TELECOM REGULATORY AUTHORITY OF INDIA

Recommendations

On

Growth of Broadband

January 2nd, 2008

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CONTENTS

PREFACE

Broadband is high speed; always-on Internet access, which is widely recognized as catalyst for economic and social development of a country. Broadband not only enables people to surf Internet, but also provide access to enormous knowledge bank, to do business more efficiently, be better educated, have access to e-health services, benefit from better governance and enjoy enhanced entertainment. Availability of Broadband services at affordable tariff can have significant impact on Gross Domestic Product (GDP) and attract new investment as well as generate more employment in addition to increase in productivity.

The Authority, recognising the importance of broadband forwarded its recommendations on "Accelerating Growth of Internet and Broadband penetration" in April 2004 to Government. Based on these recommendations, the Government announced Broadband Policy in November 2004, which also set a growth target of broadband subscribers.

The Authority has noted that inspite of various initiatives to increase the growth of broadband; the growth of broadband is poor. The Authority felt an urgent need to identify various impediments affecting growth of broadband and to adopt a forward looking approach. Various methodologies to provide broadband have been analysed keeping in view the constraints and present regulatory framework. Efforts have been made to identify all possible options to boost the broadband growth.

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In order to achieve higher growth of broadband, the Authority has undertaken an in-house study and framed its draft recommendations suo-motu under section 11(1)(a) of TRAI Act to promote broadband penetration. In line with the Authority's consultative approach, comments of the stakeholders on these draft recommendations were obtained.

While framing these recommendations due consideration has been given to stakeholders' comments and best international practices.

It is hoped that these recommendations with a forward looking approach will provide impetus to growth of broadband in the country. It is expected that the Department of Telecom will give due consideration to the recommendations and take urgent measures to spur the growth of broadband in the country.

(Nripendra Misra)
Chairman, TRAI

Chapter 1

Background

1.1 Internet Services in India were launched on 15th August 1995 by Government of India through Videsh Sanchar Nigam Limited (VSNL). The government recognized need for encouraging spread of Internet in the country. In November 1998 the Government opened the sector to Private Operators for provisioning of Internet Services. The License conditions for providing Internet services were liberal with no License Fee and allowed unlimited number of players for delivering this service. ISPs could decide their own tariff plans and can even setup their own International Gateways.

1.2 More than 95% subscribers were using dialup access at that time. The speed of such dialup connection was limited to approximately 56 Kbps only. Initially the subscriber base grew more than 200 percent per year, from 0.28 millions in March 1998 to 3.04 millions by March 2001 due to supportive government policy and entry of large number of private players resulting in lower Internet tariffs boosting subscribers' growth. However, from April 2001 onwards, the growth rate started declining and reduced to just 7% at the end of March 2003.

1.3 Meanwhile, ISPs were allowed to offer IP telephony Services with effect from April 1, 2002. Some other applications like music & video download, online gaming also became popular. Such applications required more bandwidth that could not be met by dialup access. Therefore service

providers started providing always on high-speed Internet access (more than 64 Kbps connection) using technologies like DSL, Cable TV, Wireless, and Ethernet LAN etc. With the induction of always on high-speed Internet access services annual growth rate increased to 25% by the end of March 2004. The Authority recognised the increasing penetration of high-speed Internet access globally.

1.4 TRAI circulated consultation on "Accelerating Growth of Internet and Broadband Penetration" to encourage broadband growth in the country in November 2003. TRAI sent its recommendation on "Accelerating Growth of Internet and Broadband Penetration" to Government on 29th April 2004. Subsequently, Department of Telecom issued Broadband Policy in October 2004. The Broadband Policy announced by the government has taken into consideration most of the recommendations sent by TRAI. The detailed status of TRAI's recommendations is attached at annex I.

1.5 The Broadband Policy announced by Government of India has defined the Broadband as **" An `always-on' data connection that is able to support interactive services including Internet access and has the capability of the minimum download speed of 256 kilo bits per second (kbps) to an individual subscriber from the Point of Presence (POP) of the service provider intending to provide Broadband service where multiple such individual Broadband connections are aggregated and the subscriber is able to access these interactive services including the Internet through this POP. The**

interactive services will exclude any services for which a separate 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'. The projected growth for Broadband and Internet subscribers in the country was envisaged as under:-

Year Ending	Internet Subscribers	Broadband Subscribers
2005	6 million	3 million
2007	18 million	9 million
2010	40 million	20 million

Table-1: Broadband targets

1.6 Department of Telecommunications (DoT) also set a target for Broadband coverage for all secondary & higher secondary schools, all public health care centers by the year 2007 and coverage of all Grampanchayats by the year 2010.

1.7 Growth of Internet and Broadband Penetration has not been as per the expectations. As on 31st December 2005 the total Internet users in the country were 6.70 million including 0.9 million Broadband subscribers. Thus, the target for Internet connections was achieved but the target for Broadband subscribers could not be achieved. Further at the end of June 2007, the Internet subscribers are 47.24 million and broadband subscribers are just 2.42 million.

1.8 The details of Internet and broadband subscribers are shown in table-2:

Subscribers	As on Dec. 2004 (In Million)	As on March 2005 (In Million)	As on March 2006 (In Million)	As on March 2007 (In Million)	As on June 2007 (In Million)
Internet	5.45	5.55	6.94	9.27	9.22
Broadband	0.05	0.18	1.35	2.34	2.42
Wireless Internet (through mobile handsets)	--	--	--	31.30	38.02

Table-2: Internet and Broadband Subscribers

1.9 Table-2 indicates an annual internet subscribers' growth of around 20-30% in previous two years excluding wireless internet users. It may be important to mention that 31.30 million subscribers are accessing Internet through wireless networks (GSM/CDMA) of Unified Access Service Providers (UASPs) and Cellular Mobile Service Providers (CMSPs). Therefore the growth of Internet subscribers is satisfactory but we are seriously lagging behind on broadband front. The broadband subscriber growth initially (during 2005-06) was high (more than 600 %) but subsequently declined to an annual growth of just 60-70%. The high growth rate of broadband in initial years was on a narrow base. The targets fixed for the Broadband Policy are unlikely to be achieved. There are critical issues inhibiting broadband expansion in urban as well as rural areas. They need to be addressed urgently to facilitate expansion of broadband services in urban as well as rural areas.

1.10 The urgency to provide impetus to the growth of Broadband is recognised at the highest level and the Government has declared Year 2007 as 'Year of Broadband'.

1.11 In order to fuel the growth of Broadband in the country, the Authority identified certain impediments affecting growth of broadband and sent its recommendations to Department of Telecommunications. Some of the steps already taken by the Authority for increasing growth of broadband are following :

1.11.1 TRAI recommended in March 2003 that ISPs should be allowed to use any media (including fiber, radio and copper cable), for establishing last mile to their customers.

1.11.2 Recognizing the need to reduce Internet bandwidth cost, TRAI fixed tariff ceiling for Domestic Leased Line and International Private Leased Circuits (IPLC). Cost of IPLC is one of the major inputs for providing Broadband and impacts broadband tariff.

1.11.3 The Authority recognized the high cost of International Internet bandwidth as one of the impediment and sent its recommendations on 16th December 2005 on Measures to Promote Competition in IPLC. One of the major recommendations was related to introduction of Resale in IPLC segment, which was accepted by DoT. However, DoT further sought recommendations of TRAI on Terms & Conditions for the same. The Authority sent recommendations on "Terms and conditions of Resale in IPLC" on 23rd March 2007. These recommendations are still pending with DoT.

1.11.4 TRAI also issued Regulation on "International Telecommunication Access to Essential Facilities at Cable Landing Stations" on 7th June 2007. This is

crucial as decrease in international Bandwidth charges will bring down the Broadband charges as international bandwidth charges account for approx. 65% of total cost for providing Broadband services.

1.11.5 The Authority in its recommendations on "Allocation and pricing of spectrum for 3G and broadband wireless access services" dated 27th September 2006 recommended the mechanism and pricing of Spectrum for Broadband Wireless Access. As per the recommendation, government has been requested to allocate 200 MHz of spectrum in 3.2 to 3.4 GHz band to facilitate wireless operation of 12 ISPs in a circle. One slot has been reserved to be allocated to smaller ISPs on city basis with intention to give boost to broadband penetration in smaller cities/ rural areas.

1.11.6 The Authority has also sent its Recommendations on "Improvement in the effectiveness of NIXI" on 20th April 2007. The initiative would substantially bring down ISP's expenditure on bandwidth, which is likely to reduce content download charges resulting in net reduction in Internet and broadband usage charges. It is hoped that implementation of these recommendations will enable ISPs to effectively use NIXI platform for exchange of domestic traffic encouraging web hosting services in India. It will also result in better Quality of Service (QoS) of Internet and broadband services in India.

1.12 The Authority notes with concern that many of the suggested measures are yet to be implemented. The growth of broadband remains sluggish. Only 0.47 million

broadband subscribers have been added in first six months of 2007, which is far below the growth trend required to achieve broadband policy targets. It was expected that incumbent operators BSNL and MTNL will use all the resources to provide atleast 1.5 million broadband connections by 2005. The target was not met. Even now total broadband connections provided by the incumbent operators at the end of Sep 2007 are 1.62 million. Though Government envisaged quarterly review of performance of the incumbent operators for provision of the broadband and re-defining future roadmap for the provision of broadband, the results are below expectations.

1.13 It must be recognized that deeper penetration of broadband and Internet are essential and will be catalyst for economic growth and modernization. The higher penetration of broadband has multiplier effect on economy by creation of more jobs and higher returns from IT sector on Government revenues. The recent report of Organization for economic cooperation and development (OECD) list India at the bottom of 34 countries in which countries have been ranked based on the broadband penetration. India is not only below developed countries like US, and UK but also far below even smaller countries like Denmark and Iceland. China adds 3.32 million broadband connections in a quarter whereas India add just 0.08 million. The future technology projections indicate that micro-processors will run one thousand times as many computations as are being done today. That means enormous gain in productivity and efficiency giving people unimaginable

power to access, organize and transform the information. We may miss out if measures are not adopted immediately.

1.14 The in-depth examination of the subject and recommendations has been structured in chapters two to five. Chapter 2 on "Present Status" provides overview of the existing broadband scenario. Chapter 3 on "Recent Developments" discusses technological and policy developments. Chapter 4 on "Technologies for providing Broadband" provides status of existing technologies. Chapter 5 deals with demand of Broadband in rural and urban areas. Chapter 6 is on impediments to growth of broadband in Rural & urban areas and steps required to overcome these impediments. Chapter 7 is compilation of recommendations to provide impetus to the broadband penetration in the country.

1.15 It is hoped that TRAI's call for emergent measures will generate time bound action program. All policy & licensing issues, which are obstructing broadband growth, will be addressed on priority basis.

Chapter 2

Present Status

2.1 The number of Broadband subscribers was 2.67 millions on 30th September, 2007. Out of these 2.17 million are DSL; 0.32 million Cable Modem; 0.10 Ethernet LAN; 0.02 Fiber; 0.03 Radio based customers. Following chart (fig.-1) provides various Technology trends for Broadband access: -
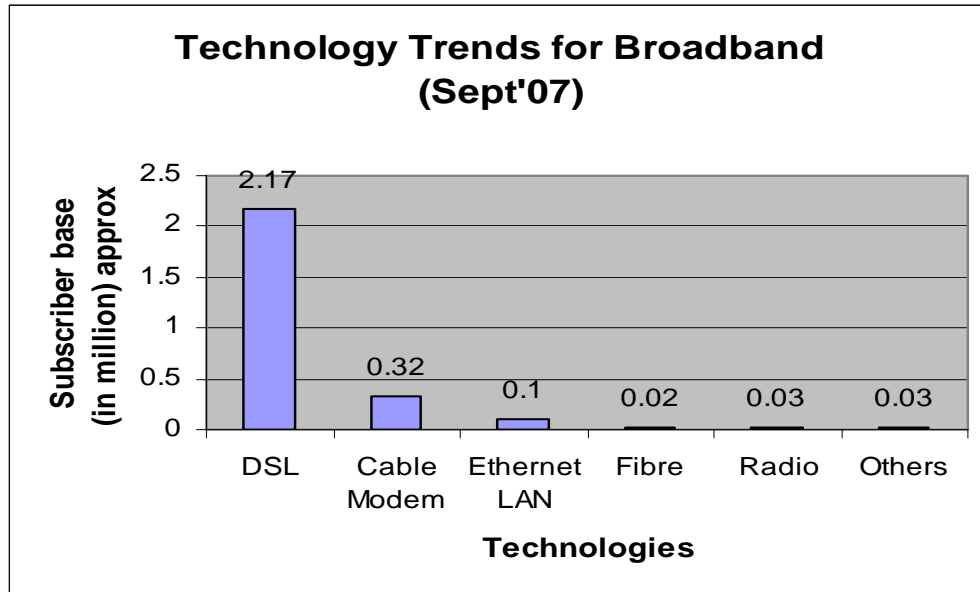
Figure 1: **Technology trends for Broadband**

Indian broadband market is dominated by DSL technology with nearly 81% share as compared to nearly 12% of Cable, nearly 4.4% of Ethernet LAN and nearly 0.8% of Fibre.

2.2 Figure-2 provides international trends for Broadband access technologies:
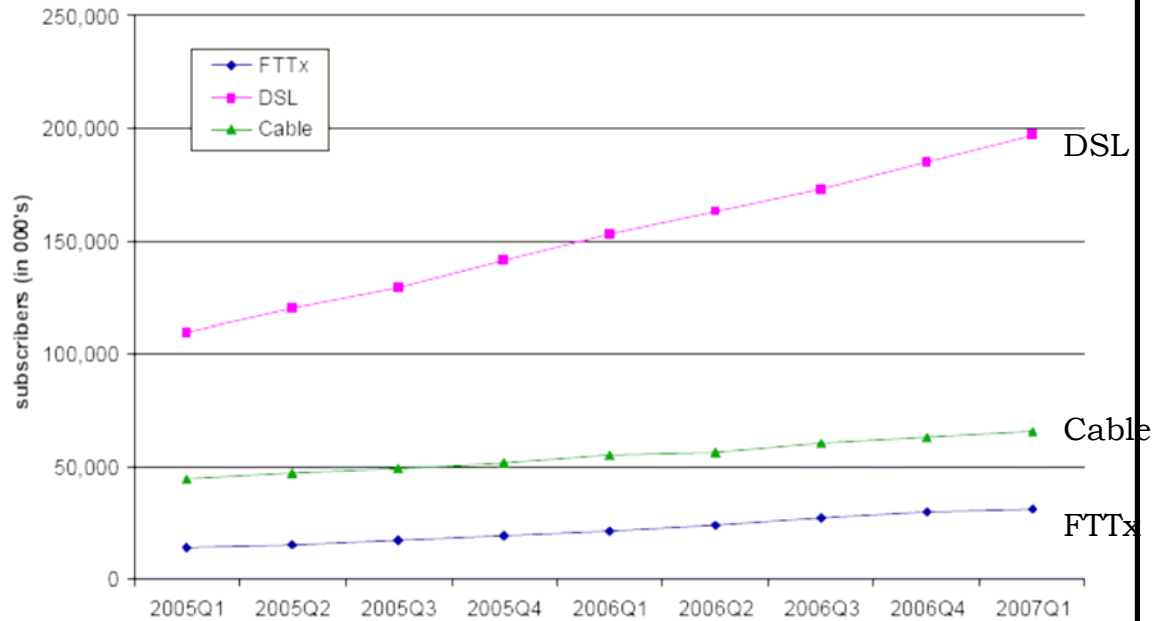
Figure 2: **International Broadband Technology trends**

International Broadband Technology trends indicate that overall market share of DSL is 66.1% compared to 20.3% of cable modem and 10.7% of FTTx while other technologies account for 2.9% market share. This clearly indicates that DSL over copper loop is the dominant technology worldwide for providing broadband. The share of DSL in India also is quite large (81.39%) as compared to other technologies (Cable 11.94%, Optical Fibre 0.8%). The expansion of cable network in India has been fast but uncoordinated. Though India have 71 million cable TV viewers, most of the present cable network is uni-directional and not in position to roll out broadband. The cost of cable TV network upgradation for giving broadband is also likely to be high. The optical fibre in access network is also very limited and not available to many locations/households even in metro and urban areas. Therefore the main technology to provide

broadband to large masses is DSL till other technologies like 3G and wireless broadband access roll out.

2.3   The Broadband Policy-2004 had estimated that there are more than 40 million cooper loops in the country with BSNL and MTNL. Out of which 14 million loops are in rural areas.   The cooper cable network of these operators is a combination of old and new cables.   Therefore, it is estimated that initially around 25-30% of the 26 million-cooper loops in urban area (Approx. 8 million) could be leveraged for providing broadband services by both the incumbents i.e. BSNL and MTNL.

2.4   BSNL and MTNL were supposed to provide 1.5 million broadband connections by the end of year 2005 (50% of overall target) whereas actually they could provide only 0.5 million by 2005 i.e. only 33% of the target fixed for them. Even at the end of March 2007 BSNL and MTNL together have provided just 1.45 million broadband connections using DSL technology. As such available copper loop to provide broadband connections have not been effectively utilised. At present BSNL and MTNL are having almost 60% market share but they are significantly behind overall targets as stipulated in the Broadband Policy.

2.5   The 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 operators are charging broadband rental between Rs 200/- to Rs 600/- and providing various options for content downloading.   Except unlimited packages the download charges range from Rs.0.70 to Rs.1.50 per MB. Some of the companies 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.1.50/- to Rs.2/- per MB. Inspite of affordable tariff, the growth has been poor.

2.6   There are 5.58 million dialup internet subscribers by March 2007, out of which 4.7 million are the subscribers of integrated service providers (UASLs and Basic Service Operators (BSOs) having ISP license). Since dialup cost is comparatively high, such subscribers should have migrated to broadband. However, the migration is negligible, perhaps mainly due to non-availability of broadband service in these areas.

2.7   International trends indicate that broadband over fiber is growing rapidly. However in India growth of broadband over fiber is very limited and there are only 0.02 million subscribers using this technology at the end of March 2007. Due to high cost of leasing fiber, it is mainly used for high capacity Internet bandwidth requirements.

2.8   TRAI in September 2006 wrote to all service providers to maintain waiting list of subscribers who want broadband connection. It is learnt that large number of subscribers has already registered to get broadband services from the incumbent. However, broadband could not be provided either due to shortage of ports or non availability of services in their area. The delay in deploying/rolling out broadband by BSNL and MTNL is resulting in poor utilization of local loop. We have already discussed the adverse impact of delay in roll out of broadband services.

At one end we have broadband demands which can fuel economic growth of the country, generate more employments and increase GDP per capita, on the other hand we have been unable to provide broadband due to procedural hick-ups mainly procurement delays and inbuilt management inadequacies in the system. Here it is important to emphasis that national resource of local loop must be utilized efficiently either by incumbents and if not, then should be allowed to others so that broadband growth can pickup.

2.9   The other method to provide large scale broadband connections is Wireless broadband technologies but spectrum has not been allocated for any of them like 3G or WCDMA or Wi-MAX. The present wireless networks are not able to support speed upto 256 kbps defined for broadband connection therefore such wireless subscriber though 3.8 million in number are not counted as broadband subscriber.

2.10 The need of the hour is to ensure that existing local loop must be utilized efficiently and without any further delay. Also spectrum for wireless broadband technologies is allocated to service providers on priority basis to fuel broadband growth. Any further delay will not only limit the number of broadband users but will also have very adverse impact on Indian Economy in times to come.

Chapter 3

Recent Developments

3.1 **Broadband Initiatives by Government/Universal Service Obligation Fund (USOF)**

3.1.1 Various government agencies have also taken initiatives to increase broadband penetration. First such initiative came from government in 2006 when it amended Indian Telegraph Act to extend USO Fund support for rolling out broadband services in rural areas.

3.1.2 The plan envisages provision of Broadband connectivity to villages in a phased manner. For this purpose service providers may deploy Pilot projects for Induction of new technological developments in the telecom sector in rural and remote areas. Such projects will be submitted to USO Fund Administrator for evaluation and if found viable may be supported through the USO Fund.

3.1.3 It has been envisaged that broadband can be provided using 3G, other wireless broadband technologies, existing copper or optical fiber network. With USO fund assistance, 10000 towers are being established for provisioning of mobile services. Three service providers have already been identified to ride in 81 selected clusters to provide 2G services. These towers can be effectively utilized to provide broadband services also.

3.1.4 USO Fund administrator has already initiated discussions to provide broadband in all blocks. All options to provide broadband (DSL, cable, wireless etc.) are being considered.

3.1.5   The plan also envisages broadband coverage of all secondary and higher secondary schools, public health care centers and Village Panchayats by the year 2008. Broadband connectivity would be provided to 100,000 Community Service Centers (CSC) covering 20000 CSCs by ADSL by September 2007; 1000 blocks by wireless broadband by December 2007 and the remaining 5000 blocks by wireless broadband with USO support by June 2008.

3.1.6   The ministries are also supporting broadband initiative by providing computers and useful contents. It is learnt that Ministry of Human Resource Development (HRD) has a program to provide tele-education. The content development work is already in progress. Ministry of Health is coordinating to provide tele-medicine services in block headquarters and identified health centers. Department of Information Technology (DIT) has drawn up big plans to provide e-Governance services.

3.2   **National e-Governance Plan**

Department of Information Technology (DIT) has drawn up a National e-Governance Plan (NeGP) for delivering Government and private services at the doorstep of the citizen. The plan has been drawn up covering 26 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.

3.2.1 **State Wide Area Networks (SWANs)**: Scheme for the establishment of State Wide Area Networks (SWANs) has been approved in 22 States/Union Territories with total outlay of Rs.3,334 crore over a period of 5 years, extending data connectivity of 2 Mega bits per second up-to the block level in all States and Union Territories in the country.

Following implementation strategies for SWAN have been suggested:

(i) Using the National Informatics Center (NIC) to establish the SWAN by suitably extending the existing NICNET upto Block level.

(ii) To engage a competent private/ public sector agency through an appropriate competitive bid process under a suitable service level agreement (BOO/BOOT etc.) to establish and run the SWAN.

(iii) To establish and own the SWAN infrastructure directly by the State and use a private service provider for operations and facility management.

(iv) Any other Public Private Participation (PPP) model considered appropriate by the State.

Various state governments have adopted different approaches for SWAN deployment. Such networks as

claimed are also capable to provide broadband upto block headquarter and village level.

