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| **SOUTH ASIAN TELECOMMUNICATIONS REGULATOR’S COUNCIL** **(SATRC)** |  |
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**SATRC REPORT ON**

**PROLIFERATION OF PUBLIC WI-FI NETWORK IN SATRC**

**Prepared by**

**SATRC Working Group on Spectrum**

**Adopted by**

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# CHAPTER-1: INTRODUCTION

## 1.1 General

In its “State of Broadband 2018 Report[[1]](#footnote-1)”, the ITU’s Broadband Commission for Sustainable Development has emphasized the importance of broadband Internet for sustainable development. Broadband infrastructure is not only a vital infrastructure, as essential as water and electricity networks, but it is also becoming more invisible and integrated in utility networks in ‘smart’ infrastructure. According to ITU, nearly 4.4 billion active mobile broadband subscriptions are expected by end 2018, strengthening the power of the mobile digital economy.

 “Broadband” is a high speed data connection that is able to support interactive services including Internet access to an individual subscriber from the point of presence (POP) of the service provider, intending to provide Broadband service. It therefore refers to a data connection capable of delivering high-speed Internet access services. Broadband has over a period of time, become a critical platform for economic growth, job creation, global competitiveness and improved way of life. It is helping emergence of new industries while unlocking vast new possibilities for existing ones. It has brought a paradigm shift in the way we impart education to children (and other students), deliver health care, manage energy, evolve public safety, engage government and access, organize and disseminate knowledge. In this regard, the World Bank’s World Development Report recently observed that on an average a 10% increase in internet penetration, is likely to lead to a 1.4% growth in the GDP of an economy. However, despite significant progress in the space of mobile telephony and mobile broadband, delivering broadband (BB) to the last mile remains a challenge.

There are many potential methods for rapidly delivering broadband, in particular, interoperable and scalable Wireless Local Area Networks (WLANs) show the promise of rapidly delivering affordable broadband services at relatively low costs. The term Wi-Fi is commonly used to refer to the array of technical standards (802.11 standards and various amendments to it) developed by the Institute of Electrical and Electronics Engineers’ (IEEE) that can be used to create WLANs. Strictly speaking, Wi-Fi is a certification provided by the Wireless Broadband Alliance (WBA), which owns and controls the “Wi-Fi Certified” logo that can be applied to products that satisfy certain interoperability criteria. The certification is centered on the following tenets:

* Interoperability is the primary target of certification. Rigorous test cases are used to ensure that products from different equipment vendors are interoperable in a wide variety of configurations.
* Backward Compatibility has to be preserved to allow for new equipment to work with existing gears. Backward compatibility protects investments in legacy Wi-Fi products and enables users to gradually upgrade and expand their networks.

WLANs created using the Wi-Fi standard can be used to connect personal computers, mobile phones, tablets and other appliances to a local network, which in turn provides connectivity to the Internet. These WLANs can be operated for private use, such as in the home, or to create short-range, public networks, known as “hotspots”, which can be found in public places like airport lounges, coffee shops or neighborhoods.

At present, mobile network data usage in SATRC countries is significantly higher than other forms of Internet usage. This can be attributed to a number of factors, including the cost and affordability of different broadband services, depth of fixedline coverage and lesser number of public Wi-Fi zones. This situation highlights the need for better proliferation of Wi-Fi networks that can offer a more affordable and flexible alternative for scaling up of Internet access.

In general, Internet Service Providers (ISPs) are required to incur substantially lesser costs in setting up Wi-Fi access infrastructure compared to mobile broadband networks like 2G/3G/4G. This is on account of the fact that Wi-Fi technology utilises unlicensed spectrum, the equipment is both cheaper and more readily available. Further, maintenance and operational costs are significantly lower. It will of course need to take into account the need for backhaul connectivity to the Internet in order to provide Wi-Fi broadband services. The lower cost of Wi-Fi delivery easily translates into lower prices per MB for the end-users, making it a more affordable service. Added to this is the fact that Wi-Fi networks can often offer faster speeds compared to mobile data, allowing users to access more data-intensive applications and content.

Wi-Fi networks therefore offer affordable, scalable and versatile technologies that can facilitate the spread of Internet access in rural and urban areas alike. Modern technology also makes it possible to integrate a server with high storage capacity with the Wi-Fi hotspot equipment. As the cost of such servers and the cost of storage have come down significantly and the form factor of such devices are very small, it should be possible to cache or download content for easy browsing even when the backhaul connectivity is not available. Such an arrangement can find great application in storing study material, educational data, agricultural and health related information, as well as movies and entertainment content, for the benefit of Wi-Fi users in areas with irregular connectivity, such as rural areas.

