Comments on the
Consultation Paper on National Broadband Plan,
Telecom Regulatory Authority of India, June '10

CHAPTER 2: Broadband – Demand & Supply

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

In order to achieve its universal access objectives, the rural broadband rollout should be complemented by a strong demand-side stimulus from the government. There are multiple ways of creating this stimulus.

1. Develop e-Government Services: Government departments should serve as the initial anchor tenants for the broadband network. Countries like South Korea are examples of how a relentless focus on delivering a range of e-government services over a national broadband infrastructure has both lowered government costs and spurred large-scale consumer demand for broadband access. Service delivery, administration and procurement processes in the public sector, for example in healthcare, education, utilities, revenue/taxation, can immediately benefit by using the broadband network as a vehicle to support online modes of operation. Since many of these e-government applications will have security or privacy implications, the government should undertake joint development with domestic product companies to ensure data confidentiality. Incentives like reduced taxes/fees etc. to be provided to users for e-governance submission for early promotion period.

2. Sponsor “Light House” Projects: The Government can play a role in supporting innovative pilot projects that utilize the broadband infrastructure and help evolve “killer” applications for various industry verticals such as defence, smart grids, telemedicine, remote learning etc. A similar approach has been adopted by countries like Singapore to promote the use of broadband infrastructure while incentizing the local industry to evolve R&D capabilities. Countries like South Korea, U.K and France have either targeted the successful adoption of a suite of advanced applications upfront in their national broadband plans or have provided special stimulus investments to the industry in order to develop a basket of these high-capacity applications.

3. Encourage Domestic Industry to create an eco-system: The Government should incentivize domestic telecom product companies to come up with innovative devices, equipments and applications that improve the user experience and at the same time reduce the overall cost of the national broadband network. The lower network costs can then be passed on to the consumer and make high-speed access more affordable for the Indian consumer. Incentives can be in the form of R&D grants for developing products and applications, long-term loans, and tax holidays. For example, South Korea has provided subsidies of up to $1.2 Billion to domestic R&D centers to develop the Core network of its national broadband deployment. Applications developed using regional languages, important national heritage and culture based on-line databases are some of such candidates.

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

The key to enhancing perceived utility of broadband is the availability of locally relevant applications and content. This is only possible if the applications and the associated networks are designed and delivered with a clear understanding of the end-user requirements. The Government should work closely with the domestic industry while designing the national broadband networks and ensure that the right applications are made available at affordable prices to the consumers. The national broadband plan should provide a platform for domestic R&D talent to effectively contribute to all aspects of the rollout process such as requirements gathering, generation of service specifications, network design and final rollout.

Consumer interest can be promoted by developing "broadband experience centers" that showcase popular applications and communicate the benefits to the general public through hands-on usage. Community-based Customer Service Centers (CSCs) may be constructed that not only provide free broadband access but also offer training to neighborhood residents and small businesses through workplace training programs. Government interventions should not be limited to investments in broadband connectivity but complemented by suitable usage incentives such as online homework assignments for students, digital literacy certifications for jobs and "broadband-ready" certifications for building owners in order to make broadband an integral part of modern-day existence.

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

Please refer to our response to Questions 5.1 and 5.2.

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

We recommend that the Government incubate centers of excellence that collaborate with domestic R&D organizations and universities to develop innovative broadband applications that are consumer friendly and in tune with the literacy levels in India. Government in partnership with the Industry can also initiate advanced skills training programs to fuel the growth of a sufficiently large ecosystem of developers that create locally relevant products and services. Dedicated appliances like “touch screen” kiosks which achieve a pointed transaction with ease of use to be promoted, on similar lines of Public telephone booths in the early 90’s, where a single skilled resource can serve multiple consumers with semi-skill/no skill with computers.

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

The experience of other countries has shown that the rate of adoption of broadband has typically exceeded the designed network capacities (e.g. the AT&T network usage post iPhone launch). We expect that with a low broadband penetration, and the low literacy levels of rural customer in India (who in turn will use higher bandwidth applications such as video and pictures) will require the network to extremely scalable and ready to handle huge capacities in future.

