide the popular content in local language.
- Twitter has 75 mn user accounts in Jan 2010.
- Folks were tweeting 5,000 times a day in 2007. By 2008, that number was 300,000, and by 2009 it had grown to 2.5 million per day. Tweets grew 1,400% last year to 35 million per day. In January 2010 it is 50 million tweets per day—that's an average of 600 tweets per second.

- LinkedIn has over 60 mn members worldwide as on feb 2010. As of last December, the network had 55 million members, so its grown by 5 million in less than two months.
- India is currently the fastest-growing country to use LinkedIn, with around 3 mn total users.
- Wikipedia has more than 350 million unique viewers in Jan 2010.

4.15 Internationally, traffic on social networking sites is increasing as evident from figure 4.5 shown:

**Figure 4.5: Global Web Traffic to Social Networking Sites**




New value added applications like Cloud and Grid computing are becoming popular that require robust broadband infrastructure supporting high speed.

4.16 Many new bandwidth hungry applications are available today. There is perceptible change in the subscribers' net usage behavior. Massive utilization of Skype for video chat, increasing use of VoD, IPTV etc. indicate steep increase in bandwidth requirement. The total bandwidth usage in the network is 505 Gbps at the end of December 2009 as compared to just 37 Gbps at the end of March 2007 indicating 13 fold increase in approximately 2 years. Extrapolating this trend and considering that a household connection is generally used by 3 to 4 persons, the bandwidth requirement per connection is expected to be minimum of 3 to 4 Mbps per household in very near future to support emerging applications (refer table 4.3).

**Table 4.3: Bandwidth requirement for bandwidth hungry applications**

| Application | BW |
|---|---|
| Video on Demand | **3-4 Mbps** |
| Online Gaming | |
| Video streaming | |
| IPTV | |

4.17 The present definition of 256 Kbps always on connection for broadband is too meager as compared to international developments. There is a school of thought, which advocates that many bandwidth hungry applications are not getting developed as they see no business model due to restrictive capacity of the Internet in India. A group of consumers feel that broadband must be re-defined to support minimum download speed of atleast 2 Mbps per subscriber. According to them, it will drive service providers to upgrade their network and fuel development of many user friendly applications. The use of high speed Internet will help to really explore potential of

broadband and will result in enhanced demand of such services. Views of stakeholders are invited.

4.18 **Issues for Consultation**

- **Is there a need to define fixed and mobile broadband separately? If yes, what should be important considerations for finalizing new definitions?**

- **Is present broadband definition too conservative to support bandwidth intensive applications? If so, what should be the minimum speed of broadband connection?**

**B- Right of Way (ROW) issues**

4.19 Complicated ROW procedures and high ROW charges to lay telecom network dissuades service providers to venture into creation of new infrastructure for telecom services. Obtaining right of way clearances has proven to be major hurdle in creating new telecom infrastructure including laying of optical fibre cables.

4.20 Different state governments have different norms/ guidelines for providing ROW to telecom operators. Service providers have to approach multiple agencies/authorities for obtaining ROW clearance which causes delay in rollout plans. ROW charges are very high and are not uniform. ROW charges range from Rs. 1,000 to Rs 20,000 per meter depending on different areas and agencies. In addition, different levies in the form of bank guarantee are asked by different municipalities/local authorities. While granting ROW permissions, local bodies/agencies put various conditions to be complied by the service providers like provision of free bandwidth to their offices for entire period of telecom license. Even some agencies demand

cashless equity shares out of total paid up equity capital of the licensee.

4.21 In case a service provider has to lay its cable along the highway, railway track or pass through forest area, it has to separately approach all these agencies for seeking ROW. Clearance procedure is complicated, lengthy and time consuming.

4.22 Agencies granting ROW do not have data base of the existing underground utilities created for public convenience. In absence of information, operators end-up damaging the existing utilities and ultimately forced to pay heavy damage charges.

4.23 Now-a-days both electricity and telecom (including broadband) are considered basic needs of society. In some states, laying of electric lines/cable is viewed as essential service and is permitted to use land for laying the electrical cable under favorable terms and conditions. However, telecom services are being treated as commercial services and service providers are required to fulfill several formalities in addition to exorbitant cost to seek ROW before starting the work. Various State Governments are charging Land conversion tax (from Agriculture land to commercial land) for installing telecom towers, while power lines are exempted from such taxes.

4.24 Some agencies providing ROW permission tend to view telecom services as a source of revenue. It seems that they do not appreciate the indirect benefits from higher penetration of telecom services. As a matter of fact, ROW charges must be minimal and restricted only to restoration charges as growth of telecom has very positive impact on development activities. Limiting ROW permission restricts broadband growth and therefore facilitates in development of the area.

4.25 Laying of telecom networks help in creation of vital infrastructure, therefore all concerned agencies must extend appropriate support to telecom operators. Expeditious approvals for right-of-way clearances to all telecom service providers are critical for timely creation of telecom networks.

4.26 In year 2000, a committee of secretaries was set up by Group on Telecom and IT Convergence (GOT-IT) to streamline the provisions of Right of Way (ROW) to telecom service licensees. The committee studied the ROW policies of various state governments and submitted its report containing model guidelines (refer Annexure-II) for streamlining the ROW provisioning. This report was circulated to all state governments on 24th August, 2000. DoT has again circulated this report vide their letter no. 820-01/2008-DS dated 9th April 2008 to all the states. The salient features of the guidelines are as below:

A. The facility of ROW may be extended for laying underground telecom cables to all licensees without discrimination and without payment of any compensatory charges/levy/lease rentals/ licence fee/free bandwidth/revenue share/cashless equity etc.

B. A performance bank guarantee @ Rs 25 per meter shall have to be furnished as security against improper restoration or damages to other underground installations etc.

C. A committee under the chairmanship of Chief Secretary of the respective state may act as a single window to coordinate all such activities.

D. ROW permissions may be granted within a period of two weeks subject to the licensee's application being complete in all respect.

E. In case, if shifting is required due to road widening, construction of flyover etc., the licensee shall do the same at his own cost.

F. In order to avoid repeated digging, the first incumbent is free to lay voluntarily extra ducts/ conduits with extra capacity to take care of future needs.

G. Licensee shall ensure the safety and security of all underground installations/ utilities and shall be solely responsible for compensation.

4.27 TRAI has sent several recommendations on issues related to ROW to Government. Main points of these recommendations are as follows:

- In recommendations on Accelerating Growth of Internet and Broadband Penetration in April 2004 it had suggested that:
  - Central Government should legislate parameters for provisioning ROW access for telecom operators in privately owned multi-dwelling buildings and residential and commercial complexes and for installing ducts for telecom services in all new projects of this nature.

- TRAI's Recommendations on Growth of Broadband in January 2008:
  - A committee should be formed at district level to study ROW requirement, which will obtain a firm demand of OFC ducts from all operators. The local authorities should evolve a duct sharing mechanisms among service providers. Expenditure of laying ducts may be shared among the operators. Alternatively Infrastructure Provider category-I (IP-I) can be encouraged to build ducts in the districts after obtaining firm demands from service providers.
  - The Central Government may consider mandating the state governments to adopt uniform ROW procedures and streamline/ rationalize ROW cost, which may primarily be limited to cost of

re-instatement only. ROW costs should be non-discriminatory and reasonable. ROW procedures should be transparent and publicly available.

- TRAI's Recommendation on An Approach to Rural Telephony – Suggested Measures for an Accelerated Growth in March 2009:
  - In section 10 after Clause (c) of Indian Telegraph Act,1885, the following clause may be inserted as 10(ca) - "The local authority will grant permission within such reasonable time as it thinks fit, but not exceeding 90 days from the date of receipt of requests for such permissions from the telegraph authority."
  - DoT, in consultation with state governments, should invoke this provision and shall appoint, in general, the District Magistrate as an officer for redressal of such disputes.
  - The requirement for land conversion from agriculture to commercial (around 400 Square meter of land) for setting up tower in rural areas by the telecom service providers should be dispensed with.

4.28 Although, TRAI has sent several recommendations to streamline the ROW procedures under various recommendations as mentioned above, government did not accept recommendations by stating that "ROW procedure including streamlining / rationalizing ROW cost is State subject and therefore Central Government can not mandate the State Governments".

4.29 The fact can not be ignored that despite various steps taken by government, ROW problems such as very high charges, lack of uniformity in decision making processes, non-availability of single window system for ROW clearance, longer time in granting ROW

permissions and non-availability of detailed GIS maps etc. remain unresolved and are impending growth of optical fibre network.

