BIF response to TRAI CP on Roadmap to Promote Broadband Connectivity and Enhanced Broadband Speed

Preamble

We thank the authority for the release of a comprehensive consultation paper. The noteworthy & ambitious goals set out in the National Digital Communications Policy, 2018 require that an achievable and incremental roadmap be designed to improve the quality and adoption of broadband services. We believe this consultation paper asks the right questions and can inform appropriate strategies for the implementation of such a roadmap.

The proliferation of broadband connectivity throughout the nation will induce economic effects that lend themselves to the growth of local economies and their citizens. The theory of spillover effects suggests that certain investments, such as in the development of transit networks, energy grids, clean water and telecommunications tend to induce economic effects that spill over to other sectors of the economy, and typically manifest as increases in total factor productivity. For all the above, these spillover effects have been found to be significantly positive. *In a recent study on the effects of infrastructure investments on firm productivity that focused on road, telecommunications, and cable investments, researchers found that telecommunications investments induced positive firm-level productivity increases that even outpaced efficiencies driven by the development of road networks **[1]**.* Other analyses of the economic effects and impacts of broadband yield similar insights. A 10 percent increase in internet subscribers has been found to increase a states GDP per capita by as much as 3.2%. *At the same time, an increase in internet traffic, as would be expected from an increase in the total number of subscribers, was also found to yield a per capita GDP increase of 3.1% **[2]**.* A consumer surplus study from 2017, that focused on the value generated from the use of rich interaction applications (RIA), found that the use of internet applications focused on communications and information sharing (RIAs) alone helped consumer save on average 803.9 minutes per week. Based on the average annual income in India (INR 94,130), the study extrapolated an annual consumer surplus of US$98 billion in 2017. *It also concluded that each user of RIAs in India receives on average US$249 of consumer surplus annually **[3]**.* There is ample evidence from the academic community, and on the ground to support the authority's intent to encourage the proliferation of broadband services throughout our nation.

*Of the 705.4 million total broadband connections in the nation, 684 million or 97% are mobile connections **[4]**.* It may be noted that the number of unique broadband subscribers would be significantly lower than the number of connections mentioned due to the fact that there would be a large number of multiple SIMs in the mobile connections. This also indicates the immense scope that still exists for connecting Indians all over the nation. Indian subscribers benefit from the mobility offered by cellular networks and most access the internet using this medium. Where mobile data networks excel at enabling access mobility, fixed networks provide reliable on-site connectivity generally preferred by enterprises, small businesses and even many retail customers. It is therefore imperative that

[1] Zhang, Y., Wan, G. & Huang, Y., 2018. The Effect of Infrastructure on Firm Productivity. In: N. Yoshino, M. Helble & U. Abidhadjaev, eds. Financing Infrastructure in Asia and the Pacific: Capturing Impacts and New Sources. Tokyo: Asian Development Bank Institute, pp. 146-159.

[2] Kathuria, R., Kedia, M., Sekhani, R. & Krishna, U., 2018. Growth Dividends of Digital Communications, New Delhi, India: ICRIER & Broadband India Forum.

[3] Arnold, R., Hildebrandt, C., Kroon, P. & Taş, P., 2017. The economic and societal value of Rich Internet Applications in India, New Delhi, India: WIK & BIF.

[4] TRAI, July 2020. Telecom subscription report. [Online] Available at: https://trai.gov.in/sites/default/files/PR_No.62of2020_1.pdf

a review of policies to promote the development and adoption of broadband must consider reforms that align with the dominance of mobile connectivity, while also providing for the development and adoption of fixed access services.

We provide below our responses to the questions asked by the Authority.

Question 1: Should the existing definition of broadband be reviewed? If yes, then what should be the alternate approach to define broadband? Should the definition of broadband be: a. Common or separate for fixed and mobile broadband? B. Dependent or independent of speed and/or technology? C. Based on download as well as upload threshold speed, or threshold download speed alone is sufficient? D. Based on actual speed delivered, or on capability of the underlying medium and technology to deliver the defined threshold speed, as is being done presently? Please suggest the complete text for revised definition of the broadband along with the threshold download and upload speeds, if required for defining broadband. Kindly provide the reasons and justifications for the same.

BIF RESPONSE

Through its notification 4-4/2009-Policy-I, dated 18th July 2013 ***[5]****,* The Department of Telecommunications revised the definition of broadband to the following

> *"Broadband is a data connection that is able to support interactive services including Interest access and has the capability of the minimum download speed of 512 kbps to an individual subscriber from the point of presence (POP) of the service provider intending to provide Broadband service."*

In the time since, communications technology has transformed radically, and entirely new markets for data services have emerged across the nation. It is our view that a nations definition of broadband must be based on a review of current state of technology as well as a desirable Quality of Experience (QoE). Numerous modern internet applications and use cases now require higher speeds than prescribed by the definition above. It is our view that since the current definition of broadband captures neither the development of the technology nor the Indian consumers' appetite for high speed broadband services, it must be reviewed and redefined.

Many nations choose to measure as well as set fixed and mobile broadband speeds separately, due largely to differences between speeds available & possible on fixed vis-à-vis mobile networks. We also recognize that guaranteeing connectivity on mobile networks is tenuous and agree that poor connectivity is often encountered in topographically unique and subterranean locations. We make our recommendations with respect to a revised definition after due consideration of such facts.

We recognize that recommending upstream bandwidth thresholds would increase transparency, and also note that a minimum amount of uplink speed is essential for ensuring a reliable video streaming experience (content consumption as well as video conferencing), which also happens to constitute a majority of traffic over the public internet. *A recent report from Mozark reveals that minimum upload and download speeds of 14 Mbps are essential*

[5] Ministry of Communications and Information Technology, Government of India, 2013. Gazette Notification. [Online] Available at: https://dot.gov.in/sites/default/files/E_Gazette_notification.pdf

for ensuring reliable video streaming & conferencing ***[6]****.* We account for the above when proposing a new definition for broadband. We also urge the authority to consider mandatory disclosure of upstream connectivity by ISPs (via labeling of services) to improve transparency and encourage the provision of better services

We also recommend that the current practice of defining broadband based on the capability of the underlying medium must be abandoned in favor of the approach to limit the definition to the speed delivered to the end consumer. As a defining characteristic, the connection speed is sufficient for consumers to make an informed decision. In all but the rarest of cases, customers concern themselves with the quality (primarily speed of access and fair use limits) of the broadband connection over the actual medium on which the service is delivered. This preference is reflected in our proposed definition at the end of this section.

The National Telecom Policy of 2012 called for the redefinition of broadband "to 2 Mbps by 2015 and higher speeds of at least 100 Mbps thereafter" ***[7]****.* The ITU also defines broadband as *"transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbits)"* ***[8]****.* We therefore recommend that a network must comply with the requirement to provide 2 Mbps download and upload speeds to be considered a broadband connection, regardless of the medium or technology used to deliver the service. We also recommend the creation of additional tiers that represent increasing levels of quality and enhance transparency in the provision of services, but are entirely optional for service providers to guarantee. At the same time, connectivity that is faster than the 2 Mbps standard is now a mainstream requirement in the market for internet access.

A segregation in the definition of Broadband into distinct speed categories is observed in the case of many nations ***[9] [10]****.* Tiered definitions, such as basic, fast and ultra -fast broadband enhance transparency in the provision of broadband services, as well as provide an incentive for service providers to offer better services. *We would like to draw attention to the EU digital strategy which defines such levels of access, and the fact that since as far back as 2012, these tiered definitions have led to increased competition within and among EU nations to maximize the reach of better, faster and more reliable broadband infrastructure and access* ***[11]****.* We believe a similar, but not identical categorization must be applied to the definition of broadband in India.