We believe that the futuristic bandwidth requirements in the Core may be significantly higher since we estimate that the number of broadband connections will touch at least 200 Million by 2014. Also, the average per user bandwidth too may be

higher than 3Mbps. For example, emerging mobile broadband technologies like mobile WiMAX or LTE are capable of delivering peak rates of up to 100Mbps. Hence, for the year 2014, an average per user bandwidth of 10Mbps would be a reasonable value to use after making allowances for the fact that not all users on the network would access high bandwidth applications during the busy hour. Combining these two aspects and assuming that only 30% of this traffic is switched in the Core, the total bandwidth requirement works out to be ~12,000 Gbps.

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

The current telecom infrastructure and service coverage is grossly inadequate to support broadband demand. We recommend that the Government invest in a new high-bandwidth network with nationwide coverage on optical fiber for efficient transport, aggregation and switching of voice, video and data. The optical transmission network should be built using standardized technologies such as SDH, DWDM and Carrier Ethernet. The proposed fiber optic network may be suitably complemented by wireless and satellite access in select geographies. Many other governments like USA, Singapore and Australia have invested in such a broadband infrastructure and India should do the same, given the strategic importance of having a broadband reach to all parts of the country.

CHAPTER 3: National Broadband Network

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

Evolving technologies such as HSPA, LTE and Mobile WiMAX are capable of delivering high-speed broadband access on a wireless medium. However, the real bottleneck lies on the "backhaul segment", which refers to the network used to transport the accumulated cellular traffic from the cell towers to the switching centers. Today, a large part of the wireless backhaul network is primarily built using microwave equipments that cannot scale to carry the amount of high-speed multimedia traffic expected to be seen in this part of the network as the broadband vision is realized over the next few years. Government should therefore utilize its broadband funds to build a high-speed optical network based on standardized transport technologies such as next-generation SDH, DWDM and Carrier Ethernet that reaches up to the last-mile cell towers. The equipments can be connected in multiple fiber rings in order to use proven self-healing capabilities of these technologies i.e., in the event of a fiber cut, traffic is automatically switched to an alternate working path within 50ms to ensure carrier-grade (99.999%) service availability for critical applications.

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

Government should continue to leverage existing copper networks as an interim solution for broadband access in areas where fiber laying is being hampered due to civil works issues or other hurdles. New IEEE standards such as Ethernet in the First

Mile (defined in IEEE 802.3ah) can support multi-megabit speeds on copper albeit for shorter distances. However, Government is advised not to lay any new copper as the technology is not fundamentally future-proofed for higher capacities as is optical fiber.

5.9 Do you see prominent role for fibre based technologies in access network in providing high speed broadband in next 5 years? What should be done to encourage such optical fibre to facilitate high speed broadband penetration? (Reference Para 3.22)

Yes, optical fiber will play a prominent role in all high speed broadband networks as it can provide nearly unlimited bandwidth for backbone networks. The fiber based networks are future proof as they can carry huge amounts of bandwidth-terabits of speed per fiber strand-have low ongoing costs with a long asset life. Also, with the increase in commercial deployment of optical fiber by several national telecom carriers, the cost of fibre rollout is fast approaching the cost of other wired networks. Government should secure Right of Way for laying new fiber, so as to ensure speedy rollout of optical networks. Both GPON as well as Carrier Ethernet technologies can be used for providing last-mile fiber access, based on the cost/benefit that will vary depending on the population density. A subsidized RoW scheme needs to be activated for Service Providers with a Unified or Wireline license.

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

Given that most of the cable TV in India is unstructured, it may not be suitable as a long-term solution, and at best delivery over Cable TV networks can be regarded as a compromise solution. Broadband over Cable also has fundamental limitations in terms of the upload speeds possible and is more suitable for asymmetric applications.

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

Yes, the non-availability of fiber between the districts/cities and villages should be addressed on priority in order to deliver broadband services to rural areas. In the short-term, the Government can address this by leasing optical fiber (wherever available) and immediately deploying build a high-capacity optical network. In parallel, special projects can be taken up by the government to connect all villages over a certain minimum population on optical fiber. Given the fact that we already have fiber reaching many parts of the country, the incremental amount of fiber that is to be deployed can be done fairly quickly. In order to ensure future scalability, the intra-district backbone rings should be designed to run at 10Gbps speeds as per international telecom standards. This will help the wider telecom market to gain access to a sub-urban/regional population with the potential to immediately reap the benefits of this connectivity due to an established social and economic infrastructure. It will also prepare the network backbone to sustain the surge in traffic that will result when the rural and remote geographies are subsequently connected.