4.30 **What specific steps do you feel will ease grant of speedy ROW permission and ensure availability of ROW at affordable cost?**

**C- Affordability of Broadband**

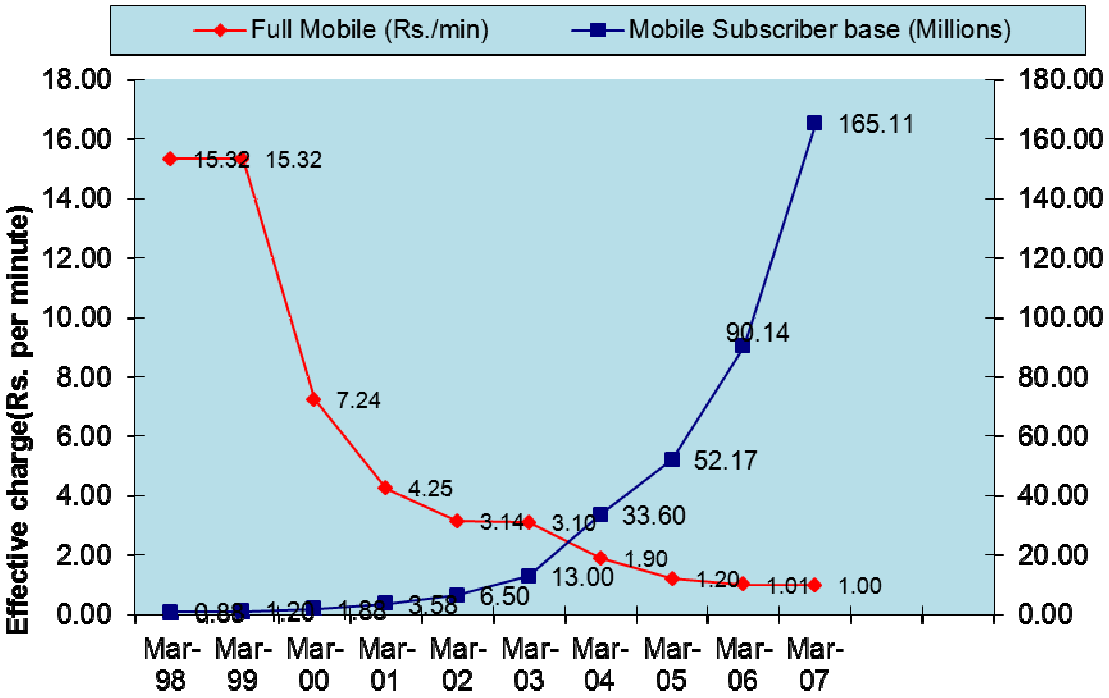
4.31 Affordability of broadband is one of the important factors impacting the growth of Broadband services. The standard broadband connection (speed > 256 Kbps) was initially available with a tariff of Rs.1,500 to Rs 1,800 after launch of broadband policy. Competition and eco friendly system has brought down broadband monthly charges to about Rs.250/- per month excluding modem rental and installation charges. Presently most of the operators are charging monthly rental between Rs 200/- to Rs 1,600/- for residential broadband and providing various options for content downloading. Except unlimited packages, most of the subscribers pay the download charges beyond free data download limits, which range from Rs.0.20 to Rs.1.00 per MB. Some of the service providers are already offering broadband services having zero rental schemes. However, in such schemes per MB download charges are comparatively high i.e. ranging from Rs.1.00/- to Rs.2/- per MB. Plans with download speed up to 2 Mbps are also being offered with monthly tariff as low as at Rs.125 /- but with data download cap of 150 MB. Tariff in two metros are even lower where one of the incumbent operators is offering entry level broadband at a monthly rental of just Rs. 49/- with data download limit of 200 MB per month.

4.32 As of March 2010, 104 ISP are providing Broadband services with 8.75 million broadband connections. Out of 8.75 million connections, top-10 ISPs dominate the market with 8.33 million connections,

which is 95.23% of the total subscriber base. The two PSUs are controlling more than 70% broadband market. This indicates lack of competition in the broadband sector.

4.33 If we take analogy and look at growth of mobile telephony in the past, it is well demonstrated that growth of mobile telephone was slow till it became affordable to common masses around March 2004 (Refer Figure 4.6).

**Figrure 4.6 :Mobile growth and effective charge per minute**




4.34 ITU in its report "The ICT Development Measurement Index 2009" has published average price for fixed broadband, average price for fixed broadband in terms of purchasing power parity (PPP) in US$, and average broadband prices as a percentage of monthly Gross National Income (GNI) per capita for 150 countries (Refer Table 4.4). As per the report, the fixed broadband tariff in India is low but when it is compared as percentage of monthly Gross National Income (GNI),

it is quite high and India is ranked at 77th place. The comparison with mobile telephone indicates that average price basket for mobile telephony is just 2.1 % in contrast to wireline broadband which is 7.7 % of the GNI per capita. This in simple terms indicates that in India one has to incur smaller part of its income for affording a mobile telephone as compared to broadband connection. The findings clearly establish adverse impact of low affordability on growth of broadband and highlight the need for making broadband more affordable.