3.2.2 **Common Services Centres (CSCs):** The Government has approved a Common Services Centres (CSCs) Scheme for providing support for establishing 100,000 Common Services Centers in 600,000 villages of India. The Scheme, as approved by the Government of India, envisions CSCs as the front-end delivery points for Government, private and social sector services to rural citizens of India, in an integrated manner. The Scheme has been approved at a total cost of Rs 5742 Cr. over 4 years, of which the Government of India is estimated to contribute Rs 856 Cr. and the State Governments Rs 793 Cr. The balance resources would be mobilized from the private sector. The Common Services Centres would be designed as ICT-enabled Kiosks having a PC along with basic support equipment like Printer, Scanner, UPS, with Wireless Connectivity as the backbone and additional equipment for education, entertainment, telemedicine, projection systems, etc., as the case may be. Each CSC will work on a self-sustaining model between the state and the Centre. While the Central government will provide a fixed stream of revenue of 33 per cent, the remaining will be shared among private players to be selected through competitive bidding basis. The government has also set up a national-level service agency to raise the finances for the scheme and monitor project implementation. The CSCs will also offer railways booking and reservation facilities, besides carrying examination results of all school and college examinations.

3.2.3 **State Data Centers (SDC):** It is proposed to create State Data Centers (SDC) for the States to consolidate services, applications and infrastructure to provide efficient electronic delivery of Govt. to Govt. (G2G), Govt. to Citizen (G2C) and Govt. to Business (G2B) services. These services can be rendered by the States through common delivery platform seamlessly supported by core Connectivity Infrastructure such as State Wide Area Network (SWAN) and Common Service Centre (CSC) connectivity extended up to village level. State Data Centre would provide many functionalities. Some of the key functionalities are Central Repository of the State, Secure Data Storage, Online Delivery of Services, Citizen Information/Services Portal, State Intranet Portal, Disaster Recovery, Remote Management and Service Integration etc.

3.3 Linking NeGP Initiatives with Rural Telecom connectivity programs

Presently various agencies including DoT, DIT and state governments are implementing different projects for creating networks for rural connectivity.

Several state governments have initiated the deployment of SWANs. Initially the networks like SWAN were supposed to provide connectivity till village for the purpose of extending e-governance facilities. However, such networks are now also being designed to provide commercial voice, video and data services. They are also obtaining licenses for providing these services. AP Broadband network is one such example.

As such there is no clear demarcation between the rural connectivity programs of different agencies. This is creating confusion.

In order to avoid any confusion Govt. should clearly define the scope of networks established under DoT's rural connectivity program and DIT's e-governance program.

Chapter 4

Technologies for providing Broadband

4.1 Broadband as per present definition is high speed Internet access (256 Kbps and above) and can be provided using various technologies.

4.2 Some of the commonly used technologies for providing broadband access are:

    i)   DSL/ ADSL over Copper loop

    ii)   Cable TV network

    iii)   DTH

    iv)   Satellite

    v)   Fibre

    vi)   Wireless

    vii)   Broadband over power lines

    viii) Other Technologies

4.3 **Digital Subscriber Line (DSL) over Copper loop**

4.3.1 Existing PSTN infrastructure having copper loops to subscriber provides most cost effective option for Broadband delivery. Digital Subscriber Line (DSL) has become an important technology option in public telephone networks for provisioning of Broadband services through the copper loop of Public Switched Telephone Network (PSTN). DSL speeds are influenced by the distance between the subscriber and the local exchange, the gauge of the phone wire, and the type of DSL technology, while offering a dedicated amount of

bandwidth that does not vary with the number of subscribers logged on in an area.

4.3.2 Different types of DSL technologies are described below:

4.3.2.1 **Asymmetric DSL** (ADSL, G.DMT, ITU-T.G.992.1) – ADSL is a form of DSL where more bandwidth is allocated to download than to upload. It provides maximum speeds of 8-10 Mbps downstream and a maximum of 1 Mbps upstream. ADSL can provide satisfactory services at a distance of 3-4 km from the local exchange. It is well suited to residential use because it shares a single twisted copper pair with voice, allowing users to use the telephone and surf the Internet simultaneously on the same line.

4.3.2.2 **ADSL** (G.lite, ITU-T G.992.2) – Originally, ADSL installations required a physical splitter to separate out voice and data traffic forcing these installations to be performed by technicians. G.lite allows for a splitter-free connection that simply requires the modem to be plugged in, thus drastically reducing the expense and difficulty of rolling out ADSL service. G.lite also extends the reach of ADSL by sacrificing speed – it can reach 5.4 km but maximum download speed will be limited to 1.5 Mbps while upload will be limited to 512 kbps.

4.3.2.3 **SHDSL** (Single Pair High-Speed DSL) – SHDSL uses a copper pair to send and receive data through two bands, allowing for speeds approximate up to 2 Mbps in each direction. By including a second copper pair, SHDSL speeds can reach approximate 4 Mbps in each direction.

These speeds are possible upto a distance of 3 km, but decreases with increase in distance.

4.3.2.4 **Symmetrical DSL (SDSL)** – SDSL is a proprietary standard mainly used in North America. SDSL offers symmetric traffic flow in each direction like SHDSL and cannot share the line with analogue signals. The capacity of SDSL is adjusted according to signal quality, and distance ranging from 160 kbps upto 7 km to 1.5 Mbps upto 3 km.

4.3.2.5 **ADSL2, ADSL2 plus** - ADSL2 is the sequel to the original ADSL recommendation, enabling improved speed, reach, power consumption and other technical elements. ADSL2 can deliver 8-12 Mbps while further extending the distance coverage. This standard also allows the use of filters instead of splitters at both ends of the connection. Further, the voice channels are realigned and often provide the ability to combine multiple ADSL2 lines for higher bandwidth to certain customers. In addition, ADSL2 systems can enter an "all-digital" mode where voice channels are reassigned to data, similar to SHDSL. ADSL 2 plus (ADSL2+) builds further on ADSL2 by increasing the bandwidth through extending the usable frequencies on the line. These increases download bandwidth from 8 Mbps with ADSL2 to 16 Mbps with ADSL 2 plus. These speeds are possible approximately upto 1.5 km.

4.3.2.6 **Very-High-Data-Rate DSL (VDSL)** – This is the latest form of DSL and offers the fastest DSL speeds to date, though over short distances (52 Mbps over a standard

twisted pair cable). This makes VDSL the optimal choice for providing broadband over short distances.

4.4 Cable TV Network

4.4.1 New technological developments in Cable TV networks have made it possible to send data in both directions via usage of different channels on separate blocks of 6 MHz frequencies, making Internet access over cable TV a viable solution. One channel sends data from the Internet to users (6 MHz of frequency corresponds to roughly 30 Mbps) while another channel receives. Cable subscribers in a small area share the same channels to send and receive data, therefore the bandwidth which a users receive is dependent on number of users utilising the service at given point of time.

4.4.2 Figure 3 shows typical setup for provisioning of broadband through Cable TV network:
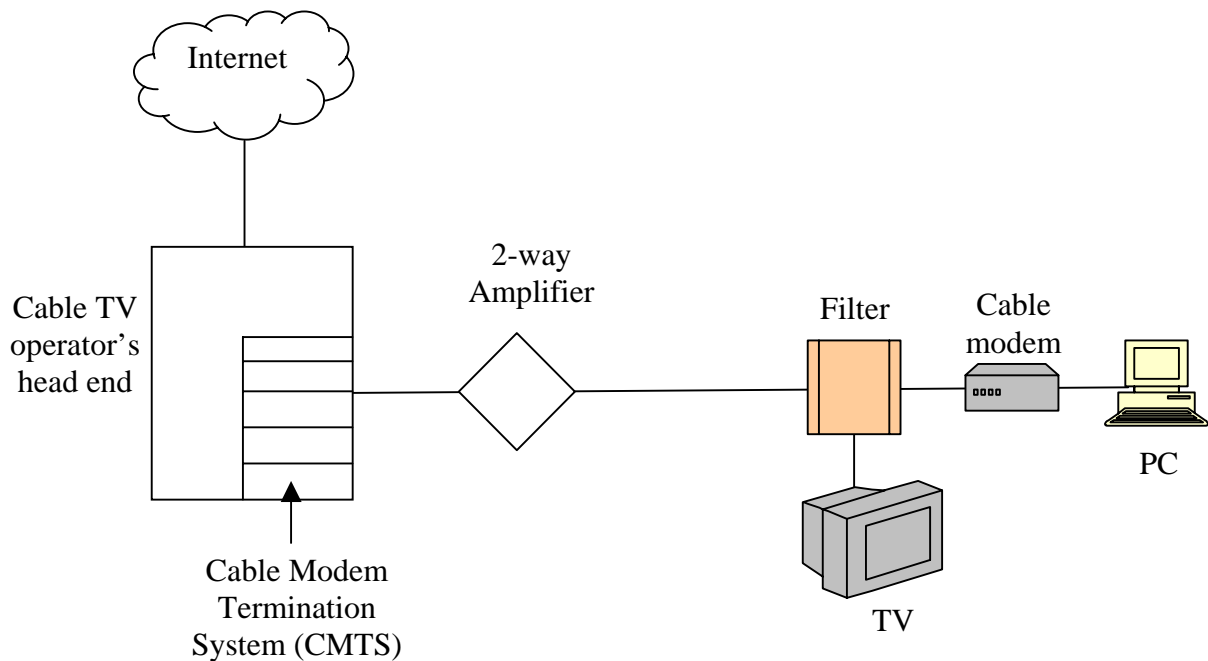
**Figure 3: Broadband through Cable TV Network**

4.4.3   Cable modem speeds range from 500Kbps to 30 Mbps. Cable modem specifications are governed by a set of standards called DOCSIS (Data Over Cable Service Interface Specification). The current version DOCSIS 2.0 has incorporated improved QoS, security features and symmetric data rates. The signals are modulated using QPSK (Quadrature Phase Shift Keying) or 16 QAM (Quadrature Amplitude Modulation) in upstream and 64 QAM or 256 QAM in downstream. The upstream band is limited to 5-65 MHz, while the downstream band is between 47-862 MHz.

4.4.4   Presently there are 71 million Cable TV subscribers in India. This last mile infrastructure reaches more people than even the copper loop infrastructure (40 million), and can be leveraged in providing cable operators with a new business model while giving a stimulus to broadband penetration. In some countries, particularly USA and Canada, the cable network is the dominant form of access for broadband services.

4.5   **Direct to Home (DTH)**

4.5.1   Another technology that can also be utilized as the medium for last mile access for broadband connections is by using Direct to Home (DTH) TV transmission. DTH is presently meant for broadcasting of TV channels only. However it can be utilised for downlink path for providing broadband connections also. Uplink (connectivity to the ISP equipment/node) in this type of service would be an independent connection most likely through dial-up/GPRS/EDGE connection. Such connections will

generally require allocation of fixed IP address and are capable to provide sufficiently high downlink bandwidth. Figure 4 shows typical setup for provisioning of broadband through DTH:
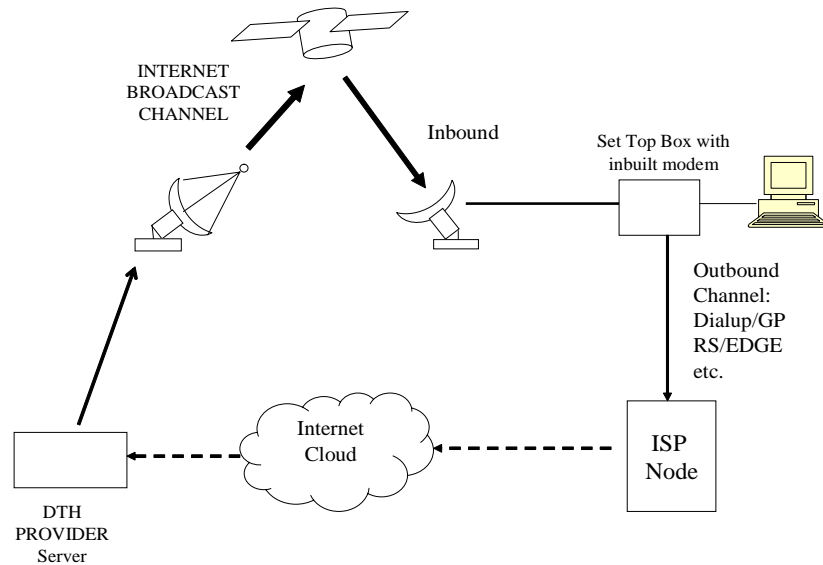
Figure 4: Broadband through DTH

4.5.2 Broadband through DTH is a viable option for both urban and rural areas if broadband uplink cost is reasonable. Some telecom service providers are planning to provide broadband through DTH in near future. Cost of uplink (dialup, GPRS, EDGE) is the main issue to determine success and popularity of this option.

4.5.3 Availability of transponders in the identified Geo stationary satellite area is also one of the constraints to provide broadband using DTH. High attenuation during rain impacts QOS. These issues need to be considered while DTH option is explored to provide broadband.

4.6 **Satellite**

4.6.1 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 rural and inaccessible hilly areas where wired access is difficult to lay.

4.6.2 Keeping in view the size of antenna to be installed at subscriber premises, only satellites operating in the Ku frequency band (10-18 GHz) are useful. It is expected that next generation satellite will expand into the Ka frequency band (18-31GHz). Satellite transponder in Ku band typically has capacity of 72 MHz. Half transponder of 36 MHz can easily serve 10,000 to 20,000 subscribers for provision of broadband service.

4.6.3   Though satellite connections have traditionally been more expensive, they can still offer some cost effective options like point-to multipoint (broadcast or multicast) applications that do not require huge bandwidth. VSATs (the small fixed earth stations used to setup satellite based communications network) have been fairly successful in the Indian market. The major users have been banking sector, lottery, distance education, fast moving consumer goods industry and the government. Figure 5 shows typical setup for provisioning of broadband through satellite:
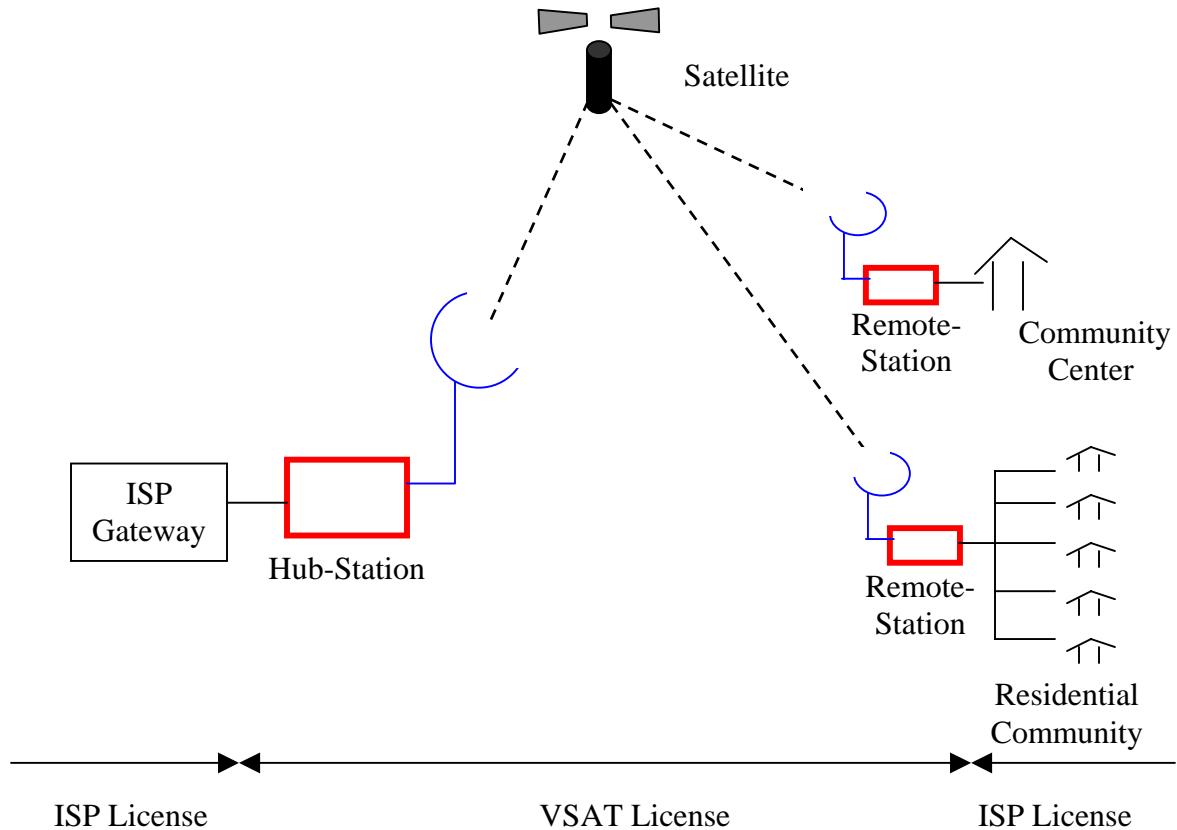
Figure 5 – Broadband through VSAT

4.6.4 Provisioning of Broadband through satellite requires main hub and remote stations. The cost of a main hub and remote station is high. As a result the broadband connections provided using satellite medium is not cost effective. Satellite is useful to provide broadband mostly in areas which are inaccessible and not feasible to be covered by using other methods to provide broadband.

4.6.5 In addition, there is a case for using Direct to Home (DTH) reception system, which is primarily used for receiving video broadcasts for downloading broadband content. The uplink in this arrangement, which is normally required to

be narrow band, can be from conventional terrestrial media (dialup, EDGE, GPRS etc.).

4.7 **Fibre Network**

4.7.1 Fibre optic cable uses lasers or light emitting diodes (LED's) to transmit pulses of light through fibre cable. Fibre optic cable can carry thousands of times more data than either electric signals or radio waves because light uses higher frequencies. The infrared laser light that is typically used in telecommunications has a frequency of roughly 100 MHz. Currently, most fibre optic cables transmit light only at one frequency, but, as technology improves, the bandwidth on fiber optic lines can be increased by simply adding more frequencies multiplying the capacity to carry data information.

4.8 **Wireless Network**

4.8.1 Wireless technologies usually provide wider broadband access solution in areas having limited communications infrastructure. Wireless is suitable for harsh landscapes and lightly populated areas, but can also be deployed to provide specialized services in urban areas. Amongst the various technologies available for broadband, wireless has a great potential because of ease of its installation, operation & maintenance, flexibility for the service providers and convenience to the end users. Moreover, penetration of copper loops is not widely spread. Therefore, wireless based access could be one of the ideal solutions for widespread last mile coverage through a

combination of different technologies like WiMAX, WiFi etc. These technologies have the added advantage of interoperability and economy of scale due to international standardisation. For the deployment of any wireless technology, suitable & sufficient spectrum availability and its efficient utilisation is a must.

4.8.2 Presently available wireless technologies are:

> WiFi
> WiMAX
> 3G & CDMA
> iBurst

4.8.3 Wireless Fidelity (WiFi)

4.8.3.1 Wireless fidelity is a term used for certain type of wireless local area networks, which use specifications in the 802.11 family. The term WiFi was created by an organization called WiFi Alliance. A wireless local area network (WLAN) uses electromagnetic waves to transmit and receive data over short distances by establishing an Access Point. Wireless LAN's are most commonly used in last mile to provide coverage for few hundred meters as diffusers of a broadband connection. WiFi technology can also be used for providing broadband access over longer distances in rural areas by increasing power levels of the equipment.

4.8.3.2 IEEE 802.11b is the most popular WLAN technology for public hotspot access in the world. It can operate in the unlicensed 2.4 GHz radio bands with maximum 11 Mbps speed. In addition to 802.11b, the 802.11 product family

now also includes 802.11a which operates in 5 GHz band with maximum data speed of 54 mbps. A new technology in 802.11 family is 802.11g which can support speed upto 54 Mbps but operates in 2.4 GHz frequency, making it backward compatible with the enormous 802.11b installed base. WiFi Alliance, a nonprofit international association, test and certify the interoperability of WLAN products based on IEEE 802.11 specification.

4.8.3.3 Primarily, WiFi was used in office environments and corporate campuses to provide connectivity to portable devices such as laptop computers all across the campus. Recently it is being utilised as commercial hotspot solutions that offer wireless connectivity in public locations, such as airports, train stations and convention centers as well as commercial locations such as coffee shops and hotels.

4.8.3.4 WiFi mesh networks are being implemented to offer portable and nomadic broadband services. Mesh connectivity can provide high speed, good quality coverage. The rollout time for such networks is also low.

4.8.3.5 For implementing WiFi in access networks backhaul is a major bottleneck. WiMAX can be utilised as a suitable technologies for back haul. However, the availability of spectrum for WiMAX has yet to be notified by DoT.

4.8.3.6 Interference can also be an issue while using unlicensed band of 2.4 GHz for WiFi devices as it is also used by

many other devices like cordless phones, microwave ovens and wireless local loop (WLL) radio systems. WiFi allows for a throughput speed of 11 Mbps under optimal conditions. When the amount of interference or distance between radios increases, the maximum connection speeds also decrease.

4.8.3.7 Security is one of the main concerns for wireless networks, since radio signals traveling through the open atmosphere and can be intercepted by individuals. Therefore strong customer management (user ID and password) and encryption management are necessary for operation of successful wireless networks. Most enterprise-level WiFi networks enable 802.1x features that automatically secure the network.

4.8.3.8 The WiFi Alliance, the IEEE 802.11 standards committee and many WiFi members are working to develop new security standards such as 802.11i and 802.1x. These new security standards use advanced encryption technologies such as AES and TKIP, as well as secure key-distribution methods to secure such networks.

4.8.3.9 Cities of Philadelphia, Chicago and San Francisco in USA, are deploying WiFi mesh networks for providing wireless connectivity across the city. In India also cities of Bangalore and Pune have prepared plans to become WiFi enabled. However, in some cities like Chicago & Taipei such networks are not getting expected success due to unsustainable business model.

4.8.4   **Worldwide Interoperability for Microwave Access (WiMAX)**

4.8.4.1 WiMAX (Worldwide Interoperability for Microwave Access) is a high speed wireless technology that supports fixed, nomadic, portable and mobile access.

4.8.4.2 Fixed WiMAX is based on an older version of IEEE 802.16 standard, (802.16-2004 previously known as Revision D, or 802.16d), that was ratified in July 2004. It is claimed that WiMAX can provide speeds upto 14.4 Mbps and likely to support much higher speeds with further advancement. WiMAX as claimed can provide a coverage upto 50 Kms in line of sight (LoS) environments and 15 Kms in non line of sight environments. Due to support for higher speeds, wider coverage and ease of installation, WiMAX is considered one of the promising technology to provide high speed internet.

