2010 Global Symposium for Regulators
Dakar, 10 to 12 November 2010

SOURCE: **Telecom Regulatory Authority of India (TRAI)**

TITLE: **Defining open access: making sense of the various concepts**

1.0 Some parts of the telecommunications networks today can be classified as "bottleneck" facilities as they cannot be easily replicated by competitive service providers. Examples are access networks and cable landing stations. In the most general form "open access" allows multiple competitors to share a bottleneck facility that is a critical input for the services that are provided using this facility. "Openness of access" requires the service provider owning the bottleneck facility to compete with the other competitors on non-discriminatory basis in terms of cost and quality.

2.0 Motivation for seeking to promote open access is to facilitate increased competition. It is important for regulators to handle abuse of market arising from control of critical facilities. Non-discriminatory and cost-oriented access to these facilities achieves this. Some of the instances where TRAI has intervened in regulation of market power and ensuring availability of bottleneck facilities to competitive service providers are sharing of domestic leased circuites and Virtual Private Networks (VPN), sharing of Cable Landing Station facilities, Intelligent Networks and Interconnection.

3.0 While there is a wide diversity of regulatory options for enforcing or promoting open access, three key elements include:

i. Regulated pricing for wholesale access to prevent a bottleneck provider to price at a level that makes wholesale access uneconomic for the provider. TRAI issued regulation on Domestic Leased Circuits in September 2007 which allowed service providers to share facilities in the access and trunk networks for the purpose of building leased circuits and VPNs. The service providers are obliged to provide such leased circuites at a price ceiling laid down by TRAI in Telecom Tariff Order(Thirty sixth amendment) of April 2007.

ii. Establishing the terms and conditions for how access will be provided. This includes defining the forms of wholesale access. In case of facilitation of access to international bandwidth, the regulation issued in June 2007 makes it necessary for the cable landing station owners to publish a Reference Interconnect Offer (RIO) and get the schedule of rates examined and approved by TRAI. The cable landing station owner would provide access on fair and non-discriminatory terms and conditions.

iii. Line of business restrictions which may (or may not) limit the range of activities that the wholesale provider of the bottleneck facilities may engage in. In broadcasting sector, TRAI has taken account of various factors to mandate that Headend-In-The- Sky(HITS) operator can give signal to the Local Cable Operator or Multi-System-Operator(MSO) but not to the subscriber directly.

4.0 Migration to Next Generation Networks(NGN) serves to decouple the services and applications from the network complexities, facilitating applications/content based services to be provided easily and also enabling third party application service providers to compete with the network operator in the provision of services making the network more open. It is recognized that this would work like a double edged weapon. On the one hand it would make access to the network open with the possibility of interconnecting at different layers enabling good competitive environment but on the other hand it creates the risk of major operators consolidating their market dominance by controlling key resources or restricting access to the upper layers of the NGN. The regulator has to make an appropriate framework of ex-ante and ex-poste regulations to tacke the situation.

5.0 From the customer's perspective, there is effective open access if an end-customer can elect to receive service from multiple service providers offering services that could reasonably be considered substitutes which are provided over a common last-mile infrastructure platform; and if the customer's range of choice is not unduly constrained by the inability of competitors to obtain access services. Moreover, with an open access configuration, the end user is not forced to buy all of its services bundled from a single service provider, but can in fact get its voice services from one service provider, while subscribing to an internet data service from another. TRAI made recommendations for local loop unbundling in 2004 which was not accepted by the government.

6.0 Internet is a powerful medium and contributes to economic growth of the country. It is, therefore, important that access to such IP networks is available to people easily and at affordable price. TRAI has taken a number of steps to ensure availability of broadband to common masses. Different licensee like UASL, CMTS, Basic service providers and Internet service providers can provide broadband under their respective license. TRAI has also issued a consultation paper on National Broadband Network to look into various impediments to broadband proliferation. Consultations have been done on many issues including building a national core network that would be available to all service providers to enhance their reach in rural and remote areas. This, if agreed to, would take open access to the next higher level in the country. TRAI is expected to publish the National Broadband Plan shortly.