We find that a review of average speeds provides necessary, though not sufficient insights for redefining broadband. According to a prominent global internet speed index updated in August 2020 ***[12]****,* Indians, on average, experience download speeds of 12.10 Mbps on mobile networks and around 43.04 Mbps on fixed broadband. The findings of crowdsourced fixed internet speed data also seem to correlate well with the tariff plans offered by some of the

[6] Mozark, 2020. State of Network Experience in India. [Online] Available at: https://mozark.ai/whitepaper/state-of-network-experience/
[7] Department of Telecommunications, Government Of India, 2012. *National Telecom Policy 2012.* [Online] Available at: https://dot.gov.in/sites/default/files/NTP-06.06.2012-final.pdf
[8] International Telecommunications Union, 2017. *Definition of Broadband Access.* [Online] Available at: https://www.itu.int/en/ITU-T/committees/scv/Documents/T17-SCV-LS-0015.pdf
[9] House of Commons Library, UK Parliament, 2019. *Broadband.* [Online] Available at: https://commonslibrary.parliament.uk/broadband-faqs/
[10] European Commission, 2020. *Broadband Glossary | Shaping Europe's digital future.* [Online] Available at: https://ec.europa.eu/digital-single-market/en/broadband-glossary
[11] Johnson, T., 2012. *Germany leads Europe in superfast broadband.* [Online] Available at: http://point-topic.com/germany-leads-europe-in-superfast-broadband/
[12] Ookla, 2020. Speedtest Global Index. [Online] Available at: https://www.speedtest.net/global-index

prominent fixed ISPs in India. We note that the tariffs reviewed below are offered by ISPs with a promise to offer speeds up to the advertised bandwidth, and not as minimum guarantees. It is however clear that the standard for retail fixed broadband services far exceeds the standard enumerated by the current definition of broadband.

Table 1: Fixed broadband plans offered across metro cities

	ISP A		ISP B		ISP C		ISP D	
	Speeds offered	**Symmetric**	**Speeds offered**	**Symmetric**	**Speeds offered**	**Symmetric**	**Speeds offered**	**Symmetric**
Delhi	40 Mbps – 1 Gbps	Yes	30 Mbps – 1 Gbps	Yes	100 – 300 Mbps	Yes	50 – 300 Mbps	Yes
Mumbai	40 Mbps – 1 Gbps	Yes	30 Mbps – 1 Gbps	Yes	None Offered	NA	50 – 300 Mbps	Yes
Chennai	40 Mbps – 1 Gbps	Yes	30 Mbps – 1 Gbps	Yes	50 Mbps – 1 Gbps	Yes	50 – 300 Mbps	Yes
Bengaluru	40 Mbps – 1 Gbps	Yes	30 Mbps – 1 Gbps	Yes	40 Mbps – 1 Gbps	Yes	50 – 300 Mbps	Yes

We therefore propose the following as the revised compliance definition of broadband

> *Broadband is an always-on data connection, provided over fixed or wireless infrastructure, that is able to support multiple information and interactive services such as Interest access and on demand video, and offers a minimum downlink and uplink speed of 2 Mbps to an individual subscriber from the point of presence (POP) of the service provider intending to provide the Broadband service.*

We also recommend the authority provide additional guidelines for higher quality broadband services. We propose the following guidelines for faster broadband services derived from review of global best practices, as well as customer expectations of quality of experience

> *Fast broadband is defined as an always on data connection that possesses all the characteristics of basic broadband but offers a minimum downlink and uplink speed of 15 Mbps.*

> *Ultra-Fast broadband is defined as an always on data connection that possesses all the characteristics of basic broadband but offers a minimum downlink and uplink speed of 30 Mbps.*

It is important to note that these are suggested only as guidelines to help the customer have a uniform and valid comparison between offerings. Compliance to the guidelines should not mandatory and should not attract any financial penalty. At best, there could be an advisory or rebuke from the TRAI to concerned market player.
We also recommend that the above definitions may be reviewed periodically to account for the growth and development of new technologies as well as the evolving QoE requirements imposed by new applications /services used by consumers.

Question 2: If you believe that the existing definition of broadband should not be reviewed, then also justify your comments.

BIF RESPONSE

We believe that the existing definition of broadband MUST be reviewed to reflect the development of technology as well as the digital aspirations of Indians across the nation. Such reviews must also be conducted periodically to keep pace with the development of access services and customer expectations.

Questions 3: Depending on the speed, is there a need to define different categories of broadband? If yes, then kindly suggest the categories along with the reasons and justifications for the same. If no, then also justify your comments.

BIF RESPONSE

We agree that there is need to define different categories of broadband. Reasons for the same as well our recommendations have been mentioned in response to question 1. We provide some additional context below

A modern lifestyle is increasingly digital in terms of communication, infotainment, shopping, healthcare and users have become heavily dependent on numerous internet applications. The speed of connectivity therefore is the ultimate fuel. Studies have shown that different apps behave differently; a video application requires burst performance where a large amount of data needs to be downloaded in a short period, social media/ e-commerce require speed bursts intermittently while real time applications such as in the case of gaming, virtual conferencing, connected healthcare etc would require high speeds burst and low latencies consistently for the entire session.

Different categories of broadband e.g. Basic, Fast, and Ultra-Fast would help set optional thresholds that can serve distinct use cases. We recommend a compliance definition of broadband as a network connection that provides at a minimum 2 Mbps download & upload connectivity, which is in line with the goals set forth in the National Telecom Policy, 2012, as well as with the definition adopted by the ITU. The additional optional categories of fast and ultra fast broadband have been recommended based on recent studies that qualify a desirable QoE **[13]** as well as global best practice **[14]**.

[13] *Supra Note 6*
[14] *Supra Note 10*

Question 4: Is there a need to introduce the speed measurement program in the country? If yes, please elaborate the methodology to be implemented for measuring the speed of a customer's broadband connection. Please reply with respect to fixed line and mobile broadband separately.

BIF RESPONSE

A Speed measurement program is critical primarily to ensure that different government institutions, hospitals, schools, enterprises, small & medium businesses, and households across the nation are covered by at least one fixed or wireless service providing assured services. As generally accepted, in customer analytics particularly, what is not either measurable or is not measured regularly and systematically, presents challenges for improvement. Also, given real time applications in the fields of tele-education, tele-medicine, communication etc. it becomes imperative to measure speeds being delivered at the last mile. Methodologies such as crowdsourcing need to be leveraged to measure speeds. We recommend approaches that consider speed to be more than just a measure of network capacity, and consider the desirability and diversity of user experiences.

A speed measurement program must be developed to accurately assess and improve network performance across the nation. Given the nature of quality of services that can be enabled on fixed vis-à-vis mobile networks, we recommend distinct mechanisms for measuring their performance.

Fixed broadband measurements should be carried out at Customers' router or the nearest/last POP.

Mobile Broadband measurements on the other hand must be based on a combination of the median of data submitted by operators, crowdsourced speed measurement apps such as Ookla, actual results from periodic drive tests and customer surveys. We also recommend that a comprehensive set of internet access metrics including at a minimum the following parameters, must be included in the design and execution of drive tests.

- Data transfer rate (upload & download) in Mbps (HTTP)
- Data transfer rate (upload & download) in Mbps (FTP)
- Latency (or average ping) reflecting the time (in ms) that data packets need to travel from user equipment through the operator's network, to a remote server and its return
- Time (in seconds) to start a video stream (Youtube, Vimeo etc)

The above parameters must also be measured and evaluated for fixed networks.

Question 5: Whether the Indian Telegraph Right of Way (RoW) Rules 2016 have enabled grant of RoW permissions in time at reasonable prices in a non-discriminatory manner? If not, then please suggest further changes required in the Rules to make them more effective.

BIF RESPONSE

We believe that the RoW Rules of November 2016 are extremely practical, reasonable and non-discriminatory in nature and if implemented pan-India, shall go a long way to streamline and smoothen the RoW process, and allow for quicker and more efficient broadband rollouts and adoption.