4.8.4.3 There is a newer version of WiMAX optimized for dynamic mobile radio channels called mobile WiMAX, which is based on the IEEE 802.16e standard and provides support for handoffs and roaming. It uses Scalable Orthogonal Frequency Division Multiplexing Access (SOFDMA), a multi-carrier modulation technique that uses sub-channelization. Service providers that deploy 802.16e can also use the network to provide fixed service.

4.8.4.4 WiMAX claims to provide complete solution for broadband services (i.e. access as well as backhaul). WiMAX has two different versions

i) 802.16d used for backhaul

ii) 802.16e used for access network

4.8.4.5 To meet the requirements of different types of access, two versions of WiMAX have been defined: fixed WiMAX (802.16d) and mobile WiMAX (802.16e). The radio frequency allocations for WiMAX are in the 2.3 - 2.5 GHz, 3.3 - 3.5 GHz and 5.8 GHz bands. Fixed WiMAX has been deployed and tried in 3.3 GHz, 3.4 GHz, 3.5 GHz and 5.8 GHz and Mobile WiMAX trials are being conducted in 2.3 GHz - 2.5 GHz and 3.3 – 3.6 GHz. TRAI has recommended to allocate 3.3 and 3.4 GHz bands for BWA applications.

4.8.4.6 The Government has recently de-licensed 50 MHz spectrum in 5.825-5.875 GHz band for WiMAX giving boost to WiMAX deployment. Some of the service providers have already initiated action to provide broadband using this spectrum.

4.8.4.7 Commercial deployment of WiMAX in India is at initial stage. The operators have started trials of WiMAX in cities like Pune, Bangalore.

4.8.5   3G & CDMA

4.8.5.1 Third Generation (3G) is the term used to describe the latest generation of mobile services which provide advanced voice communications and high-speed data connectivity, including access to the internet, mobile data applications and multimedia content. IMT-2000 is

the name given to third-generation (3G) wireless mobile standards defined in the International Telecommunication Union's Radio-communication Sector (ITU-R) Recommendation M.1457. The two most widely deployed standards are based on code division multiple access (CDMA) technology and are referred to as CDMA-Direct Spread (CDMA-DS), known as WCDMA, and CDMA-Multi Carrier (CDMA-MC), known as CDMA2000. Both have the capability to support voice and broadband data traffic, with newer revisions providing even greater data rates. A third standard, TD-SCDMA, is also based on CDMA and is being developed in China, but is not yet commercially deployed. 3G technologies provide operators with the capability to offer broadband data connections to fixed, nomadic or mobile users.

4.8.5.2 Globally, WCDMA networks have been deployed in 2.1 GHz and 850MHz bands and developments are in progress for 900 MHz deployments, as well. EV-DO systems have been deployed in the 800 and 1900 MHz bands, though some deployments are in 450 MHz, 1700 MHz and 2100 MHz also exist. The frequency bands being considered in India for 3G services (2.1GHz, 800 MHz, and 450 MHz) are in line with ITU recommendation.

4.8.5.3 3G handsets have been a barrier in the past due to high cost, but they are now comparable with 2G in terms of size, weight, reliability, choice and provide superior features. Cost of 3G handsets is still higher when compared to 2G/2.5G, but are likely to decline.

4.8.6 iBurst

4.8.6.1 iBurst was standardized as HC-SDMA (High-Capacity Spatial-Division Multiple Access) technology by the American National Standards Institute (ANSI) in September 2005. Additionally, HC-SDMA was included in the ITU-R M. 1801 Recommendation for Mobile and Nomadic applications in March 2007 by the International Telecommunication Union.

4.8.6.2 iBurst is an "always-on," IP-centric, mobile, high-speed wireless access system. It can provide approximately 1Mbps (downlink) packet data service per user simultaneously at a frequency range of 5MHz, and can support VoIP with a quality level equivalent to fixed telephony.

4.8.6.3 Currently iBurst has been deployed in several countries including South Africa, United States, Canada and Australia and the number of iBurst subscribers worldwide now exceeds 140,000.
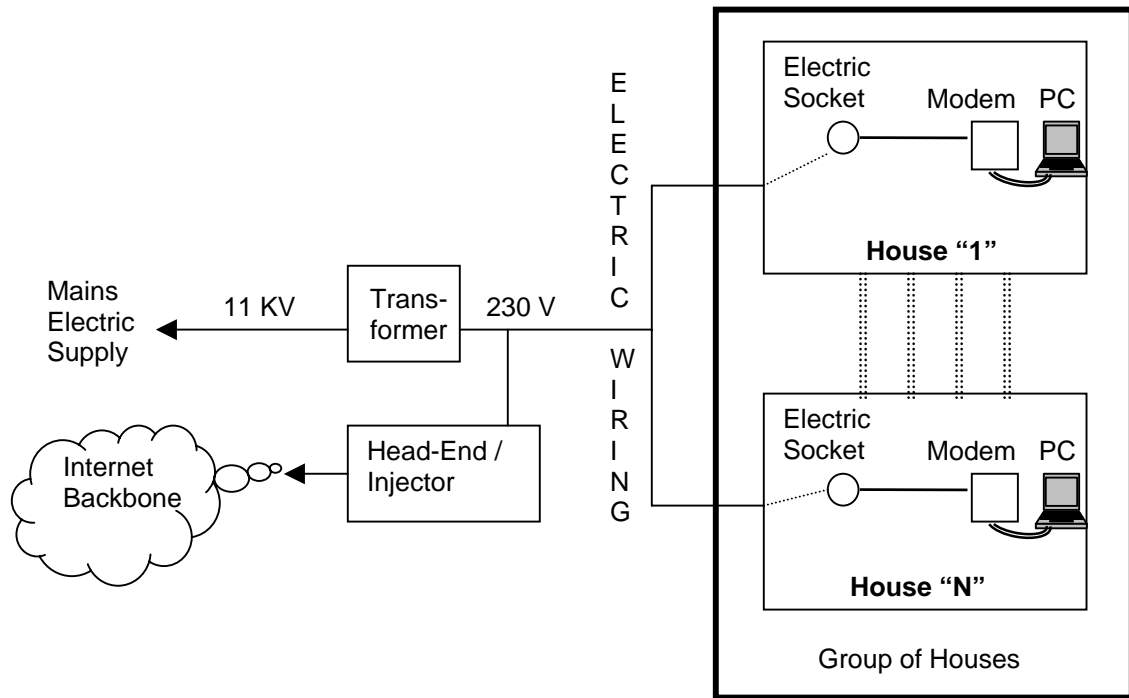
4.8.7 Broadband over Power Lines (BPL)

4.8.7.1 Power line communication (PLC) is the term describing several different systems for using electric power lines to carry radio signals for communication purposes. Power line communications technology can use the household electrical power wiring as a transmission medium.

4.8.7.2 Broadband over Power Lines (BPL) is the delivery of broadband over the existing low and medium voltage electric power distribution network.. BPL can be provided to homes using existing electrical connections and outlets. A Powerline 'injector' is fitted to the electricity supply infrastructure downstream of the distribution transformer, which converts medium voltage supply to low voltage (240V) supply. A modem is then provided at each location where it is required. Telecommunications services can then be enabled between the modems and the injector. Access to the internet or other telecommunications services can then be provided by a leased line/wireless/satellite link attached at the injector.

4.8.7.3 PLC modems transmit in medium and high frequency (1.6 MHz to 80 MHz). The asymmetric speed in the modem is generally from 256 kbps to 2.7 Mbps. In the head-end the speed is up to 45 Mbps. To connect to the Internet backbone, utilities can use optical fiber or wireless link. Typical data rates in current trials are 2-3 Mbps, but in future systems offering upto 200 mbps are going to be commercially available.

4.8.7.4 Figure 6 shows typical setup for provisioning of broadband over Power Lines:

Figure 6: Broadband over Power Lines

Chapter 5

Demand of Broadband

5.1 There has been inadequate focus on demand side of broadband to increase broadband penetration. A viable minimum level of demand is necessary to stimulate investments enabling smooth supply. Demand mainly depends on perceived utility of contents & services being provided, availability of desired quality of services at affordable price.

5.2 The parameters influencing the demand of broadband in urban and rural areas are different. In urban areas, broadband demand will be driven by individual requirements; whereas in rural areas broadband demand will be induced by various Government agencies and will take off initially at community level.

5.3 The orientation of the content may be different in different areas. The killer applications will drive the demand of broadband in urban areas and accelerate broadband growth. Subscribers are more interested in e-chatting, e-mail, online applications, VPN services, information and entertainment in urban areas. Subscribers in urban area demand high speed Internet connection. The broadband penetration in rural areas will be driven by pressing requirements. Rural broadband users are more interested in educational material, Agricultural material, Animal husbandry, e-health and e-governance (Computerized land records, Motor license, and information related to various welfare schemes). Therefore availability of content with

perceived utility is very important. We may like to mention here that one school of thought is that high cost of the customer premises equipment (Computer, Modem etc) is the prime reason for the low penetration of the broadband and immediate action has to be taken to reduce the cost of such equipments. While this factor can not be brushed off, the availability of high value consumer goods in rural and far flung areas indicates the changing trend. Availability of Motorcycles, Refrigerator, TV and other similar devices are common in villages which also require significant expenditure. It is agreed that one will not incur expenditure unless returns commensurate to expenditure are expected. The returns on expenditure to avail broadband services will be visible only when all three components i.e computer, content and high speed Internet are simultaneously available. Absence of any of them will not give encouraging returns. The availability of all the three components today is unsatisfactory. As a result the broadband demand is not picking up. A framework has to be evolved so that problem is countered from all sides (Ensure Broadband connectivity, Computers, and Content).

5.4 Some useful applications on broadband are:

- E-commerce
- Online Bill payment
- E-education/E-learning
- Entertainment
- E-Governance
- E-health
- E-Communication
- Employment

5.5   **E-commerce**

5.5.1   E-commerce is becoming an increasingly integrated part of the operation of large businesses and the most likely demand for broadband applications will be from these business users in urban areas.   It is expected that e commerce will enable companies to lower costs such as procurement, production, selling and distribution, which will lead to the development of new markets and services.   This process has the potential to reshape the supply chain by removing the need for intermediaries between suppliers and customers.

5.5.2   According to a survey report the E- Commerce Industry in India was worth **Rs 7080 crores** at the end of 2006-07, which is expected to reach **Rs. 9210 crores** by the end of 2007-08, a growth of about 30% over the current year.

5.5.3   According to this report 14.2% use the internet to buy travel tickets; 5.5% people do online shopping especially products like Books, Flowers, Gifts etc. and 5% people deal in stocks and shares through the Internet. Though the percentage contribution of E-Commerce is almost same over the years, however, the number of Internet users using E-Commerce is growing rapidly.

5.5.4   As per Internet & Mobile Association of India (IAMAI) report on Online Banking, approximately 4.6 million Internet users were using Online banking at the end of year 2005, which is expected to grow to more than 16 million by 2007-08. A report on UK indicates that 15% of GDP is contributed through e-commerce business. Considering 300 million middle level population having good purchasing power; the potential of e-commerce is very high in our country. Thus, E-Commerce is likely to be adopted by the

Internet users as a way to shop and will be a major factor in increasing the demand of broadband in urban areas.

5.5.5 E-commerce is equally relevant in rural areas but in different form. The economy of the rural areas is mainly based on agriculture and related commercial activities. Access to information on weather trends, improved farm practices, credit availability, market prices of various commodities increases livelihoods opportunities of the farmers. Farmers usually depend on Mandis situated in urban areas for selling their produce. They transport their produce to mandis and depend on middlemen to sell their produce. This not only consumes a lot of time and efforts but also reduces their profit. E-commerce can provide direct linkages between local producers, traders, retailers and suppliers.

5.5.6 One such initiative by ITC, e-Chaupal system provides farmers with information on Mandi rates and offers to buy their produce directly at previous day's closing price. If the farmer chooses to transact through the system, he needs to transport the produce to a nearby ITC hub and pay a transaction fee. Through e-Chaupals, ITC also offers seed, fertilizer and other products for farming at prices lower than the traders. Kiosk operator is able to aggregate demand and place the order on behalf of a number of farmers to an ITC representative. The farmers have benefited in terms of ease in trade (i.e. reduced cost of transporting their produce), higher profit margins and improved awareness leading to higher productivity. Besides improving the efficiency of the agricultural system, the application empowers farmers by giving them a control over their choices.

5.5.7   The government is planning to extend the Agriculture Resources Information System (AgRIS) and the Agmarknet projects to the CSCs. ARIS is a pilot project by Department of Agriculture and Co-operation (DAC), agriculture ministry and the National Informatics center (NIC) to educate farmers in good agricultural practices. The Agmarknet project is at present operational in 2,200 agricultural wholesale produce markets located across the country. The project, undertaken by the DAC and the NIC, provides market price information on 300 commodities and 200 varieties.

5.5.8   In view of above discussions, it is clear that e-commerce is very important activity and has high perceived value. Therefore, broadband supporting such applications will be desirable to boost broadband penetration.

5.6   Online Bill Payment

5.6.1   Another application, which is becoming popular in urban areas is online bill payment of finance, insurance, telecommunications and other utilities like electricity Insurance premium etc. Online bill payment is beneficial for both billers and consumers.

5.6.2   As per a research report of IAMAI, there were 0.3 million Indians pay various online bills in 2005-06, which is expected to reach 1.8 million in 2007-08.
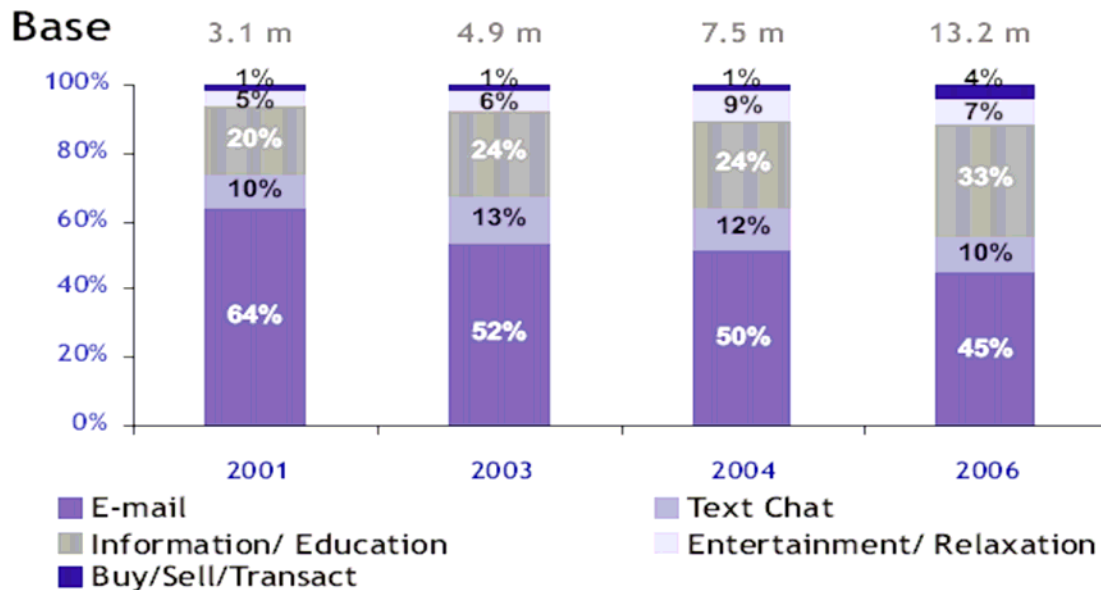
5.7   E- education/E-learning

5.7.1   E-education is such a powerful application that it may change the conventional education system in times to come. The popularity of e-education is exponentially increasing. Broadband has the capabilities to enable distance learning applications,

which deliver optimum real-time audio and video in a simulated classroom environment. In addition to many public schools which are, or will be, connected via broadband networks, there is a growing commercial market for education services offered by private companies. Broadband can also enable online learning systems via public libraries and provide improved access to information for rural and remote areas.

5.7.2 The non availability of educational materials, books which are big burden on rural unprivileged children can easily be provided using broadband and e-education platform. The flexibility of timing and pace are the added features which make e-education much popular. On top of it, one can repeat and read as per the individuals pace. Some of the e-education modules provide option to give examination as and when you desire. Such features are extremely suitable to rural environment where students may have no time in day to attend conventional classes.

5.7.3 The census data indicate that a whopping 68 per cent village had pre-primary schools and about 65 per cent villages either had secondary schools within the village or located within five km of one. If all such schools are provided with a computer connected to broadband, the students of these schools can get education and skills available on the internet. In villages without schools, education can be provided through internet enabled community centers such as CSCs and CICs.

5.7.4 Figure 7 indicates the Internet applications usage pattern for last five yeas.

Main applications used

Source: Active Users, 26 cities, I-Cube 2006

Figure 7 – Main applications used over Internet

5.7.5   From the above figure it is evident that more & more people are using Internet for education or information (approx. 33% of internet users) and it would likely to increase further.

5.7.6   E-learning or electronic learning in India is gaining prominence steadily. This is due to the fact that more than half the population of India today is below 25 years of age and the number of Internet users is growing continuously. The tremendous growth of the economy in the recent past has also helped in the growth of online education in India. E-learning in India is especially popular with the young professionals who have joined the work force quite early but still would like to continue their education that may help them move up their career ladder quickly and safely. They find online education in India very

convenient, as the nature of the course work does not require them to attend regular classes. Moreover reputed institutes like Indian Institute of Management, Indian Institute of Technology, Indian Institute of Foreign Trade are today offering e-learning courses.

5.7.7 Apart from conventional education, adult literacy program could also avail this facility, increasing e-literacy levels in villages and introducing a scientific temper in society.

5.8   **Entertainment**

5.8.1 Entertainment is an area which may prove popular for broadband applications. For example, online games and video are often cited as potential areas for growth in broadband demand in urban areas.

5.8.2 It might be anticipated that consumers are likely to pay more for broadband connectivity when it is bundled with broadcasting services.   In this context, the applications with the most potential in the residential community will be on demand video applications such as streaming video and audio services, which could be major drivers behind broadband adoption.   Services such as "movie on demand" offerings would be an excellent example of the next generation of technology-enabled entertainment applications.

5.8.3 Online gaming is the latest addition to the online entertainment arena in India. Normally for online gaming 256 – 512 Kbps band width is required. However, high precision games like require higher bandwidth.

5.8.4   As per I-Cube 2006 survey the number of users accessing internet primarily for entertainment hovers around 8-10% level which is likely to increase with the availability of newer services and applications over broadband.

5.9   **E-governance**

5.9.1   Broadband technology can be used to deliver government services directly to citizens, as well as business users. Such applications can reduce the costs of providing government services and can facilitate access to these services by citizens. Such services can range from information services, administrative documentation, renewal of a range of licences, tax submissions, etc.

5.9.2   One of the earliest initiatives in the Integrated Citizen Services domain in India is e-Seva, implemented in Hyderabad city, Andhra Pradesh. Through e-Seva portal citizens of the state can avail various services like deposit of house tax, payment of utility bills, registration of birth and death, sale and receipt of passport applications and can also interact with various local departments for their grievances. In geographic areas where no government offices are available such services allow for real-time dialogue with administrative officials at low cost.

5.9.3   Some of the other projects implemented in Andhra Pradesh as a part of e-Governance were, Computer Aided Administration of Registration Department (CARD), Vijaywada Online Information Centre (VOICE), e-Procurement System etc. Government of Karnataka under Bhoomi project digitalised all the land records and made them accessible through kiosks in 177 sub-districts across the state.

5.9.4　Haryana Government has also developed a house tax information system. The payment of the house tax also can be made online. All driving license details and vehicle registrations have been computerized under their schemes "Sarthi" and "Vahan". All registration of death and birth is done online and certificates are also issued online. Implementation of similar e-Governance model by other states will definitely help in increasing demand for broadband.

5.9.5　Other state governments are also taking such initiatives through State Wide Area Networks (SWAN), which may create interest of rural populace in Internet and Broadband. In order to increase the usage of Internet based service like E-Medicine, E-Education, E-Governance etc more and more Internet contents should be derived on local regional languages. Presently most of the Internet based content services are in English and the English literacy rate in India is quite low i.e. around 5%. This needs to be addressed to improve popularity of Internet.

5.10　Employment

5.10.1　It was envisaged in Vision 2020 that there is a need to shift rural employment from traditional to alternate and agri-based employment such as commercial agriculture (such as horticulture, floriculture, diary, livestock etc.), food processing and forestry (including commercial forestry) will require significant amount of training, skilling and support for traditional farmers to take up such new opportunities.

5.10.2　Given the lack of infrastructure and funds/ budgets to set up the additional education/ training/ agricultural extensions etc, there is a need for innovative solutions including alternate media/

communication channels that can enable a range of interactions and interfaces like Education, information, Vocational training and skills development.

5.10.3 Broadband can provide the most comprehensive set of capabilities to address all these needs at a rural level.

5.11 E-Health

5.11.1 Good medical advice is often lacking in rural areas or available very sparsely. In some remote places people have to travel miles to get medical treatment. Even if medical facilities are available at some places, for specialised treatment people have to go to urban centres. It is estimated that as much as 75% of a total 100,000 maternal deaths occurring every year in India, amounting to one maternal death every 5 minutes, is preventable if proper medical attention can be provided on time. It is possible to consult and get treatment from doctors in different parts of the nation or even the world through the Internet.

5.11.2 Broadband capabilities can be used in telemedicine applications in rural areas. This facility enables specialist doctors to provide advice to general practitioners or nurses in rural and remote areas and can be utilised for 'distant diagnosis' directly with patients. Telemedicine can potentially provide health care workers with an extensive network of specialists from whom to get support and provide patients with improved medical attention no matter where they are located. On the other hand, there are some very good web sites of preventive and curative medicine.

5.11.3 E-consultation, E-diagnosis and E-Education could become a reality making top-class medical aid available even in remote areas where people are at present forced to depend on quacks or village *hakims.*

5.11.4 The government has already decided for Broadband connectivity to all public health care centers by the year 2007.

5.11.5 Bangalore-based Neurosynaptic Communications Pvt. Ltd. and the TeNeT (The Telecommunication and Computer Networks) Group at Indian Institute of Technology, Chennai, have developed a low-cost telemedicine solution for rural areas. It includes a remote diagnostic kit and a personal computer to provide basic healthcare infrastructure in rural areas, and help people sitting in villages get advice from doctors in urban areas. The Rs 10,000-kit can be installed at villages having Internet connection. It can measure basic physiological parameters like temperature, blood pressure, pulse rate and multi-channel ECG (electrocardiogram).