**Table 4.4: Broadband Prices as a Percentage of Monthly Gross National Income (GNI) per Capita**

| Rank | Economy | Broad-band sub-basket (US$) | Broad-band sub-basket (PPP $) | Broad-band sub-bas-ket (% of GNI per capita*) |
|---|---|---|---|---|
| 1 | United States | 15.0 | 15.0 | 0.4 |
| 2 | Canada | 19.8 | 16.5 | 0.6 |
| 3 | Switzerland | 32.2 | 20.6 | 0.6 |
| 4 | Denmark | 30.4 | 17.4 | 0.7 |
| 5 | Luxembourg | 44.3 | 31.4 | 0.7 |
| 6 | Taiwan, China | 10.3 | 17.6 | 0.7 |
| 7 | Cyprus | 16.5 | 25.5 | 0.8 |
| 8 | Singapore | 21.9 | 29.0 | 0.8 |
| 9 | United Kingdom | 29.4 | 22.5 | 0.8 |
| 10 | Sweden | 32.3 | 22.0 | 0.8 |
| 11 | Macao, China | 10.0 | 14.8 | 0.9 |
| 12 | Norway | 57.0 | 33.5 | 0.9 |
| 13 | Belgium | 30.5 | 22.3 | 0.9 |
| 14 | Australia | 27.5 | 21.0 | 0.9 |
| 15 | Italy | 25.8 | 19.5 | 0.9 |
| 16 | Ireland | 38.1 | 25.2 | 1.0 |
| 17 | Hong Kong, China | 25.4 | 36.0 | 1.0 |
| 18 | Finland | 38.0 | 25.2 | 1.0 |
| 19 | Netherlands | 38.1 | 28.2 | 1.0 |
| 20 | Japan | 31.6 | 28.0 | 1.0 |
| 21 | Greece | 25.2 | 23.2 | 1.0 |
| 22 | United Arab Emirates | 21.5 | 32.4 | 1.1 |
| 23 | Trinidad & Tobago | 12.7 | 19.6 | 1.1 |
| 24 | Spain | 28.8 | 25.4 | 1.2 |
| 25 | Germany | 38.1 | 28.2 | 1.2 |
| 26 | France | 38.0 | 27.4 | 1.2 |
| 27 | Korea (Rep.) | 20.3 | 26.6 | 1.2 |
| 28 | Iceland | 57.0 | 38.7 | 1.3 |
| 29 | New Zealand | 30.7 | 25.9 | 1.3 |
| 30 | Slovenia | 27.5 | 27.8 | 1.6 |
| 31 | Bahrain | 26.7 | 40.2 | 1.7 |
| 32 | Malta | 21.1 | 22.1 | 1.7 |
| 33 | Austria | 60.9 | 46.0 | 1.7 |
| 34 | Kuwait | 46.3 | 58.0 | 1.8 |
| 35 | Portugal | 30.2 | 28.4 | 1.9 |
| 36 | Lithuania | 15.9 | 22.2 | 1.9 |
| 37 | Russia | 13.9 | 21.1 | 2.2 |
| 38 | Serbia | 9.0 | 14.7 | 2.3 |
| 39 | Croatia | 20.9 | 24.8 | 2.4 |
| 40 | Czech Republic | 28.9 | 33.3 | 2.4 |
| 41 | Hungary | 24.8 | 29.5 | 2.6 |
| 42 | Slovak Republic | 28.5 | 35.0 | 2.9 |
| 43 | Saudi Arabia | 39.7 | 57.7 | 3.1 |
| 44 | Latvia | 26.0 | 34.0 | 3.1 |
| 45 | Panama | 15.0 | 28.8 | 3.3 |
| 46 | Poland | 27.0 | 31.0 | 3.3 |
| 47 | Oman | 31.3 | 51.6 | 3.4 |
| 48 | Estonia | 38.5 | 46.3 | 3.5 |
| 49 | Maldives | 9.4 | 14.6 | 3.5 |
| 50 | Costa Rica | 17.0 | 31.6 | 3.7 |
| 51 | Malaysia | 20.5 | 37.7 | 3.8 |
| 52 | Bulgaria | 15.6 | 30.6 | 4.1 |
| 53 | Romania | 22.7 | 27.9 | 4.4 |
| 54 | Uruguay | 24.3 | 33.7 | 4.6 |
| 55 | Bosnia | 14.8 | 24.7 | 4.7 |
| 56 | Tunisia | 12.7 | 25.7 | 4.8 |
| 57 | Lebanon | 23.0 | 39.7 | 4.8 |
| 58 | Montenegro | 21.3 | 33.0 | 4.9 |
| 59 | TFYR Macedonia | 14.7 | 30.2 | 5.1 |
| 60 | Venezuela | 31.3 | 45.8 | 5.1 |
| 61 | Mexico | 37.0 | 53.6 | 5.3 |
| 62 | South Africa | 26.3 | 47.1 | 5.5 |
| 63 | Algeria | 17.3 | 30.8 | 5.7 |
| 64 | Botswana | 29.6 | 65.3 | 6.1 |
| 65 | Egypt | 8.3 | 24.9 | 6.3 |
| 66 | Thailand | 18.0 | 36.1 | 6.3 |
| 67 | Seychelles | 50.7 | 114.1 | 6.8 |
| 68 | Barbados | 49.4 | 80.0 | 7.3 |
| 69 | Grenada | 29.3 | 43.5 | 7.5 |
| 70 | El Salvador | 18.0 | 34.5 | 7.6 |
| 71 | Argentina | 38.4 | 76.7 | 7.6 |
| 72 | Chile | 53.0 | 67.2 | 7.6 |
| 73 | India | 6.1 | 16.4 | 7.7 |
| 74 | Fiji | 26.1 | 26.4 | 8.2 |
| 75 | China | 18.5 | 36.8 | 9.4 |
| 76 | Dominican Rep. | 28.0 | 50.8 | 9.5 |
| 77 | Brazil | 47.3 | 56.5 | 9.6 |
| 78 | Jamaica | 30.0 | 52.4 | 9.7 |
| 79 | Ukraine | 20.8 | 45.2 | 9.8 |
| 80 | Morocco | 20.0 | 31.1 | 10.7 |
| 81 | Mauritius | 50.6 | 88.2 | 11.1 |
| 82 | Albania | 31.4 | 53.1 | 11.5 |
| 83 | St. Lucia | 55.2 | 96.7 | 12.0 |
| 84 | Peru | 36.4 | 67.3 | 12.7 |
| 85 | Jordan | 30.9 | 54.7 | 13.0 |
| 86 | Colombia | 36.3 | 59.9 | 13.4 |
| 87 | Dominica | 47.8 | 84.2 | 13.5 |
| 88 | Iran (I.R.) | 43.0 | 123.2 | 14.9 |
| 89 | Ecuador | 39.9 | 89.1 | 15.5 |
| 90 | St. Vincent and the Gren. | 55.2 | 92.4 | 15.7 |
| 91 | Indonesia | 21.7 | 42.5 | 15.8 |
| 92 | Sri Lanka | 21.0 | 53.4 | 16.3 |
| 93 | Namibia | 46.1 | 78.8 | 16.5 |
| 94 | Guatemala | 34.0 | 61.1 | 16.7 |
| 95 | Philippines | 23.4 | 45.0 | 17.3 |
| 96 | Armenia | 39.2 | 65.5 | 17.8 |
| 97 | Micronesia | 40.0 | 52.8 | 19.4 |
| 98 | Cape Verde | 39.8 | 40.1 | 19.6 |
| 99 | Moldova | 23.2 | 43.7 | 22.1 |
| 100 | Suriname | 95.0 | 153.0 | 24.1 |
| 101 | Paraguay | 35.0 | 65.7 | 25.1 |
| 102 | Pakistan | 18.5 | 56.5 | 25.5 |
| 103 | Viet Nam | 17.0 | 53.2 | 25.8 |
| 104 | Georgia | 47.6 | 84.5 | 26.9 |
| 105 | Belize | 89.5 | 146.5 | 28.3 |
| 106 | Bolivia | 33.5 | 95.3 | 31.9 |
| 107 | Syria | 51.3 | 114.3 | 35.0 |
| 108 | Sudan | 29.1 | 51.8 | 36.4 |
| 109 | Nicaragua | 30.0 | 79.6 | 36.7 |
| 110 | Azerbaijan | 84.5 | 167.3 | 39.8 |
| 111 | Bhutan | 60.7 | 161.6 | 41.1 |
| 112 | Senegal | 29.1 | 48.4 | 42.6 |
| 113 | Guyana | 49.5 | 105.2 | 45.7 |
| 114 | Tonga | 109.8 | 157.3 | 56.8 |
| 115 | Lesotho | 48.9 | 101.5 | 58.7 |
| 116 | Côte d'Ivoire | 46.5 | 68.8 | 61.4 |
| 117 | Angola | 163.6 | 253.6 | 76.7 |
| 118 | Nepal | 22.8 | 60.6 | 80.4 |
| 119 | Samoa | 169.3 | 249.6 | 83.6 |
| 120 | Mauritania | 62.4 | 127.1 | 89.2 |
| 121 | Ghana | 64.4 | 114.7 | 131.0 |
| 122 | Zambia | 91.5 | 116.1 | 137.2 |
| 123 | Bangladesh | 53.9 | 155.1 | 137.7 |
| 124 | Mali | 58.2 | 101.6 | 139.6 |
| 125 | Cambodia | 90.6 | 271.8 | 201.2 |
| 126 | Papua New Guinea | 144.3 | 263.0 | 203.7 |
| 127 | Tanzania | 68.0 | 194.1 | 204.0 |
| 128 | Cameroon | 183.8 | 314.4 | 210.0 |
| 129 | Benin | 104.7 | 204.9 | 220.4 |
| 130 | Niger | 58.2 | 111.4 | 249.2 |
| 131 | Vanuatu | 450.0 | 787.2 | 293.5 |
| 132 | Kenya | 167.8 | 318.6 | 296.1 |
| 133 | Yemen | 225.7 | 525.1 | 311.4 |
| 134 | Rwanda | 91.8 | 231.0 | 344.4 |
| 135 | Togo | 105.8 | 202.6 | 352.8 |
| 136 | Mozambique | 100.1 | 203.8 | 375.3 |
| 137 | S. Tomé & Principe | 273.5 | 521.7 | 377.2 |
| 138 | Madagascar | 120.1 | 262.4 | 450.2 |
| 139 | Lao P.D.R. | 268.3 | 772.0 | 555.1 |
| 140 | Uganda | 170.0 | 412.9 | 600.0 |
| 141 | Comoros | 449.7 | 646.4 | 793.7 |
| 142 | Swaziland | 1'877.5 | 3'854.1 | 873.2 |
| 143 | Nigeria | 690.1 | 1'122.9 | 890.4 |
| 144 | Gambia | 383.8 | 1'051.8 | 1439.3 |
| 145 | Cuba | 1'630.0 | NA | 1671.8 |
| 146 | Guinea | 800.0 | 1'897.3 | 2400.0 |
| 147 | Ethiopia | 644.0 | 2'198.0 | 3512.8 |
| 148 | Malawi | 900.0 | 2'674.2 | 4320.0 |
| 149 | Central African Rep. | 1'395.8 | 2'266.4 | 4407.7 |
| 150 | Burkina Faso | 1'861.0 | 4'098.5 | 5193.6 |

Note: *The GNI per capita is based on the World Bank's Atlas Method.
Source: ITU.

Fixed broadband Internet sub-basket 2008 (ranked by percentage of monthly GNI per capita)

4.35 Presently most of broadband tariff plans have two components viz fixed and Variable component. The fixed component of tariff plan

caters for monthly rental as well as some pre-determined free data usages charges. Once users surpass the free data usage limit for the month, the subscriber has to pay data download charges based on per MB charge prescribed by the service provider for the additional data usages. The additional charges vary significantly across different service providers and tariff packages. In many cases, it can cost much more than the fixed monthly rental. There is no provision to monitor data usages while surfing the Internet. Quite a few service providers do have mechanism to monitor data usages; many subscribers lack information and are not able to effectively manage their usages within prescribed limit. No alert is provided to subscribers after utilization of their free download limit creating a fear in the mind of users of overshooting their monthly bill. This is also resulting in limited usage of their broadband connection due to fear of getting high bill in case data usage reaches beyond the free limit of their broadband plan. There is a need to look at the feasibility of informing the subscribers about the data usage details whenever they login to the net. This will enhance the confidence of subscribers and increase Internet usage.

4.36 Consumers often do not know how much data traffic they are likely to consume and feel more comfortable while using flat tariff plans permitting "unlimited" data download per month. There is a need to provide guidance to consumers regarding general data use for various applications in order to make more informed decisions while choosing their broadband plan. In order to enhance the broadband usage there is a need to have innovative tariff plans with flat fee offering with unlimited data usage or time based plans.

4.37 Mobile internet and broadband is picking up in India also. However its initial tariff and subsequent usage charges are very high. This

trend is very peculiar if compared with International trend. Figure 4.7 gives the average price per additional megabyte of data usage after reaching bit/data cap, for various technologies in OECD countries.

**Figure 4.7: Average price per additional megabyte after reaching bit/data cap, by technology, Oct 2009, (in USD)**


*Source:* OECD

4.38 The analysis indicates that average additional usage charges for wireless broadband are 50 times lower than the additional usage charges for DSL. The Indian situation is very different (refer table 4.5). Here, average additional usage charges for wireless broadband are much higher as compared to average additional charges for DSL (Rs 0.5 to Rs 10.0/- per Mb for wireless Vs Rs 0.2 to Rs 0.6 per Mb for DSL). Such high charges for download using wireless broadband restrict the use of Internet/ Broadband even if one has capable device and appropriate access. There is a need to look into these issues for making mobile broadband more affordable and spurring the growth of broadband in the country.