7.0 Fiber optic cables are long-life assets and installing facilities in "lastmile" networks involves a substantial commitment of fixed costs. It therefore makes sense, in many cases, to plan for a longer horizon and derive economic benefit from installing substantial excess capacity than what is immediately required.

When installing fiber, much of the cost is associated with laying ducts and conduits or other outside structures in place, and the costs are not significantly increased by drawing multiple fibers. Additionally, since much of this investment is sunk, the first carrier to deploy fiber may have a significant competitive advantage. In any case not many service providers are expected to replicate optical fiber network. This may create a bottleneck for roll out of Next Generation Networks.

8.0 In the context of NGN TRAI would consider ex-ante and ex-poste regulatory measures at the appropriate time based on the prevailing situation. TRAI is well aware excess regulatory uncertainty or fear that the policies that are inappropriate can retard investment in next generation infrastructure. On the other hand no regulation may re-establish market powers and impede competition. A win-win window would have to be found.

2010 Global Symposium for Regulators
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SOURCE: **Telecom Regulatory Authority of India (TRAI)**

TITLE: **Open access to networks: what policy and regulatory tools to enable opening up access to network facilities (i.e., international fiber networks, "essential" or "bottleneck" facilities, other networks) without harming investment and innovation?**

1.0 There are a number of segments of the telecommunications network access which could be opened by regulatory intervention for increasing competition and making services available to consumers at affordable prices. The open access concept is therefore not limited to unbundling of local loops. The regulators, however, must balance the need for open access with infrastructure development. TRAI made recommendations for passive and active network sharing among operators which was accepted by the Government. Today service providers can share towers and associated civil and electrical infrastructure for mobile and broadband services as also Radio access network and backhaul. They can share ducts and conduits and other passive elements of the network. It can therefore be said that TRAI has been able to open up access to the network to a large extent through regulatory measures.

2.0 Domestic and international leased lines are and will remain a key component for the economic growth of the country. These are also crucial building blocks for e-business, e-governance, internet access, BPO and IT industry. In the absence of competition in these markets, consumers become captive subscribers of the one or two service providers and, therefore, consumers suffer either in the form of low quality services or higher price. TRAI has issued Domestic Leased Circuits Regulation, 2007 on 14.09.2007 that puts obligation on the service providers to share their access network to provide resources to enable other service providers in building domestic leased circuits and VPNs for their customers.

3.0 Cable landing stations are important for access to submarine cables. With very few cable landing stations, they are a bottleneck facility open acces to which is important for achieving affordable rates for international leased lines. TRAI has issued the 'International Telecommunication Access to Essential Facilities at Cable Landing Stations Regulation in June 2007 which mandates owner of the cable landing station to provide access to cable landing station on fair and non-discriminatory basis to any other service provider.

4.0 Intelligent Network(IN) services like toll-free service are important for customers as these services are usually contracted by pulic-service agencies like hospitals, delivery agencies like couriers and fast-food outlets, banks and maintenance agencies. In India, in the past these services could be accessed by customers of

the same service provider who was providing the intelligent network services. In November 2006 TRAI issued a regulation making it mandatory for all service providers to open up their networks so that subscribers of any service provider are able to access toll-free numbers of any service provider.

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SOURCE: **Telecom Regulatory Authority of India (TRAI)**

TITLE: **Open Networks: How to ensure that every citizen has access to the benefits of ubiquitous broadband Networks**

1.0 Though the growth in number of mobile connections has been impressive, the target for broadband connections set by National Broadband Policy of 2004 could not be achieved. Majority of 10.08 million broadband connections installed by end of August 2101 are on copper using DSL technology. The analysis of the broadband connections reveals that 87% of broadband connections are provided using Digital Subscriber Loop (DSL) technology. Just 7% broadband connections are provided using Cable TV network, and 1.2% broadband connections using wireless technologies. Broadband penetration is about 0.85%. Growth of broadband has been limited mainly to urban areas with 60% of the broadband connections being in top 10 cities. Similarly, more than 75% of broadband connections are in top 30 cities. Just about 5% of the present broadband connections are in rural areas as compared to about 31% of total mobile telephone connections.