For the access network, wireless data communication technologies can play a significant role in the penetration of broadband due to ease of deployment and faster roll out. Moreover, it also allows telecommunication service providers to offload their cellular data through Wi-Fi networks to reduce the traffic on their data networks by making use of unlicensed spectrum. While doing so, operators are in a position to offer a better experience and higher access speeds to subscribers in the Wi-Fi zone, hence facilitating subscriber satisfaction and retention.

## 1.2 Background

For the access network, wireless data communication technologies can play a significant role in the penetration of Broadband due to ease of deployment and faster rollout. Additionally, they are affordable, scalable and versatile technologies that can spread in rural and urban areas alike. Globally Wi-Fi has captured many people’s imagination because it enables multiple users to share the same Internet connection, all of them without cables – allowing full portability using laptop, PCs or other devices. Wi-Fi technology holds much promise for member countries of the SATRC with an intent on achieving universal access to ICTs for their population in isolated rural areas or territories where the telephone or cable infrastructure are not deployed.

## 1.3 Objective & Purpose of the report

The objective of this report is to encourage SATRC members to conduct appropriate studies on issues being faced in proliferation of Wi-Fi network in the region by focusing on the following issues and share their information with other members:-

* Various standards of Wi-Fi networks
* Frequency bands for use in Wi-Fi networks
* Security considerations for use of Wi-Fi networks
* Mobile data offload through Wi-Fi networks
* Technological solutions for seamless payments

In order to carry out the study, a questionnaire was prepared and circulated to all expert members of the SATRC Working Group on Spectrum for their inputs. The questionnaire is placed as Annexure-I to this report. An analysis of various regulations and provisions in the above mentioned areas has been carried based on the inputs received from the experts of the following SATRC countries in addition to Indian experience:

1. Bangladesh
2. Bhutan
3. Iran
4. Maldives
5. Nepal
6. Pakistan

# CHAPTER-2: PROLIFERATION OF WI-FI NETWORK IN SATRC

## 2.1 Broadband Subscribers

The number of Broadband Subscribers (in various segments) in the SATRC countries are:

|  |  |
| --- | --- |
| **Segment** | **No. of Subscribers** |
| Wired | 1. Bangladesh: 5.68M(2017)
2. Bhutan: 28,631
3. India: 21.24 Million (as on 31st March 2018)
4. Iran: 28M(2015)
5. Maldives: 20,467
6. Nepal: 26,04,097 (2018)
7. Pakistan: 2.66M (2017)
 |
| Wireless | Fixed Wireless (Like Wi-Fi, Wi-Max, point to point, Radio, VSAT, etc.) | 1. Bangladesh: 0.087M(2017)
2. Bhutan: 10,034
3. India: 0.471 million (as on 31st March 2018)
4. Iran: 10M (2014)
5. Maldives: do not collect
6. Nepal: 3,27,106 (2018)
7. Pakistan: 2.15M (as of Oct 2018)
 |
| Mobile devices (Phones/ dongles) | 1. Bangladesh: 80.151M(2017)
2. Bhutan: 5,04,522
3. India: 472.25 million (as on 31st March 2018)
4. Iran: 84M (2015)
5. Maldives: 802,309
6. Nepal: 1,04,46, 797 (2018)
7. Pakistan: 60.02 M (as of Oct 2018)
 |

## 2.2 Expansion of Wi-Fi networks in remote areas

Wi-Fi technology holds much promise for rural areas or territories where the telephone or cable infrastructure is not deployed. Since there is a significant section of the population still to be connected in the SATRC countries, expansion of Wi-Fi network especially in remote areas is one of the key subjects that require significant attention. There is a need to take some measures so as to provide broadband services to the unconnected through low-cost Wi-Fi installations. Following table shows measures that can be taken to encourage the deployment of commercial models for city-wide Wi-Fi networks as well as expansion of Wi-Fi networks in remote areas:

|  |  |
| --- | --- |
| Bangladesh | 1. Encouraging ISPs for vast deployment of indoor WiFi access points, example- inside mall-builds,
2. Encouraging development of WiFi services in rural areas,
3. Encouraging BWA operators to proliferate WiFi services in city and rural areas
 |
| Bhutan | 1. Need to encourage the deployment of Wi-Fi hotspot with data cost cheaper than the mobile internet data cost.
2. The quality of data internet services through the Wi-Fi networks should be reliable and affordable.
3. Deployment of Wi-Fi hotspots in remote areas can help us to expand Wi-Fi networks in remote areas.
 |
| India |  1. Introduction of new set of small players in the Wi-Fi service provisioning space, who will be able to extend their resources through a process of incentivisation.
2. A new framework for setting up of Public Data Offices (PDOs), wherein, PDOs in agreement with Public Data Office Aggregators (PDOAs), should be allowed to provide public Wi-Fi services. This will not only increase number of public hotspots but also make internet service more affordable in the country.
3. PDOAs may be allowed to provide public Wi-Fi services without obtaining any specific license for the purpose. However, they would be subject to specific registration requirements including obligations to ensure that e-KYC, authentication and record-keeping requirements (for customers, devices and PDOs enlisted with the PDOAs). This will encourage village level entrepreneurship and provide strong employment opportunities, especially in rural areas.
4. To provide a simplified, consistent experience across hotspots from various providers means unbundling authentication, payment and accounting from hardware and software running on the Access Point. This will allow small entrepreneurs such as tea shops, Café’s, restaurants, etc. to set up and maintain Access Points.
5. PDOAs be allowed to enter into agreements with third party application/ service providers for the purposes of managing authentication and payment processes. This will encourage innovation in authentication and payment processes resulting in ease in access of the Wi-Fi services.
 |
| Iran | 1. Encouraging vast deployment of indoor WiFi access points, for example inside malls and buildings.
2. No requirement of SLA (Service Level Agreement) for public WiFi networks. Encouraging development of WiFi services in rural areas,
3. Allow ISPs to make revenue by WiFi network by means of indirect market-mechanisms, such as through digital advertisements.
4. Provide Safe-Internet for kids and teenagers through WiFi network as per parental guidelines.
5. Offloading of data via other connections to Internet through WiFi network.
 |
| Maldives | 1. There is a need to have reasonable pricing model from the ISP to the internet class license holders as to provide cost effective service to their customers.
 |
| Nepal | 1. Make the frequency bands 5150 – 5250 MHz and 5250 – 5350 MHz unlicensed and open for outdoor usage.
2. Allow all ITU recommended Wi-Fi spectrum to be used for broadband use.
3. Service experience in wireless networks is on a best effort basis and so no service level agreements (SLAs) should be enforced on public Wi-Fi networks.
4. Government should incentivize operators deploying Wi-Fi in rural regions.
5. Government should allow TSPs/ISPs to monetize through digital advertisements and location based services using the personal data given by users at the time of log-in.
 |
| Pakistan | 1. An emerging Wi-Fi monetization model is based on Location based notifications, Advertising, and Analytics. This model can be applied in outdoor as well as indoor hot spots, such as Malls. 2. Outdoor Public Wi-Fi can be offered at tourist attractions in remote areas. The cost of operations can be borne through advertisement, either by local businesses or local government. At the time of log-in, a landing page may showcase the government achievements or commercial offerings like hotel rooms, etc.3. Universal Service Fund can be utilized either to establish Tele-centers in rural areas or connecting schools by supplying, installing and maintaining of standardized ICT equipment, renewable energy power solutions, broadband connection, Wi-Fi hotspot and robust furniture at each premise. |

## 2.3 Various standards of Wi-Fi Networks

Wi-Fi uses radio waves that run at a specific frequency, generally 2.4GHz and 5GHz, to create wireless networks. The widespread adoption of Wi-Fi technology is attributable both to technological advancements in standards as well as the fact that most jurisdictions have fully or partially de-licensed the radio frequencies on which it operates, hence drastically bringing down the cost of delivering Wi-Fi services.

|  |  |  |  |
| --- | --- | --- | --- |
| Standard | Year of Introduction | Frequency | Maximum Connection Speed |
| 802.11a | 1999 | 5GHz | 54Mbit/s |
| 802.11b | 2000 | 2.4GHz | 11Mbit/s |
| 802.11g | 2003 | 2.4GHz | 54Mbit/s |
| 802.11n | 2007 | 2.4/5GHz | 450Mbit/s |
| 802.11ac | 2014 | 5GHz | 1.3Gbit/s |

Wi-Fi technology has gone through significant advancements in the years since 1997, when the 802.11 standard was first adopted by the Institute of Electrical and Electronics Engineers (IEEE). These subsequent improvements to the technology have enabled better speed, reliability and security in the usage of Wi-Fi networks. Table above summarizes the Wi-Fi generations currently in use

* The original 802.11 standard supported 1 or 2 Mbps transmission in the 2.4 GHz band using either Frequency Hopping Spread Spectrum (FHSS) or Direct Sequence Spread Spectrum (DSSS).
* It was followed by the adoption of the IEEE 802.11b standard, which operates on 2.4 GHz using DSSS and the IEEE 802.11a standard, which operates on the 5GHz band and offers data speeds of up to 54 Mbps using an Orthogonal Frequency Division Multiplexing (OFDM) encoding scheme. These standards were however not inter-operable with each other and over time IEEE 802.11b became the more popular choice, mainly due to the cheaper cost of its adoption.
* The third modulation standard, 802.11g applied the frequency division techniques of 802.11a but using the 2.4GHz band radio frequencies of 802.11b. It was adopted rapidly due to reductions in manufacturing costs as well as the desire for better speed.
* The next iteration of the IEEE standard, 802.11n, operated on both 2.4 GHz and 5 GHz bands, which reduced the interference from other products operating in the 2.4 GHz band.
* In early 2014 the IEEE ratified the 802.11ac standard, which brings gigabit speeds to Wi-Fi.4 802.11ac uses the 5GHz band and can reach a theoretical data transfer rate of up to 1.3Gbit/s. This speed is the result of three improvements.
	+ First, 802.11ac offers wider channels of 80/160MHz compared to 20/40MHz for 802.11n.
	+ Second, 802.11ac allows for up to eight simultaneous data streams between a Wi-Fi access point and a client device, whereas 802.11n can only accommodate four.
	+ Third, it uses more advanced beam forming technology to transmit data at denser modulations.