- All States, UTs and local administrative bodies need to align themselves to the abovementioned RoW Rules. According to data available with us, 13 States/UTs have already aligned to said rules and another 7 States and 2 UTs have committed to doing so soon. The Union Government is actively engaged in persuading all states and local bodies to align to the Central Rules.
- The non-uniform implementation of ROW rules makes it commercially unviable for IP-1 licensees and TSPs to undertake massive rollouts of fiber. In case of National Highways, NHAI has evolved a National Highway Construction Cost Index (NHCCI) for development of highways, which provides clarity to all the potential bidders and infrastructure developers for working out project costs.
- We therefore recommend that the authority consider the development of a fibre deployment cost index, akin to the NHCCI, as well as to recommend it be treated as a public utility since it is identified and declared as one.
- A common duct policy should be adopted in all cities of India. However, we recognize that the creation of common ducts is time and capital intensive and must be supported by alternative methods as well. All city authorities should therefore evolve mechanisms to allow the deployment of common pole infrastructure. This pole infrastructure should be designed in a way that makes it capable of supporting OFC laying and should be able to support radio antennae to improve wireless coverage.
- Such aerial networks would complement underground networks rolled out over common duct infrastructure and support the rollout of greater last mile connectivity in most cases.
- We also recommend the creation of a centralized portal for monitoring & implementation of ROW Rules 2016, with single window clearance provisions and an appellate mechanism for escalations.
- We believe the above reforms would ease the current administrative and financial roadblocks that prevent the far & wide rollout of fixed internet access networks.

Question 6: Is there any alternate way to address the issues relating to RoW? If yes, kindly elucidate.

BIF RESPONSE

Successful rollout of fibre networks is inextricably linked to RoW rules. However, new wireless technologies operating in the E & V bands, Freespace Optical Communication (FSOC), satellite communications and legacy cable TV networks are suitable alternatives that obviate the need for RoW while enabling high speed broadband connectivity. Given the nature of radio spectrum in the V band, associated infrastructure must be placed over shorter distances. Electricity poles, streetlights, and other public infrastructure can be appropriately used to expand the rollout of networks over this technology and reduce service provider's dependence on local RoW rules.

The E band which has much better propagation characteristics, can actually enable transmission of multi-Gigabit throughputs across longer distances and help obviate the challenges associated with RoW. More than 70 countries globally have opened up E & V bands and have successful deployment use cases -both over short , medium and long haul distances (the latter using daisy chain links) to tide over the fiber deployment challenges. Another great asset of these wireless assets is the time and cost of deployment which is only a fraction of that required for Optical Fiber.

One of the essential elements of the goals of NDCP 2018 and the NBM of 2019 is the fiberisation of towers. While the former has set a conservative target of achieving 60% connectivity by 2022, the latter has chosen to stretch the target to 70% by 2023. Given the fact that today we are acutely starved of fiber connectivity and are hovering at a

level of barely 30% fiberisation, we do have a long way to go. The RoW challenges are quite daunting and despite the best efforts of all concerned, it is yet to be resolved.

It is thereby proposed that to meet the NDCP & NBM targets for tower fiberisation, 50% of the 'Gap' be bridged with E & V bands and 50% with Fiber i.e. 20% of the current towers be connected with E & V bands and the balance 20% with Fiber

Given the fact that we are a geographically diverse country with vast stretches of rural and remote areas coupled with extremely difficult terrain, Satellite connectivity becomes a very cost effective medium to deploy, especially in such areas where terrestrial connectivity may be hard to establish for either technical or commercial reasons. A key benefit of satellite connectivity is the low time to deploy relative to terrestrial technologies. A true and fully functional open skies policy would allow for affordable Satcom broadband connectivity to be delivered in otherwise difficult to connect locations across the nation.

Cable TV operators, who have rolled out elaborate and intricate cable infrastructure have RoW that could also be gainfully utilized to affordably expand the presence of fibre infrastructure to the last mile.

Question 7: Whether all the appropriate authorities, as defined under the Rules, have reviewed their own procedures and align them with the Rules? If no, then kindly provide the details of such appropriate authorities.

BIF RESPONSE

Due to the federal structure of our constitution, the central rules are not legally binding on the states to follow. As a result, some states & local authorities have devised their own RoW Rules, often deviating significantly from the rules contained within the central guideline. By local authorities we are referring to State and local municipal bodies.

Question 8: Whether the RoW disputes under the Rules are getting resolved objectively and in a time-bound manner? If not, then kindly suggest further changes required in the Rules to make them more effective.

BIF RESPONSE

Since many states are currently not aligned to the Central Rules and have devised local rules, RoW matters are being resolved at the local level. Disputes if any, are typically addressed via litigation.

We believe civil society has a critical role to play in driving local demand for high speed broadband services that improve quality of life, which we believe will create incentives for local authorities to act in the interest of their constituents.

Question 9: What could be the most appropriate collaborative institutional mechanism between Centre, States, and Local Bodies for common Rights of Way, standardisation of costs and timelines, and removal of barriers to approvals? Justify your comments with reasoning.

BIF RESPONSE

Current RoW approval mechanisms require multiple approvals from different agencies, creating operational and financial roadblocks that delay rollouts. The National Broadband Mission has called for three layers of monitoring and decision making in the Mission Document, and while most of the stakeholders have been mapped in these committees, considerable gaps persist in execution. At the state level, the State Broadband Committee is entrusted with the responsibility to address issues related to Broadband proliferation. Broadband committees at District/City/Ward/Village levels, however, do not exist. The mission directorate is neither responsible nor staffed to undertake day to day issues related to impediments in roll-out of fiber in local areas, manifesting as accountability gaps at the District, City, Ward, and Village levels.

We recommend the constitution of a coordination committee with Centre, States, Local Bodies, Civil Society, Industry representatives as nominees to justify and execute the administration of nationwide RoW rules and action. This committee could take the shape of a standing coordination committee and could be instituted either at a State and/or an LSA level.

The NDCP18 mission of Connect India refers to the 'Establishment of a National Digital Grid by':

- Creating a National Fibre Authority
- Establishing Common Service Ducts and utility corridors in all new city and highway road projects, and related elements
- Creating a collaborative institutional mechanism between Centre, States and Local Bodies for Common Rights of Way, standardization of costs and timelines; and removal of barriers to approvals
- Facilitating development of Open Access Next Generation Networks

We believe the establishment of a National Digital Grid and the National Fibre Authority would be critical for the timely resolution of legacy as well as future IP1 issues, and would facilitate rapid, efficient, and coordinated infrastructure growth.

Question 10: Should this be a standing coordination-committee at Licensed Service Area (LSA) level to address the common issues relating to RoW permissions? If yes, then what should be the composition and terms of reference of this committee? Justify your comments with reasons.

BIF RESPONSE

Please see our response to question 9 above

Question 11: Is there a need to develop common ducts along the roads and streets for laying OFC? If yes, then justify your comments.

BIF RESPONSE

Yes, there is a need to have a Common Duct Policy on the lines of Ministry of Roads Transport and Highways. In 2017, a proposal to this effect was forwarded by DoT to Ministry of Rural Development, as well as the Ministry of Road Transport and Highways, however not much traction has been achieved. Simultaneously a pilot project for implementing common duct was undertaken by TRAI in Jharkhand. The importance and outcomes of having Common Ducts have been elucidated in the Consultation Paper and we agree with the anticipated benefits.
We believe the development of common ducts along roads, streets and highways would yield significant benefits for the rollout of high-speed access services over large areas, as well as help conserve, time, effort, and resources. We also find that developing common duct infrastructure is considered best practice, and we provide the following case studies in support.

Singapore

Telecom riser ducts are reserved for exclusive use by Public Telecommunication Licensees (PTLs) and Telecommunication Service Licensees (TSLs) referred to as FBOs, who provide fixed services to buildings. Any other party who use the riser ducts shall seek permission from IMDA.