**Table 4.5 : Charges for DSL and Wireless Internet Services in India***

| Particular | DSL Plans | Wireless plan |
|---|---|---|
| Monthly Rental | Rs. 125-3500 | Rs. 249-1500 |
| Free Data Download | 125-60000 MB | 256-15000 MB |
| Speed | 256kbps to 8 Mbps | Upto 3.1 Mbps |
| Charges for additional Data download per MB | Rs. 0.2 to 0.6 per MB | Rs. 0.5 to Rs. 10.0 per MB |

*Charges taken from website of leading internet service providers

4.39 The very high usage of International Internet bandwidth is also attributed to high cost of data download. Since most of the content is hosted out side India, International Bandwidth cost alone constitutes approx. 65-70% of total operational cost. This enhances the importance of content hosting within the country. Presently the content hosting charges are three to four times in India when compared with International web hosting charges. Content hosting by domestic telecom operators can play important role in reducing the content hosting charges. There is an urgent need to find out alternate methods to reduce the International Internet bandwidth requirement. Caching or mirroring of frequently visited sites within service providers network can play important role in reducing International bandwidth requirement and also enhance the user experience due to reduced latency.

4.40 Another reason for high bandwidth cost to end users is non-segregation of international and domestic traffic. International Internet bandwidth can be provided either using International Private Lease Circuit (IPLC) or through an IP port (International Internet bandwidth) by International Internet bandwidth providers. International Internet bandwidth providers prefer to route all IP

traffic (Domestic and International) through IP port instead of routing domestic traffic through NIXI and International traffic through IP port (IPLC). Bandwidth charges paid by ISPs can be reduced to some extent if domestic traffic is effectively exchanged by peered ISPs at NIXI. The reduction in international and domestic bandwidth cost will reduce per MB usage charges and make broadband more affordable.

4.41 Industry is of the view that low hosting of content in India increases Internet usage charges and these needs to be addressed on priority basis. The webhosting in India depends on availability of reliable power supply, Internet leased line cost, creating secure environment etc. There are policy issues to ensure confidentiality and security of the data hosted on such websites. As of now ISPs will do well if mirroring of popular websites is encouraged in India by different service providers. The in depth discussions on webhosting requires separate discussions. Views of the stakeholders are invited as to how affordability of the broadband can be increased to ensure high acceptability and utilization.

4.42 **Issues for Consultation:**

- **Does the broadband sector lack competition? If so, how can competition be enhanced in broadband sector?**
- **Do you think high broadband usage charge is hindrance in growth of broadband? If yes, what steps do you suggest to make it more affordable?**
- **Do you think simple and flat monthly broadband tariff plans will enhance broadband acceptability and usage?**

- **Should broadband tariff be regulated in view of low competition in this sector as present?**

- **What should be the basis for calculation of tariff for broadband, if it is to be regulated?**

- **How can utilization of International Internet bandwidth be made more efficient in present situation?**

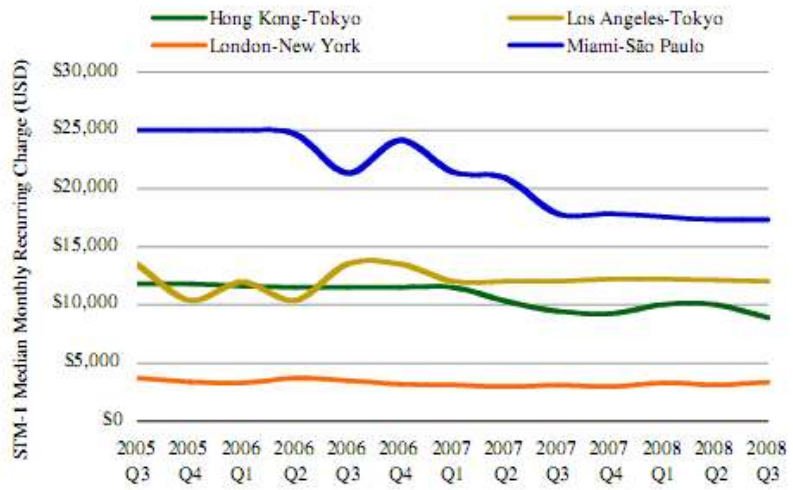
- **How can use of domestic and international internet bandwidth be segregated? Will it have direct impact on broadband affordability? If so, quantify the likely impact.**

**D- Higher International Bandwidth Prices**

4.43 International Internet Bandwidth constitute major component of broadband tariff. International Internet Bandwidth charges refer to the cost of bandwidth between International Internet Gateway in India to global Tier-I ISPs in other countries. As per the estimates, service providers pay about 65% of their revenue towards cost of arranging domestic and international bandwidth.

4.44 International median price of Internet Private Leased circuit (IPLC) is declining (Refer Figure 4.8). Majority of IPLC lines for STM-1 capacity are available at recurring charges of below 15000 USD per month. This will be approx. Rs. 9 million/ year, if calculated in Indian rupees. However, the advertised market cost of STM-1 half circuit in India varies from Rs 18.7 million to Rs 22 million per year. Though substantial discounts are given by service providers, still cost of international bandwidth is high.

**Figure 4.8: Median STM-1 Leased Line Recurring Charges**

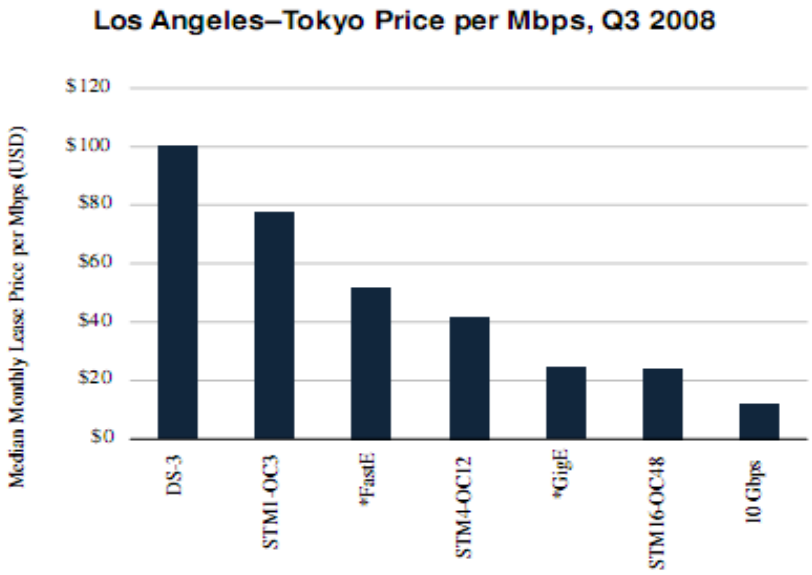



Source: Telegeography

4.45 Further analysis of International Internet bandwidth price trends indicate that higher the connectivity pipe size, lower is the price per Mb per year (Cost per Mb in case of 10Gb pipe connectivity is 1/100th as compared to cost per Mb for DS-3 connectivity) . The difference in prices is ten times, if price of per Mb per year with consolidated capacity of 10 Gb is compared with price of per Mb with consolidated capacity of DS-3. Figure 4.9 provides the details of per Mb charges of IPLC with different consolidated capacity. Today cost of 10-gigabytes bandwidth connectivity per year varies between U$5 million and U$9 million in India while it is sold at a price ranging from U$1.5 million to U$1.7 million in other Asian markets[6]. These prices are 3 to 5 times higher as compare to some of the countries in Asian market. The Indian market is segmented and most of the service providers hire bandwidth in terms of STM 1 or in some cases STM 4 only. Our networks at present lack fat backbone, which is able to support connectivity of 10 G and above. This is also contributing to higher bandwidth cost that is ultimately passed on to the customers.

[6] www.lirneasia.com news dated 18th December, 2009.

**Figure 4.9: Prices per Mb vs. Capacity**




Source: Telegeography

4.46 Apart from high cost of hiring bulk International Internet Bandwidth prevailing at present; the retail price is also very high. The retail prices lack transparency as discounts by service providers are not transparently offered to retailers and end users. The variations in offered discounts in extreme cases may be even more than 50%.

4.47 Stakeholders are requested to suggest methods to reduce International Internet Bandwidth prices and enhance competition in this sector.

4.48 **Issues for Consultation:**

- **What steps should be taken to bring down the cost of international internet bandwidth in India?**

- **How can competition be enhanced in the International bandwidth sector?**

**E- Quality of Service for Broadband**

4.49 Offering assured QoS in multi service provider broadband network is a key concern. The quality sensitive subscribers are now using a new term Quality of Experience (QoE) to lay more emphasis on required quality of service. Quality of Experience (QoE) is defined as the overall acceptability of an application or service, as perceived subjectively by the end-user. Quality of service standards for video, audio, text, graphics has to be redefined in view of increasing bandwidth sensitivity of different applications. Applications like Grid computing & Cloud computing are being launched now-a-days and will require much better broadband networks performance.