2.0 This data clearly indicates dominance of DSL technologies which use wireline network for provision of the broadband. We have about 38 Million copper loops to provide wireline telephone connections which put a theoretical upper limit on the broadband connections. Fast spread of broadband would require adoption of other technologies.

3.0 The slow growth of broadband is attributed to a number of factors such as limited infrastructure to provide broadband, limited applications, low computer & English literacy, high cost of broadband usage and low PC penetration. TRAI understands the importance of broadband and has taken a number of steps from time to time for increasing growth of broadband. Some of these are recommendation for allocation of spectrum for Broadband Wireless Access to enhance broadband penetration; to permit ISPs to use any media (fibre, radio, copper cable, Cable TV network) in establishing last mile to provide broadband; revision of tariff ceiling for Domestic Leased Line and International Private Leased Circuits (IPLC) in order to reduce Internet bandwidth cost; issuing of regulations to facilitate access to essential facilities at cable landing stations to enhance competition and reduce international bandwidth charges.

4.0 In spite of these measures, the growth of broadband in the country is far below the expectations. The available infrastructure needs to be upgraded both in access and core network to facilitate broadband growth. The access network have bottlenecks with limited availability of copper network, very low penetration of optical fibre to home or curb and limited availability of spectrum for wireless broadband. Auctions for allocation of 3G and BWA spectrum have been successfully concluded recently. Spectrum is being allocated to successful bidders. It is expected that BWA technologies (3G and Wimax) will play vital role in boosting broadband penetration. In addition, there is a need to create optical fibre access network in all major cities and metros to provide high speed broadband. There only are 42 cities having population of more than 1 million. These big cities are having optical fibre in core network but in access network optical fibre penetration is limited. In these cities, laying of optical fibre to home will be desirable in case of individual dwelling units and optical fibre to the curb would be useful for multiple dwelling units. In case of cities with population less than 1 million, fibre to the curb may be desirable. Optical fibre up to the villages may do well to start with.

5.0 The backhaul capacity is also limited. In many cases, ultimate broadband speeds are slow due to congestion in the backhaul. The sustained broadband growth in the country requires focused attention. There is a need to chalk out a national strategy that provides a long-term vision and detailed plan for the growth of broadband in the country. Various issues impeding broadband growth have to be identified to facilitate deployment of robust & scalable broadband infrastructure.

6.0 TRAI has recognized the importance of broadband and enhanced focus is being given. As per the revised target, 100 million broadband connections will be provided by 2014. To put India on a correction course, TRAI is consulting stakeholders for formulation of a National Broadband Plan to provide nationwide optical fiber network for boosting broadband growth in rural and urban areas. It is expected that the broadband plan will be published soon. In addition to other issues, the consultation paper for National Broadband Plan discusses the issue of making all 374,552 villages with a population of more than 500, broadband enabled in about 3 years tme by laying optical fiber at a cost of about US$ 6.5 billion. Needless to say such a project has the potential of providing livelihood to millions and of having a salutary effect on the economy. This backbone network would provide open access to all service providers.

