Sterlite Technologies Limited
Rider House, 4th Floor,
Plot No. 136P, Sector 44,
Gurgaon 122 002 Haryana INDIA
CIN No.: L31300DN2000PLC000340

Phone : +91-124-4026000
Fax : +91-124-4026060
www.sterlitetechnologies.com

October 13 2014

To
Shri Arvind Kumar
Advisor (NSL)
Telecom Regulatory Authority of India
Mahanagar Door Sanchar Bhawan, Jawahar Lal Nehru Marg,
New Delhi – 110002

Ref: Response of stakeholders M/s Sterlite Technologies Ltd to TRAI consultation paper No. 12/2014 "Consultation Paper on Delivering Broadband Quickly: What do we need to do? "

Respected Sir,

Enclosed herewith is Sterlite Technologies Ltd response to solicitation for input on the above referenced consultation paper. As indicated in the consultation paper, we are submitting our response in electronic form.

Please let us know of any questions or clarifications

Thanking you sincerely

AN Srinivas
Head - Business Development
Sterlite Technologies Limited | 4th Floor, Rider House, 136 P, Sector 44, Gurgaon – 122003. | HARYANA, India. Tel: +91-124-4026026 Fax: +91-124-4026060 | Mobile: +91.9372007056
www.sterlitetechnologies.com

Sterlite™

Executive Analysis

(A) PREAMBLE

It has been two decades since the World Wide Web became publicly available and provided a powerful mechanism to navigate and link content across the Internet or, simply, the "net," as we are calling it — which is the composite of the underlying Internet (which is the transport mechanism) and the World Wide Web (the content management mechanism).

Internet has expanded to encompass more than 2 billion individual users - more than 30% of the global population. India has approx 243 Mn Internet user and still more than 1.1 Bn yet starving for the connectivity to experience internet. It is the foundation for social networking, online services, cloud business, search, email, messaging and a host of other capabilities, both business-oriented and very personal, which people now take for granted. As a result, the appetite for user digital consumption is increasing multi fold year on year posing a great threat to underlying Broadband Infrastructure to cope up with the quadruplingbandwidth demands in a most economically viable and scalable approach to ensure **" Just in time availability for user segments and Investment Protection for Infrastructure providers"**

The BROADBAND is both complex in operation and simple to use, without requiring any real understanding of how it works. In truth, it is a virtual construct rather than a concrete network, composed of three distinct elements working together seamlessly `

- **User Access** (access and last mile network)
- **Transport**(Broadband Intercity and National Highway)
- **Content** (including services& their delivery via localization and cloud Data centers)

The BROADBAND construct is composed of multiple elements which are impacted by

- Regulatory norms and guidelines
- Political and policy stability,
- Cultural and societal influences
- As well as business, economic and approval environments

(B) DEMOGRAPHICAL ADVANTAGE

India's online population is significantly younger when compared with other BRIC nations with 75% falling under the age of 35. Breaking it down further, 36% of India's online population are between 15-24 year age group, 39% are between 25-34 year, 16% are between 35-44 year, 6% are between 45-54 year, and 3% are between 55-64 years.

India has the intrinsic strengths for a Broadband transformation, but concerted actions are required to address key gaps in the overall ecosystem comprising of "Consumers, entrepreneurs, enterprises and the government can build a stronger Internet ecosystem driven by India's young Internet-savvy population and strong local consumption, strong entrepreneurship and innovation, and a large pool of technically trained human capital.

Key areas to be addressed in order to capitalize on these strengths

(1) Limited availability of Internet infrastructure (India is ranked 49 out of 57 countries on Internet infrastructure and environment)

(2) High cost of access and usage, India has one of the highest median costs of broadband access among comparable aspiring countries

(3) Lack of awareness and digital literacy (lack of education on using the Internet is among the top three constraints to user adoption

(4) Limited range of applications and services

(5) Unfavorable business environment from regulatory clarity and stable policy framework side.