5.12 Community center

5.12.1 It is necessary to understand that initially concept of community center will pickup in rural areas. Therefore to start with, efforts must be made to provide broadband connectivity to community centers in villages at affordable cost. The problem of erratic power supply, which is a serious impediment, can also be solved if we concentrate only on community centers. To reach rural communities, however, Government subsidies are needed.

5.12.2 Through these community centers activities like digitisation of land records, data entry jobs for Birth/Death Certificates, etc. could easily be outsourced to rural India, and these jobs will help

in generating employment in rural areas and performing these tasks at a much lower costs for the companies handling them. This will definitely help in achieving the rural employment objective of Government of India at a much lower outflow of money from Government exchequer. The other social objectives of e-health, e-education, etc could be implemented in a much more effective manner.

Chapter 6

Impediments to the Growth of Broadband

6.1 Broadband in Urban areas

6.1.1 Boosting broadband penetration is national priority. The slow growth requires in-depth analysis of all impediments and discussions on various options to boost broadband penetration. This chapter will concentrate on all the options and likely actions to accelerate broadband penetration.

6.1.2 Presently most of the broadband proliferation is taking place in the urban areas. However, it is far less than the desired level. On an average 80000 broadband subscribers were being added per month during last one year. To achieve the broadband policy target much higher growth rate is required. Here it will be important to mention that large number of broadband connections will come initially from urban areas only as it has to be induced in rural areas where likely business model will be community service centres to start with. So need is to identify drivers to generate demand for broadband and ensure its availability so that any one, any time and anywhere can get it when ever it is desired. Analysis of impediments for this abysmal growth will be important.

6.1.3 Broadband demand is driven by perceived utility of contents and value added applications. Many applications like Railway tickets/ Air tickets, educational material, e-commerce, e-chat, e-meeting and e-governance (payment of

house tax, filing of IT returns etc) are becoming popular in urban areas which will drive broadband requirement. Hence broadband in urban areas will be driven by individual and corporate demands.

6.1.4   Broadband through DSL in urban areas

6.1.4.1 Presently DSL is the most preferred technology for broadband access world over. The global technology trends used for provisioning of the broadband are indicated in figure 8:-
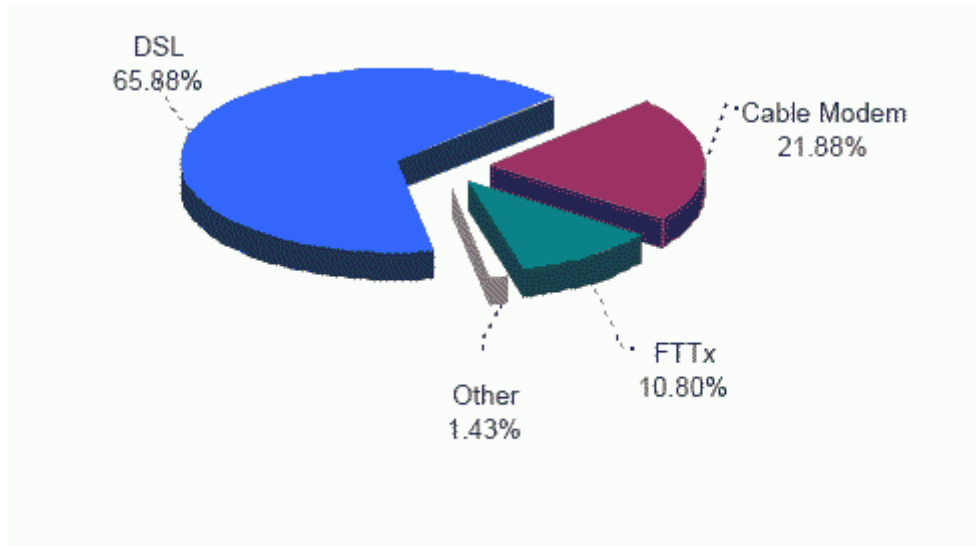
Figure-8: Total Broadband Subscribers by technology

6.1.4.2 The situation in India is no different. At the end of Oct 2007, out of 2.77 million broadband subscribers, 2.27 million subscribers (approx. 82%) were using DSL technology.

6.1.4.3 Broadband Policy envisaged a target of 1.5 million broadband connections (50% of overall target) for BSNL

and MTNL by the end of year 2005 whereas actually they could provide only 0.5 million i.e. only 33% of the target fixed for them. The Policy also gave a free hand to the access providers to enter into mutually agreed commercial arrangements for utilization of available cooper loops for expansion of broadband services. The owner of the local loop is free to decide the areas in which investment is to be made to upgrade installation/ infrastructure for broadband services. As already discussed in chapter-2, approximate 16 million copper loops are available in urban area with incumbents. The quality of the local loop is not very good and therefore it is argued that not all can be used to provide broadband. Even if it is assumed that about 50 percent of available local loop is used to provide broadband, MTNL and BSNL can provide 8 Million Broadband connection. Provision of Just 1.65 million broadband connections against usable local loop of 8 million clearly indicate that local loop is not being used effectively.

6.1.4.4 As discussed in chapter 2 increasing broadband growth is national priority and therefore requires all out efforts to effectively utilise all available resources. One way of effective utilisation of copper loop is through unbundling of local loop. TRAI recommended unbundling of local loop of incumbent operators in its recommendations on "Accelerating Growth of Internet and Broadband Penetration" date 29th April 2004. However due to complexity in implementation, DoT did not accept.

6.1.4.5 The other way could be to encourage public private partnership for provisioning of the broadband. Broadband has high growth potential in urban areas and in most cases incumbents has local loop up to subscriber premises to provide broadband, but still incumbents are not able to provide broadband. While no official information is available on the cause of slow broadband provisioning rate by incumbents, it could be either due to shortage of DSLAM ports & Customer Premises Equipments (CPEs) or non deployment of broadband in many areas. This indicates scope to improve efficiency of local loop utilisation to provide broadband using copper loop by incumbents. Franchisee model can be adopted, which will be more effective in the current scenario and can encourage broadband penetration. In such model, there is complete flexibility for provision of equipments either by franchisee or the local loop owner; hence the shortage of equipments can be solved to a great extent by adopting this model. The incumbents will issue all bills and do all subscriber management; therefore franchisee model will be able to encourage effective utilisation of copper loop in comparison of unbundling of local loop. The issues like collocation of equipments, QoS etc can easily be managed by local loop owner and still provide more broadband connections. This should be immediately adopted to boost broadband penetration.

6.1.4.6 While recommending adoption of franchisee model to increase broadband penetration, the Authority is aware that it is internal matter of incumbents and generally

interference in such matters be avoided. However considering all available options, including wireless, DSL technology is most economical as customer premises equipment cost in wireless broadband technologies is high. We have discussed in chapter 2 the positive impact of broadband growth on GDP per capita. The growth and interest of the country is uppermost and therefore increasing broadband penetration by using franchisee model by incumbents should receive high priority.

The Authority recommends that:

- **Government should increase the target fixed for BSNL and MTNL for provision of broadband connections during 2007-08. For this purpose BSNL and MTNL should be encouraged to appoint franchisees for providing broadband services to supplement their efforts. There should be total flexibility in developing a commercial model. Close monitoring be prescribed to ensure effective utilization of the local loop. Any procedural restrictions/ limitations should be addressed immediately.**

6.1.5 Shortage of Customer Premises Equipments (CPEs) for Broadband

6.1.5.1 Shortage of CPEs (modems) is one of the reasons for slow provisioning of broadband by incumbents. Usually CPEs are provided by service providers while installing broadband connections. Most of the subscribers are not aware about the availability of these CPEs in the market and therefore entirely depend on the service provider for

procurement of CPEs. Though some CPEs are also available in the market, their cost is higher than what is charged by the service provider.

6.1.5.3 The customers are also not sure about the interoperability of the CPEs, which are available in the market. As a result, subscribers did not purchase such CPE from the market to get broadband unless CPEs are tested and interface approval given by designated body. A list of CPEs models tested for interoperability should be displayed in the public domain, so that subscribers can directly purchase these CPEs from the market. TEC can play very effective roll in this respect.

6.1.5.4 High cost of CPEs is another issue of concern. Presently most of the CPEs for broadband are imported in bulk by incumbents through tendering process due to very limited availability within country. More over most of the local loop is available with the incumbents. Future plans for providing broadband using DSL technology may encourage manufacturing of CPEs within country. Government may consider encouraging local manufacturers to ensure better availability and lower price of CPEs to common masses.

The Authority recommends that:

- **TEC should undertake certification of different CPEs model for interoperability for provisioning of the broadband. All CPEs conforming to specifications for interoperability should be**

displayed on TEC website for the information of customers.

- **Incumbents may declare future plans for providing broadband using DSL technology to encourage manufacturing of CPEs within country.**

6.1.6   Broadband through Cable TV Network

6.1.6.1 Presently there are 71 million Cable TV households in India. The available data suggest that only 10% of this i.e. 7 million can be utilized for broadband access at present. However, only 0.25 million broadband connections over cable TV have been reported by March 2007. For providing broadband over cable TV network, up-gradation cost of cable TV network per line is approx. USD 200. Stakeholders contend that providing only broadband services over cable TV network may not give commensurate rate of return on investments. This seems to be one of the reasons for slow up-gradation of Cable TV network to provide broadband.

6.1.6.2 Cable TV operators want additional services like IPTV, Internet telephony and other bundled services. Migration to UASL is costly and therefore Cable TV network is not emerging as one of the alternative to provide broadband. TRAI in its recommendations on "Unified License" dated 27th October 2003 recommended provision of UASL without spectrum. This will enable Cable TV operators to move to UASL and provide various services. This needs to be looked into on priority basis to encourage up-gradation of cable TV network capable to provide

broadband, which will ultimately boost broadband penetration.

6.1.6.3 Low utilization of capable cable TV network to provide Broadband is also an issue of great concern. The cable operators feel that cost of International Internet Bandwidth and high competition do not make a suitable business model. TRAI has taken number of steps like recommendations on "Terms and conditions of Resale in IPLC", "Improvement in the effectiveness of NIXI" and regulation on "International Telecommunication Access to Essential Facilities at Cable Landing Stations" to reduce International Internet bandwidth charges. It is hoped that with these initiatives, the cost of International Internet Bandwidth and Domestic Leased Circuits (DLC) will reduce. This will encourage better utilization of cable network capable to provide Broadband services.

The Authority recommends that:

- **Looking at the large coverage of cable TV networks, Cable Operators should be encouraged to provide broadband over their network.**

6.1.7 Broadband through DTH

6.1.7.1 Direct to Home (DTH) is proliferating quickly in urban areas and is presently meant for broadcasting of TV channels only. It can be utilised for downlink path for providing broadband connection with a download speed up to 1.5 mbps. DTH uses Ku band (10-18GHz) to

maintain smaller disc size (40-60Cm) at customer premises. Presently limited Ku band transponders are available from satellites collocated in the similar Geo stationary orbit, which may limit the growth of DTH services to provide broadband as additional transponders will be required for expansion. Indian Space Research Organisation (ISRO) is planning to launch two more satellites with Ku transponders in near future. In addition ISRO is also is in negotiations with Malaysia for leasing transponders from Malaysian satellite MEASAT. Such activities need to be expedited.

6.1.7.2 Broadband through DTH will be a viable option for both urban and rural areas provided broadband uplink cost is reasonable. Presently Cost of accessing internet through dialup is Rs. 30 per hour (Rs 24/- for dialup access and Rs 6/- for Internet access), whereas cost of accessing internet through wireless networks (GSM & CDMA) is approx. Rs 36/- per hour, which also includes access and internet browsing charges. While DTH can support mush higher BW, wireless at present can support very limited speed. There is a need to provide more flexibility to provide uplink access and reduce Internet access charges to increase broadband penetration using DTH. It is expected that service providers will provide suitable tariff plans for uplink access to make it easily accessible and affordable. This will also encourage number of other interactive multimedia applications.

The Authority recommends that:

- **In order to enable the expansion of DTH services in the country, Govt. should ensure availability of more number of Ku band transponders. This will also encourage the service providers to roll out broadband through DTH platform.**

6.1.8   Broadband through Satellite

6.1.8.1 Satellite communication can also be used very similar to DTH to provide broadband; but it will be two way communications and will not require separate return path through other modes for uplink communication. The satellite media can offer easiest and fastest method to deploy broadband connectivity across the country. Though it will be especially useful in spreading broadband connectivity in remote and inaccessible areas; it can also provide connectivity in semi-urban areas and out skirts of the cities.

6.1.8.2 Satellite based broadband will also be useful where content is of broadcast/ Multi-cast nature (IPTV, VoD etc). Tele-education, Agriculture procurement and supply chain are some of the examples where such broadband connectivity will be useful.

6.1.8.3 Satellite broadband is presently deployed in Ku and Ka bands. While large volumes are still rolled out using Ku band; Ka band is upcoming technology as a better alternative especially when there is shortage of spectrum. Ka band usages a spot beam and spectrum re-

use technique that allows satellite broadband technology to reuse spectrum across the geographic areas and reduce the overall spectrum requirement. Availability of Ka band is limited in India at present.

6.1.8.4 While cost of the satellite equipments has reduced to great extent, there is high custom duty component (AD, NAD). High transponder cost, Internet bandwidth cost and custom duty make broadband through satellite costly as compared to other prevailing technologies. Government may consider reduction of custom duties and other regulatory charges on satellite to provide broadband to widely distributed areas.

6.1.9   Broadband through Optical Fibre

6.1.9.1 Fiber is a very good option for providing broadband services requiring high speed Internet. This technology has no limit as far as upstream and downstream bandwidths are concerned.   Though the technology is prima facie mature and established, it has a much lower installed base compared to DSL/cable. Fiber-Ethernet technology is picking up and will certainly become key `wired' network of future. Availability of fiber in local access network in our country is limited. Fiber mainly available in long distance network (approx. 7 lakh Route Km).

6.1.9.2 Most of the Access Providers and National Long Distance Operators (NLDOs) are laying very limited fiber in access network and mainly concentrating on wireless, as cost of Right of Way (RoW) is very high. Due to high cost of

leasing a fiber, it is mainly used for high capacity bandwidth requirements. The telecom industry is passing through new revolutions where value added services will play major role. These services are bandwidth hungry and their demand will increase day by day. Hence in times to come wireless may not be able to support huge bandwidth requirements. Therefore urgent actions have to be taken immediately to encourage penetration of optical fiber in urban area. RoW is one of the major impediments in laying of optical fiber cable which needs to be considered on priority basis.

6.1.10 Streamlining Right of Way (RoW):

6.1.10.1 For creating the new access network/ infrastructure, service providers are required to lay optical fiber cables/copper cables with-in cities/towns along the existing roads. Before laying the cables they have to approach municipalities / local authorities for obtaining Right of Way (RoW). These authorities take longer time in granting RoW. Sometimes operators have to approach multiple agencies for obtaining RoW clearance, which not only delays the rollout plans of the service providers but also increases the cost.

6.1.10.2 For granting RoW, municipalities / local authorities levy fees and bank guarantee from service providers. These charges are not uniform across the country. Some of the stakeholders mentioned that RoW charges are very high, not uniform and at times ranges from Rs 1000 to Rs 2000 per meter.

6.1.10.3 Obtaining right of way clearances has proven to be a major hurdle in rolling out new infrastructure which requires laying of cables & optical fibers and thereby restricting provisioning of advanced broadband services in a time bound manner. RoW is one very important factor which dissuades service providers to venture into creation of new infrastructure for telecom services/broadband services.

6.1.10.4 Some of the stakeholders also raised concerns ban by municipalities on open trenching in all the seasons even for fault repairing. It was also mentioned that in some of the cities the municipality does not allow to work in day time even though the work is not obstructing the public convenience.

6.1.10.5 Some of the stakeholders mentioned that the agencies granting RoW do not have data base of the existing underground utilities created for public convenience. In the absence of this information the telecom operator end-up damaging the existing utilities even though they take at-most precaution during execution. These damages force the telecom operator to pay heavy damage charges to the respective utility agency.

6.1.10.6 The RoW to all operators should be available on restoration basis as otherwise it may not be economically viable to roll-out new telecom services. Expeditious approvals for right-of-way clearances to all service providers are critical for timely implementation of telecom networks. The Central/ State Government /

Local bodies / Ministry of Surface Transport etc. should take necessary steps to facilitate the same.

6.1.10.7 In order to facilitate the timely rollout of cost effective access network, a committee should be formed at district level to study RoW requirement, which will obtain a firm demand from all operators for laying OFC. A time frame should be fixed for all the operators to coordinate and lay their cables. The uniform restoration charges should be prescribed. All such coordination should be done on single window clearance basis in a well defined time bound manner.

6.1.10.8 There are three possible options for streamlining RoW:

    i)   All the service providers should form a consortium and jointly construct the duct by sharing the construction cost.

    ii)   Infrastructure Provider category-I (IP-I) should be encouraged to build ducts in the districts after obtaining firm requirement from service providers. All the operators may be mandated to share such ducts.

    iii) Municipalities may build ducts itself and expenditure of laying ducts may be shared among the operators either by outright purchase or by rentals as per business model.

6.1.10.9 Service providers also lay cable along the highways and at present no RoW charges are fixed. The clearance procedure is lengthy and time consuming. In case the cable crosses the forest or railway track, operators also

have to obtain the clearance for concerned authorities. Such authorities not only take separate charges but also consume a lot of time in giving clearance.

6.1.10.10 To avoid such hassles, National Highway Authority of India should obtain firm demands from service providers for specified period say 5 years and build ducts along the highways. The cost of such construction should transparently be informed to service providers and taken either on outright upfront basis or as rentals as per the business model.

6.1.10.11 TRAI had recommended some measures for streamlining RoW procedure in its recommendations on 'Growth of Internet and Accelerating Broadband penetration in India'.

6.1.10.12 **In order to encourage service providers for rolling out new infrastructure and providing advanced broadband services in a timely manner the Authority recommends that:**

- **A committee needs 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/ rationalise RoW cost, which may primarily be limited to cost of re-instatement only. RoW costs should be non-discriminatory, reasonable. RoW procedures should be transparent and publicly available.**

6.1.11   Broadband through Wireless in urban areas

6.1.11.1 There are approximately 31.30 million wireless Internet subscribers at the end of March 2007 who are accessing Internet through the wireless networks of Cellular Mobile Service Providers (CMSPs) and Unified Access Service Providers (UASLs). These subscribers cannot be treated as broadband subscribers at present, as access speed in such cases is less than 256 Kbps. The penetration of wireless handsets capable to support high speed Internet is increasing day by day. It is expected that approx. 10% of present wireless internet subscribers will switch to 3G enabled handsets, and easily get broadband when 3G services are rolled out. Cost of 3G handsets is also decreasing, which will enable more subscribers to use 3G services and hence more number of broadband subscribers. However, spectrum for 3G services is not allocated at present.

6.1.11.2 Another wireless technology WiMAX has the potential to provide both fixed and mobile high speed internet services in urban area. Fixed WiMAX is based on IEEE 802.16-d standards, while mobile WiMAX is based on

IEEE 802.16e standards and operate in the 2.3 GHz, 2.5 GHz, 3.3 GHz, 3.4-3.8 GHz spectrum bands. Although 2.4 GHz and 5 GHz non-licensed bands are also available for WiMAX deployment, their usage could be limited to trials because of the risks of interference preventing QoS commitments. So far WiMAX Forum has certified 30 products for fixed WiMAX. Certification of mobile WiMAX equipments is going on and the first certified products is expected in first quarter of 2008.

6.1.11.3 Cost of WiMAX mobile CPEs is high at present due to limited deployment and consequent low volume of CPEs. The cost is likely to come down with increasing availability.

6.1.11.4 In addition to the use of WiMAX in access (point to multipoint), it can also be used for the backhaul (point to point) purposes. Combination of WiFi in access and WiMAX in backhaul can be a good option to provide broadband in urban as well as rural areas. Municipal corporations of Pune and Delhi are planning to deploy citywide wireless network using this combination.

6.1.11.5 Non-availability of spectrum for 3G and WiMAX is the major impediments for their deployments. In order to expedite the provision of broadband using these technologies there is an urgent need for allocation of spectrum for 3G and WiMAX.

6.1.11.6 The Authority in its recommendations on "Allocation and pricing of spectrum for 3G and broadband wireless access services" has already recommended the

mechanism and pricing of Spectrum for 3G and Broadband Wireless Access. These recommendations are still pending with the Govt. and need immediate action.

The Authority recommends that:

- **Government should expedite decision on TRAI's recommendation regarding mechanism and pricing of Spectrum for 3G & Broadband Wireless Access.**

- **Spectrum for 3G & WiMAX should be made available at the earliest to boost the deployment of broadband using these technologies.**

6.1.12 Broadband enabled buildings

6.1.12.1 Presently in Metro and nearby suburban areas construction of multiple dwelling units (MDUs) like apartments, housing societies, and shopping malls is on the rise. Lot of new multimedia applications like VoIP, IPTV, e-commerce, online gaming, video & audio on demand, e-education, online booking of Railway & Air tickets, e-filing of Tax returns etc. will drive residents of such buildings to go for broadband connections.

6.1.12.2 Number of such applications are bandwidth hungry and increasing day by day, which will drive subscribers to go for very high bandwidth in years to come. Therefore there is a need to take action to encourage broadband enabled buildings/dwelling units in metros and major cities.

6.1.12.3 Presently in MDUs no centralised infrastructure is provided for providing broadband connection. A service provider has to lay cable till the subscriber's house, which is very cumbersome and is not so cost effective.

6.1.12.4 Broadband in residential MDUs will become the next utility after gas, water and electricity. These buildings can be made broadband ready by internal wiring. Service providers can provide broadband service to all the occupants by connecting at single point of appropriate bandwidth to such buildings. Such connectivity can be provided through fibre or wireless. This makes a viable business case for service providers to provide affordable broadband connections in such buildings and very convenient to the users. Much better QoS can be ensured in such well planned environments.