7.0 The Digital Dividend spectrum in 700 MHz range has very good propagation characteristics. This makes this spectrum particularly well suited to providing mobile broadband coverage in rural and suburban areas. Studies have established that it is approximately 70% cheaper to provide mobile broadband coverage over a given geographic area using UHF spectrum than using the 2100MHz spectrum, which is widely used for mobile broadband today. Being a sub 1GHz frequency, the 700MHz band has the following advantages:-

- Better propagation characteristics ;

- Signals travel farther and pass through walls and other obstacles much better than existing cell phone networks do, leading to a less number of cells to provide the same coverage;
- Less capital expenditure is required for roll-out of services.
- Less power is required to run a mobile phone/Internet cell on the 700 MHz band than other bands, which are at higher frequencies.
- Due to less CAPEX, larger wavelength and better propagation characteristics, this band is useful to provide wireless broadband services particularly in rural & far flung areas. Also, it is suitable for the higher bandwidth hungry application i.e IMT advanced serviced. Thus higher bandwidth at lower cost can be provided.
- The spectrum in the 700 MHz band allow for the creation of a national broadband public network with enhanced communication capability.

8.0 In India, the TRAI in its recommendations on Spectrum management and licensing framework dated 11th May 2010, has stated that allocation of 700 MHz band could stimulate innovation for lower-cost communications especially in rural and remote areas of the country. Efficient allocation and assignment of this spectrum will deliver the full social and economic benefits of the digital dividend. Accordingly, it has recommended to the Government that spectrum in the 700 MHz band:-

- 585-698 MHz may be earmarked for digital broadcasting services including Mobile TV.

- 698-806 MHz be earmarked only for IMT applications.

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SOURCE: **Telecom Regulatory Authority of India (TRAI)**

TITLE: **Open Internet: How to handle Traffic management over increasingly congested networks while applying fair rules**

1.0 Increasing digitalization and expansion of network capabilities are enabling network convergence which facilitates provisioning of telecom, broadcasting & IT enabled services over the same network. This convergence is leading to higher bandwidth requirements. India is targeting 100 Million broadband connections by 2014. The volume of Internet traffic has been forecasted to increase fourfold during the period 2008-2012. To get an idea of the enormity, one may look at applications like YouTube, Blogosphere, Facebook and Twitter. There are more than 70 million videos on YouTube as on March, 2008 and YouTube is visited by more than 100 million viewers per day. It is streaming 1.2 billion streams per day. There are more than 400 million active users on Facebook as on 30th May, 2010. Six months ago, this was 250 million, indicating around 60% increase in users. People spend over 500 billion minutes per month on Facebook. These Web 2.0 applications allow customers to create, upload, edit and share content.

2.0 Although India is a low ARPU market, it has about 150 million data users, who are growing @ about 47% each year as per a CLSA study conducted recently. Of these data users, about 50-60 million subscribers already own 3G handsets and 3G handsets account for 10-12% of total handset sales. Entry level 3G handsets cost has come down and is around $110.

3.0 In this changing scenario and in view of users' preference to be always connected the demand of bandwidth per user will exponentially increase. Assuming that 5% (11.5 Million), 20% (48 Million) & 40% (100 Million) households will have broadband by 2010, 2012 & 2014 respectively, the bandwidth requirement even with most conservative estimate of 3 Mbps per household, with a contention ratio of 1:50, will be a huge 750 Gbps, 3000 Gbps and 6000 Gbps respectively. Optical fibre is one of the options being perceived as long term solution to carry enormous bandwidth in core network.

4.0 Adequate availability of bandwidth to the end user will be a challenge both technically and commercially. While networks can be designed considering the futuristic bandwidth requirement trends, the cost of creation of such networks would not be commensurate with the returns by higher bandwidth utilization. The increasing competition has created a scenario where bandwidth demand per

user is increasing but ARPU is decreasing. This is an emerging challenge to service providers. In order to ensure business viability, service providers are adopting models which rely more on returns from value added services. Incidences of selective blocking of various applications for commercial reasons are also being reported. This has put Net neutrality on priority agenda of regulators.

5.0 Incidences of other imbalances have also been reported. While most of the subscribers want flat tariff plan to limit their monthly commitment towards broadband and prefer unlimited packages, some of the users consume abnormally high bandwidth. This impacts the network performance and creates serious problems to ensure QoS. Some service providers have started using fair usage policy to curb such usage. This is being resisted by consumers groups as they feel that in packages permitting unlimited download, use of any restrictions is against the set practice.