(C) APPROACH

The Government authorities have started building smart cities and broadband corridors and the air is cleaner since smart grids and improved utilization of natural resources followed the increased automation and government driven national projects for broadband highways becoming a reality

The government intervention to centrally drive such initiatives will continue however a methodical thought through top down working model has to be established with joint collaboration from public and private players along with government support to come up with a **"National Next Gen Broadband Blueprint to meet the Young IP India Nation"** for today and decades to come

Key deliverables should include:

- Categorization of the end to end broadband delivery ecosystem starting all the way from end consumer Point of Usage “PoU” moving upward in the hierarchy with clearly defined layers and their respective standard governed handoffs in consideration to the National Broadband blue print covering from Consumer Usage Point to :
    - ✓ **Access n/w – Edge Network – National Backbone – International Peering**
- Clear Demarcation for Technology (Wireline / wireless) and platforms (Wi-Fi, 3/4G, FTTH) deployable to be defined for each layer considering
    - ✓ Ease of access and coverage limits considering services present and future bandwidth and quality demands
    - ✓ Capitalization of the existing deployed assets both wireline/wireless with optimal restructuring considering technology coverage and capacity limitations for future growth
    - ✓ This approach will ensure best economically scalable model for
        - Demand Fulfilment just in time
        - Investment protection considering scale and growth
        - Minimal recurring environmental invasion
- Government to consider framing clear guidelines and mandate compulsory deployment of network for respective layers within the defined Technology and Platform framework
- All the network and services enablers (SPs, PSU, Infrastructure providers, Last mile providers) need to adhere to the laid policy and norms for their defined jurisdictions.
- Compulsory Norms to be defined for all associated in the end to end delivery ecosystem
    - ✓ Builders and Developers (for inclusion and provision of telecom at design stage)
    - ✓ Infrastructure Providers (Unbundling of networks, sharing and colo flexibility)
    - ✓ Content and Data centre providers (for localization and co Hosting, peering)
    - ✓ Service Providers (for Platforms and backbone sharing)
    - ✓ Regulatory and Governing Authorities (for policy simplifications, incentive on sharing, ease for interconnects and peering

Q7. Are PSUs ideal choices for implementing the National Optical Fibre Network (NOFN) project?

Q8. Should awarding of EPC turnkey contracts to private sector parties through International Competitive Bidding (ICB) be considered for the NOFN project?

Q9. Are there any ways in which infrastructure development costs can be reduced? Is it possible to piggyback on the existing private sector access networks so as to minimize costs in reaching remote rural locations?

Q10. What can the private sector do to reduce delivery costs? Please provide specific examples

For questions Q7, Q8, Q9 and Q10 – Please refer "NATIONAL OPTIC FIBRE NETWORK ROLLOUT"

National Optic Fibre Network rollout

(A) HISTORY

The Indian government approved a cabinet note on the scheme to create the National Optical Fibre Network dated 25 October 2011. The implementation framework, budget, technology architecture and other issues related to NOFN were worked out by a high level committee constituted by the Department of Telecom (DoT) under the chairmanship of an adviser to the Prime Minister and Chairman UIDAI (constituted on 26 April 2011). The Special-Purpose Vehicle Bharat Broadband Network Limited (BBNL) was incorporated to execute the project, implemented by three prominent telecom PSUs (BSNL, RAILTEL & PGCIL) in the ratio of 70:15:15. To grant right of way, a draft tripartite memorandum of understanding (MoU) among the government of India, the SPV and the State governments of India was sent to the state governments and Union Territories for their concurrence. Eventually, all the states signed the MoU (Except TN) and charges towards RoW were waived for the NOFN Roll-out.

It's a noble vision of the Government to reach out to the village population where private networks have very scarcely deployed till today because of lower ROI. Moreover, most of the presence of these private networks in rural is through microwave radios which are serving their base stations (2G BTS). A 'Social Fibre' commissioned through this USOF initiative will give permanent and scalable connectivity of Rural Population which is almost contribute 60% of country's population and help building Digital India in true sense.