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

Yes, there is a definite need to create a national optical fiber network extending up to the villages in order to deliver a true broadband experience. In order to simplify the engineering effort involved and achieve measurable returns as the project progresses, we recommend that the Government implements this in a phased manner. Phase I could focus on capacity expansion in district-level networks, Phase II on extending optical fiber connectivity to 50% of the villages (e.g., those with a population greater than 500) and the final Phase III can address the remaining villages. Without such an effort, the vision of taking scalable broadband connections to villages will remain unfulfilled.

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

Yes, a specialized nodal agency will certainly help. To begin with, it can use the fiber assets that are already available with operators like BSNL, Powergrid, RailTel, GAIL etc. and which can be expanded as described earlier.

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

The national broadband project may be handled by a specialized agency under full government ownership or by a consortium of service providers in the public sector until the roll-out is completed. This will ensure that the government objectives of nation-wide coverage and universal service are not diluted by commercial considerations. Similar programs in the best performing countries like S.Korea, Japan, Sweden etc have had the governments investing over the long-term as a strategic choice as opposed to using short-term stimulus measures. At the same time, many countries esp. in Europe are careful not to crowd out private investments in geographies where a competitive broadband market is realizable without government intervention. Being a national asset, under direct government control, we can also be sure of protecting our long term security considerations.

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

Since optical fiber has a long asset life, often in excess of 25 years, it is important to anticipate future evolution of market needs while deploying this infrastructure. Learning from similar experiences around the world, India should be far more aggressive in expecting broadband growth and plan for a highly-scalable, future-proof network.

In terms of passive infrastructure, the amount of cable to be deployed in a particular area, duct space to accommodate future cable growth should consider variations in population densities, types of end-users (residential, businesses, government agency etc), nature of service access (symmetric,

asymmetric) and expected yearly growth in traffic accessing the broadband network. The total ownership cost and utility of the fiber optic network will be strongly governed by how well it is optimized as per the needs of the serving area.

The fiber topology is an important consideration for flexible and cost-effective service delivery. Two popular approaches for fiber deployment are point-to-point and point-to-multipoint (PON). In point-to-point deployments, each home/community center/school/office will have its own dedicated fiber optic cable to the point of presence (POP). This is a very flexible architecture as it permits electronics to be changed in a single location, without additional civil engineering expenses. It allows multiple retail providers to connect at various places and add their own innovative electronics more readily, for each individual subscriber, at a relatively central location. Thus it can support high-speed symmetric bandwidths making it future-proof and competition friendly at the same time. In passive optical network (PON), fiber from the POP is fed into an optical splitter in the neighborhood and then divided into individual fibers going into each home – varying from 32 to 128. PON networks are more difficult to unbundle to offer wholesale services since the optical splitters are located in the outside plant where it's difficult for a competitive retail provider to collocate and offer services. Both technologies have their place in delivering rural broadband connectivity – PON is suitable for sparsely populated rural areas where the services delivered are mostly residential in nature, whereas point-to-point technologies such as active Ethernet may be used in densely populated districts.

In terms of timelines, immediate network rollouts can be started in the next 6-12 months using the fiber assets already available (Phase-1 covering all district levels). In parallel, new

fiber can be laid where needed, which can be completed over next 24-36 months. Phase I (6-12 months) could focus on capacity expansion in district-level networks, Phase II (next 12-24 months) on extending optical fiber connectivity to 50% of the villages e.g., those with a population greater than 1000 and the final Phase III (next 24-36 months) can address the remaining villages.

CHAPTER 4: Regulatory Challenges and Future Approach

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

Mobile broadband technologies have advanced to a stage where it is now possible to deliver end-user applications at high speeds with excellent quality of experience. With the recent conclusion of license auctions for 3G and BWA spectrum, mobile operators in India too are expected to roll out high-speed mobile networks based on advanced mobile broadband standards such as HSPA, Mobile WiMAX and TD-LTE by the end of the year.