4.50 There are number of parameters like speed of data transfer, availability of bandwidth, latency, jitter, packet loss, contention ratio to define QoS of broadband services. The Regulations on "Quality of service of Broadband Service' issued in October 2006, stipulated several parameters and benchmarks for Broadband service (refer Annexure III). The main purpose of this Regulation is to protect the interests of consumers of Broadband service and enhance customer satisfaction.

4.51 TRAI monitors these parameters by obtaining quarterly performance reports from service providers providing broadband service. In order to ensure accuracy of these reports, TRAI conducts audit through independent agencies. In addition TRAI also conducts customer survey through independent agencies for measuring customer perception regarding Broadband service. The audit and survey report for the quarter ending March 2010 indicate that most of the service providers are meeting most of the prescribed benchmarks and customers are generally satisfied with the quality of broadband

services. However, complaints received by TRAI indicate that customers want better broadband services.

4.52 Incidences have come to the notice of TRAI where subscribers allege lower speed of Broadband connections than subscribed speed. The most common concern of stakeholders was that service providers' prime attention always remains to acquire more subscribers and least importance is given to timely upgradation of the network. In order to ensure availability of minimum bandwidth to cater given number of subscribers, contention ratio is one of the parameters generally used. Though it is primarily a network designing parameter, it is very effective tool to ensure availability of adequate bandwidth in the network. TRAI issued guidelines in February 2009 to all service providers (ISPs, UASLs, CMSPs, BSOs) to adhere to well defined contention ratio for providing broadband/ Internet services. These guidelines stipulate:

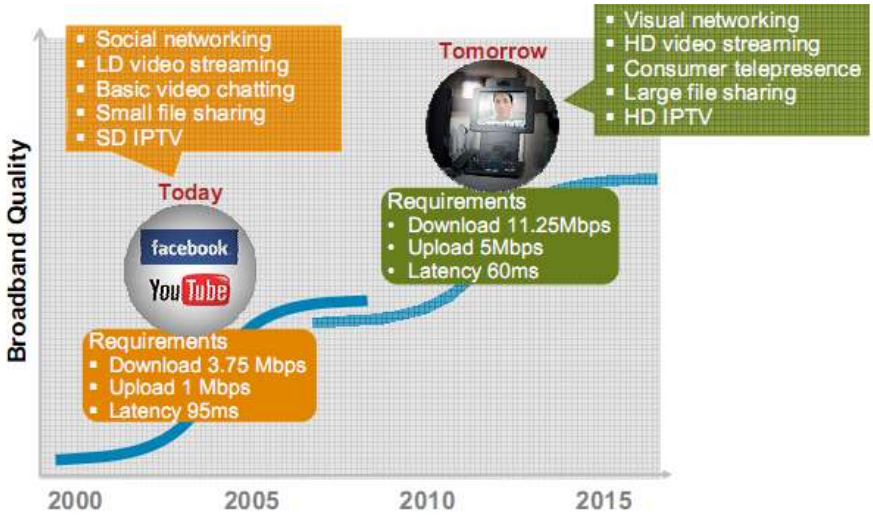
- Provide adequate information to subscribers regarding Internet/broadband services being offered and marketed as a good business practice.
- Provide information regarding contention ratios adopted for different services by service providers in their tariff plans submitted to TRAI, manual of practice, call centers and on their websites.
- Publish contention ratio for different Internet/broadband services on their website quarterly to facilitate subscribers to take informed decision.
- Ensure availability of minimum required bandwidth in their network according to maximum contention ratio suggested by TRAI for different services based on number of subscribers.

4.53 The speed of broadband, availability of bandwidth, contention ratio, affordability, network availability and spread are some of the parameters which are important for the subscribers but are intricately interlinked. Any change in one of them may impact the others. The Authority while giving highest importance to QoS of broadband adopted a light touch regulation and issued guidelines to service providers so that they will improve availability of the bandwidth and inform subscribers in unambiguous terms the contention ratio being used in their network. It was envisaged that all service providers will also display on their websites the contention ratio adopted with different tariff plans. Unfortunately, that has generally not happened. Subscribers continue to complaint regarding inadequate availability of detailed information about contention ratio.

4.54 Quality of broadband is considered one of the most important factors to ensure positive consumer experience on the web. A new parameter commonly known as Broadband Quality Score (BQS) has been evolved to compare the quality of a broadband connection provided in a country. A country's Broadband Quality Score (BQS) combines actual download and upload throughput and latency, with different weights matching current and future application requirements. Most countries do well for today's applications but future ready quality of broadband encourages ICT diffusion, enhances web usage and help to create knowledge economy.

4.55 With the changing demand toward high speed applications customer perspective towards QoS is changing. Figure 4.10 indicates expected quality of service with increased video streaming and high definition (HD) TV roll out. The future will demand much higher data download speed, better upload speed and reduced latency to meet customer requirements.

**Figure 4.10: Broadband Quality Present & Future**




Source: CISCO

4.56 The Oxford Team analysis has summarized key factor determining the quality of broadband in table 4.6 :

**Table 4.6: Key Factors in Determining Broadband Experience**

KEY FACTORS IN DETERMINING BROADBAND EXPERIENCE

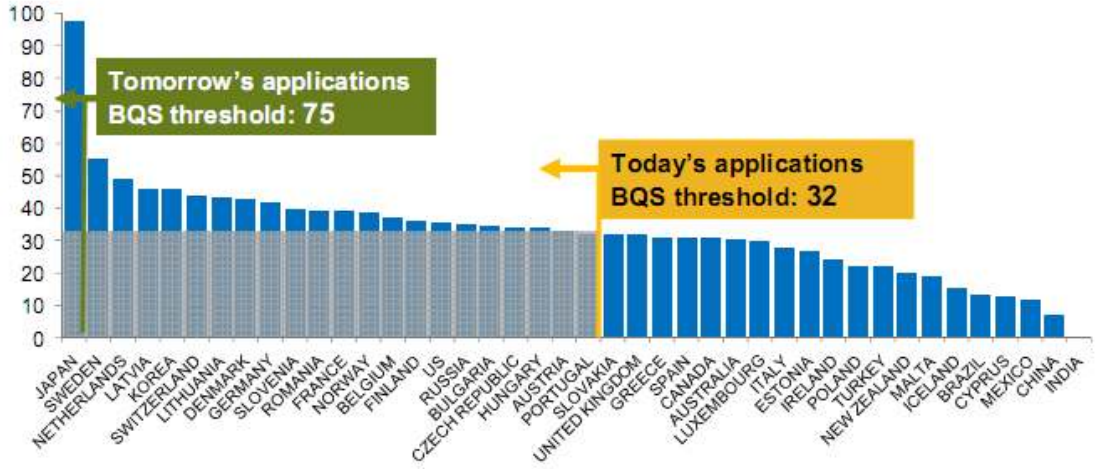
| Factor | Description | Example |
|---|---|---|
| Download Throughput | Net bit rate of downstream data that transverse the network and the broadband connection | Critical for streaming high quality video, sharing large files such as pictures or video |
| Upload Throughput | Net bit rate of upstream data that transverse the network and the broadband connection | Increasingly relevant for two-way high-quality video communications, uploading/sharing pictures and videos |
| Latency | Time taken for a packet of data to reach from source to destination | Very important for real-time applications such as VoIP communications and gaming |
| Other | Network oversubscription, packet loss, jitter, service continuity. Typically embedded in throughput factors | Critical for video broadcast distribution and overall end-to-end experience |

Source: Expert interviews; Oxford Team analysis, Aug 2008

4.57 Broadband Quality Score of various countries is given in figure 4.11. India is far behind from threshold BQS required to support available applications. This clearly identifies the seriousness of the issue and

urgency.

**Figure 4.11 : Broadband Quality Score by Country**




Source: CISCO

4.58 A good quality of broadband is need of the hour. While we all appreciate that broadband is best effort service and service providers have control only on their network to enhance the broadband experience, it has become crucial to identify all issues to enhance quality of broadband experience. Stockholders' views are invited to improve the quality of service for broadband.

4.59 **Issues for Consultation:**

- **QoS of broadband, availability of bandwidth, adherence to given contention ratio, affordability, availability and spread are some intricately linked parameters. In your opinion what should be done to ensure good quality broadband to subscribers?**

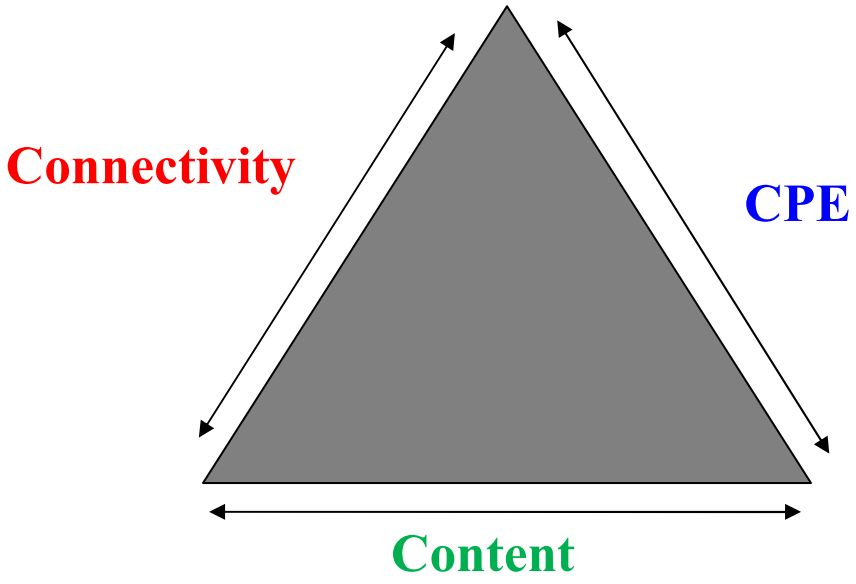
- **Do you think that bad quality of broadband connection is impacting the performance of bandwidth hungry applications and hence crippling the broadband growth? If so, please suggest remedial actions.**

- **Is there a need to define new/redefine existing quality of service parameters considering future bandwidth hungry applications, time sensitivity of applications and user expectation? What should be such parameters including their suggestive value and should such parameters be mandated?**

**F- Broadband Growth**

4.60 Broadband growth depends on three critical factors, namely connectivity, content and customer premises equipment (PC) (Refer figure 4.12). So far we have discussed issues related to connectivity, the other two Cs, Content and CPEs are equally important factors for growth of broadband.

