Journal Of Research Technology & Engineering

www.jrte.org

MINI-REVIEW

Sri Lankan Mobile Broadband Future With 5G

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Abstract: Radio technologies have proven a rapid and multidirectional development with the launch of analog cellular systems in the 1980s. From that point, digital wireless communication systems are consistently determined to satisfy the growing need of human beings. 5th Generation Mobile Network or simply 5G is the approaching revolution of mobile technology. The highlighting features and its convenience are much beyond the presumption. With its ultra-high speed, it is adequately expected to change mobile broadband's meaning and importance. This review paper discusses the future of Sri Lankan mobile broadband and its industry with the upcoming revolutionary 5G technology. By manifesting about 5G and its expectations, this review paper also discusses the current situation of the mobile broadband industry in Sri Lanka and how 5G helps to improve efficiency in both the public and private sectors. Additionally, this shows the obstacles that must be expected when implementing 5G networks.

Index Terms: Broadband, 5G, MIMO, Spectrum, Mobile

1 INTRODUCTION

Increasing demand for high-speed internet traffic has driven mobile broadband technology to next-generation with guaranteed low latency, aiming to replace existing 3G and 4G LTE technology. While searching for solutions to the known issues of 5G technology, many of the world's known mobile broadband corporations are moving forward to implement 5G networks in their countries' major cities. As an under developing country, Sri Lanka has also stepped up for this technological revolution. Two out of four major mobile broadband providers have already invested in 5G trials and attached their 5G networks to Sri Lankan mobile broadband networks. Several 5G User-Experience Centers were recently opened for Sri Lankan mobile broadband subscribers to get the upcoming 5G experience. Although it was expected to improve 5G technology locally and globally at the end of 2021, under the COVID-19 situation, they were dramatically slow down.

Before the pandemic, work and learning from the home community was small, and their spread was congregated around major cities. But with the increase of the work and learn from the home community and its spread, the demand for high-speed internet connectivity with a better quality of service has also increased significantly and outspread from all major cities. The value of providing 5G internet connectivity and the advanced connectivity it brings has been recognized globally even though it struggles with short-term affordability [1].

2 SRI LANKAN MOBILE BROADBAND MARKET

Currently, Dialog Axiata PLC, Sri Lanka Telecom Mobitel PLC, Hutchison Telecom Lanka PLC, and

Bharti Airtel Lanka PLC are the only four mobile broadband service providers available in Sri Lanka, and only Dialog Axiata PLC, Sri Lanka Telecom Mobitel PLC, and Hutchison Telecom Lanka PLC have invested for new 5G mobile broadband trial networks.
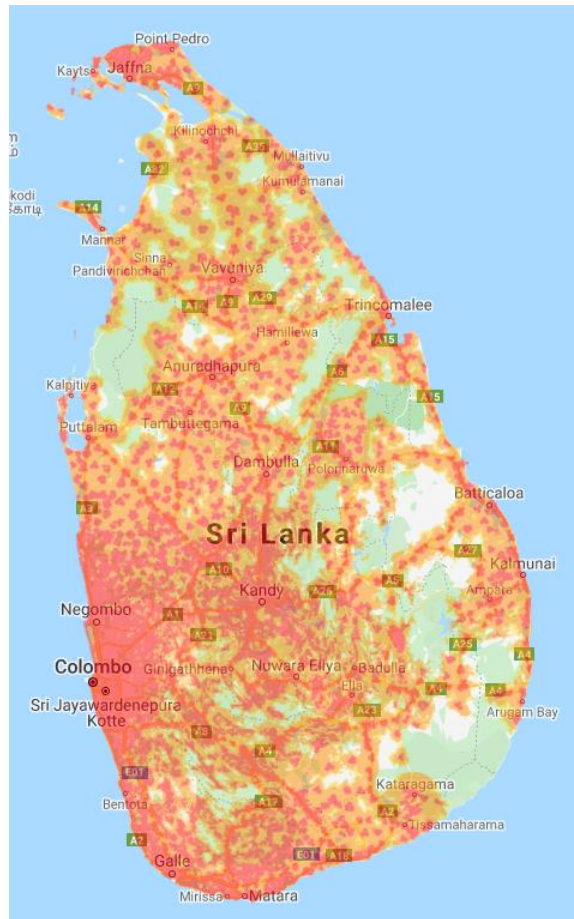