These guidelines are applicable to In-Building Terrestrial Telecommunication System Licensee (IBTSL) who are required to apply to IMDA to lay cables in telecom riser ducts of commercial buildings or within the telecom conduits of HDB's electrical and telecom (E&T) riser ducts.

In October 2019, a consultation paper was issued by the Info-Communications Media Development Authority (IMDA) on incorporating common duct networks as an interconnection related services on submarine cables.

China

In Oct 2008, MIIT, along with other regulators, issued the Urgent Circular on Promotion of Joint Construction and Sharing of Telecom Infrastructure, which specifically points out that “MIIT have decided to vigorously promote the joint construction and sharing of the telecom network facilities in response to actual conditions of the telecom restructuring and a new round of upcoming network construction.

For the sake of fair competition, the base stations as scare resources should be shared. It is required that in the network construction since 2009: existing iron towers and pole lines must be shared; new iron towers and pole lines must be established jointly; other base station facilities (iron towers, roofs, equipment rooms, interior distribution systems, special transmission lines for base stations, power supplies, etc.) and transmission lines (ducts, pole lines, optic cables, etc.) must be jointly constructed and shared if conditions allow.

Chile

In April 2018, the Ministry of Transportation and Telecommunications of Chile published supreme decree 167 to guarantee freedom of choice in contracting and receiving of telecommunications services in private estates, buildings, and co-owned real estate. Read together with its accompanying technical rule published as exempt

resolution 766 of Subtel, the nation's Undersecretary of Telecommunications, the rules apply a framework to enforce Chile's 'Ley De Ductos' or duct law, which establishes the following minimal conditions of construction and design that allow for free access to telecommunications services by owners or lessees of units in private estates or building projects

- Real Estate Project Registry: The Regulation calls for the development of a web-based real estate project registry for MNOs to access real time detailed information relevant for network expansion. Municipal approval of projects requires compliance with this registration
- Telecom Projects: Real estate projects must include telecommunications plans, that include the design and construction of, "the necessary capacity for multiple telecommunications operators to provide their services to the relevant units of the private estate or building, under equal conditions...".
- Access to Existing Buildings & Regional dwelling units: The rules include a special regime for existing buildings and dwelling units. Special protocols for use of and access to shared installations, feasibility and procedures for installation or extension of internal and/or external telecommunications networks and dispute resolution are regulated as well.

Baltic Data Highway

In Jan 2015, Estonia, Latvia and Lithuania finished the five-year construction of the Baltic Highway – a broadband backbone network that takes advantage of fibre-optic assets from three Baltic energy and utility entities.

The Highway is a seamless fiber backbone of 3,000 kilometres (1,864 miles) across the Baltic region, connecting Northern Europe's new mega-data centers in Tallinn to Western Europe's data hub in Frankfurt, Germany, with the possibility of extending connections to Russia and Belarus.

The construction and operation of the Baltic Highway is a great example of regional cooperation and infrastructure sharing.

- The Baltic Highway was created by Data Logistics Center (part of Lietuvos Energija, a state-owned holding company of Lithuanian energy suppliers), Latvenergo (a state-owned electric utility company in Latvia) and Televõrk (a subsidiary of private energy firm Eesti Energia in Estonia).
- Unlike previous data highways, this network was built by laying optical fiber over high-voltage electricity lines and gas pipelines that belong to energy companies, as opposed to using different segments of telecommunications networks that have been "stitched together."
- Today, Baltic Highway clients have the opportunity to utilize one seamless regional infrastructure system from a single point.

Transportation/Utility Corridors of Alberta

In the mid-1970s, the Government of Alberta established Restricted Development Areas (RDAs) around Edmonton (see map). The lands included in these RDAs were designated for the Transportation/Utility Corridor (TUC) uses, being the ring road systems, major power lines, pipelines and municipal utilities.

The TUCs were established on the principle that long term planning for the accommodation of a number of transportation and utility facilities within corridors can maximize the use of those corridors and also provide an open space in an area that will be surrounded by urban development.

Primary Uses Within the TUC - The TUCs are planned to accommodate linear transportation and utility facilities. These uses include ring roads (and associated interchanges), stormwater management facilities, petroleum pipelines, power transmission lines, and municipal regional water, sanitary and storm sewer lines.

Secondary Uses usually occur next to roadways, above underground pipelines, or below power lines. These uses include telecommunications lines, agriculture, utilities, parking, outdoor storage, recreation and commercial activities. Secondary uses also include subdivision-related contouring that encroaches onto a TUC, noise attenuation barriers, pathways and supplemental landscaping plants. These uses can easily be altered, or displaced, to accommodate primary uses.

New Zealand

It is governed by 'National Code of Practice for Utility Operators' access to transport corridors which provides the mandatory requirements and supporting guidance to assist Utility Operators and Corridor Managers in exercising these rights and complying with legislation. Specifically, the code recognizes that transport corridors are utility corridors and there is no primacy of one utility over another.

The Code requires corridor mangers to coordinate the work of the various utilities within their districts, including their own, in a way which ensures the best outcomes for all New Zealanders in terms of the performance and longevity of the utility services and the transport corridor. The Code applies to the activities of all transport corridor managers and utility operators throughout New Zealand. It provides a nationally consistent and cooperative framework for corridor managers and utility operators, to manage transport corridors while also providing for the access rights of utility operators

The Code was developed as an industry-lead initiative to define the roles of the various stakeholders in the management of access to the transport corridors (road and rail) by utility operators. Representatives of all utilities, local authorities, the NZ Transport Agency and KiwiRail have collaboratively developed the Code and it underwent several rounds of public consultation before being approved by the Government

Yokohama-Kawasaki- Japan

To make local infrastructure more resistant to disasters, a 220-kilometer common utility duct is being planned for the Yokohama-Kawasaki area in Japan. The Ministry of Land, Infrastructure, Transport and Tourism has awarded a contract for the project, and work is currently in progress in the Shin-Sugita district, located along the coast of Tokyo Bay in Yokohama where the duct is being constructed directly beneath Capital Expressway Route 357. A Kajima joint venture is responsible for a 3.3-kilometer segment of the construction.

The Kajima joint venture proposed tunneling deeper beneath the surface than what had been called for in the basic design, because the shallower land is soft and spongy, while tunneling in a deeper and more stable stratum would

minimize the impact of the project upon the Capital Expressway Coastal Viaduct on the surface and allow for a more earthquake-resistant structure. This proposal received very positive reviews, and the company was awarded a design-build contract.

In order to build a stable lifeline that has a long Project Workflow service life and is highly resistant to disaster, the duct and its ancillary elements have all been designed to last 75 years, which is unprecedented in the industry. The Kajima joint venture is pouring every bit of its know-how into the design and construction of the common utility duct that will provide area residents with safety and peace of mind in the future.

Portugal

Portuguese government has made infrastructure sharing mandatory in Portugal in 2009. The availability of sharable infrastructure made new network deployments economically viable, contributing to an increase in household coverage in the country. As of 2016, Portugal extended its next-generation broadband to 95% of households ranking 5th in Europe in terms of high-speed broadband.

Question 12: How the development of common ducts infrastructure by private sector entities for laying OFC can be encouraged? Justify your comments with reasoning.

BIF RESPONSE

Appropriate incentives must be put in place to incentivize the participation of private sector entities. Capital intensive by nature, the rollout of OFC is typically evaluated based on population density and local demand for high-speed connectivity. So far, fibre rollouts have largely occurred on a per service provider basis, and often in the absence of common ducts. This has expectedly led to costly & repeated digging in dense urban centers. A significant cost incentive must be provided to private sector entities and service providers to incentivize the development of common ducts infrastructure.

We recommend a mechanism that offers a measurable cost saving to participating service providers, in proportion to the capacity laid down by each. In addition, we recommend that rules be created to ensure that new real estate projects include communications plans and minimal infrastructure that ensures equal access to all service providers with respect to each dwelling unit.