(B) CURRENT EXECUTION STRUCTURE

In the current execution structure, the special Purpose Vehicle, BBNL is the implementing and monitoring authority of NOFN network with 3 Central PSUs (BSNL, Railtel and PGCIL) taking the responsibility of laying & maintaining the fibre optic network in their respective areas. Accordingly BBL has procured OFC and GPON equipment directly through the tender and the work of execution is given to three CPSUs (BSNL, RAILTEL &PGCIL). In-turn, these PSUs will call smaller tenders (at district & state levels) for the procurement of HDPE Duct and trenching/Laying of the Optical Fibre Cables.

The process is so multi-tiered that hundreds of tenders are floated by PSUs for procurement of PLB ducts and execution but most of them are not concluding due to intrinsic issues. Moreover, there is a clear lack of ownership for the execution of work which has led to unprecedented delay in meeting the initial targeted timelines.

(C) CURRENT PROJECT STATUS

The NOFN Project for connecting 2.5 lac Gram Panchayats across India to their respective Blocks for high bandwidth connectivity and delivering citizen services had following major milestones.

Sl.No	Milestone	Status
1	Central Procurements (OFC & GPON)	1. OFC – In Control 2. GPON – Supplies yet to start
2.	De-centralized Procurements (Duct)	~10,000 Km Procured
3.	Execution Work Orders	~5000 Kms
4.	Cable Laying	~2000 Kms

5	GPON Installation	None except Pilot sites
6	Gram-Panchayat Commissioning	Nil

Evidently, there is a big push from the Government to complete the project expeditiously but the urgency is not getting shifted to the field due to lack of effective implementation model and strategy. The primary reasons for this disconnect are:

1. Lack of common NOFN project goal amongst all stake holders
2. Cumbersome procurement process of PSUs
3. Vendor/contractor community engaged with present scope of tenders for PLB and laying services is of very small scale.
4. A single commodity or service if purchased through various tenders all over India will come at different prices. With a precedence of lower price, finalisation of the other tenders may face difficulties.
5. Project execution and operation requires lot of resources and involves opex costs. Present model have inherent disadvantages addressing these needs to deliver project implementation as per targets.

To complete 2.50 Lac GPs by 31.12.2016, a run rate of laying and integrating 10,000 Kms of Fibre is required from now on, which translates into ~350 kms every day. By this standard just a very insignificant portion of work is completed in last 18 months with the present status ordering and actual execution on ground.

(D) Suggested NOFN Execution Model to address key challenges

To complete the Project in the stipulated time lines, a radical shift from the current model is required. The focus need to shift from physical network deployment in piecemeal approach to service delivery expectations. Then proposed changes in model should not only bring-up the network rollout faster but also ease DoT / BBNL from the present time and efforts it is currently putting up in executing this project.

Present model will address deployment upto 100k Grampanchayats and increased attention by DoT/ BBNL in monitoring the project progress as we experience now will help delivering revised targets for first 100k GP. For the balance 150K Gram Panchayats, DOT/BBNL may examine the option of “Lumpsum Turnkey Solution” with service delivery accountability. The scope may include,

1. Supply, laying , installation & commissioning of OFC, GPON Eqpt at the sites
2. Deliver SLAs (mpbs availability, up-time etc) and QoS as per tender scope
3. Operation & Maintenance of the network for 3-5 years

India has sufficient turnkey expertise availability in Private &PSU sector and industry is already actively participating in infrastructure building for airports, seaports, roads, industrial corridors and power transmission lines in big way.BBNL may divide 150K GPs in four zones (geographically) to increase participation of prospective turnkey solution providers and award the tender using transparent tender selection mechanism.

Key benefits that one can see form proposed turnkey solution approach will be…

- Quick decision making & faster network rollout
- Improved accountability of end deliverable of NOFN
- Attract competent large scale private / PSU sector
- Private sector / PSU with turnkey approach can bring best industry practices towards planning, delivering and maintaining network and yet cost effective.
- Frozen project costs once awarded for entire execution and O&M
- Minimum resources from BBNL to monitor project implementation so that BBNL can invest more resourceful time towards network usage with content delivery

Q11. What are the major issues in obtaining right of way for laying optical fibre? What are the applicable charges/ constraints imposed by various bodies who grant permission of right of way? In your opinion what is the feasible solution?