6.1.12.5 In order to encourage broadband enabled buildings, Municipal committees may be asked to include a clause for making such buildings broadband ready by providing internal wiring while giving clearance for the construction of all such buildings in future. This will provide a boost to broadband growth in the country for a longer duration and ensure readiness of such houses to have high capacity broadband in near future. It will not be out of place to mention that such practices are being followed in many countries abroad.

The Authority recommends that:

DoT should encourage through state governments that all Municipal committees include a clause for making Multiple Dwelling Units/ buildings broadband ready by internal wiring while giving clearance for the construction of all such buildings in future. This will help to create infrastructure to provide broadband in future and will be very convenient to users.

6.1.13 Other Initiatives

6.1.13.1 There are 1.3 million always on Internet subscribers using technology, which can support broadband but use access speed less than 256 kbps due to high cost of internet bandwidth. If the cost of inputs like international internet bandwidth and domestic bandwidth can be further reduced to make broadband more affordable, these subscribers can switch over to broadband.

6.1.13.2 TRAI has already sent its recommendations on "Terms and conditions of Resale in IPLC" on 23rd March 2007 and "Improvement in the effectiveness of NIXI" on 20th April 2007. These initiatives would substantially bring down ISP's expenditure on domestic and international bandwidth and will further reduce the Broadband charges as bandwidth charges amount to approx. 65% of total cost for providing Broadband services.

6.1.13.3 These recommendations are still pending with the Govt. and need expeditious action.

The Authority recommends that:

- **Govt. should expedite the action on TRAI's recommendations on "Terms and conditions of Resale in IPLC" and "Improvement in the effectiveness of NIXI". This will reduce internet bandwidth cost and will encourage customers to switch over to broadband.**

6.2 Broadband in Rural areas

6.2.1 The skewed development of Broadband is bothering the planners as well as service providers to revisit the broadband deployment strategy otherwise digital divide between urban and rural populace will further increase. It is also an accepted fact that present state of other infrastructure in rural areas, except a few progressive States, is far from satisfactory. Broadband growth cannot be taken as complete unless rural areas also get the benefit of broadband and contribute to its growth.

6.2.2 Presently broadband penetration in the rural areas is very limited. To achieve the targets of Broadband Policy, there is a need to proliferate broadband in rural areas. Some of the limitations for broadband growth are as follows:

    i)   Backhaul cost is very high
    ii)   Absences of good business model, as operators are not sure about minimum number of subscribers and financial returns per month.
    iii) Low PC penetration
    iv)   Low English literacy

6.2.3 While deciding technology alternatives, it is necessary to understand that initially concept of community center will pickup in rural areas. Therefore to start with, efforts must be made to provide broadband connectivity to community centers in villages at affordable cost. The problem of erratic power supply, which is a serious impediment, can also be solved if we concentrate only on community centers.

6.2.4 Broadband through DSL in rural areas

6.2.4.1 Today, the main advantage of DSL and cable is the cost of ownership. The CPE and overall cost of DSL is low and hence affordable, and ripe for mass consumption. Though DSL can also be used to provide broadband, penetration of copper loops is not widely spread in rural areas and in some cases length of copper loop does not support DSL.

6.2.4.2 BSNL has very extensive network with 20000 rural exchanges connected through optical fiber. It can be utilised to provide broadband using DSL within 3-4 Km area around such exchanges. However, there is a huge delay in implementation by BSNL as procurement of equipments is time consuming. There is a need to expedite provisioning of broadband in these areas in time bound manner.

6.2.5 Broadband through Satellite

6.2.5.1 Creating infrastructure to provide connectivity to remote and difficult terrain will be very difficult and requires substantial cost. Satellite is a very effective media to

provide broadband connectivity to such areas. Satellite is also good option for providing broadband in hilly areas like Northeast, J&K, HP, Uttrakhand etc. However, high cost of providing broadband over satellite indicates that it is not a viable business case and needs to be subsidised for providing broadband services in rural, hilly terrains and remote areas that have no other real broadband options. Suitable incentive schemes need to be worked out so that broadband can be provided in rural, remote and far flung areas. USO fund may be utilised to provide subsidy for provisioning of broadband services through satellite in remote and hilly areas. The amount of subsidy may be limited to the difference of cost of providing broadband through satellite and through other prevailing technologies.

6.2.5.2 In USA, Australia and Canada subsidy is being provided to service providers for provisioning of broadband services in remote and rural areas.

6.2.5.3 DTH can also be utilised for providing broadband connectivity in rural areas. As already discussed in chapter 3 uplink connectivity can be provided through EDGE/GPRS and Govt. is envisaging rollout of mobile services in rural areas with USO Fund support. Therefore broadband through DTH will make a viable business model in rural areas also.

The Authority recommends that:

- **USO fund may be utilised to provide subsidy for provisioning of broadband services through satellite in remote and hilly areas. The amount of subsidy may be limited to the difference of cost of providing broadband through satellite and through other prevailing technologies. Public private partnership need to be encouraged to provide advantage of such facilities to rural masses by encouraging various value added applications.**

6.2.6 **Broadband through Wireless in rural areas**

6.2.6.1 Wireless technologies usually provide a competitive broadband access solution in areas with no communications infrastructure, or where the existing infrastructure cannot be easily and economically upgraded. Wireless is suitable for harsh landscapes and lightly populated areas. Wireless access technologies allow direct connections between the subscriber and the access hub without the need for wire lines (whether fibre, coaxial cable or twisted pair cable).

6.2.6.2 **WiFi**

6.2.6.2.1 WiFi is a cheaper technology and can provide good coverage in villages with few access points. This will be very effective to increase broadband penetration. 2.4 GHz band has already been de-licensed and therefore can be used effectively for this purpose.

6.2.6.2.2 IIT Kanpur has undertaken a project, called Digitial Gangetic Plains, for connecting infokiosks in Kanpur and Unnao districts of Uttar Pradesh to IIT Kanpur using WiFi. Directional parabolic grid antennas (2.4GHz 24dBi) are used to establish point to point links.

6.2.6.2.3 Presently only low power outdoor usage of WiFi is permitted. The increase in power radiation in rural areas for this purpose can be considered in a limited way. Some selected sites may first be permitted for deployment and based on the experience; decision for its generalization can be taken.

6.2.6.3 **WiMAX**

6.2.6.3.1 WiMAX is an option for backhaul in rural areas, as it can be utilised for access as well as backhaul purpose.

6.2.6.3.2 WiMAX can provide speeds upto 14.4 Mbps and likely to support much higher speeds with further advancement. WiMAX as claimed can provide a coverage upto 50 Kms in line of sight (LoS) environments and 15 Kms in non line of sight environments. The WiMAX Forum has estimated that new WiMAX equipment will be capable of sending high speed data over long distances (40 Mbps over 10 kilometers in a line-of-sight fixed environment). At these distances, WiMAX equipment could play a key role in helping bridge the digital divide as long-distance wireless links could help deliver higher-

speed access to areas traditionally out of reach of fixed-line networks.

6.2.6.3.3 Presently cost of WiMAX CPEs is high, which likely to come down with advancement of technology and large scale deployment.

6.2.6.3.4 For providing broadband in rural areas combination of WiMAX in backhaul and WiFi in access is a good option. However, spectrum for WiMAX is not allocated so far.

6.2.6.3.5 Though broadband in rural areas has been covered under USO fund, for identifying broadband providers using other technologies like WiMAX, no plan has been worked out. If allocation of WiMAX spectrum is to be done on auction basis, it is to be ensured that selected service provider who get spectrum are also considered for USO fund subsidy on the basis of prescribed guidelines.

6.2.6.4 **3G**

6.2.6.4.1 3G will be able to providing high speed data connectivity for enabling easier and affordable access to e-governance, e-learning and e-commerce programs in rural areas. These have often failed in the past due to the unreliability and high cost of niche wireless connectivity options and low fixed-line penetration.

6.2.6.4.2 Government recognising the importance of 3G in spreading high speed internet connectivity in rural areas has decided to subsidise the provision of

broadband using 3G in rural areas. However, non availability of spectrum is the main constraint in rolling out the services.

6.2.7 Sharing of Backhaul

6.2.7.1 Technological options like combination of WiFi & WiMAX or 3G will be very useful. The cost of creating backhaul infrastructure in rural areas is substantial, which acts as a deterrent for a new operator. There is need to encourage new entrants in rural areas for installing their backhaul by providing incentives.

6.2.7.2 The broadband penetration in rural area will be initially dominated by Community Centers, Schools, Panchayats, health centers etc. and therefore viability of such projects will directly be related to operational cost. The high leased line cost for backhaul is working as deterrent and needs to be subsidized to support Broadband penetration in rural areas.

6.2.7.3 TRAI in its recommendations on growth of Telecom services in Rural India dated 3rd October 2005 recommended that backbone sharing in rural area be mandated. The operator using the backbone shall pay only 70% of the cost of the link based on the tariff fixed by TRAI. The link provider shall get 10% incentive over the TRAI fixed rate for mandatory sharing. 40% of the cost of such links based on TRAI fixed price shall be reimbursed from the USO fund. This will increase the availability of the back haul and help in increase the penetration of the broadband in rural areas.

Since broadband penetration in rural areas is very low and 65% operational expenses will be in terms of Bandwidth requirement, initially subsidy upto 40% will be desirable including cost of International Internet Bandwidth.

The Authority recommends that:

- **USO fund may be utilised to subsidise backhaul charges including International Internet Bandwidth initially for a period of 3 years to support the rollout efforts to provide broadband service. It may be reviewed subsequently.**

6.2.8 USO support for Broadband

6.2.8.1 With an aim to provide impetus to growth of broadband in rural areas, Govt. has decided to cover broadband under Universal Service Obligation fund (USOF) scheme. Support from USO Fund will be provided for broadband connectivity. It has been envisaged that broadband can be provided using 3G, other wireless technologies, existing copper or optical fiber network. With USO fund assistance, 10000 towers are being established for provisioning of mobile services. Three service providers have already been identified to ride in 81 selected clusters. This infrastructure can effectively be used to provide broadband also.

6.2.8.2 USOF Administrator is already exploring the possibilities to provide Broadband using different technologies. Selection of the service provider and technology will be

important to roll out Broadband services effectively in time bound manner. The roll out of services will depend on availability of the spectrum. Hence while selecting the service provider, it must be considered that adequate spectrum is available with the service provider to roll out services as spectrum is proposed to be allocated based on auction process.

6.2.8.3 Concerns are also raised from time to time regarding number of operators to be identified in a particular area and whether preference should be given to any particular technology. The broadband business in rural and remote areas is going to be very limited at least to start with. Hence it will be argued that only one service provider should be selected to provide broadband in such identified area and subsidy be provided from USO Fund. This will at least give him some business scope to develop and sustain in times of come. The counter argument will be that selection of just one service provider may create monopoly in the area and development efforts may not penetrate to rural areas in real sense. In fact whole plan to cover rural areas may get upset due to failure of this identified service provider. It is therefore suggested to prescribe some roll out obligation and USO subsidy to be provided in a phased manner linked with roll out obligation.

6.2.8.4 In view of above discussions and considering the past experience identification of at least two to three service providers per area will be desirable. This will not only increase competition but also facilitate launch of new

services to increase popularity of Broadband. As far as technology options are concerned, TRAI is technology neutral and therefore any technology suitable to provide broadband should be permitted. The choice of technology should be left to the service providers, considering their own business model.

The Authority recommends that:

- **As TRAI has already recommended allocation of spectrum for various wireless technologies capable to provide broadband on floor price or through auction, a precondition for selection of service provider identified for USO Fund subsidy to provide broadband should have spectrum for suitable technology.**

- **In order to increase the competition, more than two service providers seeking minimum subsidy should be identified. Roll out obligation should be prescribed to ensure the establishment of network and USO subsidy to be provided in a phased manner based on roll out aspect.**

6.2.9 **Other Initiatives:**

6.2.9.1 **High Cost of PC and other access devices** commonly known as **CPEs** is also acting as a major impediment in the spread of broadband & Internet connectivity in India. This fact has been recognized by the regulator as well as Government. Incumbents are also aware of the fact and some actions have been initiated by them to some what nullify its effect. One of the incumbent operators has started bundling CPE cost along with broadband tariff plans and it has been observed that there has been a good response to this scheme of the incumbent. Another major

service provider has also tied up with a PC manufacturer to offer customer friendly bundled tariff plans for the customers. Such type of bundling of cost of subscriber terminal with tariff plans has provided much needed impetus to the growth of mobile subscribers earlier and it is hoped that such polices by the service providers will also spread broadband connectivity quickly.

The bundled CPE with Broadband tariff plan are being provided by major operators in big cities only.   Further no special incentive has been announced by the operators for remote/rural areas. Even marketing of such schemes is not being promoted in rural areas. Many prospective subscribers are even not aware of such schemes. This is holding the popularity of such schemes resulting in slow growth of broad band.

Some of the stakeholders suggested that Corporates may be allowed higher rates of depreciation in case of computers and related peripherals so that the same can be written off in one year. The used IT hardware may then be recycled and donated to educational institutions and corporate may be incentivised by way of fiscal benefits to recycle/donate their hardware for educational and social purposes.

TRAI in its recommendations on "Accelerating Growth of Internet and Broadband Penetration" date 29th April 2004 recommended several measures for making PC and other access devices affordable.

6.2.9.2 **Content**

Presently most of the Internet based content is in English and the English literacy rate in India is quite low i.e. around 5%. A lot of international bandwidth (IPLC) is being consumed for this Internet content paid service just because of the reason that at present most of web-hosting is outside India (mainly US) and lot of internet traffic goes out of India. There is a need to promote web-hosting industry in India as it will automatically give boost to internet and broadband growth. It is important to note that web-hosting in India is costly and thus becomes un-competitive as compared to international standards.

TRAI in its recommendations on "Accelerating Growth of Internet and Broadband Penetration" date 29th April 2004 recommended measures for developing content and applications.

Chapter 7

SUMMARY OF RECOMMENDATIONS

7.1 Broadband in Urban areas

7.1.1 Broadband through DSL

The Authority recommends that:

- Government should increase the target fixed for BSNL and MTNL for provision of broadband connections during 2007-08. For this purpose BSNL and MTNL should be encouraged to appoint franchisees for providing broadband services to supplement their efforts. There should be total flexibility in developing a commercial model. Close monitoring be prescribed to ensure effective utilization of the local loop. Any procedural restrictions/ limitations should be addressed immediately.

- TEC should undertake certification of different CPEs model for interoperability for provisioning of the broadband. All CPEs conforming to specifications for interoperability should be displayed on TEC website for the information of customers.

- Incumbents may declare future plans for providing broadband using DSL technology to encourage manufacturing of CPEs within country.

7.1.2 Broadband through Cable TV Network

The Authority recommends that:

- **Looking at the large coverage of cable TV networks, Cable Operators should be encouraged to provide broadband over their network.**

7.1.3 Broadband through DTH

The Authority recommends that:

- **In order to enable the expansion of DTH services in the country, Govt. should ensure availability of more number of Ku band transponders. This will also encourage the service providers to roll out broadband through DTH platform.**

7.1.4 Streamlining RoW procedures

The Authority recommends that:

- **A committee needs 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/ rationalise RoW cost,**

which may primarily be limited to cost of re-instatement only. RoW costs should be non-discriminatory, reasonable. RoW procedures should be transparent and publicly available.

7.1.5 Broadband through Wireless

The Authority recommends that:

- Government should expedite decision on TRAI's recommendation regarding mechanism and pricing of Spectrum for 3G & Broadband Wireless Access.

- Spectrum for 3G & WiMAX should be made available at the earliest to boost the deployment of broadband using these technologies.

7.1.6 Broadband enabled buildings

The Authority recommends that:

- DoT should encourage through state governments that all Municipal committees include a clause for making Multiple Dwelling Units/ buildings broadband ready by internal wiring while giving clearance for the construction of all such buildings in future. This will help to create infrastructure to provide broadband in future and will be very convenient to users.

7.1.7 Other initiatives

The Authority recommends that:

- Govt. should expedite the action on TRAI's recommendations on "Terms and conditions of Resale in IPLC" and "Improvement in the

effectiveness of NIXI". This will reduce internet bandwidth cost and will encourage customers to switch over to broadband.

7.2   Broadband in Rural areas

7.2.1 Broadband through Satellite
The Authority recommends that:

- **USO fund may be utilised to provide subsidy for provisioning of broadband services through satellite in remote and hilly areas. The amount of subsidy may be limited to the difference of cost of providing broadband through satellite and through other prevailing technologies. Public private partnership need to be encouraged to provide advantage of such facilities to rural masses by encouraging various value added applications.**

7.2.2 Sharing of Backhaul
The Authority recommends that:

- **USO fund may be utilised to subsidise backhaul charges including International Internet Bandwidth initially for a period of 3 years to support the rollout efforts to provide broadband service. It may be reviewed subsequently.**

7.2.3 USO support for Broadband
The Authority recommends that:

- **As TRAI has already recommended allocation of spectrum for various wireless technologies capable to provide broadband on floor price or through**

auction, a precondition for selection of service provider identified for USO Fund subsidy to provide broadband should have spectrum for suitable technology.

- In order to increase the competition, more than two service providers seeking minimum subsidy should be identified. Rollout obligation should be prescribed to ensure the establishment of network and USO subsidy to be provided in a phased manner based on roll out aspect.

Status of TRAI's recommendations on "Accelerating Growth of Internet and Broadband Penetration"

Recommendations Accepted by Govt.:

i) Broadband definition, Goals for Internet and broadband subscriber base and penetration.

ii) Allowing Internet service provision to multiple distinct customers using VSAT infrastructure suitable amendment to clauses 2.2 (iii) and 2.3 of VSAT license.

iii) Streamlining the clearance process from WPC and SACFA

iv) Waiving off the requirement for SACFA and WPC clearance for receive-only VSAT installation.

v) Waiving off the requirement for SACFA and WPC clearance for DTH installation with Receive Only Internet.

vi) De-licensing of bands 2.4 – 2.48 GHz for low power outdoor use and 5.15 – 5.35 GHz band for the low power indoor use of WiFi systems.

vii) De-licensing of 5.725-5.85 GHz band to facilitate deployment of Wireless access for broadband.

viii) Allowing provision of Internet services via DTH platform.

Recommendations which were not accepted:

i) Recommendations pertaining to Local Loop Unbundling.

ii) Removal of restriction on minimum size and throughput for VSAT services

iii) Concessions of 2% in license fee to the VSAT and DTH operators.

iv) Reduction of WPC charges from 4% to 1% of AGR and excluding sale of VSAT hardware from the licensee fee.

v) Exempting from spectrum royalty fees for DTH operators for up linking from within India.

vi) Recommendations pertaining to Streamlining Right of Way (ROW).

vii) Mandating Access Providers to provide local links to backhaul operators in a time bound manner subjected to technical feasibility.

viii) Waiving off of license fee and bank guarantee for infrastructure provider category II (IP-II) and waiving off of Portion of license fee on lease line revenues of BSOs/USAL, NLDOs and ILDOs.

International Experience

1. Australia

The Australian Government announced the Australian Broadband Guarantee program in March 2007 by committing $162.5 million to provide subsidised Internet access for Australians currently unable to gain a reasonable access to broadband service at their principal place of residence or small business.

Under this program consumers are required to check the availability of suitable broadband services in their area through the program's Broadband Locator, available at the website of Dept of Communications, Information Technology and the Arts (DCITA). If there is no service available to their premises they can receive a subsidised service.

Internet service providers can apply to register under the Australian Broadband Guarantee subject to certain conditions, and once registered, will receive a payment for every eligible premise connected to one of their registered Australian Broadband Guarantee services.

There are two levels of payments

- ➢ High cost payments set at $2500 for satellite services only.
- ➢ Low cost payments set at $1000 for terrestrial services.

Australian Broadband Guarantee services are price-capped and providers are required to perform at a guaranteed minimum level of service.

The first phase of the program will end on 30 June 2008 when it will be reviewed. If required, the program will continue in remote areas where

high quality broadband services might still not be available and Govt. will provide funds from its $2 billion Communications Fund from 1 July 2008.

The Guarantee is part of the transition to the $600 million Broadband Connect Infrastructure Program, which is aimed to establish an efficient, sustainable broadband infrastructure base across regional Australia to enable the roll-out of higher speed broadband.

2.   USA

The US Department of Agriculture (USDA) initiated programs under Rural Utilities Service (RUS) to provide grants to improve rural infrastructures providing broadband service.

One such program is Rural Broadband Access Loan and Loan Guarantee Program, which provides loans for the construction, improvement, and acquisition of facilities and equipments for broadband service in eligible rural communities. A wide variety of entities are eligible to obtain loans to serve small rural communities. Priority is given to applications that are proposing to serve areas where no residential broadband service currently exists.

Since its inception, the program has approved 70 loans in 40 states, totaling over $1.22 billion. The broadband loans serve 1,263 communities with a total of 582,000 household subscribers. Approximately 40 percent of these communities were unserved at the time of the loan approval, and an additional 15 percent had only one provider.

Another program, the Community Connect Program provides grants to deploy transmission infrastructures to provide broadband service in communities where no broadband services exist, and requires grantees to wire specific community facilities and provide free access to

broadband services in those facilities for at least 2 years. Grants can be awarded to entities that want to serve a rural area of fewer than 20,000 residents. Approximately $9 million was appropriated in 2004 as well as in 2005 for this purpose.

3.   Canada

The National Satellite Initiative was launched in October 2003 by Industry Canada in partnership with Infrastructure Canada, and the Canadian Space Agency. It was created to make available affordable satellite capacity for the deployment of broadband services (such as tele-health, tele-education, e-commerce, etc.) to communities in the far to mid-north, and in isolated and remote areas of Canada, where satellite technology is the only practical solution. The Government of Canada has contributed $155 million towards the costs of implementing this initiative. Of the $155 million, $85 million provided from the "national priority project envelope" of the Canada Strategic Infrastructure Fund. Canadian Space Agency provided $50 million in form of satellite capacity. Industry Canada contributed $20 million through additional satellite capacity for public benefit.

4.   Colombia

In 2005, the Colombia government budgeted US$ 25.5 million for providing broadband connectivity for public institutions, including 3,000 public schools, 624 city halls, 120 public hospitals and 30 military facilities. Compartel (Colombian USO Fund) also provided US$ 20 million to upgrade infrastructure to provide broadband services to rural and low income areas.

5.   Brazil

E-Government - Services for Citizens (GESAC) is a Brazilian Government initiative for taking broadband to the communities situated in isolated and underserved areas. The project implemented by Ministry of Communications is comprised of over 3.200 localities connected through satellite, providing services like Web access, Web pages hosting, e- mail and training. Priority is given to the communities with the lowest Human Development Index (HDI). Ministry of Communication also made agreements with various ministries like Social development Ministry, Defence Ministry for leveraging the infrastructure.