A web-based platform may also be commissioned to ensure real time information is available to service providers, with functionality to notify and invite participation in building, maintaining and providing services using common duct infrastructure.

A secondary market for duct capacity will further improve the business case for infrastructure providers and real estate developers, and must therefore also be allowed to develop.

Question 13: Is there a need to specify particular model for development of common ducts infrastructure or it should be left to the landowning agencies? Should exclusive rights for the construction of common ducts be considered? Justify your comments with reasoning.

BIF RESPONSE

Common ducts could be developed by the land-owning agencies with relative ease and can leased or sold to service providers. The National Highways Authority of India (NHAI) for instance, should consider the development of common ducts for OFC along all new highway projects or even at times of reinforcement and expansions. The scale of projects executed by NHAI would ensure a high degree of cost-optimization in the construction for common ducts across the nation, as well as allow for the creation of a new revenue stream for NHAI.

Alternatively, land-owning agencies could grant one-time, long term RoW to utility companies, which could in turn develop, maintain & operate common ducts infrastructure. Land-owning agencies should in such cases either be allowed to charge a one-time fee or enter into a public-private partnership arrangement with the developer of common ducts infrastructure.

In the first case, where the land-owning agency intends to charge one-time fee, it can make public its intent to grant a one-time, long term RoW for developing common ducts infrastructure under a competitive bidding process. The ownership of infrastructure would lie with the utility. In the second case, where the land-owning agency intends to enter into public-private partnership arrangements with the developer of common ducts infrastructure, it may partner with the private sector through a transparent process. Under such a model, the land-owning agency may provide RoW for developing common ducts infrastructure while the private sector partner may invest in the development of the infrastructure. RoW charges may be waived off in lieu of part ownership of the common ducts' infrastructure proposed to be developed by the implementing agency.

The Rajarhat New Town, Kolkata, a greenfield city, formed a Joint Venture company called New Town Telecom Infrastructure Development Company Ltd. (NTTIDCO) between West Bengal Housing and Infrastructure Development Corporation (HIDCO), a Government company, and WEBFIL, a private sector telecom infrastructure company. NTTIDCO invested in creating common ducts in a planned utility corridor across the city. This infrastructure is being offered to service providers on a long-term lease for them to lay their optical fibre cables through these ducts.

We do however wish to express concern that if structured inappropriately, such mechanisms could give rise to monopolies. We therefore urge the Authority to carve out regulatory provisions to prevent exclusive arrangements. At the same time, in a diverse country like India, adoptions of different models by States and Local Bodies is conceivable. Accordingly, there would be a need to put in place institutional mechanisms to check the accumulation of market power. We propose that intervention by TRAI in cases where warranted may suffice to control abuse of market dominance by a few.

A National Fibre Authority as suggested in the NDCP, under the TRAI, or independent control would be ideal to focus on this essential part of Infrastructure.

Question 14: How to ensure that while compensating the land-owning agencies optimally for RoW permissions, the duct implementing agency does not take advantage of the exclusivity? Justify your comments with reasoning.

BIF RESPONSE

The Response to the Questions have been provided in Response to Q13

Question 15: What could be the cross-sector infrastructure development and sharing possibilities in India? Justify your comments with examples.

BIF RESPONSE

Cross-sector collaboration could be enabled at the beginning of the infrastructure development itself or at later stage by leveraging existing assets within and across sectors.

The NDCP-2018, for implementing a 'Fibre First Initiative', emphasizes on 'Leveraging existing assets of the broadcasting and power sector to improve connectivity, affordability, and sustainability'. In the broadcasting sector, the RoW permissions available with cable operators for establishing coaxial cable network could be used for laying aerial fiber network. Similarly, electricity transmission and distribution networks & infrastructure could also be effectively utilized to roll-out wireless broadband networks.

For collaboration in the beginning of the infrastructure development itself, voluntary joint trenching or coordinated trenching emerge as feasible approaches. This is also referred to as a 'Dig Once' policy. Voluntary joint trenching requires that two public utility companies like electricity and telecom formulate joint construction plans and receive approvals to excavate in public rights of way simultaneously.

One example of such voluntary joint trenching is Telangana's 'Mission Bhagiratha' project. Under this project, the establishment of the local optical fibre network is integrated with 'Mission Bhagiratha', a project to bring safe drinking water to all villages and city households in the state. The plan includes the installation of ducts for optical fibre along with the extensive water pipeline network being laid under Mission Bhagiratha. This will allow the state to cut down costs that would have been required to install a separate OFC network. Other examples of voluntary joint projects are the optical fibre networks of GAILTEL and POWERGRID. Such voluntary agreements could take shape among two unrelated entities as well.

Coordinated trenching requires informing interested excavators, such as broadband providers, before underground work or road construction work commences so they can be prepared to install equipment during scheduled excavations. In coordinated trenching, use of ICT plays an extremely important role.

As per the Indian Telegraph Right of Way Rules, 2016, the appropriate authority shall develop an electronic application process (through an online portal) for submission of applications for RoW permissions. These rules also provide that State Governments may at their discretion establish a single electronic application process for all appropriate authorities under their control. The same online portal can be used by all other public utilities also to apply for RoW permissions. In such cases, it (online portal) can be used to inform interested excavators, such as broadband providers, in advance when any other utility applies for permission to carry out underground work or road construction.

The 'Dig Once' policy minimizes disruptions in the procurement and administration of public rights of way. Public utilities like water and electricity have somewhat similar network architectures as traditional telecommunications networks, and are therefore suitable vehicles for combined rollouts. The use of ICT to enable real-time collaboration and administration would be essential for minimizing project delays.

The 'Dig Once' policy is used to minimize the number and scale of excavations when installing telecom infrastructure. This policy has several advantages:

- Cost Savings – Limiting the number of times a road must be excavated to deploy broadband is the greatest advantage of implementing dig once practices and policies. When fibre installation is coordinated along with road or utility projects, adding broadband infrastructure becomes relatively cost effective. In some places with high RoW charges, nearly a fifth of all costs can be eliminated using such an approach.
- Economic Benefits – Increase in penetration of broadband would foster growth in existing businesses in the area as well as boost local economies
- Decrease in time needed to deploy fiber – If common ducts are already in place at the time of fibre installation, the time and effort needed to deploy fibre will be significantly lower than in the absence of such ducts.

Various states in India are increasingly adopting new PPP models and associated policies to encourage the co-deployment of OFCs during the construction of roads. Indian Metro Rail Networks are among the fastest growing in the world. Of the 67 metro projects across 27 cities in India, almost 54 projects are in various stages of development. Metro networks require both over ground and underground infrastructure development for operating metro rail, both of which can be harnessed for OFC deployment. This can not only cut down infrastructure development costs incurred by telecom companies but can also serve as an additional source of revenue for the metro rail networks. Deployed infrastructure could also be used for providing broadband access inside metro rail stations, generating further additional revenue for both broadband service providers and metro rail corporations.

As noted earlier, cross-sector collaboration could happen at later stages also by leveraging or sharing the existing assets of other sectors. One such example is 22,500 km long optical fibre network being implemented in Andhra Pradesh over existing electric poles. The project cost came down to 333 crores from the initial estimate of 4,700 crores because the Government opted for an aerial fibre network, wherein optical fibre lines were laid over existing infrastructure such as electric poles to drastically reduce rollout costs.

Other examples of cross sector infrastructure sharing are LCOs using electric poles for laying aerial OFC and Coaxial cables to deliver cable TV. The same broadcasting infrastructure could be used to deliver broadband services. The rollout of 5G networks is also expected to generate significant demand for passive telecom infrastructure. 5G will use much higher radio frequencies than today's cellular networks, and while these higher frequencies carry larger amounts of data, they propagate over much shorter distanced. For 5G to work well, many additional small radios or "cells" must be installed close together — often as close as 200 feet apart. Electrical poles emerge as highly suitable vehicles for hosting the kind and volume of small cells infrastructure required for faster rollout of 5G networks in India. Empirical evidence suggests that cross-sector infrastructure sharing lowers deployment costs, and increases market entry, making markets more competitive.