Furthermore, it is anticipated that future iterations of 802.11ac will be able to achieve speed up to 3.5Gbit/s. Another improvement is that 802.11ac reduces latency through multiple user Multiple-Input and Multiple-Output (MIMO) technology, which enables the Wi-Fi transmitter to communicate with different client devices via multiple data streams simultaneously.

## 2.4 Frequency bands for use in Wi-Fi networks

The use of unlicensed spectrum has been one of the key enabling factors in the growth and widespread adoption of the Wi-Fi standard. Accordingly, in an effort to provide maximum flexibility for innovation and lower entry costs for ubiquitous wireless devices including those that utilize the Wi-Fi standards, many countries have set aside certain bands (such as the 2.4 GHz and 5 GHz bands) exclusively for unlicensed users. However, apart from the unlicensed frequencies typically utilised under the Wi-Fi standard, there are several other frequency bands which can be utilized for wireless provision of Internet access.

Further, in addition to the need for designating additional bands for wireless devices, as seen from the above discussion, the recent standardization work on Wi-Fi has focused on improved performance and the use of bands other than the 2.4GHz band, which is recognised as becoming increasingly crowded. While the pressure to designate additional bands for use by Wi-Fi devices, will remain, globally, there is also a move to consider expanding backhaul capacity by utilising other bands of spectrum that remain largely unused. For instance, by utilising TV White Spaces (TVWS) - spectrum in the Very High Frequency (VHF) and Ultra High Frequency (UHF) bandwidths, which is currently earmarked for TV broadcasting but remains unused.

The details of various frequency bands used for public Wi-Fi in SATRC countries are highlighted in table 2.1

***Table 2.1:* Details of various frequency bands used for public Wi-Fi in SATRC countries**

|  |  |
| --- | --- |
| Bangladesh | 1. 2400 to 2483.5 MHz
2. 5725 to 5850 MHz
 |
| Bhutan | 1. 2.4GHz
2. 5GHz
 |
| India | 1. 2400-2483.5 MHz
2. 5825- 5875 MHz

 Recently the following frequencies for outdoor and indoor use have been approved to be used in India**:**1. 5150-5250 MHz
2. 5250-5350 MHz
3. 5470-5725 MHz
4. 5725-5875 MHz
 |
| Iran | 1. 2400MHz - 2483.5MHz
2. 5150MHz - 5250MHz
3. 5250MHz – 5350MHz
4. 5725MHz – 5825MHz
 |
| Maldives | 1. 2.4GHz
2. 5.7GHz
3. 5.8GHz
 |
| Nepal | 1. 2400MHz - 2483.5MHz
2. 5150MHz - 5250MHz
3. 5250MHz – 5350MHz
4. 5725MHz – 5825MHz
 |
| Pakistan | 1. 2.4 GHz2. 5.7 GHz |

## 2.5 Security consideration

1. ***Security Consideration for use of Wi-Fi networks***

Ensuring the security of Wi-Fi networks is of utmost importance, which if breached, can lead to misuse by anti-social elements.

The details of security consideration for use of public Wi-Fi networks in SATRC countries are tabulated as follows:

|  |  |
| --- | --- |
| Bangladesh | 1. Public Wi-Fi networks with list of access point/hotspot location should be known to the telecom regulator.
2. From security point of view, the process of authenticating the customer device is an issue.
 |
| Bhutan | 1. At customer end, we recommend our public to use strong Wi-Fi password and change the Wi-Fi password periodically.
2. At network operator side, we recommend them to have secured authentication procedures and have timely updates of the software and database related to Wi-Fi networks.
 |
| India | The following norms are to be ensured by the licensees for securing the use of WiFi services: 1. Provision of secured Internet services, including through Wi-Fi, through use of Login ID and password.
2. Temporary login ID for public Wi-Fi hotspots to be allowed after (1) retaining a copy of the subscriber's photo ID; or (2) Provision of login ID and password on subscriber's mobile phone through SMS,
3. Deployment of suitable customer premise equipment for wired/ wireless connectivity. Users’ Wi-Fi routers need to get the Wi-Fi connectivity registered with the Licensees.
4. The Internet services of any subscriber using Wi-Fi connectivity without being registered with the Licensees be suspended.
 |
| Iran | 1. Authentication of users by means of their ID and Password or other indirect methods such as requesting cell-phone/fixed line phone number.
2. Use the formatted SSID (Service Set Identifier) to identify the Wi-Fi hotspot with a combination of an indirect recording system (such as CCTV cameras in internet cafes).
3. Use other Wi-Fi security abilities such as WPA, WEP, etc.
 |
| Maldives | All the public Wi-Fi hotspots are working on an authentication.  |
| Nepal | 1. SSID Login Authentication & encryption (WEP, WPA2)
2. Client device isolation (Layer 2)
3. Use of firewall
4. Use of secure websites
5. Captive portal authentication
6. Extensible Authentication Protocol – Subscriber Identity Module (EAP-SIM) authentication
7. Internet Protocol Security (IPSec) tunneling
 |
| Pakistan | According to Draft Wi-Fi Hotspot Users Registration and Data Retention Regulations, 2018:1. The operator shall retain log of temporary usage of broadband service (i.e. both by temporary users and operators’ existing subscribers) for One (1) Year. This log shall be made available to Authority and/or security agencies as and when required.2. The recording and maintenance of Network Address Translator (NAT)/Port Address Translator (PAT) System Log from their Corporate Customers will be mandatory and responsibility of its compliance will rest with the operators. |