Using satellite-based broadband access to the Internet, distant schools, advanced military posts, rural and border settlements and hospitals located in the most remote regions have been connected.

These centres are also used by the Social Ministry to work as Telecentres offering following services:
- Validate cards which poor people will use to by food
- Work as development centre to the community in order to market local goods

Currently, the **GESAC** is present in 3-4 per thousand points of the domestic territory and is supposed to jump for 20 per thousand up to 2008.

Gist of Stakeholders' comments

1. USOF

Backhaul charges including international bandwidth are of recurring nature. It has been suggested, that USOF should subsidize up to 40% of the cost of such links based on TRAI fixed price. However, no mention has been made of the time period from which subsidy should be given. While the word "initially" has been used, it would be appropriate for TRAI to recommend the number of years for which such subsidy should be paid.

2. Federation of Salem District Consumer Organisation

The Members of Public feel the rent of Broadband connection is too much. Hence the rental charges may kindly be reduced from Rs.250/- to Rs.150/-.

3. AUSPI

(a)   Unbundling of Local Loop

The competition is limited in wire line and skewed heavily towards the   incumbents whose market share in wire line is nearly 83% which should be considered as a national resource (built over the years from Government exchequer) for unbundling as suggested by TRAI in 2004. The unbundling puts competitive pressure on incumbent operators and hasten its efforts for expansion of market and services. Therefore unbundling of local loop is important to expand broadband services and optimally utilize the huge potential of the ubiquitous copper network of incumbents. We request the Authority to send its earlier recommendation on unbundling of local loop again to the government for reconsideration.

(b)   Fiscal Incentives

o Cent percent depreciation for PCs, STBs etc in the first year itself so that the same is available in resale market.

o Zero customs duty with no CVD for imported broadband equipment and parts.

o Zero Excise duty for procurement of indigenous broadband equipment.

o No entertainment tax (currently upto 30% in some states) applicable to broadband in the short and medium term.

o Service tax waiver for broadband services.

o Spectrum allocation especially in 2.5 GHz for faster deployment of broadband should also be considered as a measure to boost competition in this sector.

o USOF support for developing Applications and Contents in local language etc for the benefit of rural folk.

o Tax status for expenditure on connectivity / usage (similar to policies for other public welfare services such as education allowance, medical allowance etc).

(c) Right of Way (RoW)

Right-of-way is a critical requirement for roll out of telecom networks. In addition, service providers require access to in-building wiring in multi-unit buildings in order to supply services to customers. There has been increasing resistance from municipalities for giving access to such vital infrastructure requirement. Right of Way access should be available in time.

The expense incurred for RoW permission particularly in the Metros is highly disproportionate to even the Broadband equipment and installation costs. The state governments should rationalize the RoW costs to enable faster uptake of broadband in the country. The Authorities suggestion for mandating the state governments to adopt uniform RoW procedures and rationalize RoW charges shall be a major impetus for Broadband services.

AUSPI also requests the Authority to make the following additional recommendations to the State Governments:

(i) Modification of the building and Co-op society by-laws to make it mandatory for them to invite Broadband service providers to get the building broadband enabled by at least @ 10 Mbps per household. They should provide free space for electronics and permit in-building cabling to facilitate connection of Broadband to each house or customer unit.

(ii) Municipal authorities to provide blanket clearance to connect street furniture of upto size 100 cm* 80cm*30cm

without any restriction and also provide for upto 100 watt of power for each such cabinet.(like a street lamp)

(iii) City civic authorities should declare safe hours (time slot of 8 hours) when any maintenance related to optical fibre or broadband cable jointing/repair is allowed up to a stretch of 15 meters without any permission.

(d) Support from USOF for Rural Broadband

The objectives under USO for provision of broadband services in rural areas may be immediately reviewed and various projects be funded to provide backhaul connectivity to rural and remote areas which are essential to provide broadband services. AUSPI has already suggested a number of projects to the USF Administrator which are given below. The Authority may consider to recommend early implementation of these projects using funding from USF.

- Early action for USO Fund announced schemes like additional towers, infrastructure and services for rural areas.

- OFC and satellite connectivity to rural and remote areas.

  ➢ OFC and satellite connectivity for Ladakh region of J & K.

  ➢ OFC connectivity in Assam and North-Eastern region.

  ➢ OFC connectivity in Uttaranchal.

  ➢ Satellite communication links from Andaman & Nicobar Islands to the main land.

- USO Fund support for Telecommunications Satellite for providing easy communication to remote and rural areas.

- For enhancing support for rural connectivity and extending broadband services to the rural areas.

We propose USO Fund support as follows:

  ➢ Optical fibre connectivity upto all SDCCs.

  ➢ Optical fibre connectivity to BSCs & BT i.e. rural mobile towers from the nearest SDCC / Block Headquarters.

4. CASBAA

Broadband via DTH Satellites

Conversely, with regard to provision of broadband via DTH satellites, we believe that TRAI has appropriately identified expansion of competitive DTH services throughout the country as beneficial to expansion of broadband services to consumers. We join the TRAI in believing that there is today an inadequate number of Ku band transponders available to support DTH services by the range of providers who wish to offer services. TRAI has recommended that the government ensure availability of a greater number of DTH transponders; we applaud that recommendation. Separately, the TRAI has recommended to the government that one way to accomplish this would be to move toward a non-restrictive "open skies" policy for satellite services; we applaud that recommendation as well and believe that TRAI should continue its advocacy of that market-based solution to the transponder supply crunch.

Prospects and Problems of the Cable Broadband Industry

The "Going Digital" subgroup of the Planning Commission astutely observed that triple-play services – information, communications and entertainment (ICE) – piggybacking on entertainment-related applications would be in a position to create the most viable business models for the spread of rural connectivity – rural being the operative word, since much of the government's emphasis on digital broadband development and legislation has been on India's massive, largely yet to be serviced but extremely promising countryside.

The cable TV-broadband industry in the country is poised on a launch-pad. But the countdown is being delayed, or stymied, by governmental regulations that often militate against the myriad advantages of communications technologies and content. In fact, in an industry where operating platforms are rapidly converging, and more and more "broadcast" content is actually being distributed via telecom systems, for government to separate the regulation of programming supplied by cable or DTH systems from that supplied over telecom lines looks strange.

Why the broadband revenue stream is choking

The contribution from digital broadband to the Indian economy is low-key. One of the culprits is high bandwidth charges. Where wireless bandwidth is concerned, a tight hold over spectrum by Indian defence

forces has added to the challenges of making available bandwidth in public domain for other communication purpose.

With a much less taxing fiscal regime in place, broadband's contribution to the GDP is 10 times greater in China and in the UK than in India, more than 20 times greater in Taiwan, and 30 times greater in Korea.

If India could achieve half of China's current level of GDP contribution from broadband digital services, (a reasonable target, given that India's growth in other areas, including mobile phone subscribers, has overtaken China's) the addition to India's GDP would be roughly Rs. 54.6 billion (**CASBAA report on India Digital Strategy**) which would, in turn, quite likely generate an estimated 100,000 new jobs. The government's kitty too could bulge in the form of tax revenue.

Industry revenues in India illustrate the contemporary differential. While the annual turnover (subscription and advertising) of India's cable television sector is US$4.3 billion, making it one of the largest in the Asia Pacific region, only a fraction — less than US$ 100 million — flows from broadband digital services. This is both distressing and cause for optimism: the contribution is so low that it can only grow.

Cable TV networks: last-mile obstacles

This state of affairs is hardly surprising: despite its status as India's leading 'last mile' connector, the cable-TV industry in India has been unable to break into the evolutionary next stage of network upgrades and the deployment of digital television and broadband services. In modern India, cable television networks, built rapidly by private capital, are the country's most important and most dependable last-mile pipeline.

However, penetration of broadband digital services by the cable networks remains minimal and hardly any consumers subscribe to a bundle of broadband and cable TV.

Cable's last-mile infrastructure in India reaches more homes (71 million) than even the copper loop telephone infrastructure (40 million). It can be leveraged to provide cable operators with a new business model while galvanizing broadband penetration. In some nations, particularly the USA and Canada, the dominant form of access for broadband services has been the cable network.

Cable television, in countries with a critical mass of cable-connected TV homes, typically becomes a key force in driving broadband digital penetration. The cable industry's success in this regard is led by its

inherent advantage over other networks: upgrading cable networks for two-way broadband digital capability is not overly costly and 'multi-play' digital services are easily bundled for consumers over the cable pipeline that directly reaches consumers. Cable networks have the capability to generate significant new revenues for investment in network upgrades, by sourcing and promoting premium forms of video content – a luxury entertainment product that consumers will willingly purchase.

Cable systems have evolved in the US into the nation's leading broadband digital platform. In other markets around the world, from Korea to Chile, cable is a driving societal developmental force. Cable networks are also claiming pride of place as a key enabler for the delivery of new "triple play" bundles, which combine voice, data and video services.

The problem with broadbanding cable in India seems to be monetary. A core condition holding back India's cable industry from quickening its evolution into the leading digital television and broadband platform is lack of capital to fund the requisite network upgrades. Local cable operators number 30,000 or more, and are often small, serving less than 1,000 homes each. Last-mile networks, for the most part, remain narrow band and one-way. Currently, less than 10 per cent of the nation's cable homes enjoy an upgraded two-way digital cable network.

Furthermore, cable TV operators want to provide additional services like IPTV, Internet telephony and other bundled services, which the current ISP regime disallows them from providing. Migration to UASL is expensive, and this is what led the TRAI, in its recommendations on 'Unified License' on 27 October 2003, to suggest UASL be provided without spectrum.

The beginnings of some encouraging movement can be perceived on the part of the major multi-system operators, who have begun setting out long-term capital expenditure plans to acquire last mile networks, consolidate the market and upgrade networks. The multi-system operators, while committed to investment, operate in a challenging environment: in the last few years, cash flows have been severely constrained by increasingly restrictive regulations.

A necessary pre-requisite to the infrastructure upgrades is a large influx of capital. With significant new capital, cable networks in India have the potential to evolve quickly into the country's leading broadband digital platform.

Broadband through DTH

DTH seems to have been designed for last-mile broadband access. Currently, DTH is restricted to broadcasting of TV channels, and largely in urban conglomerations. Downlink paths for providing broadband connections can, however, be carved out of the present technology. Uplink (connectivity to the ISP equipment/ node) would be an independent connection most likely through dialup/GPRS/EDGE connection. Such connections will necessitate the allocation of fixed IP addresses and, as things stand, downlink bandwidth will not pose a problem.

Perhaps the major impediment to DTH uplink would be the availability of transponders in the identified geostationary satellite footprint. And, of course, India's well-known inclement weather: DTH quality of service in the Ku-band has always suffered from rain impacts.

DTH, which can provide download speeds of up to 1.5 Mbps, uses the Ku band (10-18GHz) merely in order to maintain a smaller satellite disc size. At present, only a few Ku band transponders are available from satellites collocated in the relevant geostationary orbit, which is constraining the growth of DTH services to provide broadband, since more transponders will be required for footprint and bandwidth expansion.

India could derive great benefit from using transponder capacity on international satellites. But this is prevented by the national policy of maintaining a closed market in satellite services, despite the full maturity of India's own satellite industry. TRAI has recognized this, and urged the government to move to an `Open Sky' policy and let non-Indian satellite operators directly sign long-term contracts with Indian operators of DTH services. We hope the government will take up this important TRAI recommendation; if it does not the transponder crunch may continue and severely impact propagation of broadband.

A very important ongoing debate – economically and, inevitably, politically – is whether uplink communication through *telecom networks* needs to be encouraged in order to facilitate broadband services on one-way platforms such as DTH and one-way cable networks. As things stand, TRAI says that it will "monitor industry response to provide uplink facilities to encourage non-conventional platforms to provide broadband and may interfere if felt necessary". The question is: If the authorities support self-regulation, as they frequently aver, why should interference be mentioned as such an easy option?

The RoW row

Right of Way (RoW), TRAI agrees, is "one very important factor which dissuades service providers to venture into creation of new infrastructure for telecom services/broadband services".

Obtaining RoW clearances from a plethora of agencies that have to be conferred with has long proven to be a hurdle in establishing new infrastructure that often requires laying of cables and optical fibers.

The major problems are a lack of uniformity and cohesiveness in decision-making processes about public and private RoW owners, the availability of detailed GIS maps, and the need to create new ducting infrastructure to carry data cables, even where civic projects have been recently completed and can be altered with minimal public discomfort.

The fact remains that unless this issue, which forms the very basis of much of cable TV-broadband expansion, is sorted out, and a single-window clearance procedure introduced, India's broadband infrastructure would continue to lag.

India's future: broadband or the narrow path?

Analyses from advanced markets as well as India suggests that digital television over cable networks can be one of the most important drivers of innovation and growth in the information and communications technology sector, with digital television providing a secure plinth:

- to stimulate growth in the local content industry leading to a diversity in programming never witnessed before;
- to enable a narrowing of the digital divide, opening the full potential of interactive services to parts of society that otherwise may remain excluded from a purely PC-based digital world.

Moreover, advancement of digital television and broadband services over cable networks will afford consumers the ability to choose from more than one infrastructure provider to buy advanced converged services. Consumer choice, as it stands today in leading countries, is largely between the competing infrastructure players – telecom companies via digital subscriber lines, cable operators via hybrid fiber coaxial cable, and DTH satellite operators in partnership with xDsL, cable, or wireless broadband operators. Indeed, the *tandem development* of cable broadband, and overall broadband penetration, in parts of Asia, most of Europe and almost all of the US clearly shows that countries with robust

infrastructure-based competition most often lead in overall household penetration and growth of advanced services.

It has been demonstrated the world over that digitalization has a snowball effect. In addition to macroeconomic dividends, the creative and information dissemination technology behind digitalization would massively galvanize activity within the television/entertainment sector, rendering it better financed by dual financial flows from consumers in India and abroad. These consumers would undoubtedly be prepared to pay more for better content. Niche consumers would get the specifically-tailored content they long for. Advertisers, on their part, would greatly benefit from the intrinsic ability of digital architecture to deliver more messages to a more precisely targeted audience with more meaningful content for that particular audience.

Private investment: the winner's bet

Joint development of cable TV and broadband services is a preferred route to the much-touted "convergence" for markets unburdened by old digital, or even analogue, technology. India, being one of these markets, has much to gain from such a giant leap into the electronic age.

All of the funding necessary for cable TV-broadband joint development can be mobilized voluntarily from the private sector. However, the government needs to create a supportive environment, with a positive regulatory framework. If investors, domestic and foreign, were to perceive the Indian environment for investment in broadband digital/pay-TV infrastructure as economically promising and undisturbed in the long-term, a combination of these major international players and the domestic interests who have already mobilized huge flows of capital for other industries, including telecom, would bootstrap a major upgrade of the Indian economy.

Right thoughts, wrong signals

Often enough, when TRAI suggests corrective measures, the government – in its reluctance to release its traditional control over infrastructure – waters it down till it is no longer relevant to progress on the issue. For example, even as the government allowed the provision of Internet services via DTH platforms, it turned down TRAI's recommendations pertaining to Local Loop Unbundling and the all-important recommendations pertaining to streamlining Right of Way (RoW).

India needs a coherent and realistic vision of the future from the government/regulators. There is no repudiating the fact that both cable TV and broadband are here to stay, and stimulating them to greater

synergy and greater levels of economic activity sooner rather than later will be very much in the public interest.

5. ISPAI

• ISPAI supports appointing of franchises by telcos. However, this may not be enough. We believe that all telcos must be mandated to share their infrastructure with other service providers at wholesale prices.

• Standards for CPE for DSL services are not critical impediments to broadband growth. They should be left to the market. There are few DSL providers in the country and it is quite easy for them to select specific vendor equipment that offers economies of scale.

• We hope Indian manufacturers can compete successfully with cheap imports.

• Government should ensure that cost to ISPs of spectrum is reasonable. An open auction where the ISP's have to compete with the large players is not acceptable. In such a case the spectrum would be cornered in hands of few to the detriment of the spread of broadband and consumers. In fact companies who are being given 3G spectrum should not be given spectrum for BWA. Pure play ISP's should be incentivised to make a good business case thereby promoting spread of broadband.

• We believe any operator keen to provide broadband in rural areas – whether he is telco or ISP or cable operator- must be able to compete for USO subsidies.

6. Airtel

The Hon'ble Authority will appreciate the fact that the overall growth of the Industry at the desired level, would require all operators to contribute and merely depending upon the Incumbent operators will not serve the desired purpose despite the fact that they will play significant role in achieving the broadband targets. Thus, we feel that in order to enhance the penetration of broadband services, it is essential that the private operators should be provided equal incentives and opportunities as being extended to the Incumbent operators, which will creates the level playing field among all the players.

As the Hon'ble Authority is aware that the over the decades, the Incumbent operators have created massive infrastructure, especially in rural and remote areas. While, the Hon'ble Authority has already

recommended the Government for Local Loop unbundling, however, these recommendations are still pending with the Government. We suggest that that the Hon'ble Authority may once again draw the attention of the Government towards the Local Loop Unbundling. Needles to say that it is not essential that the entire capacity is unbundled and also the further capex cost can be borne by the Private Operator in order to maintain the local loop and get the maximum benefit out of the huge un-utilized infrastructure.

The suggestion of the Hon'ble Authority on appointment of franchisees by the Incumbent operator is indeed a welcome step. For the growth of any Industry, the public-private partnership has played a significant role wherein the strength and expertise of both the parties are used extensively. There is no doubt that the private operators have requisite marketing skills with talented manpower and accordingly, we recommend that the private telecom operators should be allowed to act as a franchise of the Incumbent operators on revenue share model or any other model, which maintains the principle of level-playing field, which we are sure will enable the Industry to achieve the broadband growth much faster then being expected.

7. Amplebit Technologies

One way to increase the Broadband penetration is to encourage PC OEMs to bundle Broadband modems. For eg., apart from the external Ethernet based ADSL modems which are sourced by the Operators, PCI internal and USB based ADSL modems are also currently available. The advantage of such internal modems is that since they do not require additional power supply or external box, they are much lower cost than the external modems. In fact, internal ADSL modems can have price points that are closer to those of internal dial up modems rather than external DSL modems. Similarly external USB ADSL modems (for bundling with Laptops) without external power supply are available at price points lower than Ethernet based DSL modems. If every consumer desktop PC ships with an internal DSL modem, which is bundled at low incremental cost compared to a dial up modem, the consumers will be more encouraged to avail of broadband connections. This will also address the issue of shortage of CPEs which is hampering broadband growth.

Based on the above, we submit to you to include a recommendation at the end of section 5.1.5.3 to the following effect :

"Government should encourage Indian PC/Laptop OEMs and vendors to bundle Broadband DSL CPEs. Government should encourage desktop PC vendors to bundle internal DSL modems due to the resulting cost

advantage of such modems. Laptop vendors should be encouraged to bundle external DSL CPEs."

8. BSNL

i. If the Broadband Services have to reach to remotest corner of country and to the common man, these have to be highly cost effective and affordable. At present, only highly literate and professionals are the key users of this service. To make it affordable for majority, certain crucial steps are required to be taken. For development of Broadband infrastructure and to encourage telcos to take a proactive approach, there should be a Tax Holiday (No Service Tax and License Fee on Broadband Revenue, No spectrum charges for the wireless technologies being used for Broadband) for at least a fixed period say 3 years. This will encourage the Service Providers to take initiative and their losses of taking such initiatives, if any, shall be offset to a great extent.

ii. Further in its study, TRAI has stated that there is ample availability of PC/ Laptop in comparison to Broadband Connections. However, most of the PC and Laptop are with corporate and they are using one Broadband connection to connect multiple PCs. For a common man, PC is still out of reach costing from Rs. 17,000/- to 50,000/-. To make PC affordable for a common man, the Excise Duty, Custom Duty and Sales Taxes have to be reduced on PCs. The Korean Government used these measures to reduce the cost of PC & Laptop by waiving off the Taxes on these. As a result, the Broadband penetration in Korea reached to 90%.

iii. The status of power supply especially in semi-urban and rural areas is pathetic. In order to provide Broadband (which by definition is "Always ON") in the semi-urban and rural areas, the power to Rural Telephone Exchanges should be given from the Main Feeder (the feeder from which the connections are given to Railways, Water Works, Hospitals) considering it as an essential service. Moreover, to make the Broadband Services affordable in rural areas, the electricity should be given at non-commercial rates. Therefore, this issue may have to be taken up with the appropriate ministry in Government of India.

iv. The e-Governance contents and services should be in vernacular in order to make these services useful for masses. The main site should be in vernacular and English should be the alternate or translation language instead of using English as main language and Vernacular as translation language. This is more important to reduce Rural/ Urban Digital Divide.

v. Provisioning of Broadband through WiMAX and 3G is going to be very expensive as TRAI, in one of the earlier recommendations, has

recommended auctioning of the spectrum required for this purpose. This may enable provisioning of wireless broadband in Urban Areas but will not encourage its provisioning in semi-urban and rural areas. It is, therefore, recommended that rollout of wireline networks have to be encouraged by providing adequate incentives e.g. exemption from license fee, compensation through ADC, higher origination/ termination charges through premium services like NLD, ILD, roaming and other value added calls as well as cost effective provisioning of ROW etc.

9. CISCO

i) We believe sharing of infrastructure is the solution rather than appointing of franchises. We believe that local loop sharing and also access ducts should be easily shareable.

ii) We do not believe standardization of any equipment or technology can accelerate BB penetration. Market forces will decide choice of equipment and technology.

iii) Other matured technologies like Wi-FI Mesh exist today and have been implemented successfully in several cities around the world and these should also be encouraged.

iv) Funding and PPP partnerships should be encouraged for mature & promising technologies whist we wait for resolution of issues (example spectrum in 3G, Wi-Fi Max) and low-cost CPE development. Here Wi-Fi Mesh as a technology has been implemented in several cities and continues to gather momentum.

10. Ericsson

i. Add the following in 1.9:
It may be important to mention that 31.30 million subscribers are accessing Internet through wireless networks (GSM/CDMA) of Unified Access Service Providers (UASPs) and Cellular Mobile Service Providers (CMSPs). It shows that, similar to the voice telephony, recent high growth in internet subs was fueled largely by the mobile phones based internet. Means, in order to achieve the broadband targets as set by the government, the mobile based broadband has to be given the highest priority.