6.0 Ensuring QoS is another challenge. TRAI has issued 'Quality of Service of Broadband Service Regulations 2006' by prescribing the various benchmarks for quality of service. Benchmarks have been prescribed for various parameters including connection speed, service uptime, bandwidth utilization, packet loss, latency, service provisioning, billing performance etc. TRAI monitor's the performance of service providers on quarterly basis against the prescribed benchmark for these parameters. However, Offering assured QoS in multi service provider broadband network is a key concern. The quality sensitive subscribers are now using a new term Quality of Experience (QoE) to lay more emphasis on required quality of service. Quality of Experience (QoE) is defined as the overall acceptability of an application or service, as perceived subjectively by the end-user. Quality of service standards for video, audio, text, graphics has to be redefined in view of increasing bandwidth sensitivity of different applications. Applications like Grid computing & Cloud computing are being launched now-a-days and will require much better broadband networks performance.

7.0 As such, ensuring congestion free network with guaranteed QoS and affordable cost will be a challenge to regulators in times to come. Move towards high bandwidth fiber and broadband wireless access and high bandwidth fiber based backbone with migration towards Next Generation Network is expected to bring relief to customers as well as the operators. The issues are, however, quite complex and would need continuous attention to keep meeting future challenges.

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SOURCE: **Telecom Regulatory Authority of India (TRAI)**

TITLE: **Open access to content: what role for regulators in bringing public services online (i.e., e-government, e-education, e-health) and creating demand for such services?**

1.0 Government of India chalked out a National e-Governance Plan (NeGP) in 2006 with an outlay of approximately Rs. 6000 crores for delivering government and private services at the doorstep of the citizens. Under this project funds were provided to State governments for installation, operation and maintenance of State Wide Area Networks (SWAN), for delivering e-governance applications. Many state governments and government-run agencies have incepted several e-governance projects like e-chaupal, Bhoomi, n-Louge, Akshaya, Gyandoot etc for benefit of common masses.

2.0 The National e-Governance Plan (NeGP) comprises 27 Mission Mode Projects (MMPs) and 8 components. The existing or ongoing projects in the MMP category, being implemented by various Central Ministries, States, and State Departments would be suitably augmented and enhanced to align with the objectives of NeGP. Central MMP were established for the areas such as banking, central excise & customs, income tax, insurance, National Citizen Database, passport, immigration and visa, pension, e-Office etc. State MMPs were specifically for agriculture, commercial taxes, e−District, employment exchange, land records, municipalities, gram panchayats, police, road transport, treasuries and Integrated MMPs are for Common Service Centres(CSC), e-Biz, e-Courts, e-Procurement, EDI For e-Trade, national e-governance Service Delivery Gateway, India Portal etc.

3.0 Department of Information technology (DIT) has also planned to deploy 104,881 CSCs in rural areas all over the country under NeGP in order to deliver e-governance services in the rural areas. The project was started with an estimated cost of Rs. 5742 crores to roll out these CSCs in 4 years. However 80,000 CSCs (Common Service Centres) have been established so far in the country. 600 of 1,100 citizen centric services launched in 2006 are now available online and the rest will be operational by 2014.

4.0 Recently the Government announced that in all, the total outlay for all projects together is almost Rs. 30,000 crore, inclusive of both capital expenditure and the operational expenditure. Almost Rs. 10,000 crore expenditure has already

been done, and another Rs. 20,000 crore will be incurred during the remaining project life. Since this includes the operational expenditure, it may spill even beyond 2014. The services now available online are just 14 of the 27 Mission Made Projects of the NeGP. The rest of the services will be functional by 2014.

5.0 Under Bharat Nirman-II scheme, as on July, 2010, 96,971 villages have been provided broadband coverage and all the 2.5 lakhs Gram panchayats will be provided broadband coverage by year 2012.