1. ***Login/Authentication Procedure:***

The details of login/authentication procedure for accessing Wi-Fi hotspots in various SATRC countries are:

|  |  |
| --- | --- |
| Bangladesh | 1. Public Wi-Fi network can be logged in/authenticated by providing the cellular phone number as the phone is registered using biometric. Faster connectivity to verify biometric during authentication process is an issue as the internet speed goes slow.
2. Authentication of users by means of their SSID and Password or other indirect methods such as requesting cell-phone/fixed line phone number.
 |
| Bhutan | 1. Authentication process for BT-OFFLOAD is EAP-SIM/EAP-AKA based on the IMSI of the SIM. The IMSI is queried in the HLR for the validity of the user. EAP SIM-for 3G user and EAP-AKA for 4G user.
2. Authentication process for BT-WIFI is through secured username/password via dedicated AAA server.

There are no challenges when it comes to authentication but the charging is interim based. |
| India | A user has to either provide a photo ID or avail of a one-time password (OTP) option through SMS in order to use a public Wi-Fi service. Challenges that deter consumers from using public Wi-Fi services:1. In places with high population density - like airports, busy markets, national monuments, railway stations etc. - often face cellular network congestion leading to delays in the delivery of the OTP.
2. Log-in problems are also faced by foreign tourists when they try to obtain an OTP by SMS using their home country’s ISD code and mobile number.
 |
| Iran | Authentication of users by means of their ID and Password or other indirect methods such as requesting cell-phone/fixed line phone number. |
| Maldives | Authentication is done via service provider’s portal, wherein time can be bought at a certain price. No challenges as of now. |
| Nepal | The current standard login mechanism for accessing Wi-Fi hotspots in Nepal is via the use of SSID Login Authentication & encryption (WEP, WPA2), captive portal authentication, EAP-SIM authentication that make use of usernames and passwords. The challenges being faced are:1. No policy for user identity verification
2. The usernames and passwords for accessing Wi-Fi hotspots are valid for multiple login sessions simultaneously resulting in slow Internet speed
3. Language barrier – since the login credentials are in English language, those who do not know English will have difficulty in logging-in
4. Technology illiterate – due to lack of know-how of using technology certain population have difficulty in log-in
5. Most of the passwords and usernames are short and use simple characters. Such credentials can be easily hacked.
6. Social media log-in (e.g. automatically require Facebook log-in)
7. Fake IDs in social media makes tracking of users difficult
8. SMS authentication for ISPs is a concern (user needs to bear the cost of the SMS)
9. Layer 2 isolation is not used and so another user can perform packet sniffing
10. Access point should authenticate device's MAC address (MAC binding)
 |
| Pakistan | According to Draft Wi-Fi Hotspot Users Registration and Data Retention Regulations, 2018:1. Any person in the vicinity of a Wi-Fi hotspot shall only be able to use Wi-Fi service through a secure and password protected access.2. After connecting with Wi-Fi Hotspot, the users shall be directed to a registration page and following minimum information shall be required from the user (i.e. both local & foreigner):a) For Pakistani National: Full Name, National Identity Card Number, Mobile Number b) For Foreigners: Full Name, Country of Origin, Passport Number, Mobile Number3. Operator, upon provision of required information by the temporary user and agreement to its’ Terms & Conditions shall provide login ID and a randomly generated password through an SMS on given mobile number.4. The registration process shall be repeated on every reconnection with Wi-Fi hotspot network in locality of a particular public place. |