**Figure 4.12: Factors for Growth of Broadband**




**Customer Premises Equipments (CPEs)**

4.61 The fruits of broadband will be realized only if one has broadband connectivity and suitable device to access broadband. High Cost of PC and other access devices commonly known as CPEs is one of the major impediments in spread of broadband & Internet. The cost of

CPEs is high and not affordable to common masses. There is a need to provide suitable options like use of thin client, recycling of old PCs/ Laptops for making CPEs affordable.

4.62 Low cost netbooks with heavy applications running on the backend can be one of the possible options. Due to low cost of the terminal, Netapps are globally acceptable as CPE for increasing broadband penetration. Lower obsolesce rate, easy virus control and almost no maintenance of software favors use of such terminals for internet access. The centralized applications facilitate easy upgradability of software and hence increase their popularity. Service providers can also come up with schemes to bundle PC/Laptop/Netbooks with broadband subscriptions and provide it on installment basis. It will be important to note that similar schemes have been very popular in Mobile telephone sector and helped to improve mobile telephone growth.

4.63 One of the measures to make CPEs more affordable may be to provide incentives through fiscal policies. Incentives could be in the form of reduction of taxes & levies on CPEs and financial incentive in terms of rebate in income tax to encourage affordability of CPEs. The broad objectives of providing fiscal incentives are to make CPEs affordable to the consumers and to stimulate investment for the domestic manufacturers for boosting indigenous production.

4.64 **Issue for Consultation:**

- **What measures do you propose to make Customer Premises Equipment affordable for common masses? Elaborate your reply giving various options.**

**Content**

4.65 Availability of local applications and content is another area of concern. Most of the contents available on the websites are in English and the English literacy rate in India is quite low (around 7%). The content in Indian vernacular languages will increase interest of the local population in broadband utilization. Therefore considering specific regional requirements, content development in vernacular languages has to be encouraged.

4.66 Now, large number of software are available to translate the content from one language to other language. Conversion from speech to text and text to speech is also available for different languages. Though the accuracy of these software depends on the product and actual requirement, there is sufficient scope to further work on these areas to boost the development of the content in Indian vernacular languages.

4.67 Given India's strengths in IT and the recent trend in the traditional entertainment industry, infotainment can be big booster for broadband. We can potentially target entertainment content to boost broadband demand. This can be a high growth driver which may require some initial nurturing but may enhance broadband demand especially to non English literate subscribers.

4.68 **Issue for Consultation:**

- **What measures are required to encourage development of content in Indian vernacular languages?**

**G- Other Issues**

4.69 Broadband market is non competitive at present. Though there are large number of ISPs, they depend on integrated operators for various resources and are not competitive. There is a need to examine the issue as to how to increase the competition in broadband sector.

4.70 This paper highlights some relevant issues impacting the growth of broadband. There may be other important issues perceived by stakeholders which may also be of importance for enhancing the growth of broadband in the country. In order to ensure proper attention to all relevant issues to encourage growth of broadband, all stakeholders are encouraged to identify any issue they feel is relevant to boost broadband growth in India.

4.71 **Issues for Consultation:**

- **Do you perceive need for any regulatory or licensing change to boost broadband penetration?**
- **Are there any specific competition and market related issues that are hindering growth of broadband?**
- **What other fiscal/non-fiscal measures should be considered to boost broadband penetration?**

# CHAPTER 5: Summary of Issues for Consultation

**CHAPTER 2: Broadband – Demand & Supply**

**5.1 What should be done to increase broadband demand? (Reference Para 2.23)**

**5.2 What, according to you, will improve the perceived utility of broadband among the masses? (Reference Para 2.23)**

**5.3 What measures should be taken to enhance the availability of useful applications for broadband? (Reference Para 2.23)**

**5.4 How can broadband be made more consumer friendly especially to those having limited knowledge of English and computer? (Reference Para 2.23)**

**5.5 Do you agree with projected broadband growth pattern and futuristic bandwidth requirements? (Reference Para 2.35)**

**5.6 Do you agree that existing telecom infrastructure is inadequate to support broadband demand? If so what actions has to be taken to create an infrastructure capable to support futuristic broadband? (Reference Para 2.35)**

**CHAPTER 3: National Broadband Network**

**5.7 What network topology do you perceive to support high speed broadband using evolving wireless technologies? (Reference Para 3.22)**

**5.8 What actions are required to ensure optimal utilization of existing copper network used to provide wireline telephone connections? (Reference Para 3.22)**

**5.9 Do you see prominent role for fibre based technologies in access network in providing high speed broadband in next 5 years? What should be done to encourage such optical fibre to**

**facilitate high speed broadband penetration? (Reference Para 3.22)**

**5.10 What changes do you perceive in existing licensing and regulatory framework to encourage Cable TV operators to upgrade their networks to provide broadband? (Reference Para 3.22)**

**5.11 Is non-availability of optical fibre from districts/cities to villages one of the bottlenecks for effective backhaul connectivity and impacts roll out of broadband services in rural areas? (Reference Para 3.39)**

**5.12 If so, is there a need to create national optical fibre network extending upto villages? (Reference Para 3.39)**

**5.13 In order to create National optical fibre core network extending upto villages, do you think a specialized agency can leverage on various government schemes as discussed in para B? (Reference Para 3.39)**

**5.14 Among the various options discussed in Para 3.35 to 3.37, what framework do you suggest for National Fibre Agency for creating optical fibre network extending upto village level and why? (Reference Para 3.39)**

**5.15 What precautions should be taken while planning and executing such optical fibre network extending upto villages so that such networks can be used as national resource in future? What is suitable time frame to rollout such project? (Reference Para 3.39)**

**CHAPTER 4: Regulatory Challenges and Future Approach**

**5.16 Is there a need to define fixed and mobile broadband separately? If yes, what should be important considerations for finalizing new definitions? (Reference Para 4.18)**

**5.17 Is present broadband definition too conservative to support bandwidth intensive applications? If so, what should be the minimum speed of broadband connection? (Reference Para 4.18)**

**5.18 What specific steps do you feel will ease grant of speedy ROW permission and ensure availability of ROW at affordable cost? (Reference Para 4.30)**

**5.19 Does the broadband sector lack competition? If so, how can competition be enhanced in broadband sector? (Reference Para 4.42)**

**5.20 Do you think high broadband usage charge is hindrance in growth of broadband? If yes, what steps do you suggest to make it more affordable? (Reference Para 4.42)**

**5.21 Do you think simple and flat monthly broadband tariff plans will enhance broadband acceptability and usage? (Reference Para 4.42)**

**5.22 Should broadband tariff be regulated in view of low competition in this sector as present? (Reference Para 4.42)**

**5.23 What should be the basis for calculation of tariff for broadband, if it is to be regulated? (Reference Para 4.42)**

**5.24 How can utilization of International Internet bandwidth be made more efficient in present situation? (Reference Para 4.42)**

**5.25 How can use of domestic and international internet bandwidth be segregated? Will it have direct impact on broadband affordability? If so, quantify the likely impact. (Reference Para 4.42)**

**5.26 What steps should be taken to bring down the cost of international internet bandwidth in India? (Reference Para 4.48)**

**5.27 How can competition be enhanced in the International bandwidth sector? (Reference Para 4.48)**

**5.28 QoS of broadband, availability of bandwidth, adherence to given contention ratio, affordability, availability and spread are some intricately linked parameters. In your opinion what should be done to ensure good quality broadband to subscribers? (Reference Para 4.59)**

**5.29 Do you think that bad quality of broadband connection is impacting the performance of bandwidth hungry applications and hence crippling the broadband growth? If so, please suggest remedial actions. (Reference Para 4.59)**

**5.30 Is there a need to define new/redefine existing quality of service parameters considering future bandwidth hungry applications, time sensitivity of applications and user expectation? What should be such parameters including their suggestive value and should such parameters be mandated? (Reference Para 4.59)**

**5.31 What measures do you propose to make Customer Premises Equipment affordable for common masses? Elaborate your reply giving various options. (Reference Para 4.64)**