Question 16: Whether voluntary joint trenching or coordinated trenching is feasible in India? If yes, is any policy or regulatory support required for reaping the benefits of voluntary joint trenching and coordinated trenching? Please provide the complete details.

BIF RESPONSE

Such initiatives have been attempted by various operators at different points in times. It is however important to note that business priorities are not common for different operators, and that Capex planning processes, and allocation cycles can deter such partnerships. We recommend that joint and coordinated trenching by ISPs should be voluntary and not enforced via fiat, given the unique business plans and priorities of businesses. As an alternative, A national Common duct approach, combined with simplified aerial access administration would complement the Row rules of 2016, and ease the rollout of access services.

Question 17: Is it advisable to lay ducts for OFC networks from coordination, commercial agreement, and maintenance point of view along with any other utility networks being constructed?

BIF RESPONSE

A common utility duct policy for the nation is highly desirable. However, such synergy requires highly meticulous planning. At design stage, all flexible points like joint chambers, branching points etc should be very well defined. Effective design helps in better operational coordination during O&M while ensuring longer life of the network. This also helps improve the monetization potential of the network. Extensive use of digital tools and technologies combined with coordinated process and control will be the ultimate key for the success of such initiatives – both commercially and operationally.

Guidelines in the form of a brief manual could be prepared for circulation to project engineers for their project planning and implementation of other utilities which guide them in including ducts for OFC networks in a manner whereby the cable, when installed, is safe and maintainable.

Inter-utility cooperation and coordination would be facilitated in this manner.

Additional context has been provided in our response to Question 15 above

Question 18: What kind of policy or regulatory support is required to facilitate cross-sector infrastructure sharing? If yes, kindly provide the necessary details.

BIF RESPONSE

We propose the development and adoption of a Dig Once framework for laying of Common Duct Infrastructure. The Digital Grid, once fully formed would need to work closely with the Power Grid, Roads & Highways and Water Authorities

Digital India is all about convergence of services. We therefore call for expediency in the constitution of a joint committee between authorities of various utilities in India to coordinate and optimize infrastructure growth and minimize wasteful expenditure.

We recommend the Authority consider the following mechanisms to facilitate cross-sector infrastructure sharing.

- Inclusion of OFC ducts must be made mandatory in the design of all utilities and infrastructure.
- Telecom experts must be consulted during the DPR stage of any project planning. Also, necessary cost should be built into the project while considering monetization benefits. Better monitoring and control of utility and infrastructure using captive telecommunications networks must be encouraged as it would drive OPEX savings throughout the complete lifecycle of the project.
- IP-1 registered vendors must be included during execution and subsequent lifecycle management.
- DoT may consider, allocation of partial capex to utility and infrastructure agencies with right to leverage some of the fiber assets for various programs of Government like Bharatnet, Rural institutions connectivity, Rural Wi-Fi projects etc.
- Utility and Infrastructure companies should be mandated to provide power and colocation facilities at their location for housing Telecom equipment. This equipment is mostly required for the installation of Amplifiers/ repeaters and in some cases may also be needed for creating switching points to serve the local population.
- Active Sharing should be allowed and incentivized for creating Access Infrastructure involving following technologies like, Radio Equipment – BTS / BBU, RRH, Active / Passive Antenna, Active / Passive DAS system, Wi-Fi Access infrastructure sharing (Wi-Fi AP, Switch, WLC etc), GPON OLT, GPON ONT, Access Switch Beyond Network Edge and any other equipment meant to serve end customer beyond the Transport Network Edge of Licensed Service Provider(UL – Access / NLD).
- Power Distribution Policy for FTTx and Wireless Infrastructure needs to be liberalized. Currently, power distribution in public areas is not permitted for any entity other than an authorized discom. However, with wide proliferation of 5G technology, huge number of small cells will be required to be installed in outdoor environment. Innovative 'hybrid cables', are being developed to support both power and optical fiber needs for connecting such small cells, and rollouts of such associated infrastructure would be hindered by existing rules.

Question 19: In what other ways the existing assets of the broadcasting and power sector could be leveraged to improve connectivity, affordability, and sustainability.

BIF RESPONSE

The broadcasting sector, through the LCOs and the MSOs, has formidable connectivity reaching each household in the country. Similarly, the power sector too has reached many remote areas. The reach and availability of existing broadcasting and power infrastructure can be utilized to support the growth of broadband connectivity. Deployment of core backbone networks using high capacity fibers using powerlines and pylons is techno-economically viable and would result in massive savings in RoW as well as repairs and maintenance costs. Networks of LCOs and MSOs can be utilized at the access layer. Amalgamation of the Power Infrastructure available on "Tarang" and Fiber Grid can be carried out subsequently.

Following are the suggestion for leveraging power sector assets:

- All High voltage and medium voltage power transmission towers are great candidates for OPGW OFC deployment.
- These towers are of particular interest in dense and difficult to reach city areas due to its reach at the last mile and its physical connection to critical facilities like Data Centers. OPGW cables are also suitable for long distance networks and provide high uptime with little OPEX. However, colocation facilities may be needed at power sub-stations for housing active telecom network equipment.
- Power Distribution poles can be leveraged to expand last mile coverage. However, illegal access to distribution poles should be made a punishable offence, as unrestricted access may be hazardous and could cause damage to poles due to heavy loads.

Question 20: For efficient market operations, is there a need of emarketplace supported by GIS platform for sharing, leasing, and trading of Duct space, Dark Fibre, and Mobile Towers? If yes, then who should establish, operate, and maintain the same? Also, provide the details of suitable business model for establishment, operations, and maintenance of the same. If no, then provide the alternate solution for making passive infrastructure market efficient.

BIF RESPONSE

We urge expediency in the development of an e-marketplace supported by a GIS platform to help facilitate sharing leasing & trading of passive infrastructure. As on date, more than 900 IPs-I, and 1600 TSPs and ISPs are operating in India. Further, approximately 60,000 LCOs are also laying OFC for cable TV and broadband services. This number is increasing with time as the demand for passive infrastructure and fixed broadband increases substantially.

Passive infrastructure such as Dark fibre, Right of Way, Duct Space, and Towers established by IPs-I can be leased or sold by them to TSPs/ ISPs for delivering telecommunication/broadband services. However, for facilitating such commercial transactions, no single platform is available where the details of demand and supply for passive infrastructure are available. This may be leading to inefficient market operations.

For attracting investments in passive infrastructure development as well as for ensuring its sustained growth, it is necessary that the market for passive infrastructure operates efficiently. This could be achieved through an e-marketplace for passive telecom infrastructure. This e-marketplace could register details of demand and supply for passive infrastructure, and the same could also be used for leasing/ trading of passive infrastructure. It could be supported by a Geographic Information System (GIS) platform, where the details of available ducts, OFC, and towers can be mapped. Mapping of fibre networks is extremely desirable for purposes of transparency, as well as better planning by service providers. Such accounting of resources is commonplace in many nations, and signals market maturity. The FCC in the United States of America collects such data via electronic shapefiles **[15]**, and regularly publishes updates both in the form of periodical coverage reports **[16]** and as updated interactive maps detailing

[15] Federal Communications Commission, 2020. *Fixed Broadband Deployment Data from FCC Form 477.* [Online] Available at: https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477

[16] Federal Communications Commission, 2020. *FCC releases Form 477 data on broadband deployment.* [Online] Available at: https://docs.fcc.gov/public/attachments/DA-20-262A1.pdf

coverage data at a national level **[17]**. Access to such information has the potential to improve the network planning and marketing efforts of service providers, provide useful insights for consumers, as well reduce searching costs for small, medium and large enterprises looking to expand their operations.