## 2.6 Regulatory Issues/Licensing Restriction:

In SATRC countries, there exist certain regulatory issues or licensing restrictions that directly or indirectly hamper the growth of public Wi-Fi services in the country. The details for the same have been tabulated as follows:

|  |  |
| --- | --- |
| Bangladesh | Some issues include:1. Service Agreement between fixed wireless service providers and mobile operators to establish WiFi in public areas,
2. Data protection from access of unauthorized users.
 |
| Bhutan | 1. Cost of Internet from the International Transit.
2. Certain power limitations in Wi-Fi frequency band allocated in ISM band in the National radio plan which is a free band.
 |
| India | 1. Limitations on spectrum availability
2. The authentication process for connecting with a public Wi-Fi is cumbersome and inflexible.
3. Available modes of payment cater only to a very small section of population who has access to electronic modes of payment.
4. Physical vouchers also suffer from logistic problems and associated distribution costs.
 |
| Iran | 1. Security issues due to anonymous users of Wi-Fi in public areas.
2. Data protection from access of unauthorized users.
3. Harmful interference to other radio communication services, especially to meteorological Radars.
4. Poor efficiency due to the high RF noise level.
 |
| Maldives | 1. Provision of Wi-Fi internet to the mobile less coverage islands under the name of “internet class license”.
2. Number of islands as of now is 54.
 |
| Nepal | 1. Devices shall be restricted to indoor operations in order to reduce for harmful interference to other operations in 5150MHz - 5250MHz band.
2. Operated predominantly indoors. (5250-5350MHz)
3. Permitted to be used either indoors or outdoors. (5250-5350MHz)
4. Shall comply to employ antenna elevation mask fo-r EIRP levels higher than 200 mW but not exceeding 1W. (5250-5350MHz)
5. Maximum output power of Transmitter = 1 Watt (30 dBm). [Power restriction for 2400-2483.5MHz & 5725-5825MHz]
6. Maximum Effective Isotropic Radiated Power = 4 Watt (36 dBm)[Power restriction for 2400-2483.5MHz & 5725-5825MHz]
 |
| Pakistan | The Wi-Fi node linked to a mobile network cannot be used as a Wi-Fi hot spot that provides fixed or limited mobility services. Mobile operators can only provide public fixed or limited mobility Wi-Fi services to their own customers and that too under a commercial arrangement with a fixed network operator. |

## 2.7 Mobile data offload through Wi-Fi Networks

With the advent of smart phones and other similar smart devices which dominate the market, the mobile networks are chiefly dominated by data. The user demand for data is increasing rapidly and reaching to the order of exabytes (1 billion gigabytes). This has led to a paradigm shift in the network planning of the mobile network operators who are now focusing on devising effective and economical ways to cater to the growing user demand. The network operators plan on offloading the data and associated signaling traffic to a cheaper solution to improve their economics. The change in approach is also fueled by the fact that the further technological developments and enhancements in cellular architecture are bound by physical limitations. Also, to cater to high bandwidth and high speed data, huge capital investments are required which are not economically viable. This has forced the operators to explore alternatives using small cell technologies like Wi-Fi to efficiently handle the growing mobile data traffic.

The standardization in the field of cellular/Wi-Fi integration started as early as 2002 when GSMA formed the “WLAN Interworking Task Force” group to study the possible interworking and integration scenarios for cellular and Wi-Fi technologies. This resulted in 3GPP formulating a number of specifications for cellular/Wi-Fi integration. These specifications can be seen as divided into two groups depending on the mobile core network they pertain to, viz.UMTS (Universal Mobile Telecommunication System) or EPC (Evolved Packet Core).

Smart devices today, are so designed that they prompt the user to log on to Wi-Fi networks for data transfer when one is in range as compared to cellular networks. But this kind of implementation is a very primitive one and is dependent on the user’s choice to opt for Wi-Fi network or not. The standardization bodies like IETF, 3GPP, ITU etc. however, have been working to develop specifications for the implementation where the offload from cellular to Wi-Fi networks is more network-driven than user-driven.

Following table shows the measures as suggested by SATRC countries that are required to encourage interoperability between cellular and Wi-Fi networks.

|  |  |
| --- | --- |
| Bangladesh | 1. Accessibility of the Wi-Fi network to the cellular network i.e., sharing of active and passive elements.
2. Cellular data off-loading to Wi-Fi network.
 |
| Bhutan | Deployment of Wi-Fi hotspot in Cellular Tower where there is huge cellular data traffic congestion. |
| India | 1. Sharing of Wi-Fi infrastructure can facilitate offloading of mobile traffic on to Wi-Fi networks, thereby easing network congestion on mobile networks in high density public footfall areas.
2. This can be facilitated through bilateral agreements between service providers towards sharing public Wi-Fi infrastructure on a rental/ revenue sharing basis.
 |
| Iran | Government may standardize the agreement format for the fulfillment of interoperability requirements; which may be signed by the interested parties. |
| Maldives | No encouragement as of now. |
| Nepal | 1. Public Wi-Fi networks can be used for mobile data offload to ease network congestion on mobile networks in high density areas. TSPs may use this feature for their own mobile traffic offload or may decide to enter into an agreement with other ISPs/TSPs for sharing of public Wi-Fi infrastructure on rental/ revenue sharing basis.
2. Sharing of network infrastructure between ISPs and TSPs.
3. Integration with core network authentication and policy management systems.
4. Integration of Wi-Fi data traffic into the core network for seamless mobility and feature parity.
5. Standardization of the agreement format towards fulfillment of interoperability requirements by the government
 |
| Pakistan | 1. As per Telecom Policy of 2015, Wi-Fi offloading of mobile traffic to a Wi-Fi node linked to a mobile network or to a Wi-Fi hot spot linked to a fixed network may be undertaken by mobile licensees. 2. In the spirit of the license granted to a mobile operator, the Wi-Fi node linked to a mobile network may be used to provide offloading of mobile traffic only from its own subscribers and from those that are roaming on its network.  |