**5.32 What measures are required to encourage development of content in Indian vernacular languages? (Reference Para 4.68)**

**5.33 Do you perceive need for any regulatory or licensing change to boost broadband penetration? (Reference Para 4.71)**

**5.34 Are there any specific competition and market related issues that are hindering growth of broadband? (Reference Para 4.71)**

**5.35 What other fiscal/non-fiscal measures should be considered to boost broadband penetration? (Reference Para 4.71)**

**List of Acronyms**

| Sl No | Acronyms | Full Text |
|---|---|---|
| 1. | 21CN | 21st century network |
| 2. | 3G | 3rd Generation |
| 3. | 3GPP | Third Generation Partnership Project |
| 4. | AAS | Adaptive Antenna Systems |
| 5. | ADSL | Asymmetric Digital Subscriber Line |
| 6. | ACA | Additional Central Assistance |
| 7. | APON | ATM Passive Optical Network |
| 8. | ATM | Asynchronous Transfer Mode |
| 9. | BPL | Broadband Over Power Line |
| 10. | BPON | Broadband Passive Optical Network |
| 11. | BPSK | binary phase shift keying |
| 12. | BQS | Broadband Quality Score |
| 13. | BWA | Broadband Wireless Access |
| 14. | BT | British Telecom |
| 15. | Capex | Capital Expense |
| 16. | CDMA | Code Division Multiple Access |
| 17. | CPE | Customer premises equipment |
| 18. | CSC | Common Service Center |
| 19. | DECT | Digital Enhanced Cordless Telecommunications |
| 20. | DOCSIS | Data Over Cable Service Interface Specification |
| 21. | DIT | Department of Information Technology |
| 22. | DSL | Digital Subscriber Line |
| 23. | DSLAM | Digital Subscriber Line Access Multiplexer |
| 24. | DTH | Direct to Home |
| 25. | EDGE | Enhanced Data Rate for GSM Evolution |
| 26. | EPC | Evolved Packet Core |
| 27. | e-PRI | e-Governance for Panchayati Raj Institutions |
| 28. | ETSI | European Telecommunications Standards Institute |
| 29. | EV-DO | Evolution Data Optimization |
| 30. | FDD | Frequency Division Duplex |
| 31. | FTTB / C | Fibre to the Building / Curb |
| 32. | FTTH | Fibre to the Home |
| 33. | GDP | Gross domestic products |
| 34. | GEPON | Gigabit Ethernet Passive Optical Network |

| | | |
|---|---|---|
| 35. | GPON | Gigabit Passive Optical Network |
| 36. | GPRS | General Packet Radio Service |
| 37. | GSM | Global Standard for Mobile |
| 38. | HDSL | High Bit Rate Digital Subscribe line |
| 39. | HFC | Hybrid fibre coaxial |
| 40. | HSPA | High Speed Packet Access |
| 41. | HSUPA | High-Speed Uplink Packet Access |
| 42. | ICT | Information and Communication Technology |
| 43. | IDI | ICT Development Index |
| 44. | IEEE | Institute of Electric and Electronics Engineers |
| 45. | IMT-2000 | International Mobile Telecommunication Global Standard |
| 46. | IP | Internet Protocol |
| 47. | IPLC | International Private Leased Circuits |
| 48. | IPTV | Internet Protocol Television |
| 49. | IPv6 | Internet Protocol version 6 |
| 50. | ISP | Internet Service Providers |
| 51. | ITU | International Telecommunication Union |
| 52. | LAN | Local Area Network |
| 53. | LOS | Line of Sight |
| 54. | LTE | Long Term Evolution |
| 55. | MC | Multi Carrier |
| 56. | MIMO | Multiple Input Multiple Output |
| 57. | MMOG | Multi Media Online Gaming |
| 58. | NeGP | National e-Governance Plan |
| 59. | NGN | Next Generation Network |
| 60. | NG-PON | Next generation Passive Optical Network |
| 61. | NLOS | Non Line of Sight |
| 62. | NLD | National Long Distance |
| 63. | NIXI | National Internet Exchange of India |
| 64. | NREGS | National Rural Employment Guarantee Scheme |
| 65. | OAN | Optical Access Network |
| 66. | ODN | Optical Distribution Network |
| 67. | OECD | Organisation for Economic Co-operation and Development |
| 68. | OFC | Optical fibre cable |
| 69. | OFDM | Orthogonal Frequency Division Multiplexing |
| 70. | OFDMA | Orthogonal Frequency Division Multiple Access |
| 71. | OLT | Optical Line Termination |

| | | |
|---|---|---|
| 72. | ONU | Optical Network Unit |
| 73. | Opex | Operating Expense |
| 74. | OSA | Open Service Architecture |
| 75. | PC | Personal Computer |
| 76. | PLC | Power Line Communication |
| 77. | PON | Passive Optical Network |
| 78. | POP | Point of Presence |
| 79. | POTS | Plain Old telephone System |
| 80. | PSK | Phase Shift Keying |
| 81. | PLMN | Public land mobile network |
| 82. | PSTN | Public Switch Telephone Network |
| 83. | QAM | Quadrature Amplitude Modulation |
| 84. | QoS | Quality of Service |
| 85. | QPSK | Quadrature phase-shift keying |
| 86. | RAN | Radio Access Network |
| 87. | RAT | Radio Access Technologies |
| 88. | ROW | Right Of Way |
| 89. | SC-FDMA | Single Carrier Frequency Division Multiple Access |
| 90. | SDSL | Symmetrical DSL |
| 91. | SDMA | Space Division Multiple Access |
| 92. | SHDSL | Single Pair High-Speed DSL |
| 93. | SNI | System Network Interface |
| 94. | SOFDMA | Scalable Orthogonal Frequency Division Multiplexing Access |
| 95. | TDD | Time Division Duplex |
| 96. | TDM | Time Division Multiplexing |
| 97. | TRAI | Telecom Regulatory Authority of India |
| 98. | TV | Television |
| 99. | UE | User Equipment |
| 100. | UMB | Ultra Mobile Broadband |
| 101. | UMTS | Universal Mobile Telecommunications System |
| 102. | UNI | User Network Interface |
| 103. | USOF | Universal Service Obligation Fund |
| 104. | UTRA | Universal Terrestrial Radio Access |
| 105. | VDSL | Very High Data Rate Digital Subscriber Line |
| 106. | VoIP | Voice Over Internet Protocol |
| 107. | VSAT | Very small aperture terminal |
| 108. | WCDMA | Wideband Code Division Multiple Access |

| | | |
|---|---|---|
| 109. | WDM | Wave Division Multiplexing |
| 110. | Wi-Fi | Wireless Fidelity |
| 111. | WiMAX | Worldwide Interoperability for Microwave Access |
| 112. | WiBRO | Wireless Broadband Internet |
| 113. | WMAN | Wireless Metropolitan Area Network |

**Annexure - I**

**Government of India**
**Ministry of Communications & IT**
**Department of Telecommunications**
**Sanchar Bhawan, 20, Ashoka Road. New Delhi - 110 001**
**(DS- Cell)**

**No 813-07/1/2010-DS** **Dated 01/04/ 2010**

To,

Secretary
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Sadan
Jawahar Lal Nehru Marg, Old Minto Road
New Delhi.

**Subject: Review of the definition of Broadband connectivity**

Broadband policy was announced in 2004. The definition of Broadband connectivity as mentioned in the policy is reproduced as below:

*"1.0 **Broadband connectivity:***

*Keeping in view the present status, Broadband connectivity is defined at present 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."*

2. Under the Broadband Policy 2004, the definition of Broadband connectivity, inter-alia, covers an **'always-on'** data connection that has

1 of 2

the capability of the minimum download speed of 256 kilo bits per second (kbps).

3. Even though the minimum download speed data capability may be 256 kbps to an individual subscriber from the Point of Presence (POP) of the service provider using wireless technologies like 3G and BWA etc., but it may not meet the requirement of "**always on**" data connection due to technological limitations.

4. Predominant media of provision of Broadband has been through wireline technology so far and all data connections meeting the definition of Broadband connectivity are being taken as broadband connections. However, with the use of more and more wireless technologies, it would be appropriate to review the definition of Broadband connectivity in the Broadband policy 2004.

5. Accordingly, TRAI is requested to provided their recommendations on review of the definition of Broadband connectivity in terms of the Clause 11(1)(a) of the TRAI Act, 1997 as amended by TRAI amendment Act 2000.

01/04/10

(Nitin Jain)
DDG (DS)
Tel: 011-23714232

**Annexure- II**

Government of India
Ministry of Communications & IT
Department of Telecommunications
Sanchar Bhawan. 20. Ashoka Road. New Delhi - 110 001
(DS-Cell)

No.820-01/2008-DS Dated: 09/04/2008

Subject :- **Report of the Committee set up Group on Telecom & Information Technology Convergence (GOT-IT) for Streamlining the Provision of Right of Way to Telecom Service Licensees.**

Uniform Right of Way(RoW) procedures and streamlined / rationalized RoW cost are crucial for growth of Telecom Services as well as speedy role out of Broadband. It has been decided to circulate the report of the **Committee set up Group on Telecom & Information Technology Convergence (GOT-IT) for Streamlining the Provision of Right of Way to Telecom Service Licensees** to all States and Union Territories. A copy of the report is being enclosed with this letter.

