Dear Sir/Madam,

Thank you for the opportunity to share comments for the document titled *"Consultation Paper on Proliferation of Broadband through Public Wi-Fi Networks"* released on 15th November 2016. I sincerely appreciate the initiatives made by TRAI to improve broadband penetration across India – steps which will help uplift a large section of Indian citizens.

Please find below, my inputs to the questions posted in Chapter IV of the document. I am reachable by email at sudeep.divakaran@gmail.com or phone at +91 9008790446 for any clarifications.

Regards
Sudeep Divakaran

Questions from TRAI for consultation and response

Q1. Is the architecture suggested in the consultation note for creating unified authentication and payment infrastructure will enable nationwide standard for authentication and payment interoperability?

The proposed architecture is ***not*** solving the *main* challenge that hurts internet penetration in rural areas today.

Building the *backhaul infrastructure* to provide high speed broadband service to the vast population in rural villages is the bigger challenge to address. This architecture only addresses the problem of providing access at the edge. We need to separate out connectivity challenges in densely populated urban or semi-urban areas from the bigger obstacles faced connectivity in remote rural villages.

Nevertheless, we *acknowledge* that the proposed architecture can be an *effective enabler* as having a nationwide standard for authentication and payment interoperability has its unique merits than will ease entry of service providers for WiFi hotspots wherever backhaul links are already available. On the other hand, the question is why the existing architectures can't be easily *extended* to enable this with minimal effort and what additional features does the proposed architecture bring (for example, UPI is being used by other sectors now).

For sure, UPI option for payment and a centralized authentication system that is proposed will help – but this proposal shouldn't be the only solution and all players must be given a *choice* whether to extend their existing architecture to accommodate UPI or implement one separately as recommended in this document. For new market players, this can be a good reference to start with.

Moreover, UPI need not be the only option that the end-user should have. It could be using other means like Credit Card or Debit Card or Mobile Wallet like the case today and avail the same flexibility. In addition to this, the process for the subscriber to register and available the WiFi service by accessing a captive portal is also something which already exists. Do we really need to define a new way to achieve the same which is already in practice, except that the user interfaces may vary. From authentication point of view, currently, if the user is not a registered subscriber of the WiFi hotspot provider, the user has options to use OTP method to authenticate. We agree that this method isn't very useful for those who are unable to receive OTP, like foreigners, whose SIM would be in roaming mode. On the contrary, the alternative that this architecture proposes *doesn't* solve the problem either. In fact it puts an additional requirement to pre-install an application which will take care of the authentication using credentials like Aadhaar. Inability to install an application for authentication in the first place can become a blocker to get access to a WiFi connection. Also, specifying details like MAC-IDs of other devices which the user would like to use to access the internet is too complex for an average user. A better *user-friendly* solution is needed.

In general, we agree that to achieve the goals of Digital India, public Wi-Fi can indeed complement the wired and wireless infrastructure to provide better coverage and capacity. But as mentioned in Chapter 1 Section C of the document, there are specific problems and challenges that need to be resolved to get the benefits effectively in full.

Our opinion is that though this consultation paper currently only aims to address a subset of the various challenges to achieve the goal for widespread wireless, the approach can help enhance the ecosystem to promote *monetization* and build business models that are sustainable. Nonetheless, we believe, these advantages will be seen only in urban and semi-urban areas where broadband connectivity already exists.

Globally, a large amount of data is accessed via WiFi [3]. But this is primarily because of faster speeds and in most cases, the last mile connectivity is free. And the data traffic is higher via WiFi in urban areas where backhaul challenges are lower. In Indian context, the TRAI report clearly highlights that India subscribers are predominantly wireless devices users, which applies to both rural (42%) and urban areas (55.6%) [1]. To add, the next wave of wireless access uptake is going to be higher in rural areas. One significant factor to take note is that as far as broadband access is concerned, cellular access share is outstanding at 94% and only less than 1% users use other wireless technologies for access like WiFi or WiMax [1]. Clearly, it is because low cost backhaul is not possible in rural areas to give the same advantage which WiFi has in urban areas.

To conclude, though this is a good proposal, it only takes a very *narrow* view to address the bigger challenge of enabling wider connectivity in urban and rural areas. The key issue is that country-wide Public WiFi has bigger limitations at the backhaul side which need to be addressed first.

Q2. Would you like to suggest any alternate model?