## 2.8 Technological Solutions for seamless payments

As discussed earlier, users can benefit greatly from seamless connectivity across Wi-Fi networks and interoperability between different service providers providing broadband services through Wi-Fi. Presently, there is no centralised mechanism for payment across networks, making it a cumbersome process for a user to pay for the usage of each hotspot as s/he moves from one place to another.

During survey on slow off take of data usage through public Wi-Fi, consumers informed that (a) mechanism of payment is cumbersome (b) even if one buys a voucher and there is a balance of unused data, it cannot be used on some other hotspot. This effectively makes data costlier. Subscribers of Wi-Fi services can currently pay for the use of hotspots either through the purchase of physical Wi-Fi vouchers or by making electronic payment through credit card, debit card and net-banking. The following are some issues that may be faced by consumers in these payment models:

* Available modes of payment cater only to a very small section of population who have access to electronic modes of payment.
* Different operators have back-end arrangements with different payment gateways.
* Physical vouchers also suffer from logistic problems and associated distribution costs.
* Log-in problems are also faced by foreign tourists when they try to obtain an OTP by SMS using their home country’s ISD code and mobile number. At present, there is no explicitly defined criterion on whether the OTP can be sent to a foreign mobile number

While using Wi-Fi services, consumers may find certain distinct advantages in opting for pay-as-you-go tariff plans instead of fixed contracts. For instance, a user may not want to commit to a long term contract; avoid unexpected bills; or perhaps as a light user, the subscriber may not want to pay for a connection that is used infrequently. In such circumstances, a pay-as-you-go tariff plan can enable the user to monitor his/her usage and top up the usage allowance only when needed. Such customers appreciate not being tied to a lengthy duration contract and the freedom that it gives them. But, there are a few possible downsides to a short term or prepay deal, particularly the fact that prices per GB of data allowance or an amount of days’ usage tend to be a little higher vis-à-vis the prices on contract.

Given this background, one of the possibilities of implementing a risk free and friction-less mode of payment for Wi-Fi services is to develop a payment platform which would facilitate easy access to Wi-Fi services across ISPs and through any instrument of payment viz; credit cards, payment wallets, bank accounts etc. Such a platform should ideally offer the following facilities:

1. It should provide for registration of the ISPs on to the platform and also all types of payment agencies/instruments. A customer should be able to register himself/herself on this platform using any one of the payment instruments mentioned above and access the Wi-Fi service seamlessly across the ISPs in any part of the city or any part of the country.
2. The payment arrangement should be totally interoperable and agnostic to the payment instrument.

Responses from SATRC experts on the issue of payments are as follows:

|  |  |
| --- | --- |
| Bangladesh | Most of the public Wi-Fi networks are free of charge. Some MNOs and ISPs charge their customers. In that case, MNO will charge directly as they have the primary subscribers and then revenue is shared among other Wi-Fi networks as secondary basis as per agreement. |
| Bhutan | Payment mechanism to access the public Wi-Fi is basically done on package wise and deduct the amount as per the data packages. No challenges faced in this regard. |
| India | 1. A customer should be able to “pay as you go” so that s/he pays only for the amount and duration of data usage and not on the basis of already fixed data limits or duration.
2. There should be complete traceability of access made by any customer so that all the security requirements are billed into the system to avoid any malpractices or security risks.
3. The customer may be permitted to fix a limit on the money to be spent or the access of Wi-Fi service so that he/she is assured that his/her account will not be debited beyond a certain limit, unless expressly authorised.
 |
| Iran | Payments are made in two ways:1. Directly through the Wi-Fi provider portal,
2. Indirectly through the bank's network and registering the code in the operator's portal.