The same GIS platform could also be used to map other utilities, which would encourage coordination between existing TSPs and IPs-I as well as between TSPs/IPs-I and other utilities like Road, Rail, Gas, Water, and Power Distribution, etc.

This common GIS platform could also help mitigate disruptions, and cost of maintenance, especially through its use for automatically notifying respective utility companies before undertaking any digging, trenching, etc. This platform could also facilitate cross-sector collaboration for co-deployment of passive infrastructure.

As an ICT platform, GIS has the unique ability to:

- Integrate data from multiple sources, and update as well as maintain the database from all utilities
- Present them visually using geography as a common element of these various data sources
- Help understand patterns and relationships between these data elements

Question 21: Even though mobile broadband services are easily available and accessible, what could be the probable reasons that approximately 40% of total mobile subscribers do not access data services? Kindly suggest the policy and regulatory measures, which could facilitate increase in mobile broadband penetration.

BIF RESPONSE

We provide the following as an explanation for why approximately 40% of total mobile subscribers do not use data services:

- While Mobile Voice Coverage or 2G is present at many locations, Mobile Broadband Coverage (4G) is not accessible everywhere. Additionally, fixed broadband is only available to enterprises and in few households in Metros & Urban cities
- 40% of mobile users use a 2G device and are connected to the 2G network, which does not support broadband access
- Mobile Broadband access is not supported by adequate backhaul capacity due to challenge in availability of fiber and high capacity backhaul because of not having access to the E & V bands
- There are many rural & remote areas where rollout of terrestrial connectivity is challenging. Such areas would need Satellite based Broadband Connectivity. A liberalized Satcom Policy which enables the use of benefits of latest Satellite technologies to offer High Speed Broadband services

Suggested Policy & Regulatory measures required to overcome this could possibly include the creation of an Open Access Bandwidth Grid/Exchange, (also envisaged in NDCP-18) by pooling the digital transmission networks of all

[17] Federal Communications Commission, 2020. *Fixed Broadband Deployment Data.* [Online]
Available at: https://broadbandmap.fcc.gov/#/

the owning entities including IP-1s and cable Operators mentioned above, through the formation of Blockchain cooperatives using smart contracts and a functional separation concept.

Question 22: Even though fixed broadband services are more reliable and capable of delivering higher speeds, why its subscription rate is so poor in India?

BIF RESPONSE

We offer the following possible reasons

- Lack of availability of Fiber everywhere. India is fibre starved by almost 60% with Fiber requirement lagging at 2.68Mn Fiber kms against the required 7.5Mn Fiber kms
- Fiber to the Tower is only available at 30% towers as against a requirement of 80-90%.
- Higher cost of deployment and maintenance vis-à-vis mobile networks
- Lack of Mobility as a feature
- A mobile phone delivers the entire internet experience package. Fixed line broadband implies allied expenditures on telephone instruments/laptops/desktops/TV's/ Wi-Fi modems for accessing voice and data content. The smart phone is today a popular medium for accessing a wide range of services and also allows flexibility across services.

At the same time, we recognize that those with high bandwidth requirements, whether an enterprise or a retail customer, prefer fixed networks.

A Policy & Regulatory framework to enable deployment of Wi-Fi in the last mile would stimulate the rollout of FTTX.

Question 23: What could be the factors attributable to the slower growth of FTTH subscribers in India? What policy measures should be taken to improve availability and affordability of fixed broadband services? Justify your comments.

BIF RESPONSE

Some of the measures that should be taken to improve growth of FTTH subscribers are:

- Increased availability of last mile fibre
- Easing, supporting, and complementing RoW rules with aerial network planning and administration
- Mandating the 'Dig-Once' Policy
- Mandating a Common Duct Infra Policy
- Neutral Host policy inside building permitting fair, reasonable and non-discriminatory access to infra/service provider
- Declare fibre as essential infra protected by law.

Additional context for each of the above has been provided in our responses to previous questions.

Question 24: What is holding back Local Cable Operators (LCOs) from providing broadband services? Please suggest the policy and regulatory measures that could facilitate use of existing HFC networks for delivery of fixed broadband services.

BIF RESPONSE

Most LCOs in India use an older DOCSIS standard that does not support high speed requirements typically desired in large areas. LCOs also primarily use unstructured OFC and Coaxial cable deployment which are fault prone. Additionally, DOCSIS also requires amplification of power at regular interval and power unavailability can also cause faults. Only a few LCOs use fiber broadband technology like GPON or Ethernet LAN but do so over poor quality of hardware and elements resulting in poor customer experiences.

Hence, instead of salvaging existing outdated HFC networks, the government should encourage adoption of Fiber based technologies like GPON in the network. For implementation of last mile network by LCOs, government can consider tax incentives to them to make their offering more competitive. Also, initiatives to create synergy for infrastructure creation will encourage LCOs also to adopt to planned infrastructure rather than using unreliable infra like Trees, Poles and building etc. This will help reduce OPEX, make them more professional and improve end user experience. This ultimately will lead to better customer retention for LCOs.

It is also our assessment that the imposition of a licence fee, as a percentage of adjusted gross revenue, and including revenues from broadcasting is a primary disincentive for Local cable operators, who by definition operate small businesses. In addition, prohibitions on sharing of active infrastructure further disincentivizes participation from LCOs.

We therefore propose a special category of light licences to be created and applied on such entities to permit provision of Fixed broadband-Broadband to Homes etc. with a token licence fee as entry fee and Nil revenue share on AGR, as was done for ISPs.

Question 25: When many developing countries are using FWA technology for provisioning of fixed broadband, why this technology has not become popular in India? Please suggest the policy and regulatory measures that could facilitate the use of FWA technology for delivery of fixed broadband services in India.

BIF RESPONSE

Despite the rapid growth in mobile broadband services, there is a large underserved and unserved market for fixed broadband. This market can, to a large extent, be served cost efficiently with FWA, when it would be built on technologies such as V band, LTE and 5G New Radio (NR).

Specifically, using V-band (57-64 GHz), there is an extremely big opportunity for FWA in the form of wireless high capacity distribution networks that can be deployed as an alternative to optical fiber backhauling. V-band FWA can considerably reduce right-of-way hurdles in dense urban and sub-urban areas. As a last mile solution, complimenting fiber, V-band devices can be used to provide gigabit internet access to people and businesses at a fraction of the cost of buried fiber. The V-band has extremely high oxygen absorption, which makes it nearly interference-free,

especially when combined with other interference mitigation techniques. V-band devices can also serve as backhaul links for 3G/4G/5G cellular, and potentially lower the cost of delivering mobile coverage and capacity. V-band solutions can also help address new use cases for Smart Cities by providing critical infrastructure for gigabit backbone for WiFi access points and other sensors.

The standards for the V-band have been developed as part of the IEEE process, and are classified as 802.11ad and 802.11ay and are commonly referred to as "WiGig" and "Wireless Fiber." According to these standards, the recommended channelization is 2.16 GHz to enable high capacity applications. Multiple manufacturers in the industry, including Qualcomm, IDT, Infineon, Renesas, Cambium, Siklu, Accton (IgniteNet), Ubiquiti, Mikrotik, Radwin and Huawei, have already started manufacturing devices per these IEEE standards for either SRD or FWA. SRD consumer functionality are now being included in mass-scale, off-the-shelf consumer devices, which will be used both indoors and outdoors. FWA and cellular backhaul equipment, primarily used by operators in the outdoors, will co-exist with the SRD consumer equipment.

Considering the utility of the V band, many regulators around the world, such as the Ofcom in the United Kingdom, the FCC in the United States, and CEPT in Europe, have recommended delicensing the V-band for both SRD and FWA. In nations where the band has been delicensed, innovation in the 60 GHz band has flourished, allowing for the development & roadmap for the near-term rollout of wireless fibre networks capable of delivering high speed, and gigabit capacity broadband connectivity.

Similar reform will allow for the proliferation of FWA technology in India.