However, from a definition perspective, fixed broadband will always have higher capacity and lower cost/bit as compared to mobile broadband and hence separate definitions should be provided for mobile and fixed broadband.

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

Yes, the current broadband speed metric of 256kbps is inadequate for most high-speed applications. We recommend

that the broadband definition be revised to a minimum throughput of 2Mbps. However, it may be noted that the average broadband access rate requirement may be significantly higher, up to 10Mbps, in order to support emerging video based applications, 4G mobile broadband and for enterprise services.

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

We agree that the National Broadband network should be treated as vital national infrastructure and the ROW process must be simplified since a large number of munipalities and state authorities will be involved in a nation-wide rollout. In our opinion, the agency or consortium responsible for the rollout should have enhanced powers to access existing underground ducts, wherever available, in order to avoid inordinate delays. Telecom facilities may be further supplemented by access to infrastructure owned by public utilities such as electric poles for aerial fiber stringing, oil and gas pipelines etc which can also be invaluable for a speedy rollout. Once fiber has been laid, the additional fiber can be provided to other private operators (on payment of appropriate charges), so that the total cost of laying the fiber comes down since it will be amortized over multiple usages.

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

The Government/Agency owning the broadband infrastructure should be regulated to offer wholesale bitstream services in the

form of 10/40 Gbps wavelengths, dedicated leased circuits (E1, E3/DS3, STM-1/4/16, Fast Ethernet and Gigabit Ethernet) and shared Ethernet bandwidth. This approach provides maximum scope for product differentiation and innovation to the retail providers and promotes healthy competition that would maximize end-user choice and lower broadband prices in the market.

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

Service providers seeking to monetize the national broadband infrastructure could be asked to provide price undertakings as part of the tendering process to establish broadband price ceilings in the market, facilitate affordable retail pricing and prevent monopolistic practices. Further, building an "open access" optical network infrastructure would help lower entry barriers for new service providers and create a competitive marketplace for broadband. Affordability should also be addressed by providing the requisite stimulus to the domestic telecom industry in the form of R&D grants and loans to develop cost-effective device and equipment designs that are customized for the Indian telecom environment.

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

We believe that broadband prices in the market today may reflect the combined effects of the cost of service delivery and the intensity of competition. Higher costs of entry due to access and backhaul network bottlenecks in the form of limited control

over available last-mile wireline assets (primarily copper today) have resulted in insufficient competition and consequently resulted in higher prices. By suitable Government intervention in the form of building a neutral active fiber infrastructure, the supply constraints in these network areas can be eliminated. Third-party access can be significantly eased through open access policies and this will automatically lead to greater competition and lower broadband prices.

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

It would be useful for the Government to introduce price ceilings for entry level broadband offerings (e.g., less than 2Mbps access) so as to ensure rapid diffusion of broadband in backward areas and amongst poorer households. However, we believe that the Government should not actively regulate prices for the mid and higher speed tiers in the initial years. This would allow retail service providers to have sufficient flexibility to come up with innovative service bundles with other multimedia offerings such as packet voice and video.

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

We suggest that the absolute entry-level broadband tariffs in India from current service providers be benchmarked against similar offerings in other countries. Relative affordability of these prices should be determined on the basis of per-capita gross domestic monthly income in PPP (purchasing power parity) terms. These could then form the basis for calculating the entry-level prices.

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

Please to our response to Question 5.27.

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

Please to our response to Question 5.27.

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

Please to our response to Question 5.27.

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

The deployment of a national fiber-optic infrastructure for universal broadband delivery is expected to spur a large market for home-grown content that would rapidly correct the anomalies that are currently plaguing the international bandwidth sector. Once we have enough broadband content in India (as mentioned below), and users in India as well, broadband will become less dependent on expensive international bandwidth for its success. Independently, due to larger volumes of data to/from India, and availability of alternate undersea cables out of India, the international bandwidth prices can come down, as competition increases.