Q12. Should the Government consider framing guidelines to mandate compulsory deployment of duct space for fibre/ telecommunications cables and space for telecommunication towers in all major physical infrastructure construction projects such as building or upgrading highways, inner-city metros, railways or sewer networks?

For questions Q11 and Q12 – Please refer "RoW CHALLENGES & SUGGESTIONS"

RoW Challenges & Suggestions

RoW plays a very critical role in the timely execution of the project. It is a key facilitator for the faster rollout of the Broadband network.

There are many impediments in getting the RoW clearances.

Some of the challenges are:

- Lack of Uniformity in the process of getting the clearance and the rates of RoW –both Interstate nor Intra State
- Since there is no single window for clearance, the process is long, cumbersome and takes lot of time
- Lack of Legal, Administrative & Regulatory framework to oversee the issue of RoW permissions
- The local authorities/state government /other authorities levy arbitrary charges/permission fee/lease rentals/license fee/free bandwidths etc. for grant of RoW permission, and as such, seeking to reap telecom as the source of their revenue
- There is no central body to resolve disputes between service providers and local authority for refusing permission or prescribing stringent/restrictive conditions to get RoW (Even though provision exists in the Sec 15 of the Indian Telegraph Act 1885).

Applicable Charges/constraints

- The variation in RoW charges have huge variation which may range from Rs 1 Lakh per Km to more than Rs 50 Lakh per Km from state to state
- There is a variance of RoW charges even within State, being charged by local bodies
- Reasonableness of rates – discrimination & variances in ROW Vs Restoration
- The local bodies are framing restrictive policies, procedures and bye-laws etc. in the pretext of regulating the grant of RoW permission
- There are also varying type of charges - in terms of free bandwidth provision, giving away duct space, annual rental or one time RoW charges

Feasible solutions

RoW – process simplification approach

- Unified rates - States should be advised to adopt “Restoration costs” as per recommendation of TRAI in April 2011.
- Unified RoW policy - standardization of process in terms of the maximum timeline to be fixed for attaining ROW from different agencies
- Central agencies like Railways, BRO, NHAI, National forest etc can be issued with guidelines on ROW for time and cost
- Single window clearance and Simplified approval process and clearance within stipulated timelines
- Legal & Admin framework enforced upon State Govt/ MCs to facilitate faster Infrastructure build

RoW – basic infrastructure approach

Government should mandate compulsory deployment of utility duct space for all essential services which include fibre/ telecommunications cables in all major physical infrastructure construction projects such as building or upgrading highways, inner-city metros, railways or sewer networks. The move is set to benefit to all Telecom & broadband service providers and reduce their capex / opex cost as these players incur millions in repairs, repeated digging of trenches and maintenance. This initiative will help to create robust network which fuels broadband connectivity. This is proven successful concept worldwide.

Q13: What are the impediments to the provision of Broadband by Cable operators? Please suggest measures (including policy changes) to be taken for promoting broadband through the cable network.

Digitalization of the Analog TV transmission network of CATV to provide digital media and broadband services has multiple challenges as the digitalization will drive the Bandwidth demand for access and backhaul requirements which the present ecosystem of CATV providers are finding hard to manage.

Also the lack of IP capability and support on the CMTS platforms poses further challenges on fuelling the growth as it becomes difficult to integrate the CMTS networks with present evolved

IPMPLS networks to gain cost and scale advantage to create a cloud based Multicast backbone for effective video delivery

Key challenges in case of the HFC network found in Indian CATV environment are:

a. Unstructured Cable deployment with low redundancy, as most of the deployment is on spur with no protection

b. Wide use of amplifiers to increase signal strength which in turn increases the noise level in the CATV signal. In case of the CATV signal this can be removed by rectifier, but in case of the Internet delivery amplifiers have to be specialised so that they can improve the signal quality in both directions (As internet requires upload and download).

c. Quality of Coaxial cable deployed is susceptible to power interference and lower quality of services.

d. Lack of device ecosystem for IP ready implementation

Recommendation:

Coaxial cable is generally present in all the homes and hence it will be easy to access and efficient to use the available infrastructure for the broadband deployment. However some key initiatives required as follows:

a. Coaxial cable to used only in the last mile within the building rest all should be OFC.

b. Optical fiber cable ensures less susceptibility to power interference and will improves quality of signal, with lower usage of the amplifiers.