2. It is requested to confirm the compliance of the report within one month of receipt of this letter which will help not only in faster proliferation of Broadband services through out the country but also in achieving Broadband targets defined as per Broadband Policy 2004.

09.04.08

(Subodh Saxena)
Dir.(DS-II)
Tel: 011-23372601
Fax: 011-23359454

To,

**The Chief Secretary/Administrator of Sate/Union Territory**

STATE GOVERNMENTS

1. Chief Secretary , Andhra Pradesh
   Government of Andhra Pradesh .
   Hyderabad , Andhra Pradesh

## MODEL GUIDELINES FOR STREAMLINING THE PROVISION OF RIGHT OF WAY TO TELECOM SERVICE LICENSEES /INFRASTRUCTURE PROVIDERS.

Government has realized the need for creating a robust telecommunication infrastructure with adequate bandwidth at affordable rates in order to promote development and proliferation of Information Technology, Electronic Governance, E-Commerce, convergence of Information, Communication and Entertainment sectors so as to improve the state of economy, enhance the quality of life of the citizens and to ensure development of urban and rural areas with equity throughout the country.

Keeping the above objectives in view, this Committee recommends the following broad guidelines under which Right of Way permissions may be granted to licensed telecom operators and registered infrastructure providers for laying telecom cables/ ducts under, over, along, across, in or upon a property vested in or under the control or management of a local authority or of any other person including public authority, public corporation, autonomous body, State Government or Central Government in their respective licensed service area during the currency of their licence:-

1. Any authorized licensee of Department of Telecom /Registered Infrastructure Provider is eligible to seek/avail Right of Way facility/permission. However, enforceability of the permission so granted shall be restricted to the extent of provisions/scope of service contained /defined in the licence agreement of that licensee & for the purpose for which it is granted.

2. Either by content or by intent, the purpose of extending Right of Way facility is not to enhance the scope of licence of a licensee and such Right of Way permissions are only enabling /facilitating in nature.

3. The facility of right of way for laying underground telecom cables, shall be available to all licensees (irrespective of existing or future) and

registered/ licensed infrastructure providers, without discrimination and without payment of any compensatory charges/ levy/ lease rentals /licence fee/ free band width/revenue share/ cashless equity etc. subject to the condition that this right of way facility shall be available to licensees to the extent of provisions contained in their licence agreements and the reinstatement charges shall be borne by such licensees.

4. A performance bank guarantee @ Rs 25 per route metre with a validity of one year initially (extendable if required till satisfactory completion of work) shall have to be furnished by each licensee as a security against improper filling /unsatisfactory compaction / restoration and damages caused to other underground installations / utility services and interference, interruption, disruption or failure caused thereof to any services. Notwithstanding this, licensee shall be liable to pay full compensation to the aggrieved owners for any damage sustained by them by reason of the exercise of Right of Way facility. However, in case of NH land, instead of furnishing the said bank guarantee, the payment of restoration charges would have to be made in advance by the licensee to the owner i.e. MOST or its designated agency before permission is granted.

5. In order to expedite Right of Way clearances to the licensees in a time-bound manner through an appropriate and effective approval mechanism, a committee under the chairmanship of Chief Secretary to the respective State Governments may act as single window to co-ordinate all activities in this regard. Each State Government may select a Nodal Point/ Secretary of a department to function as Secretary to this Single Window Clearance Committee. However, in case of NH land, licensees would be required to take permission from the Regional officers of MOST stationed at different States for laying of cables. As regards NH routes executed by the State PWD, the concerned State Chief Engineer (NH) may act as nodal

point/ single window to coordinate the activities whereas in respect of the NH routes held by NHAI & BRDB, the designated officers of NHAI & BRDB may be assigned this task.

6. The Right of Way permissions may be granted by the said nodal office to a licensee within a period of two weeks subject to the licensee's application being complete with route details (including authority/ownership of concerned sections of the route) and compliance to eligibility requirement, payment of reinstatement charges, furnishing of requisite bank guarantee and execution of an agreement having operational details. The above stated Single Window Clearance Committee may be responsible to co-ordinate in case of any dispute for ownership of property and to expedite grant of Right of Way clearance thereof so as to adhere to the stipulated time-frame.

7. In case any shifting or alteration in the position of the laid telephone cables is required due to widening of highways and constructing of flyovers or bridges, the licensee shall do the same at his own cost at a later date within specified period indicated by the respective agency.

8. In order to avoid repeated digging on the same routes, if possible, the first incumbent is free to lay voluntarily extra ducts/conduits with extra capacity so as to take care of future needs. The capacity/excess capacity can be commercialized by the incumbent with suitable mutual agreements with the respective State Government /utility agencies. However, the creation of excess capacity by the first incumbent shall not be a pre-condition for giving Right of Way clearances. The Central/ State roadways authorities may consider laying ducts/conduits at the time of construction of roads to facilitate laying telephone cables for which suitable charges could be imposed.

9. Licensee shall ensure safety and security of all underground installations/ utilities/ facilities and shall be solely responsible for compensation/indemnification of concerned authority for damage caused/claims or replacements sought for at the cost and risk of licensee.

10. Licensee shall be liable to give a notice of 15 days with route details prior to trenching for fresh or maintenance/repair works. A separate performance bank guarantee for maintenance/repair works shall be furnished by licensee.

11. The period of validity of Right of Way permission shall be co-terminus with the validity of licence.

**Annexure- III**

**Quality of Service Parameters and Benchmarks for Broadband Service**

| Sl. | QoS Parameters | Benchmarks | Averaged over a period of |
|---|---|---|---|
| i. | **Service Provisioning /Activation Time** | 100% cases in =<15 working days (subject to technical feasibility). In all cases where payment towards installation charge & security deposit is taken and the Broadband connection is not provided within 15 working days, a credit at the rate of Rs.10/ per day, subject to a maximum of installation charge or equivalent usage allowance shall be given to the customer, at the time of issue of first bill. | |
| ii. | **Fault Repair / Restoration Time** | By next working day: > 90% and within 3 working days: 99%<br><br>Rebate:<br>(a) Faults Pending for > 3 working days and < 7 working days: rebate equivalent to 7 days of minimum monthly charge or equivalent usage allowance<br><br>(b) Faults Pending for > 7 working days and < 15 working days: rebate equivalent to 15 days of minimum monthly charge or equivalent usage allowance<br><br>(c) Faults Pending for > 15 working days: rebate equivalent to one month of minimum monthly charge or equivalent usage allowance | One month |
| iii. | **Billing Performance**<br>• Billing complaints per 100 bills issued<br>• %age of Billing Complaints resolved | 2%<br><br>100% within 4 weeks | One Month |

| | | | |
|---|---|---|---|
| | • Time taken for refund of deposits after closure: | 100% within 60 days | |
| iv. | **Response time to the customer for assistance** | % age of calls answered by operator (Voice to Voice)<br><br>Within 60 seconds > 60%<br>Within 90 seconds > 80% | One Month |
| v. | **Bandwidth Utilization/ Throughput:**<br><br>**a) Bandwidth Utilization**<br><br>**i) POP to ISP Gateway Node [Intra-network] Link(s)**<br>**ii) ISP Gateway Node to IGSP / NIXI Node upstream Link(s) for International connectivity**<br><br>**b) Broadband Connection Speed (download)** | <br><br><80% link(s)/route bandwidth utilization during peak hours (TCBH). If on any link(s)/route bandwidth utilization exceeds 90%, then network is considered to have congestion. For this additional provisioning of Bandwidth on immediate basis, but not later than one month, is mandated.<br><br>Subscribed Broadband Connection Speed to be met >80% from ISP Node to User. | One month |
| vi. | **Service Availability/ Uptime**<br>(for all users) | > 90% quarter ending June 2007; > 98% with effect from quarter ending September 2007 and onwards | One Quarter |
| vii. | **Packet Loss**<br>**(**for wired broadband access) | <1% | One month |
| viii. | **Network Latency**<br>(for wired broadband access)<br><br>• User reference point at POP / ISP Gateway Node to International Gateway (IGSP/NIXI)<br><br>• User reference point at ISP Gateway Node to International nearest NAP port abroad (Terrestrial)<br><br>• User reference point at | <br><br><120 msec<br><br><350 msec | One month |

| | | | |
|---|---|---|---|
| | ISP Gateway Node to International nearest NAP port abroad (Satellite) | <800 msec | |
| ix. | **Customer perception of Services** | | One Quarter |
| (a) | % satisfied with the provision of service | >90% | |
| (b) | % satisfied with the billing Performance | >90% | |
| (c) | % satisfied with help services | >90% | |
| (d) | % satisfied with network performance, reliability and availability | >85% | |
| (e) | % satisfied with maintainability | >85% | |
| (f ) | % satisfied with Overall customer satisfaction | >85% | |
| (g) | % satisfied with Customer satisfaction with offered supplementary services such as allocation of static/fixed IP addresses, e-mail IDs etc. | >85% | |