There can are be one or more models to address the Authentication and Interoperable payment gap. Some of the alternate models are:

- *Extend* the existing model adopted by Internet Service Providers (ISPs) using their own captive portal (or in case of new players, setting up their own captive portal) accessed via standard web-browser or dedicated application. UPI option for payment can be provided in addition to the existing methods like OTP, Registered subscriber, etc.

- Use technologies like *Passpoint [6] and Next Generation Hotspot* to enable easy discovery of hotspots and authentication, in addition to roaming capability between hotspots owned by different Internet Service Providers or private players.

- Telecommunication Service Providers (TSPs) can deploy solutions based on the latest standards around *WiFi-LTE interworking* to bring quick cellular access to hard-to-reach areas where WiFi deployment or installation is easier. This can be done by TSPs themselves or with tie ups with ISPs or owners of the premises. This can be more applicable for urban areas with dense data traffic. This can also be extended to rural areas. The backhaul can be either Cellular links or satellite/microwave links (including newer solutions like TV White spaces [4]) or even optical fibre (which involves high cost due to multiple reasons). The last mile connectivity using WiFi can be provided by the TSPs themselves or by private companies with suitable agreements with the backhaul provider to share the costs.

Public WiFi is generally very popular in areas where it is free. But, providing Public WiFi free across all areas (urban and rural) is typically not feasible due to higher costs – both in terms of infrastructure to install the backhaul links and also getting the Right of Way to lay the cables and build infrastructure. The bigger focus must be on how this cost of this can be shared and to do this, the democratization of not just WiFi hotspot providers, but also enabling more private players to engage in Wireless and Wired *backhaul infrastructure* (like using E-Band, TV White Space spectrum or even fibre optic cables). For example, usage of TV White Spaces [4] for backhaul (middle mile and even last mile) especially in rural areas holds great promise. Similarly, small cell based solutions using higher spectrum like millimeter wave bands for short range backhaul for LTE can help reduce right of way and cable laying costs and other challenges in urban areas. These factors must be taken into consideration while laying guidelines for such architecture. WiFi hotspot providers who have service contracts with wireless access users can have customized price plans which includes costs to be shared or borne for setting up the backhaul connection infrastructure.

The architecture should provide *flexibility* for authentication and payment for different market players to be able to provide solutions meeting the specified requirements, i.e., the charges to the user can be dynamically set based on various factors that ensure

profitability like population size, usage time, location of the access point, backhaul infrastructure costs, bandwidth/data plans, etc.

Q3. Can Public Wi-Fi access providers resell capacity and bandwidth to retail users? Is "light touch regulation" using methods such as "registration" instead of "licensing" preferred for them?

Yes, public WiFi access providers can be allowed to resell capacity and bandwidth to retail users. This will help optimize infrastructure costs borne by retailers if they want to setup WiFi hotspots themselves.

However, while monetizing public WiFi, which uses unlicensed band is beneficial to cover the infrastructure costs, the cost per byte is expected to be much lower than what TSPs can provide using their cellular solutions. Since cellular solutions need to pay for licensed spectrum in addition to meeting a lot of regulatory requirements, this may be seen as unfair competition, especially for data services. But, this shouldn't be the case. The counter argument to that would be that TSP could themselves come with alternative competitive solutions like setup public WiFi Access points and also leverage a combination of both Wired and Cellular connectivity solutions to provide the backhaul support, unlike non-cellular ISP which rely on wired connections only. There is a higher potential for demand of guaranteed QoS based cellular solutions compared to solutions that use unlicensed spectrum, which can get crowded out quickly when the number of users increase.

Through effective bundling of services combined with QoS metrics for the respective wireless modes of service, the market players can innovate with different types of plans to attract users and build business models around them.

Q4. What should be the regulatory guidelines on "unbundling" Wi-Fi at access and backhaul level?

Yes, unbundling Wi-Fi at access and backhaul level is a good option to extend the reach of middle mile and last mile access, especially in densely populated areas where traffic density is high and also in rural areas where the cost of developing the backhaul infrastructure is high.

Unbundling enables different players to come in with various value propositions that will enable building a scalable network profitably.