One of the main reasons of slow growth is lack of Local applications/contents maturity & end user understanding of the benefit of BB. Hence, government should launch programs to demonstrate the benefits BB bring to the common man. Govt. should encourage Tie-ups /

JVs between Service Providers & Entertainment / Media / News Agencies/Broadcasters/Gaming & Communication Partners to popularize the use of Entertainment, Gaming & other value added applications by means of broadband.

ii.
2.2: This clearly indicates that DSL over copper loop is the dominant technology worldwide for providing broadband. Very large share of DSL & Cable based broadband in the mature markets is due to the high penetration of copper & cable. These countries had no choice but to rely on wireline to offer broadband. The broadband grew on this media before wireless based broadband access became better alternatives. India, on the other hand, has very low penetration of DSL. And now, more efficient and better suited mobile technologies are available for broadband. India can leap frog to wireless technologies to boost broadband. Nevertheless, the available copper should be effectively utilized for broadband.

iii. As per 1.9, around 31.30 million subscribers are accessing Internet through wireless networks (GSM/CDMA) of Unified Access Service Providers (UASPs) and Cellular Mobile Service Providers (CMSPs). This is more than 80% of the total internet users, and this will grow. Let's introduce a new category for "Broadband to a handset", where EDGE should be good enough. This is how we believe many poor people will experience the Internet!

iv. Chapter 3: Parallel to WiFi, WiMAX & DTH; HSPA/WCDMA should be added.

v. Add the following in 4.7.1:
Therefore, wireless based access could be one of the ideal solutions for widespread last mile coverage through a combination of different technologies like WiMAX, WiFi, HSPA/WCDMA etc.

vi. Add 4.7.5.4:
The HSPA/WCDMA is now very mature technology. It has more than 138 HSPA (of more than 179 WCDMA networks in 80 countries) networks in commercial service in 66 countries as of July 2007. There are more than 311 HSPA devices (of more than 700 WCDMA devices) from more than 71 suppliers including handsets, data cards, notebooks, wireless routers and USB modems.

vii. Add the following in 5.2.6.4:
3G will be able to providing high speed data connectivity for enabling easier and affordable access to e-governance, e-learning and e-commerce programs in rural areas. This has been shown very successfully in a pilot project called "GramJyoti", launched recently in a cluster of villages near

Chennai using HSPA/WCDMA technology. These have often failed in the past due to the unreliability and high cost of niche wireless connectivity options and low fixed-line penetration.

11. Indusind Media

(i)　To achieve the target of BroadBand as planned by TRAI in India is important. Over 71 million Cable homes in Urban and rural areas should get a level playing feed along with the other platforms DSL/ ADSL over Copper loop, Satellite, Fibre, Wireless.

(ii)　BroadBand in urban areas should be strongly promoted through cable with support of the local government and to clear the issues like Right Of Way (ROW) for the practical benefits of enhancing the quick BroadBand growth of various customers where up gradation/two way is also required.

(iii)　We do observe the TRAI has recommended the policy of Broadband enabled buildings which we believe should be at par for Cable also We do support the Broadband enable buildings, however the encouragement by DOT through the State Govt and the municipal committees for the internal wiring should also be adopted for cable, as the very same logic is there for providing Broadband services by Cable, especially by fibre in cable.

(iv)　Regarding private-public partnership , we believe the unbundling of the spectrum available by the largest public sector group BSNL /MTNL ,should be initiated .This is because the marketing and operational delivery of the private sector groups will enhance faster BroadBand growth of the largely BSNL's/MTNL's unutilized spectrum especially in the rural areas.

(v)　Incentives and subsidies for the rural areas should be immediately given to cable groups, as we are aware out of 71 million homes; over 50% homes are in the semi urban areas and rural areas.

(vi)　With the combination of WiFi and WiMAX, cable can be a strong method for enhancing the BroadBand growth in those areas. Before passing the benefits to DTH, Cable Broadband options for rural areas should be explored and strengthened by various possible sops

(vii)　The ROW requirement for the cable should be strongly considered for all the benefits (like other Broadband players). Several times cable is considered as a weak BroadBand participant. The ROW issues for cable ducting (mostly underground) in Metro cities and

large cities continue to be unclear and without any streamlined positive mechanisms.

12. MTNL

Para 1.5 : The definition of Broadband in Broadband policy may be modified as following" ....The interactive services will exclude any services for which a separate license is specifically required <u>and include all IP based services for which separate license is not specifically required</u>. For example............"

Para 3.1.6 : There can be other modes for providing backhaul of WiFi like DSL, Fibre etc.

Para 6.1.3 : Following may be considered for streamlining RoW procedures.

    a)   There should be cost based charges for RoW and service provider should not be squeezed by claims of exorbitant amounts of reinstatement charges. Ideally, State Government should keep RoW charges to as minimum as possible.

    b)   Priority should be given for laying cables in existing ducts meant for Broadband provision.

    c)   Municipal authorities should be directed to give permission on priority for digging to lay the cables meant for Broadband provision to achieve the targets set by the Government.

    d)   Authorities should not have profit motive in RoW as it is adversely affecting the development of Broadband infrastructure.

Para 6.1.4 : Besides the issues stated in the paper, Government should also try to keep the homogeneity in the spectrum on lines with world-wide acceptance of various bands for WiMax. This will help in availability of lower cost of equipment and terminals for the country.

Para 6.1.5 : Provision of infrastructure as mentioned below to provide broadband in future in all multiple dwelling units/buildings should be ensured by concerned Municipal authorities.

    a) Builders should provide one room as communication room in the building preferably on ground floor.

    b) Duct should be provided to lay 6-fibre Optical Fibre Cable from road to the communication room.

    c) Cat-5 cable should be laid from communication room to each flat house with flexibility to reach every room in the house. Also duct should be provided between the communication room to each house.

Para 6.1.6 : (a) International Bandwidth charges need to be reduced.

(b) NIXI must ensure that domestic traffic is charged only at appropriate NIXI rate and not at international rate by the international bandwidth provider irrespective of how they route. This will help in faster implementation of NIXI policy.

Other Comments : Broadband growth is also linked to the following factors:

a) There should be efforts to develop new interactive applications for the Broadband platform.
b) Absence of Local Content Providers. Content creators and providers should be encouraged to provide Broadband specific content.
c) Development of a content hub which can be accessed by all at nominal charges.
d) Government should take initiative to market Broadband service as an emerging necessity of modern life.

13. ORTEL

i) Broadband policy should be based on technology neutrality. It should be noted that despite the hype about wireless technologies such as 3G mobile and Wi-Max, wireline broadband still leads with more than 99% deployment globally. Although DSL's contribution in this percentage is more then 60, due to its pre-dominance in Europe and Asia, Cable Modem is the dominant technology in North America. Since North America particularly USA, is the world leader in Information Technology and has adopted the most competitive policies to promote broadband, the draft should focus more on the American experience.

ii) The impressive growth of broadband in USA has been possible because of the forward looking policy of US government, to provide for a convergent regulatory platform in which the Cable TV Service providers do not face any regulatory barriers in providing broadband services derived from their Network Infrastructure. The Telecommunication Act of 1996 passed by US Senate, removed all line of service restrictions on both cable and telecom service providers, to provide broadband services, on a level playing field. We feel similar legal measures are required in India to accelerate the growth of broadband services in the country.

iii) Chapter 6 devotes only a small paragraph on Wireline Technology like DSL and lays much greater emphases on Wireless Technologies like Wi-Max. We would like to state that as per our information, Wi-Max is

only in a trial stage in China and Malaysia and some other countries. As rightly bought out in section 4.7.4 of the draft, the Wi-Max CPEs are under trial and are likely to be very expensive. In contrast, Cable Modem Access Networks employing Cable Network Data Architecture provide Broadband services over Hybrid Fibre Coaxial (HFC) network, with Quality of Services (QoS) guarantees. Such broadband access technologies based on ITU approved DOCSIS specifications are proven technologies. The draft recommendation has completely ignored this important technology. We would request the authority to include a section on HFC / DOCSIS in the summary of recommendations. Since the number of TV sets in India exceeds 100 million and is estimated to more than 10times more than that the number of PCs, the important role of Cable TV Service Providers (CSPs) such as ORTEL in bringing the broadband revolution in the country cannot be ignored . We have already deployed HFC / DOCSIS in Orissa.

iv) In case, adequate incentives like reduction in customs duty and raising the FDI limit to 74% is given to CSPs , they will upgrade their analogue network to digital, employing the next generation network architecture. Such a network can provide broadband internet access, as well as voice and video services, including IPTV with QoS guarantees. Such a network can provide seamless broadband services from a Cable TV infrastructure. It will be seen that an HFC based cable TV network offers a very attractive alternative to DSL based broadband network. Since DSL is based on copper loop, which is almost 100% owned by incumbents like BSNL and MTNL, by only bringing out the role of DSL as the broadband wire-line technology in chapter 6, if we may say so, the regulator is promoting the dominance of the incumbent in broadband services market. Regulators globally try to curb the market power of the incumbents to promote competition.

v) The Authority should highlight the financial incentives, which must be given to CSPs to upgrade to digital. It will also accelerate the introduction of NGN in the country, which is also one of the objectives of the government.

vi) Regarding the recommendation relating to broadband in rural areas, we would like to state that broadband through satellite is still not a proven technology. Therefore, the only practical alternative is to employ wire line technologies. The proposal to give USO funds to mobile operators for broadband also suffers from the same lacuna, as 3G / Wi-Max technologies are still not proven. Moreover they do not provide TV quality video on a big screen such as that of TV set / PCs. Their CPEs are quite costly, and still undergoing trials. We would like to submit that, at present, the only viable alternative for real

broadband experience is DSL / Cable Modem, which do not require any spectrum and therefore should be supported from USF.

vii) The USO support should be given in all high cost areas, served by CSPs / TSPs as is the practise in developed countries like USA. The system in USA, is based on a computerised 'Proxy Cost Model'. The model embeds forward looking costs. The cost incurred by operators in excess of the least cost option, which is generally the DSL option, should be supported from the USF. We feel that such a funding mechanism should be adopted in the country to take broadband to rural areas.

To summarise, we request the authority to address the following issues

I. The entire broadband policy and the authority's recommendations should be technology neutral and factor HFC Cable networks as one of he important medium of delivery

II. FDI limit for Cable networks should be increased from current 49 % to 74 % by amending the cable Act so as to bring it at par with ISPs and Telcos.

III. Duty reduction should be considered for all equipments used in Cable Plants.

IV. Cable Operators and ISPs should be encouraged to use USO Fund for growth of broadband in rural areas.

14. Reliance

1. The Broadband is a global phenomenon which is transforming the way we conduct business, interact, and learn. This medium offers limitless possibilities, providing users with multi-media applications involving data, voice, and video. The broadband based services have virtually unlimited potential to enhance opportunities in education, health care, commerce, governance and entertainment. E-mail, chat rooms, blogs etc. are exciting internet applications to provide platforms for information dissemination. Broadband is also crucial to the development of telemedicine.

2. The suo-motu initiative of the TRAI to promote broadband services in the country is heartening. Though "hands-off" policy is better for the growth of the service but initial support from the Government is required for fostering healthy growth of the broadband. By fostering supportive environment, economies shall be able to create and expand self-sustaining broadband networks.

3. We welcome all the recommendations of the TRAI for the growth of broadband services. Additionally we would like to make following

suggestions which may be considered while formulating the final recommendations to the government.

A. Unbundling of Local Loop

(i) Worldwide, majority of DSL connections are provided by the incumbent operators either directly or through resale/franchisee. In European Union, approximately 80% of market share is directly held by the incumbent operator and substantial portion of the rest by the franchisees. Therefore incumbent's role is important for expansion of broadband services over copper networks.

(ii) Even though local loop unbundling has a small market share but it provides very important stimulus of competition which facilitates the efforts of incumbent and all other operators in the market for expansion of services. Therefore unbundling of local loop is important to expand broadband services and optimally utilize the huge potential of the ubiquitous copper network of incumbents.

(iii) The incumbents are hugely supported through ADC, which is not admissible to other private operators. The ADC support has raised the entry barrier in the copper wire line segment. The risk involved for wire line network for the incumbents has been hedged as the TRAI had been ensuring full cost recovery of their copper access network and as such, there is no reason for the incumbents to share their infrastructure with other operators for expansion of broadband services.

(iv) The targets set by the government for broadband services shall have no pressure on the incumbent operators for expansion of broadband services till they have competitive pressure from other operators. Since it is difficult to replicate the copper network, the incumbent operators would continue to enjoy the virtual monopoly in the DSL market segment and competition can only be induced through unbundling of the local loop.

(v) **It is therefore suggested that the government may be requested to reconsider the TRAI's earlier recommendation on unbundling of local loop made vide Para 3.4.2.13 to 3.4.2.15 of the Recommendations on Accelerating Growth of Internet and Broadband Penetration.**

B. Right of Way

(i) For telecom networks, access to Rights-Of-Way is a critical requirement. In addition, service providers require access to in-building wiring in multi-unit buildings in order to supply services to customers. These elements are essential facilities. Without access to them, telecommunication service providers are unable to provision their networks or provide service to their end customers. There has been increasing resistance from municipalities for giving access to such vital infrastructure requirement. Right of Way

access should be available in time, and any disputes regarding the terms of access must be resolved expeditiously as per the laid down procedure.

(ii) The expenses incurred for RoW particularly in the Metros are highly disproportionate to even the Broadband equipment and installation costs. The state governments should rationalize the RoW costs to enable faster uptake of broadband in the country. The TRAI's suggestion for mandating the state government to adopt uniform RoW procedures and rationalize RoW charges shall be major impetus for Broadband services.

(iii) The Delays in obtaining access can lead to delays in the construction of networks and the provision of services. The TRAI's recommendation for a committee to study RoW requirements, facilitate duct sharing etc shall also help in the expeditious project implementation and reduction of costs.

(iv) We would like to make following additional suggestions for facilitating RoW:

- Modify the building and Coop. society by-laws to make it mandatory for them to invite Broadband service providers to get the building broadband enabled by at least @ 10 Mbps per household. They should provide free space for electronics and permit in-building cabling to facilitate connection of Broadband to each house or customer unit.

- There should be a central agency for providing the RoW clearances.After submission of Drawings and payment of demand notes, the clearance should be provided by this agency. The charges for RoW need to be standardized according to the category of city/municipal authority.

- Municipal authorities to provide blanket clearance to connect street furniture of up to size 100 cm* 80cm*30cm without any restriction and also provide for upto 100 watt of power for each such cabinet.(like a street lamp)

- City civic authorities should declare safe hours (time slot of 8 hours) when any maintenance related to optical fiber or broadband cable jointing/repair is allowed up to a stretch of 15 meters without any permission **during all seasons.**

C. Fiscal Policies for Broadband Services Penetration

(i) One of the main reasons for low adoption of broadband services is the issue of affordability. The fiscal incentives are provided by the government to stimulate investment in a sector. The fiscal incentives also bring down cost to provide service and make them

affordable to a number of potential users. Though license fee on broadband services is not applicable but there are other taxes like service tax, entertainment tax which are prohibitively high. The following fiscal incentives shall make broadband services more affordable:

- All Broadband infrastructure/service providers regardless of underlying technology or media to be provided with a 10 year income tax waiver.

- Customer premises equipment for providing services (DSL Modems, WiMax CPEs, STBs Ethernet devices etc.) should be subjected to a maximum of 5% custom duty and excise duty.

- Allow 100% depreciation allowance on equipment for broadband.

- Recommend Exemption for broadband services for the next 10 years from payment of entertainment tax imposed by state governments which is approximately 30% in certain states.

- Exempt Broadband services from the payment of service tax.

- Digital content (education, health, governance, local language, web content, interactive entertainment) to be treated as soft infrastructure industry.

D. Rural Broadband Objectives and USO Policy

(i) One of the Universal Service Objective is to provide basic data transmission facilities atleast in those villages where regular post offices are located. In addition there is also a provision to install High Speed PTIC by upgrading the existing VPT to provide wideband applications like e-education, telemedicine etc. These objectives should be immediately reviewed and new projects implemented for giving impetus to the rural broadband services. Some of the projects suggested by the Industry to the USOF Administrator are given below. TRAI may recommend to the USOF Administrator to expeditiously consider projects which can be implemented using USOF.

- Early action for USO Fund announced schemes like additional towers, infrastructure and services for rural areas.
- OFC and satellite connectivity to rural and remote areas.

  ➢ OFC and satellite connectivity for Ladakh region of J & K.

- OFC connectivity in Assam and North-Eastern region.
- OFC connectivity in Uttaranchal.
- Satellite communication links from Andaman & Nicobar Islands to the main land on satellite.

- USO Fund support for Telecommunications Satellite for providing easy communication to remote and rural areas.

- For enhancing support for rural connectivity and extending mobile and broadband services to the rural areas, we propose USO Fund support as follows:

  - Optical fiber connectivity unto all Block Head Quarters.
  - Optical fiber connectivity to BSCs & BT i.e. rural mobile towers from the nearest SDCC / Block Headquarters.

E.   Spectrum Allocation Charges and Spectrum Fee

(i)   We welcome the TRAI's proposal that Government should expedite adoption of the recommendations on 3G and Broadband Wireless Access. We would also request the TRAI that it should also commence the exercise to formulate recommendation on allocation of 700 MHz, 2.3 GHz and 2.5 GHz spectrum for WIMAX technology.

(ii)   The TRAI's recommendation of charging 1% of AGR as spectrum fee shall be highly damaging for the growth of broadband services. This fee is proposed in addition to the acquisition fee for the Broadband Wireless Access spectrum. It is proposed that the spectrum fee should not be more than the 0.025% of the AGR so as to recover the administrative charges only.

(iii) In case of broadband through WIMAX, the CPE s should be exempted from   requirement to pay license fee of Rs 1000 per CPE.

(iv)   Frequencies for WIMAX should be allotted circle wise in stead of city wise.

15. SIFY

i. User experience and value proposition

Though establishing the benchmark of 256 Kbps for broadband connections was the first significant attempt to quantify the definition of broadband, for the end subscriber the **user experience** plays a more pivotal role than technical specifications. One of the main impediments

to growth of broadband has been the lack awareness at the bottom of the value chain. Potential subscribers of broadband are still unsure or unaware of the benefits that access to the Internet brings along with.

In this context, educating the common masses may ease this challenge to a large extent and definitive polices from the government for the same will make an efficient head start. Private-Public partnership programs for inducting the usage of Information Technology and highlighting its inherent benefits shall also be pertinent.

ii. Making computer literacy mandatory at primary levels

As per data released by IAMAI, 71% of the population do not buy a PC because they do not understand its usefulness, 45% do not buy because of high cost while 24% are not confident about using a PC. Such level of disparity can only be eliminated by mass awareness programs designed at the national level. Numerous initiatives, programs and projects may have been initiated but the exposure to computer and Information and Communication Technologies remains limited to only a privileged few especially at primary education levels.
With hardware costs plummeting down, most primary schools may actually afford to have basic computer labs with little financial support from the government. Multiple schools in close proximity can pool financial and infrastructural resources to set up computer labs and share this infrastructure.

Basic computer education at primary levels may be mandated by forward looking policies. It is only when young minds become familiar with technology will they realize the need to access information from the Internet. Admittedly, these steps may not result into an immediate surge in Broadband uptake but such forward looking measures will definitely go a long way in creating an Internet friendly ecosystem even in the deepest level of society.

iii. Cost of access devices

The high cost of access devices especially computers; still remain one of the most significant reasons for the poor uptake of broadband in the country. The instant paper highlights the role of mobile phones as access devices. Though penetration of mobile phones has been unprecedented, its effectiveness as an Internet access device is questionable. Considering the fact that only about 5% of the mobile devices are high end devices with a fully featured browser, the use of a mobile phone as an Internet access device is really very restricted. Data throughput is theoretically capped at 115 Kbps using GPRS/EDGE while the actual throughput often drops below that of a dial-up connection.

This scenario is bound to improve with the introduction of 3G services but even then personal computers shall remain the most reliable and user friendly access device primarily due to the high cost of high end mobile devices. To make computers available at cheaper costs for the common man, some innovative measure may be taken.

Corporates may be allowed higher rates of depreciation in case of computers and related peripherals so that the same can be written off in one year. The used IT hardware may then be recycled and donated to educational institutions and corporates may be incentivized by way of fiscal benefits to recycle/donate their hardware for educational and social purposes.

As per IAMAI, an average Internet user spends 55% of the time in text chatting and emailing. Another 33% is spent on educational purposes. Applications like Emailing, chatting and educational browsing which constitutes more than 85% of the time spent online requires minimal processing power and bandwidth. Only about 10% applications like gaming and streaming video requires high processing power. Considering the above facts, technologies like **THIN CLIENT COMPUTING** becomes very much relevant in India. A typical thin client deployment will allow distribution of computing power over many end users who will only access the central server using minimal hardware. Thus the total cost of ownership will come down drastically for the end user and at the same time fulfill the requirement of an access device. It is pertinent to say that Internet Service Providers should be encouraged to deploy thin client technology and at the same time bundle connectivity packs to end users at easy installments.

iv. Public Internet Access

Having the operational experience of operating the largest chain of cyber cafes in the world, we have come to realize that the **PC sharing mode**l shall go a long way in easing the high cost barrier of access devices. As present a staggering **55%** of the Internet users in India access Internet through cyber cafes. Sify has played a major role in 'organizing' and branding this model of public access which till few years ago was largely unorganized. The PC sharing model not only eliminates the huge CAPEX for the end user but also provides access at the convenient costing of the common man. Other public access model includes access through **Wifi Hotspots** which are becoming increasingly popular though admittedly, the number of hot spots in India is still minuscule.

We strongly believe that relevant effort and support from the government in the form of fiscal incentives and tax sops shall provide adequate boost

to public access models. **Waiver of service tax for cyber cafés may be considered immediately** which will not only bring down cost of access but shall also provide enough incentive to local entrepreneurs to invest in cyber cafes. Additionally, if cyber cafes maintain certain minimum quality of service standards, each terminal of a cyber café may be considered as a broadband subscriber.