From regulatory perspective flexibility in sharing and collocation regulations and framework shall be put in place to reduce the cost for incremental built-up. This will also require bringing fiber access network closure to the building and creating an effective converged content delivery network.

Q2: What are the impediments to the deployment of wireless technologies in the access network? How can these deployments be made faster? Please reply separately for each technology.

Wireless technologies have been the most preferred option for broadband delivery in India by most of the operators in India.

Comparative study for each wireless technology is as below:

##	Parameters	2G (GSM,CDMA)	3G (WCDMA)	LTE (4G/4G advanced)
1	Data Rate	0.3Mbps max with EDGE technology. Challenges: >> Doesn't support high speed internet.	42 Mbps with HSPA+ This is a shared cell throughput not a per user experience	Upto 100Mbps throughput in ideal conditions This is a shared cell throughput not a per user experience Would require lot of spectrum in continuous chunks
2	VAS	VAS specifically designed for low speed internet services will be supported.	VAS offering limited not suited for HD based content and services.	VAS on IMS cloud specifications still to be made hence VAS offering will be limited
3	Frequency Band	800/900/1800Mhz >> 800/900 Mhz is the best band giving optimum coverage and capacity		2.3Ghz Hence problems due to coailageetc . As well signal strength fades fast with Concrete walls.
4	Radiation	Towers required are less as compared to both 3G and 4G deployments . However radiation hazards do exist	Though tower requirements are less as compared to 4G but increases as compared to 2G and hence radiation hazards are greater.	As the number of towers required is more, radiation hazards in nearby area increases. If power radiated by Antenna is low then CPE has to radiate more for coverage. Hence in both cases Radiation hazards exist
5	Devices on LTE	All mobile devices are supported	All mobile devices support and there is a huge vendor ecosystem	Limited devices on LTE-TDD which can latch on to the network.
6	Future Roadmap	Migration to 3G/4G	Migration to 4G	1Gbps maximum.
7	Capacity	Per cell 800 active users approximately	Per cell 300-400 active users.	Per cell 200 active users. Considering 3 sectors, 600

				active users.
8	Power Consumption	Low	Medium	High.
9	Interoperability	NA	NA	Cost of managing divergent protocols and interoperability for both data and voice is difficult and will take time
10	Complimenting Technologies	2G shall be a technology where the customer can be given a basic browsing experience. For good experience people need to move on to 3G/4G	3G shall give good experience for browsing and basic internet services on the go. However not an ideal solution for high speed internet services	LTE will be a technology to give you High speed Internet access and coverage, but have limited support for Multicast and HD related delivery

From the above comparison following inference can be made in terms of the challenges faced by these technologies in each of the areas:

a. Data rates which can be achieved with 4G requires more towers and spectrum.
    a. For towers there is again a radiation hazards coupled with permissions to install and maintain them.
    b. For spectrum as the additional spectrum needs to be re farmed it will be a difficult option in the near future.

b. Within wireless, LTE will be the most suitable medium term technology expected to substitute most of the “mass” broadband demand as primary access mode in India. However, the spectrum availability is very low and requires installation of more antenna and hence higher capex and opex