Public Service Delivery – The National Broadband network would synergize investments in e-governance resulting in a range of

new services and content such as a) online maintenance of electronic health records, transfer of large medical imaging files, remote health consultations on video and large hospital networks, b) online curriculum content, educational material and collaborative research networks (e.g., NKN), c) large volumes of sensor data for traffic management, remote monitoring of critical infrastructure such as dams and smart grid networks and d) online administration and access to basic government services such as passport, PDS, taxation etc.

Entertainment – The availability of high-speed broadband would result in an explosion of entertainment content and catalyze the development of innovative business models for video delivery over multiple pathways such as the Internet (over-the-top video), IPTV, Video-on-Demand and even ad-supported models. It can be reasonably expected that a signficant percentage of this content would be hosted within the country, by service providers or third-party content providers, resulting in a gradual lowering of demand for international bandwidth.

Home-based Entrepreneurship – Various studies have shown that there is a strong correlation between residential broadband penetration and home-based entrepreneurship. Home-based entrepreneurs set up small businesses that sell goods and services over the Internet. The growth of this segment can be expected to trigger a significant demand for local web-hosting services that will not only have a favorable impact on domestic content hosting charges but also on the volume and proportion of searchable web content available within the country.

Also, as users increasingly start demanding higher broadband speeds to run various high-capacity applications, many of the bottlenecks such as bandwidth constraints in the backbone and

high cost per megabit on international links will be taken care of by market forces over time.

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

The Government is advised to make use of distributed test tools such as SpeedTest that measure the actual speeds being experienced at the user-end, besides carrying out carrier-end testing of throughput and latency measures. Together these can truly confirm if there is significant variance between advertised and actual speeds delivered to consumers.

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

As per recent surveys, over 85% users in India experience broadband services over xDSL technology. With xDSL, the peak data rates delivered are strongly dependent on the length of the copper loop from the exchange leading to significant variability in broadband quality. However, as fiber penetrates deeper into the access network, either to the home, a community center or up to a multi-tenant building basement, the quality of broadband connections will be seen to improve by an order of magnitude. Also, on fiber, there will be no proportional drop in speed with distance – all residences/businesses/service centers falling within the maximum range of optical signal will receive identical service. Hence, we recommend that the Government

invest in an optical fiber infrastructure to solve quality of service issues.

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

We believe that the Government should increasingly make a distinction between upload and download throughputs as more bandwidth hungry applications start getting deployed on the broadband networks. This is because many of these applications like two-way video calling, video-conferencing, real-time gaming are symmetrical in nature and consumer higher bandwidths in both uplink and downlink directions. Also, capacity contracts should have both a Committed Information Rate (CIR) and an Excess Information Rate (EIR) component. CIR would refer to the minimum committed bandwidth whereas EIR would be a variable amount that would be delivered in a fair-share manner based on the level of end-user activity in the network.

In implementing a next-generation broadband infrastructure for high speed applications, the Government is advised to define additional product specifications for security enablement, classes of service, multicast support and real-time reporting. In this respect, the Government may follow an approach similar to the regulatory bodies in U.K (Ofcom) and Australia that have come up with standard technical requirements for next-generation bitstream services that accompany the broadband policy documents. Both these regulators have preferred to recommend an interface technology, Ethernet, right at the

outset in order to simplify the generation of technical requirements. The choice of Ethernet has been driven by its simplicity, infrastructure independence, flexible bandwidth provisioning capabilities, security and QoS features.

Security: The broadband network should be able to support network security and integrity to ensure secure delivery of services and clean separation of various end-user streams. The network shall support IEEE 802.1ad and IEEE 802.1ah to enable scalable traffic separation between the end-user of the service, retail service provider and the wholesale provider. In case, the end-user is a security-sensitive establishment such as a government agency, it should be possible for the agency to transparently apply a variety of encryption and authentication schemes to bolster security.

Classes of Service: Although the use of standard traffic parameters like throughput delay, jitter, packet loss would suffice for most applications, it will be required to define differentiated performance values for these parameters depending on various classes of service. We believe that there is a requirement to support at least eight classes of service so that the consumers (businesses or residential) and retail service providers have sufficient choice in selecting a combination of classes as per their application needs.

Multicast Services: Efficient delivery of next-generation video services that are transmitted in a one-to-many architecture requires the support of multicast technology on the broadband network. The availability of multicast capabilities will ease barriers to entry for new video service providers since the deployment of advanced services like IPTV would either require bandwidth-heavy unicast backhaul of video streams or the

installation of expensive equipments at co-location points to provide multicast functionality.