Question 26: What could be the probable reasons for slower fixed broadband speeds, which largely depend upon the core networks only? Is it due to the core network design and capacity? Please provide the complete details.

BIF RESPONSE

The Internet uses packets for transfer of information, which are bursty in nature. The technology permits use of a link (Bandwidth) by several users simultaneously. The number of users who can share the given bandwidth without impacting the quality of service depends on the kind of application, frequency of use, and numerous other parameters. This leverage allows ISPs to accommodate more subscribers using a given amount of bandwidth and reduces the cost of providing access. This ratio of number of subscribers per unit of bandwidth is commonly known as 'contention ratio', and it may vary depending on and composition of traffic, and the quality of service the ISP is planning to offer.

Speed of broadband is largely dependent upon three factors, i.e., bandwidth utilization, latency, and contention ratio. Bandwidth hungry applications like Social Media, Video on demand (VoD), real-time gaming, video conferences, and Rich Communication Services send and receive continuous stream of packets and thereby require more bandwidth over simple text and information. As per the Ericsson Mobility Report June 2020, "Video traffic in mobile networks is set to grow by around 30 percent annually up to 2025, and will account for nearly three-quarters of mobile data traffic, up from just over 60 percent in 2019.

Mobile video traffic growth is driven by the increase of embedded video in many online applications, growth of video-on-demand (VoD) streaming services in terms of both subscribers and viewing time per subscriber, and the evolution towards higher screen resolutions on smart devices. All of these factors are influenced by the increasing penetration of video-capable smart devices. Social network traffic is also expected to increase by around 20 percent annually over the next 6 years. However, its relative share of traffic will decline from 10 percent in 2019 to around 8 percent in 2025, because of the stronger growth of video. Accordingly, designs and capacity of internet networks must be constantly reviewed to accommodate such changes in the consumption basket. This may necessitate lower contention ratio, since the alternative would incentivize service providers to accommodate a greater number of subscribers, which may eventually bring down the quality and speed of the broadband and lead to network congestion.

Bandwidth utilization and latency are two other important factors that affect the end-user broadband speed. Bandwidth refers to the maximum capacity of an internet backbone. The term latency refers to any of several kinds of delays typically incurred in processing of network data, the most obvious delay being the time it takes for a packet of data to go from a user's computer to the website server they're visiting and back (round-trip-time or RTT). Each hop a packet takes from router to router adds to the latency. Therefore, it also becomes important that in maximum how many hops, a network can reach destination server on which the content is hosted. This describes the importance of the data centres, CDNs, Mobile Edge Computing and IXPs in improving the broadband speed.

For matching the global average broadband speed, delivery of maximum content to users at the edge of the network becomes a necessity. This delivery however is beholden to the design and resilience of core networks as well as how much of the traffic originates outside the nation. It is pertinent to mention here that the performance of core networks affects the performance of the fixed and mobile broadband together.

Question 27: Is there a need of any policy or regulatory intervention by way of mandating certain checks relating to contention ratio, latency, and bandwidth utilisation in the core network? If yes, please suggest the details. If no, then specify the reasons and other ways to increase the performance of the core networks.

BIF RESPONSE

Response to this question is given above in our responses to Question 26

Question 28: Should it be mandated for TSPs and ISPs to declare, actual contention ratio, latency, and bandwidth utilisation achieved in their core networks during the previous month, while to their customers while communicating with them or offering tariff plans? If no, state the reasons.

BIF RESPONSE

While these are important parameters, it is also a fact that many subscribers would have trouble relating all parameters to service experience. We therefore recommend the authority consider the mandatory disclosure of minimum download and upload speeds only.

Question 29: What could be the probable reasons for slower mobile broadband speeds in India, especially when the underlying technology and equipment being used for mobile networks are similar across the world? Is it due to the RAN design and capacity? Please provide the complete details.

BIF RESPONSE

Some of the reasons which could be attributed to the slower speeds and are unique to India could be:

- Inadequate spectral holding among operators – out of line with global best practices
- Largest number of users/Mhz served, leading to much lower average speeds
- Backhaul challenges. Most Backhaul in India is based on low capacity MW networks. Fiber reaches barely 31% of our Towers, unlike other nations where Fiber reaching 80-90% of the towers is commonplace
- In rural areas, poor backhaul medium is a major challenge. Over 85% of rural sites are not connected on optical fiber backhaul. Microwave backhaul is not cable to support quality high speed wireless broadband in rural areas.
- A primary reason attributable to poor quality in urban areas is RAN issues related to Coverage and capacity. Urban areas require significant deployment of small and microcell sites to support proper coverage with capacity. However, the deployment of small cell in India is insignificant and almost all coverage is served using macro sites. Also, the already low site fiberization is unevenly distributed within cities.

Question 30: Is there a need of any policy or regulatory intervention by way of mandating certain checks relating to RAN user plane congestion? What should be such checks? If yes, then suggest the details, including the parameters and their values. If no, then specify the reasons and other ways to increase performance of RANs.

BIF RESPONSE

Unable to comment

Question 31: Should it be mandated to TSPs to declare actual congestion, average across the LSA, recorded during the previous month over the air interface (e.g., LTE Uu), in the radio nodes (e.g., eNB) and/or over the backhaul interfaces between RAN and CN (e.g., S1-u), while reaching out to or enrolling a new customer? If so, then suggest some parameters which can objectively determine such congestions. If no, then specify the reasons and other ways to increase performance of the RAN.

BIF RESPONSE

Unable to comment

Question 32: Is there a need of any policy or regulatory intervention by way of mandating certain checks relating to consumer devices? If yes, then please suggest such checks. If no, then please state the reasons.

BIF RESPONSE

All devices allowed for use in the Indian market, whether manufactured locally or imported, should conform to a homogeneous mix of local and international standards.

This should be policy driven or by way of regulatory interventions. Checks could be done at the time of TTQC mandatory testing to ensure that all devices conform to mandatory regulations and standards

New and emerging technologies such as the Internet of Things, as well as ongoing innovation in the fields of augmented and virtual reality, will accompany a wide variety of devices that would impose even greater requirements on networks. As a result, some specifications would be necessary to ensure such devices function effectively and within the intended framework of operation. Given that such devices are expected to number in the millions in only a few short years, screening and evaluation methods must be evolved to ensure the security and privacy of Indian consumers.

Question 33: To improve the consumer experience, should minimum standards for consumer devices available in the open market be specified? Will any such policy or regulatory intervention have potential of affecting affordability or accessibility or both for consumers? Please justify your comments.

BIF RESPONSE

Buying decisions today are driven by factors like Price, Camera, Screen Size, Memory and Battery Life. One critical component which impacts on experience and network performance i.e. Device Category is seldom considered. Most consumers are completely unaware of the fact that device and network performances are interlinked, and not all devices will deliver at the same level of efficacy under similar network conditions. Each smartphone model applies different algorithms (modulation type, carrier aggregation) in network decision making, resulting in performance deviation in terms of connectivity, speeds and hence variance in end user experience. Another important factor could be different cellular bands device supports especially in low priced tier devices which can limit access to 3G 4G speeds across different carriers. Additionally, user experience may also vary due to the modem/network radio hardware used in devices that fall within the same category.

Studies have shown that devices in low and mid-tier price ranges have high variance in experience. We therefore feel that minimum standards of all consumer devices should be specified. This should be based on an amalgamation of Indian and International standards with the aim to ensure uniform quality of service. A standardized QoE rating mechanism, developed in consultation with industry, may be considered by the Authority. This QoE standard must also be applied to devices that accompany emerging technologies such as IoT, AR/VR and others. Such standards must however be prescribed only to ensure the bare minimum performance required to support a desirable QoE.

Since QoE determinations are inexorable linked to ongoing innovations and consumption patterns, it is critical that industry be a prominent stakeholder in the development of any rating mechanism that attempts to qualify a desirable QoE across device categories.

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