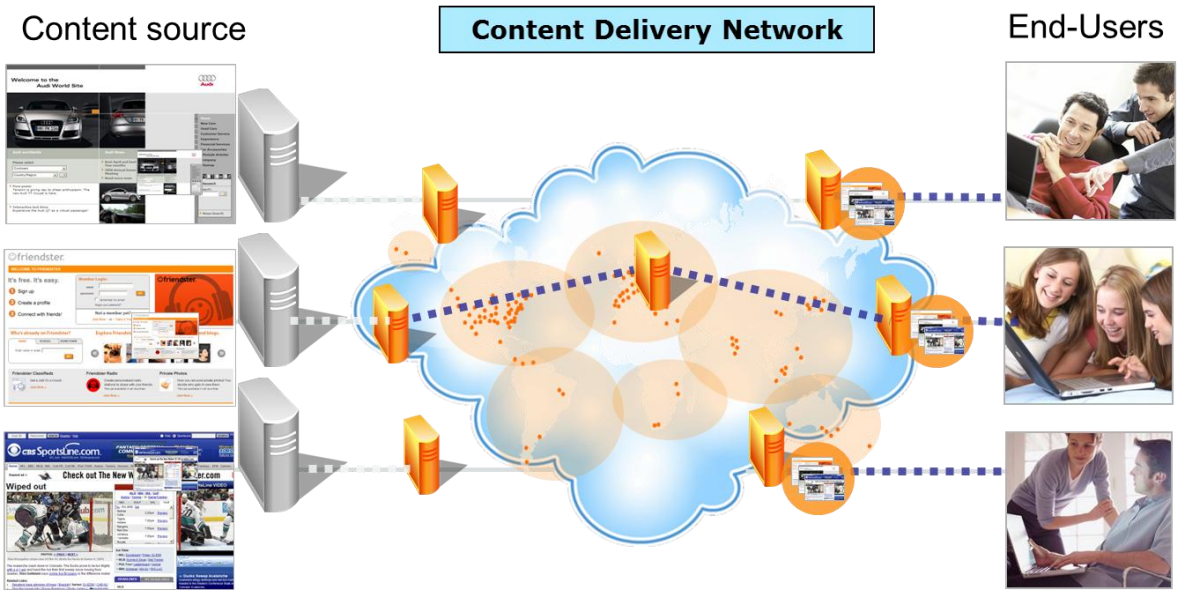
c. For a high usage and multi device customer, fixed broadband offers a much more compelling price proposition that wireless cannot match.Cost for Telco for high wireless data consumption is too high

Recommendation:

a. Usage and deployment of fixed line infrastructure for giving coverage inside home use and usage in offices, common areas etc. This can be done through WiFi, small cells etc. This will decrease dependency on the Wireless spectrum and towers required, thereby addressing the capex and opex requirement.

Fiber based Distributed Antenna System as the technology must be made madatory for all future tower deployment as it reduces the overall radiation and power requirement. This is technology allows BTS hotelling and is scalable and future proof.

Q6: Would the hosting of content within the country help in reduction of the cost of broadband to a subscriber? If yes, what measures are required to encourage content service providers to host content in the data centre situated within India?



Above picture depicts how user access content from different sources and the role content plays in the users internet behaviour.

Benefits of content closer to the user enable the following advantages:

a. Less latency in accessing the content
b. Better Quality of services
c. Reducing the reliance on international bandwidth

The content localization can help in reducing cost and improving the Quality of the services. Most of the content can be categorized in to three parts:

1. Basic internet services
2. Value added services
3. HD content and video based services

Enabling local internet services enable the service providers to provide localized content at cheaper rates and charging the VAS and HD content for additional revenue models.

Thus basic internet services can be made available on flat charges model while additional amount will be charged depending upon the Quality of services and the type of content that a user wants to be provided with.

As these contents are to be hosted in the Data centre it is important that we need to address the challenges in setting up data centres in India first.

Major factors affecting data centre creation in India:

I. Cost of Internet bandwidth which is attributed to following two factors:
   a. Cable landing charges
   b. 2-3 major players who own the cable landing stations in India resulting into less competition

II. Rising cost of real estate and power in India

III. Licensing for managing large data centres also needs to be regularized.

IV. According to Cushman and Wakefield recent study India is ranked 29th in the global list of setting up data centers in India. Considering this India is 2nd riskiest country in the world to setup data center

V. Regulatory flexibility and long terms policy stability are other concerns

Drivers for local content hosting:

- Faster delivery
  - ✓ Content and Applications are served from locations near to end users

- Reliability and scalability
  - ✓ No single point of failure
  - ✓ Sizing in Service providers control