Real-time Reporting: With the increasing use of real-time applications on the broadband network, the service providers should be required to provide timely and on-demand reports on available capacity to the consumers. Standards on performance monitoring and reporting are available in Ethernet OAM standards (IEEE 802.1ag and ITU Y.1731)

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

The Customer Premise Equipment, as it is popularly defined, would actually include two types of devices – a) one which serves as a network termination unit (NTU) which could be either shared or used one per user, e.g., a DSL modem or a Cable modem and b) the actual user terminal such as a laptop, a desktop, a smart mobile handset or tablet used to access the data network. An NTU would be expected to be located as a shared device at a Customer Service Center (CSC) in a village neighborhood. With reference to the NTU, we recommend the use of point-to-point Ethernet based CPEs as a solution that marries low costs with bandwidth scalability and ease of use. Because Ethernet switches are standards-based, used universally and shipped in huge volumes every year, the economics of Ethernet-based products is very attractive. Ethernet-based CPEs can deliver standard IP services such as VoIP, Video and IP VPNs etc, are highly inter-operable and work with a variety of access media including fiber, copper and wireless. The end-user terminals will also be provided at CSCs but may also need to be subsidized through soft loans or provided as part of innovative

service schemes to poorer customers and rural schools to encourage wider adoption of broadband.

Further cost reduction is possible by encouraging the domestic telecom talent to come up with innovative and cost-effective designs for Customer Premise Equipments. Indian entrepreneurs who do R&D and IPR to create telecom products must be actively encouraged. Like in other countries, government should create a telecom R&D corpus and provide upto 50% of the R&D costs in the form of grants or soft-loans. The Equipments once successfully tested and validated may be procured through USO funds and deployed in the National Broadband Network.

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

Please refer to our responses to 5.1, 5.2, 5.3 and 5.4.

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

Broadband penetration is closely related to affordability which is linked to the overall cost of service delivery for the network operator.

In addition, given the need for local content and eco-system for broadband, if a domestic telecom product and application industry is encouraged, in the long term it will boost broadband penetration. A certain portion of the operators revenues (e.g., from the USO) can be dedicated for creating a domestic broadband infrastructure industry. As in other countries, Government projects of national significance such as the National Broadband Plan, should also be leveraged to develop a vibrant telecom product eco-system from India. The National

Broadband Network should only use Indian products, if available, as far as possible. As long as Indian products meet the global standards on technology and quality, they should be actively promoted since this is the only way the domestic industry will gain economies of scale required to make it competitive on price, lower service costs for the operator and consequently boost broadband uptake in the country.

There is need to encourage niche operators for providing broadband in a specific village or locality instead of asking for license for the entire State/Circle. The assistance from Government/USOF should also be available to all operators, manufacturers, innovative R&D establishments and new upcoming technology providers even though they may not have past experience.

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

The growth of broadband in India is currently being hampered by the non-availability of a scalable and affordable delivery infrastructure such as optical fiber thus posing a major barrier to entry for new service providers. Government can play an important role in creating a level playing field by partially subsidizing this infrastructure and investing in a nation-wide optical active fiber infrastructure with open access policies. Open Access policies will lower entry barriers and create a competitive marketplace for broadband thus delivering higher capacities at lower prices to more of the population. A similar level playing field should also be created on the infrastructure front by incentivizing domestic product companies to compete effectively with foreign manufacturers. Offering preferential access to domestic telecom companies on strategic projects like

National Broadband Plan will prove to be a “win-win” for both the local telecom industry and the end consumer through availability of affordable broadband.

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

We believe that the “National Broadband Network” presents a great opportunity for the Government to catalyze the domestic telecom industry and develop a rich ecosystem of local telecom device and equipment suppliers, manufacturers, service providers and application developers that will boost broadband usage through innovative and cost-effective solutions. As far as possible, the National Broadband Network should be built using products that have been designed and developed by Indian companies with complete IPR residing in India. If such products are not available for some parts of the network, the products used should at least be manufactured in India. Such companies may be given suitable tax/fiscal incentives.