In either case, the usage tariff is specified by the regulator (CRA). |
| Maldives | From a mobile number credit through the portal a sum of many been deducted each time a person buys certain minutes of WiFi data.  |
| Nepal | The current mechanisms of making payment for public Wi-Fi are the following:1. In restaurants where Wi-Fi is available there is no charge for using Wi-Fi
2. In hotels where Wi-Fi is available users login to a web-portal which keeps track of the duration of Internet usage and the users get billed accordingly
3. In the case of using Wi-Fi from TSPs, money is deducted from pre-paid or post-paid mobile balance (SMS based charging)
4. Content based charging

The challenges being faced are:1. Broken electronic payment system
2. Lack of secure authentication for e-banking or m-banking facility
 |
| Pakistan | Most of the public Wi-Fi networks are free of charge. Some ISPs do charge the customers as per monthly subscriptions. In an emerging form of Wi-Fi monetization, Service providers’ partner with advertisers to offer subscribers targeted notifications and access to retailer loyalty programs and coupons based on contextual information, such as where they are and what they want to buy. |

# CHAPTER-3: SUGGESTIONS/ CONCLUSION

Wi-Fi as a technology can play a pivotal role in connecting the unconnected. Since there is a significant section of the population in the SATRC countries still to be connected, there is a need to take some measures so as to provide broadband services to the unconnected.

Public Wi-Fi hotspots play a stellar role in delivering Broadband Internet to people. The need for ubiquity and demand for high quality Internet connectivity from users is likely to further drive the growth of public Wi-Fi hotspots.

One of the most interesting aspects of the significant changes ongoing in the public Wi-Fi ecosystem is the increase of hotspots owned or managed by venues and other brands. According to recent research conducted for iPass by Maravedis-Rethink, 50% of all commercial hotspots are controlled by brands whose core business is not telecommunications. This is because actual signup and allocation of passwords is often ultimately controlled by a hotel chain, group of coffee stores or a municipal authority.

Public Wi-Fi can contribute in a significant way to bridge the digital divide in a cost effective way. Based on the inputs received from the SATRC expert members, the major findings/ suggestions are as under:

1. The first and the foremost requirement for the Regulators and Governments is to create favorable environment for growth and availability of affordable broadband services through public Wi-Fi networks in the country. The obstacles to their developments need to be addressed and suitable policies need be formulated.
2. De-licensing certain additional spectrum bands could catalyze the market for public Wi-Fi services, and enable delivery of Wi-Fi services to the last mile, including in remote and far flung areas.
3. To provide a simplified, consistent experience across hotspots from various providers means unbundling authentication, payment and accounting from hardware and software running on the Access Point. This will allow small entrepreneurs such as tea shops, grocery shops etc. to set up and maintain Access Points. Whereas, device manufacturers, payment companies, ISPs/Telcos and Consumer Internet companies can provide the remaining pieces to set up Public Data Offices.
4. It is also suggested that the Public Wi-Fi Hotspots store data of community interest locally and allow access to it through negligible costs, without need to pay internet charges.
5. Interoperability between multiple systems is very important for a seamless connectivity and good user experience. All public Wi-Fi Hotspots including the airports, railway/ metro stations, bus etc should be inter-operable and payments made for one should be valid for the others.
6. In order to improve economies, offloading cellular data to cheaper Wi-Fi networks can be made more effective if the offload is network driven rather than user driven.

# ANNEXURE – 1

**Questionnaire for work item on
“PROLIFERATION OF WI-FI NETWORK IN SATRC”**

1. Please provide Number of Broadband Subscribers (segment wise) in your country.

Example:

|  |  |
| --- | --- |
| **Segment** | **No. of Subscribers** |
| Wired |  |
| Wireless | Fixed Wireless (Like Wi-Fi, Wi-Max, point to point, Radio, VSAT, etc.) |  |
| Mobile devices (Phones/ dongles) |  |

1. Status of Public Wi-Fi in your country. Which frequency bands are being presently used for the purpose?
2. Are there any regulatory issues, licensing restrictions or other factors that in your opinion are hampering the growth of public Wi-Fi services in your country?
3. What measures in your opinion can encourage the deployment of commercial models for city-wide Wi-Fi networks as well as expansion of Wi-Fi networks in remote areas?
4. What measures can encourage interoperability between the Wi-Fi networks of different service providers, within the country?
5. What measures are required to encourage interoperability between cellular and Wi-Fi networks?
6. What are the security considerations for use of public Wi-Fi networks in your country?
7. What is the login/authentication procedure for accessing Wi-Fi hotspots in the country? Are there any challenges being faced in the process. If yes, please elaborate.
8. What is the mechanism for making payments to access public Wi-Fi? Are there any challenges being faced in the process? If yes, please elaborate.
9. Any other relevant issue you would like to add.

**Submission details:**

Name : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Organisation : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Country : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Contact details: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Email : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. THE STATE OF BROADBAND 2018: BROADBAND CATALYZING SUSTAINABLE DEVELOPMENT available at URL: https://www.itu.int/dms\_pub/itu-s/opb/pol/S-POL-BROADBAND.19-2018-PDF-E.pdf [↑](#footnote-ref-1)