Fig. 1. Sri Lanka's 3G mobile broadband coverage [2]

Fig. 1 shows coverage map of 3G technology in Sri Lanka, indicating high signal strength areas in red color, mid-strength signal areas in green color and low strength signal areas in yellow color.

General Packet Radio Service (GPRS) and Enhanced Data for GSM Evolution (EDGE) technologies under 2G band and Universal Mobile Telecommunication System (UMTS) and High-Speed Packet Access or plus (HSPA/+) technologies under 3G band coverages are provided in all over the country. As the country's largest telecommunication operator with a 15.3 million subscriber base, Dialog Axiata PLC launched its first commercial 3G network in 2006, while India only managed to allocate 3G spectrum in 2010. This early access to spectrum enabled Sri Lanka to become first Asian country to offer 3G mobile broadband service. In 2012, Dialog Axiata PLC was able to pull out the first 4G mobile broadband network, by allowing Sri Lanka to become as the first South Asian country to launch a mobile 4G LTE network. Later, other service providers, Sri Lanka Telecom Mobitel PLC, Hutchison Telecom Lanka PLC and Bharti Airtel Lanka PLC followed up providing 4G LTE mobile broadband service covering all the major urban areas and some suburban areas [3].
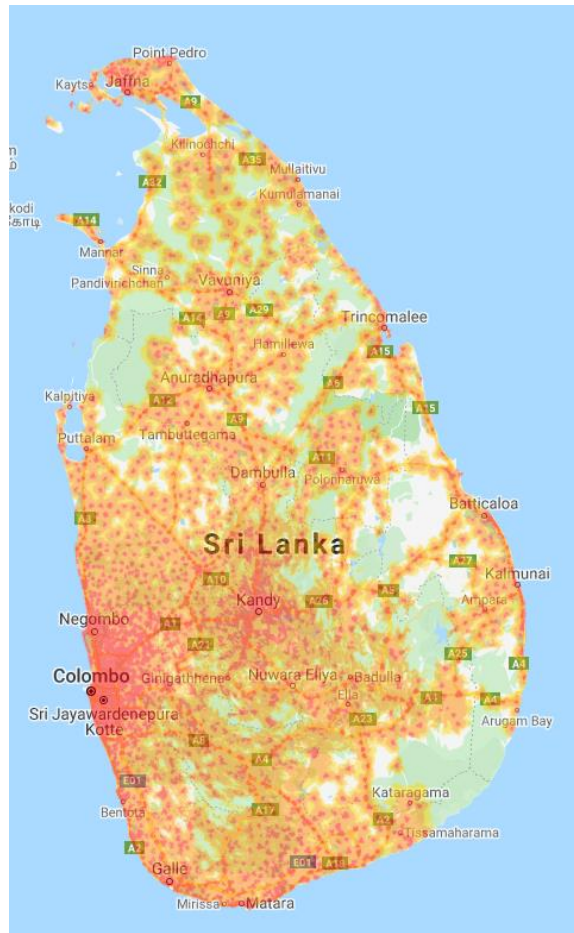
Fig. 2. Sri Lanka's 4G mobile broadband coverage [2]

Fig. 2 shows coverage map of 4G technology in Sri Lanka, indicating high signal strength areas in red color, mid-strength signal areas in green color and low strength signal areas in yellow color.