6.0 TRAI has taken many initiatives regarding promoting policy for network modernization and infrastructure investment at country level. One such initiative is floating of consultation paper on 'National Broadband Plan'. Presently consultation process is going on with all the stakeholders where many relevant issues including creation of National broadband network, are being deliberated. The concept of connecting all the villages by providing OFC connectivity has been deliberated in the consultation paper.

7.0 Regulators may encourage access by way of creating awareness among the citizens for the use of e-governance, e-education and e-health. Regulators may also like to encourage government department to interact with the citizens through on line and may request them to put as much material as possible on the web for accessibility of the citizens. Regulators are required to ensure connectivity of broadband of all primary health centres and specialized hospitals so that citizens may feel benefit of connecting through high bandwidth to these services. E-education may also be encouraged through providing good course material on the web. Content is the most important part for success of these services and citizen would only realize importance of these services when they are able to desire data on the web. Environment is required to be created for use of high quality multimedia services.

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SOURCE: **Telecom Regulatory Authority of India (TRAI)**

TITLE: **Challenges to open networks (i.e., cyberthreats, unforeseen aspects of the Information Society, disputes, regulatory efficiency and consistency across services and networks): what strategies?**

1.0 Development of open networks with the possibility of one billion connected people increases the security threats. Protection of consumers from data theft, fraud, denial of service attacks, hacking, cyber warfare, has become a challenge. Some cyber-attacks targeted against systems, controlling infrastructure, which would have debilitating effect. Cyber security will become of paramount importance as open networks will not be limited to providing vital services to citizens but will also be used as core network to provide various citizen centric services.

2.0 Developing a framework for cyber security and CIIP (Critical Information Infrastructure Protection) will be of prime importance. IP networks, being based on open architecture and well known protocols, are vulnerable to cyber attacks. The number of cyber attacks is increasing day by day. As per the information submitted by Computer Emergency Response Team India (CERT-In), the referral agency to monitor computer security incidents in India, during the month of June, 2010 alone there were 70 security incidents and 690 Indian websites were defaced. There is a definitely a need to create awareness about the risks of technological progress among consumers and take necessary measures for data protection, consumer rights, and protection of minors & vulnerable segments of the society.

3.0 In order to protect the critical information higher order encryption would be required. However, with higher order encryption it will be difficult to intercept the messages by Lawful Interception & Monitoring Agencies for maintaining law and order and national security. A balanced approach would be required for creating a framework for protection critical information.

4.0 IP networks are being widely hailed as the most efficient, robust, resilient, scalable networks; able to support desired quality of service and a wide variety of applications. Rapid technological developments and universal acceptability of IP networks is driving convergence across the globe. The convergence is the main driving force for all IP networks known as Next Generation Networks (NGN).

5.0 Presently, most of the policies still reflect the pre-convergence era in which all the intelligence resided in the core network as against the Internet architecture in which most of the intelligence is at the edge of the network. This gives higher flexibility for launch of new value added services. The future network scenario is likely to be very different and complex as network topologies, protocols and services offered by different service providers will be different. Present interconnection among the operators is channels based and inter service providers interconnect usage charges are calculated based on total usage in minutes. The adoption of IP based backbone will bring in the concept of capacity based interconnection and charging will be done based on the volume and guaranteed QoS at Interconnection point. There are indications that established interconnection regulatory regime may not be flexible enough to meet the emerging requirements and may require substantial changes.

6.0 Security has to transition from the traditional reactive stance to an incrementally proactive stance by reducing windows of vulnerability, improving reaction times, and effectively mitigating attacks. Preventing attacks by patching vulnerable systems implementing firewalls or other access control technologies, monitoring through intrusion detection systems, logs and OS calls and responding to the threats in real time have become crucial to operations of the networks. Customers need end-to-end and automatic protection so that a system of implicit trust does not disintegrate into a system of pervasive distrust.