Public access kiosks may well be a very effective end point in the content delivery chain eliminating the last mile gap. ISPs in India are well equipped to establish, operate and maintain such kiosks at key locations if such initiatives are backed with proper institutional and infrastructural support from the government. Not only will such kiosks provide affordable and 'easy-to-reach' access to information but can also act as a vital touch-point for all **E-Governance** initiatives taken by the government capable of providing a single-window for multiple services as envisaged in the National E-Governance Plan.

v. Relevant content

Creation of local content in regional languages shall act as a major driver for broadband uptake. Even today more than 70% content accessed in India is hosted outside India. This not only escalates the cost of access but also limits the access to content in regional language. Internet Data Centers form the critical infrastructure for content hosting but service providers in India finds little incentive to establish IDCs. Fiscal incentives for local content hosting and operation of data centers should be thought of as an immediate measure. In addition, exclusive content providers must also be encouraged to generate content in local Indian languages.

We have already entered the age of Web 2.0 where content generation is no longer centralized. User generated content in the form of blogs, social networking sites among others are significantly contributing online content that is locally relevant. Such innovations and other emerging applications like streaming video shall play a major role popularizing broadband. It is of utmost importance that such emerging technologies are properly incubated and inducted in our information society with minimal or no regulatory friction.

vi. Internet Telephony as adoption driver

In our numerous past representations to the Authority we have time and again submitted that the scope of Internet telephony allowed as per the ISP license may now be expanded to include UNRESTRICTED Internet telephony including but not limited to termination of IP calls in the Indian PSTN. Reliable and cost effective voice services alone have the

potential to accelerate the adoption of broadband in a significant quantum.

Advances in IP technology coupled with economies of scale brought about by large scale deployments have resulted in unprecedented drop in cost of offering voice services on IP while preserving the quality to almost 'carrier grade'. We have already started offering voice services to our retail subscribers but the inherent regulatory limitation of restricting the calls to "any IP device" is acting as a major cause of inertia in the part of subscribers. There are also instances where subscribers have been ready to subscribe to a broadband data plan just to make voice calls. Such forward looking and optimistic demands from subscribers only intensifies our urge for regulatory clearance to unrestricted Internet telephony. Hence, we reiterate our pledge to the Authority to expand the scope of Internet Telephony for ISPs as elaborated hereinabove.

vii. Response to specific recommendations

A. Broadband through DSL

We support appointment of franchisees by our incumbents if that helps in accelerating broadband up take. However, we feel that standardization of DSL CPEs may not have some any significant impact on broadband proliferation.

While encouraging local hardware manufacturing is a forward looking effort, service providers should not be restricted to source their hardware only from Indian manufacturers. The decision is best left to market forces and business requirements of individual service providers.

In addition relaxation of import duties not only for DSL CPEs but also for other broadband hardware will bring down cost of broadband services.

B. Broadband through DTH

We uphold Authority's view and we believe that DTH operators can contribute significantly in proliferation of broadband.

C. Streamlining RoW procedures

Heterogeneous procedures in different states for obtaining ROW is indeed a dissuading factor for service providers as rightly pointed out in the instant paper. We agree that streamlining the RoW procedures

as outlined in the paper shall surely benefit all service providers in an equal footing.

D. Broadband through wireless

In the absence of unbundled local loops, wireless becomes the next most viable and cost effective access technology to bridge the last mile gap. Both 802.16d and 802.16e standards shall play a crucial role in near future for wireless broadband access. Spectrum for both the standards should be immediately made available for allocation. Revision of the National Frequency Allocation Plan is long over due and the same may be expedited with distinct allocations for spectrum for wireless broadband access.

2.5 GHz to 2.69 GHz band is specifically vital for mobile Wimax. Part of this band has already been allocated to few ISPs. The remaining portion in this band may also be earmarked for WIMAX as this is a worldwide harmonized band for mobile Wimax.

We had earlier submitted our opinion about pricing of spectrum for ISPs as a percentage of Adjusted Gross Revenue. At a time when most ISPs are expanding their network and installing more and more base stations, payment for spectrum on "per-BTS" basis is becoming cost prohibitive. Under such circumstances, computation of spectrum fee as a percentage of AGR may be thought of.

E. Broadband enabled buildings

We agree that this is a unique proposition and is indeed commendable. Multiple dwelling units should be mandated by local municipal authorities to have STANDARDIZED CAT 5 CABLE wiring installed during the building phase. Such wiring shall ensure broadband availability at customer premises with equal ease and minimum effort from the service provider. The wiring should conform to 100BASET Ethernet standard. This will enable ISPs to provide the last mile through high speed Ethernet last mile. A parallel wiring using standardized copper twisted pair terminating in RJ11 sockets shall also be mandatory. The later will enable provision of broadband services though xDSL technologies.

In the above context, we feel that a word of caution is in order. While the above is definitely desirable, due regulatory intervention is needed to ensure that the wiring infrastructure along with the switching room (the room where all such wiring will terminate) **DOES NOT** become a monopoly of a particular service provider. The wiring along with the switching room in the building should be made available as **"open access"** so that multiple service providers may co-

locate their equipments in the switching room. This will ensure that any one particular operator will not have monopolistic control over the wiring infrastructure in the building and the residents may be able to choose a broadband service from a service provider of their choice and as per their specific requirement.

F. Other initiatives

Cost of bandwidth is still a major portion of the operational expenditure for an ISP and all necessary steps should be expedited by the Government to bring down cost of bandwidth in India. We have submitted our comments regarding resale of International traffic and believe that allowing resale of International bandwidth will definitely bring down bandwidth costs.

G. Broadband in rural areas

We wholeheartedly support Authority's recommendation of utilizing the USO fund to subsidize backhaul charges by 40%.

H. USO support for broadband

We concur with the Authority's recommendation about providing USO fund support for roll out of broadband in rural areas.

16. TATA

- TTL is of the view that the franchisee model in Broadband has not succeeded in its full parlance as can be seen from the low penetration of broadband in our country. TTL is therefore of the firm view that introduction of franchisees should not delay the local loop unbundling. Hence, the only way forward is to unbundled the local loop. As the competition is limited in wire line and skewed heavily towards the incumbents whose market share in wire line is nearly 83%. TTL therefore, strongly suggest the Authority to recommend the "Local Loop Unbundling" at the earliest.
- If UASL/CMSPs choose to set aside some of their existing precious bandwidth for offering wireless broadband services, they must be encouraged/ incentivised for doing so.
- Since the wireless internet access is becoming very popular in India, it is necessary that measures such as reduction of duties on wireless internet devices and reducing Government levies on revenues earned by operators from wireless internet services be initiated on priority to fuel the wireless broadband penetration.
- The Spectrum allocation for faster deployment of broadband should also be considered as a measure to boost competition in this sector.

- No spectrum charges for spectrum to be used for provisioning of broadband services in rural areas.
- To expedite BWA frequency allotment process (WiMAX) to catalyze growth of broadband in India in line with world standards.
- The Authority in its recommendation on 'Allocation and pricing of Spectrum for 3G and BWA services' dated 27th September 2006 has recommended allocation of additional spectrum for CDMA operations in the 800 MHz band dedicated to Ev-DO services. TTL requests the Authority to recommend immediate allocation of this spectrum in order to boost the roll out of broadband services.
- Reduction of effective import duties for access devices i.e. CPEs imported by service providers.
- Cent-percent depreciation for PCs, STBs etc in the first year itself so that the same is available in resale market.
- Zero customs duty with no CVD for imported broadband equipment and parts.
- Zero Excise duty for procurement of indigenous broadband equipment.
- No entertainment tax (currently up to 30% in some states) should be applicable to broadband in the short and medium term.
- Service tax waiver for this sector in short and medium term.
- TTL recommends Telecom sector income tax breaks/ holidays be extended to broadband sector as well.
- Broadband through satellite in remote and hilly areas with spectrum made available but without any cost.
- TTL recommends that the USO fund should be used for creating nationwide last mile copper/fiber infrastructure which could be offered on an unbundled basis to operators from the very same day. Further, USOF support for development Applications and Contents in local language etc for the benefit of rural folk should also be made.
- TTL recommends Tax deductible status for expenditure on connectivity/ usage (similar to policies for other public welfare services such as education allowance, medical allowance etc.).
- TTL recommends that there should be no backhaul charges. If there are any then USO should fund the same.
- Subsidy for installation of non conventional energy sources for provisioning of broadband services in rural/remote and hilly areas.

17. VSNL

1. Broadband in Urban areas

1.1   Broadband through DSL

In order to ensure proliferation of wireline based broadband services, it is necessary that the following areas are addressed:

(i) A new UASL license without spectrum should be provided for in the licensing regime. The consultation paper on the draft recommendations also supports the same in its para 5.1.6.2 extracted below:

> "5.1.2.6……… Migration of UASL is costly and therefore Cable TV network is not emerging as one of the alternative to provide broadband. TRAI in its recommendations on "Unified License" dated 27th October, 2003 recommended provision of UASL without spectrum. This will enable Cable TV operators to move to UASL and provide various services. This needs to be looked into on priority basis to encourage upgradation of cable TV network capable to provide broadband, which will ultimately boost broadband penetration".

> TRAI in its recommendations on Review of licence terms and conditions and capping of number of access providers dated 28th August, 2007 has supported the same view point and recommended as follows:

> "2.55   Today the spectrum allocation follows grant of UAS License. On payment of certain they free, the applicant is given the license and subject to availability, he is given a certain amount of spectrum in the 2G band. In case the applicant does not require this spectrum for providing the access service, he may want to use only wireline or may want to provide service using some other spectrum, e.g. BWA, there is no clear cut path for him. He is required to pay the full license entry fee. The Authority in the past has also recommended that the license fee should be separate from the spectrum fee. With the advent of new technologies where 2G band will be used, spectrum other than resolution of this issue is becoming critical. As recommended earlier, the Authority again reiterates that spectrum should be de-linked from the licensing regime. There is also a need to clearly specify the license fee charges without spectrum. The Authority is of the view that license fee charges should be on a reduced scale to facilitate penetration of telecom services. Bifurcating present entry fee in to license fee and spectrum charge is difficult. It is also a fact that entry fee determined in 2001 does not bear any relationship to present spurt in the telecom market. Keeping in mind that spectrum is a scarce resource, the Authority recommends that the DoT

should examine the issue early and specify appropriate license fee for UAS licensees who do not wish to utilize the spectrum."

According to us, there should be a migration path allowed to the ITSPs for migrating to the UAS License without any 2G spectrum entitlement, with an entry fee which should commensurate with the entry fee charges for the sovereign right as well as cost of administration of the telecom sector while ensuring a level playing field and no-worse off position for the existing UASL and CMSP license holders. The above recommendations should be therefore followed up with DoT for evolving a new licensing regime for a new category of license for UAS without 2G spectrum and simultaneously providing migration path to the ISPs for migrating to the said new license category. This new category should be treated as distinct and distinguishable from the existing UAS license with 2G spectrum. Once this is done, every broadband connection provided by these ITSPs who obtain the new proposed Access Service license (without 2G spectrum) would contribute towards the crucial tele-density and would also result in the growth of the fixed service in the country, which is presently on the decline.

1.2 Unbundling of local loop:

Local loop unbundling should be mandated to encourage immediate growth in Broadband services in India. Private basic operators have already entered into co-location agreements with DSL providers; similar arrangements should be made mandatory to the incumbents also.

Shared unbundling of the copper loop from the customer to the central office / local exchange is most applicable for the Indian market. In smaller cities & towns, the copper loop is likely to be beyond 2-3 kms and may not be suitable for Broadband. Hence, partial unbundling of copper loop at cabinet / pillar should be done.

TRAI should state commercial benchmarks for the unbundling, in terms of price ceilings (per line), service levels including provisioning time, etc..

The pricing for the unbundled local loop should recognize the following three costs that basic operators incur in implementing unbundling:

- One-time costs for provisioning the connection

- Allocated capital and operating costs of the local loop, preferably in the form of a fixed monthly per line charge.
- Collocation costs including the cost of renting space, site preparation, power usage etc.

For effective local loop unbundling (LLU) to be achieved, TRAI should lay down the guidelines for the calculation of the above costs, and specify ceilings. These could also be based on market benchmarks of pricing for services offered on the copper by the BSOs. TRAI should also lay down guidelines in terms of time-frame for the implementation of LLU. This would ensure that the incumbents do not delay the effective implementation of LLU.

1.3   Broadband through DTH

In order to enable the expansion of DTH services in the country, Govt. should ensure availability of more number of Ku band transponders. This will also encourage the service providers to roll out broadband through DTH platform."

1.4   Broadband through Wireless

While we support the draft recommendations as above, we would like to invite your kind attention to the following additional steps which are required to be taken for facilitating BWA role in proliferating the broadband density:

a.   Some of the ISPs already have been allocated spectrum in 3.3 GHz band and some of the WiMAX networks are being rolled out by these ISPs in metro cities. Once these networks are in place and operational, it is expected that large number of customers will be served by wireless broadband technologies resulting in the proliferation of an equivalent number of CPEs. Hence, it is imperative that CPEs for broadband services should be treated at par with other wireless devices (e.g. mobile handsets) in so far as regulatory levies and import procedures and concerned. There should not be any import license required for importing Broadband wireless CPEs and the same should also be exempted from royalty charges which are presently required to be paid. This would go a long way in increasing wireless broadband services in the country and reducing entry costs (including CPE) to the customer. Further, the existing spectrum that has been allocated to operators at 3.3GHz should be rationalized to conform to telecom circles wise licenses to bring in parity with the rest of the licenses such as UASL, ISP, etc. A pro-rated license fee for the amount of

spectrum being held at 3.3GHz on the proposed floor prices for 2.5Ghz should be applied and those ISPs which are willing to pay the same could get the existing 3.3 GHz spectrum rationalized across their areas of operation (area being defined as telecom circles). The Authority should also explore opportunities of making the various spectrum that has been allocated to operators in 3.3Ghz contiguous for each operator so that each operator can leverage the benefits of having a single continguous spectrum.

b. For promoting broadband services, there should be exemption for all equipment used for such services from customs duty, excise duty and sales tax so that input costs of broadband service providers are reduced.

c. Since already one year has elapsed since the recommendations were issued by the Authority on BWA spectrum, it is requested that not only the spectrum in the band of 3.3 to 3.6 GHz should be offered to the eligible service provides but also the spectrum in 2.3 to 2.4 GHz band and 2.5 to 2.69 GHz band should be made available to these eligible service providers for provision of broadband wireless access services in a cost effective manner through auction as recommended by TRAI in its recommendations of September, 2006.

2   Broadband in Rural areas

2.1   Broadband through Satellite

VSNL supports the idea of providing broadband services through satellite in remote and hilly areas.

2.2   Sharing of Backhaul

We would like to suggest that the cost of the backhaul from the SDCC to the rural area should be subsidized 100% on the basis of allocated costs.

2.3   USO support for Broadband

* As TRAI has already recommended allocation of spectrum for various wireless technologies capable to provide broadband on floor price or through auction, a precondition for selection of service provider identified for USO Fund subsidy to provide broadband should have spectrum for suitable technology.

* In order to increase the competition, two service providers seeking minimum subsidy should be identified. Some roll out obligation can also be prescribed to ensure the establishment of network and USO subsidy to be provided in a phased manner based on roll out aspect."

We would like to suggest that in the interest of proliferation of broadband services in the rural areas, spectrum in the frequency band of 2.3 – 2.4 GHz and 2.5 – 2.69 GHz band should also be made available to the ISPs for bidding in the auction or at the floor price as already determined. It is also felt that the quantum of roll out should be prescribed if USO support is to be decided through the mechanism of bidding.

In addition, we would like to suggest some more measures to revamp the internet services sector which would further accelerate the growth of broadband which is the objective of these draft recommendations.

Currently, there is no clear provision in the ISP license in respect of infrastructure sharing. It is a proven fact that infrastructure sharing, if allowed results in substantial saving to the national cost in building up a network. We would, therefore, like to recommend that adequate provisions should be recommended to be added in the ISP license so that Infrastructure sharing is allowed for the ISPs, ISPs should also be allowed to share RAS with each other. Since ISP is also an access service provider who is allowed to lay wireline/wireless local loop/ last mile, they should be allowed to share the last mile with other service providers like UASPs/NLDOs/ILDOs on the basis of a mutual commercial agreement. This will create a new stream of revenue to improve the economic viability of the last mile which is being created by the ISPs. Since all other telecom licences allow for infrastructure sharing the same should be extended to the ISPs in the interest of level playing field and the larger public interest.

18. Keshvamurthi K.K

1 Broadband in Urban areas

1.1 Broadband through DSL

- I agree completely with this proposal. Performance of BSNL and MTNL has to be improved with the help of any business models which they feel feasible.

- There is no mention about type of encouragement. I feel it should be in the form of TAX holiday for certain number of years.

- This is very urgent and important task for TEC. Not alone the CPEs but also VoIP handsets and Set-Top boxes. All 3 arms of triplay have to be standardized with minimum required technical specifications.

1.2 Broadband through DTH

- I won't support broadband through DTH platform since this is in broadcast mode. Internet will function best only in the unicast environment. Since the uplink data is also increasing substantially due to gaming and chatting applications the narrowband uplink channel will not serve the purpose. There'll be quite a big latency in this method which will not meet the future QoS of internet service.

1.3 Streamlining RoW procedures

- The proposals have to be discussed immediately in the cabinet meeting since a day lost is comfort lost for citizens. The civic work is going on in the country at impeccable speed and we should lose no time in brining above proposals to an act so that unnecessary digging is avoided in future. The future civic layout plans should involve the presence of conduit for triplay with sufficient diameter similar to presence of drainage and sewage system.

1.4 Broadband through Wireless

- The proposals has been quite often repeated and I expect government to act on it with severity it deserves. Once the above proposals see the light then the current mobile internet subscribers will automatically get migrated to broadband subscribers without much effort.

1.5 Broadband enabled buildings

- I don't support the above proposal. May be DSL might be popular all over the world but in India it will be wireless last mile. None other than mobile telecom revolution in India bears the testimony to this fact.

1.6 Other initiatives
- Have to be done as quickly as possible. Unless the cost of international bandwidth is reduced rest of the steps will not yield the required results. This proposal is centre of the fulcrum to

launch the broadband penetration. I won't classify this as 'Other initiatives' but as 'Main Initiative'.

2 Broadband in Rural areas

2.1 Broadband through Satellite

Broadband through VSAT is a fantastic Idea especially for CSCs in rural areas. This is unicast method unlike DTH hence QoS can be guaranteed. Since the satellite has national footprint it can reach the remotest part of the country. The subsidy would help in spreading the wings of Internet. The type of transponders used should left the market force. It can be C-band, Ku-band or Ka-band. If the operator wants to cover the more rainy areas then he can use C-band and if he wants to cover more clear sky areas with large number of users he can use Ku-band.

In addition to the above proposals I would like to add the following comments on growth of broadband in India.
The main reasons which I feel acting as impediments for broadband growth are the following.
1) ***Non-availability of meaningful and useful content***
2) ***Non-allocation of 3G & WiMax spectrum***
3) ***The poor state of government websites***

1)Content ::

a) Regional Language Content:
     Unless we address this issue there can't be any growth in the broadband in rural areas. The government should subsidize the web hosting services (through BSNL) of regional language websites. All the state government websites should be very user-friendly and should always have regional language as one of its options.

b) Utility Services:
     The utility services of state governments have to be available through web. This will certain help the rural masses to look at Internet instead for traveling to District head quarters. The services like applying for LLR, water charge payment, electricity payment, telephone bill payment etc.., should be available. Once the above services are available in the Net the government should also help the masses in using those services. The government should issue *cash cards in panchayat offices* so that people can use the e-pay without requiring credit or debit cards.

c) Multimedia:

The easiest way to pull the rural folks is to show them songs and movies. This can be achieved if we can encourage internet radio and internet TV (not IPTV). So government can mandate all the broadcasters of the free channels to make available their streams even in Internet through IGMP.

2) Non-allocation of 3G & WiMax spectrum::

The future of broadband in India is _wired back-haul and wireless last mile_. The liking for wireless and mobility is more intense here than in any other country. This aspect we have clearly witnessed in telecom revolution. Once the spectrum allocation is done then we can witness unprecedented growth in Broadband. Once this growth starts then we face another issue. I feel around 50% of broadband usage from then on will remain only with handheld devices. In order to support this new scenario we have to prepare ourselves on 2 levels

a) All the government websites should be ready to provide WAP portals.
b) The size of the mobile display should be enlarged and handsets should come with QWERTY keyboard. Government should encourage this kind of handsets in the market through subsidies. We can call those as "_Broadband ready Handhelds_".

Broadband over Power Line(BPL)::

This is an emerging technology and if it becomes operational then no other technology could compete with it. The power lines are ubiquitous and reaches almost very corner of the country. This will help in providing broadband to any household in India without any additional investment. This will also help in providing uninterrupted broadband connection in _electric trains_ without any additional investment.

Nationally funded research should happen on this technology in premier scientific institutes like IISc, IITs with specified time-line.

Research results from other countries should form the base for our research.

19. Lt.Col.V.C.Khare

- The paper is not directed at convergence of technologies and talks about TELCO domain, wireless communication domain and Cabled TV Broadcast domains.
- Consumer Broadband usage can be divided into the following category of users :-

(a) Users with Internet usage as a part of their profession/occupation with dictates of operation from residences.
(b) PC homes in TELCO connectivity domains.
(c) Cable Homes with Cable Modems connectivity for PCs.
(d) Cable Homes with ISP franchisee Broadband connectivity on CAT5 access.

- Cable homes wanting internet access on TVs. These users are information savvy and not bothered about text generation or storage. It is this segment which even in one way connectivity will proliferate broadband.

- TELCOs have trans-national fiber laid. Add to that partially utilized fiber of Railways and Gas Authority. Then there is Municipality limited fiber network of Cable Operators. But at policy and implementation level the mind set is NOT convergent because TELCOs are governed by DoT and consider Cable TV networking inferior. Cable TV networks are governed by I&B Ministry wherein the potential of Cable TV networks as a national asset has not been realized. Even for digitalization of Cable TV, operation from one central/national Headend transporting QAM TV content converted to IP for long haul to Municipal Headends, converting IP to QAM at these nodes for delivery to subscribers should be considered. Then the same Municipal Headend can have an ISP point of presence to integrate Broadband delivery through Cable Modems, even voice through a Class 5 switch, should have been suggested. **This alone can raise Broadband penetration at the lowest cost to 80 million subscribers.**

- If the present management of Cable TV services is NOT interested in investing or promoting Broadband, a raise in FDI limit from 49% to 74% could prompt foreign MNCs to take on Convergent Cable TV networking with an enviable business prospect. With such an indicative policy approach, even TELCOs in India may consider this business mode.