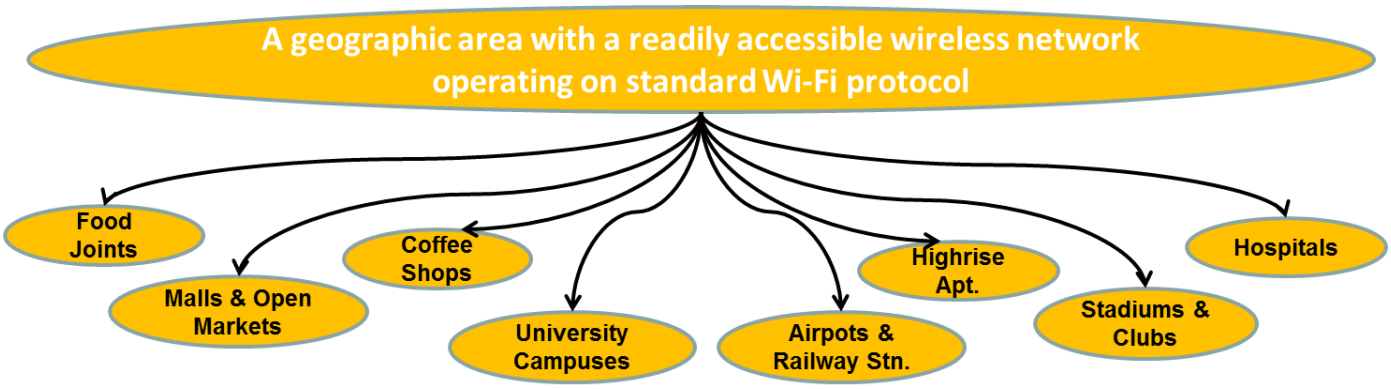
- Cost Efficiency
  - ✓ International BW reduction
  - ✓ No over provisioning
  - ✓ Simple to manageand Monitor

Measures that can attract content providers for local content hosting are as follows:

a. Infrastructure availability for creating regional data centres
b. Backhaul availability and scalability
c. Government support in licensing clarity for managing data centres
d. IT Systems and Technology to manage the DRM rights and providing hassle free wallet share for user consumption

Q15: Are there any regulatory issues in providing internet facility through Wi-Fi Hotspots? What are the reasons that installation of Wi-Fi hotspots has not picked up in the country? What type of business model needs to be adopted to create more Wi-Fi hotspots?

WiFi hotspots can be categorized into different segments based on the below diagram:



Type	No. of AP	Area (sq.ft.)
Small	**1-2**	**<10000**
Medium	**2-8**	**10K-40K**
Large	**>8**	**>40K**

Major Drivers for the WiFi hotspot services are as follows :

a. Carrier-grade operation
    a. Wireless performance
    b. Interference mitigation
    c. Reliable coverage
    d. Robust capacity and throughput
    e. Control of security, management, mobility, authentication, billing, policy
    f. Standards-based
b. Seamless end-user experience
    a. Intra-network & inter-network
    b. Roaming/mobility
c. End-to-end scalability
    a. Network design to support millions of users and exponential traffic growth

From worldwide WiFi hotspot deployments can be seen that Europe & North America contribute to greater than 80% sessions.

By venue Airports, Hotels & cafes contribute over 80% of usage worldwide.

Regulatory and security:

a. Free band possess lots of interference challenges
b. Radio signals are susceptible to jamming and interference
c. Lack of security due to protocol vulnerability and lack of end to end ecosystem for central authentication
d. Limited mobility support
e. Issues in handoff and roaming,
f. Lack of devices ecosystem to facilitate enhanced handoffs in heterogeneous network environment
g. Painful login and authentication process flow as the standards for seamless authentication and discovery still evolving

Recommendation:

a. Wifi hot spots shall not be seen in isolation. They are perfect solution for allowing Mobile Data Offloading, hence increasing coverage and capacity on the existing wireless infrastructure
b. Fiber based Distributed Antenna System as the technology must be made mandatory for all future tower deployment as it reduces the overall radiation and power requirement. This is technology allows BTS hotelling and is scalable and future proof.
c. The network infra must be designed as fiber based converged infra, allowing off and on loading of data anywhere anytime
d. There is no stand alone business model for wifi hotspots