Q5. Whether reselling of bandwidth should be allowed to venue owners such as shop keepers through Wi-Fi at premise? In such a scenario please suggest the mechanism for security compliance

Yes, the bandwidth available can be used for commercial purpose too. Models like Freemium, Advertisement based, etc. as listed in [2] already exist. In addition to this,

there could be models, for example one where user gets reward points while purchasing a product or using a service from the vendor, which can be used to avail free WiFi instead of paying for the it. Several such models are possible and it should be encouraged. From a security compliance perspective, mobile number can be used for authentication and providing the service.

Q6. What should be the guidelines regarding sharing of costs and revenue across all entities in the public Wi-Fi value chain? Is regulatory intervention required or it should be left to forbearance and individual contracting?

Since the challenges in rural and urban areas are different, the guidelines are described for each separately below:

- Rural Areas

In rural areas, typically the connectivity speed requirements are lower. The bigger challenge is the connectivity reach, especially in remote sparely populated areas. In such areas, multiple players must be roped in to build infrastructure in such areas instead of relying on the big TSP/ISPs. Usage of unlicensed spectrum like TV White spaces, millimeter wave backhaul or even LTE relay nodes to build the backhaul using wireless means is the best alternative to laying cables, where Right of Way is a big challenge. With such solutions, enabling WiFi as the last mile connectivity can be highly successful in a cost effective way compared to cellular solutions. For the middle mile and last mile connectivity, no specific regulatory requirements are needed and it should be left to *individual contracting* and *forbearance*.

- **Dense Urban areas**

WiFi can help to provide additional coverage in-doors and also additional bandwidth – to supplement the cellular access. WiFi can be provided by venue owners or even by TSP/ISPs taking advantage of the various Cellular-WiFi Interworking solutions available that enables seamless transition between the two, taking into account better load balancing and quality of service parameters. The cost to build supporting infrastructure for both cases is high. Therefore, a revenue model based on sharing of costs would enable generate interest from private sector in the deployment and speedup of the roll out. From a regulatory point of view, though licensed spectrum based cellular solutions need to meet strict QoS regulatory requirements, for the unlicensed band WiFi provided by the venue owner or by TSP/ISP, there is no need to have any specific regulatory requirements. Quality of service requirements should be left to *individual contracting* and *forbearance*.

However, in both cases though, when it comes to usage of equipment and their installation, the *standard regulatory requirements* must be met, especially in a public place. For example, certified radio requirement and compliance to technical requirements like power limits, EMF radiation norms, etc. must be met.

General Closing Inputs

India, with a population for over 1.25Billion, has about 60-65% literates and roughly the same percentage of citizens who are 15years and above. This is the primary target group to use internet. This comes to around 750Million people.

TRAI[1] reports indicate that out of the 1.06 Billion Telephone subscribers, Wireless subscriptions in urban area accounts for 55.61% and Wireless subscriptions in rural areas accounts for 42.01%. Wireline subscriptions are less than 3%. Research reports by several companies also clearly show that growth for wireless is going to be the highest in rural areas. From narrowband and broadband internet users perspective too, cellular mobile devices users account for about 94% of the total, with less the 1% using other technologies like WiFi, WiMax.

Backhaul connectivity and capacity is a key challenge to connect both rural areas and in some urban areas, where bandwidth capacity requirement is very high. To enable broadband adoption in *rural* areas, a *3 tier approach* would help achieve the goals of Digital India, which is:

- Minimum Basic Broadband capability to each and every individual across India
  - Basic connectivity: To enable access to government portals and services, enable cashless transactions and access to general Internet, etc
  - Requirements
    - **Tier 1 Connectivity: Basic User**
      - Basic Data Package : 2-5GB (Government services, Cashless transactions, etc)
      - Minimum broadband speed: 2Mbps

- Enhanced Broadband connectivity
  - Advanced Connectivity: To enable the broader goal for a fully digitized society.
  - Requirements
    - **Tier 2 Connectivity: Medium Data User** (Video/Voice call, Email, Content access (various types), Chat, Real-time services, etc)
      - Data Package: 5-20GB
      - Bandwidth : 2-10Mbps
    - **Tier 3 Connectivity: High Data User** (HD Multimedia content, Video conferencing, etc)
      - Data Package: >20GB
      - Bandwidth : >10Mbps

References

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[2] TRAI Consultation Paper on Proliferation of Broadband through Public Wi-Fi Networks
[3] Ericsson Mobility Report June 2016
[4] Affordable Broadband in India using Backhaul in TV White Space https://www.ee.iitb.ac.in/tvws/
[5] Wi-Fi CERTIFIED Passpoint
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