As per the speed test statistical report published by the Telecommunication Regulatory Commission of Sri Lanka (TRCSL), which was obtained from all four mobile broadband providers, indicates outstation average 3G mobile broadband download speed is around 6.47 Mega-bits per second (Mbps) to the nearest Singapore server and 9.89 Mega-bits per second (Mbps) average mobile broadband download speed can be expected in Colombo and its suburban areas. 21 Mbps and 13 Mbps of average 4G mobile broadband download speed are expected in Colombo and outstation areas respectively [4].

3 VISION OF 5G

This section overviews mainly about improvements happened on 5G technology. 5G is the successor of the 4G LTE technology emphasizing five (5) main features [5].

1. Millimeter waves
2. Massive MIMO
3. Small cells
4. Beamforming
5. Full duplex

The key factor of 5G is the millimeter wave which can lead download speed theoretically up to 20 Giga-bits per second and transmit beyond 6 GHz of bandwidth up to 100 GHz. In contrast to the existing 4G LTE technology, 5G can reach up to 20 to 100 times faster and 238 times faster than the existing 3G

HSPA+ technology [6]. European Union 7th Framework Program (EP7) manages European 5G research activities and reduced response time from 45 milliseconds available at 4G LTE technology, to 1 millisecond [7]. Massive MIMO (Multiple Inputs – Multiple Outputs) includes utilizing an enormous number of smart micro-antennas situated on a panel (somewhere in the range of 8 and 128 today, however, the number will increment with the utilization of frequencies over 6 GHz). The tempt of utilizing Massive MIMO is twofold:

1. First, the technology makes it conceivable to expand data rates, on account of spatiotemporal multiplexing.
2. Second, it makes it conceivable to focus in energy on a device to improve its link financial plan, on account of Beamforming.

On classic mobile broadband networks, transmission and reception occur either on different frequency bandwidths. But in 5G, full-duplex is intended to empower the synchronous transmission and reception of data, on the same frequencies, simultaneously, and in the same area [8].

As the IOT appliances are getting increased every day, it is anticipated that all the IOT appliances need to have an instant connection to the internet, which in real time information exchange. With 5G, the number of devices connected to one network has increased to one million scales per square kilometer. Naturally, 5G is a software-defined network that allows network slicing to provide adjusted connectivity for various specific needs [9].

4   5G TRENDS IN SRI LANKAN MOBILE BROADBAND INDUSTRY

Enabling revolutionary 5G in-country, TRCSL allocated a 3.6 GHz trial spectrum for a 5G pre-commercial trial, which showcased download speed over 1.4 Gbps utilizing a commercial 5G mobile handset, the highest speed that has been accomplished utilizing a mobile handset in South Asia. Delivery of Gigabits of Speed is a good demonstration of the capabilities and the future potential of 5G networks. This pioneering activity to bring 5G with mobility as opposed to fixed devices was lauded by the Sri Lankan Information and Communication Technology (ICT) community as it builds on the ubiquitous mobile phone and smartphones, which has empowered a generation of Sri Lankans to lead Sri Lanka towards a knowledge-rich society [10].

Sri Lanka has seen exceptionally solid growth in mobile broadband penetration over the past six years, driven by rising utilization of video streaming and the price drop of LTE- enabled smartphones. Between 2012 and 2017, total mobile data traffic increased by an average of 76 percent per annum and is expected to grow by 48% in the next four years. Although, the market stays at an early phase of development, with penetration well beneath most other developed Asian countries. This growing demand indicates potential for operators to capitalize on new opportunity to drive business growth in high-speed broadband services [11].

Implementing 5G will mean faster speeds for consumers, as well as limitless opportunities to automate industrial and home environments. Aiming at 254 USD million investment, Dialog Axiata PLC and Sri Lanka Telecom Mobitel PLC have upgraded over 20% of their expansive base station network to a "5G Ready Status" by deploying Massive MIMO technology. The same infrastructure will transmit 5G speeds upon the licensing of commercial 5G spectrum in Sri Lanka, empowering the conveyance of nationwide 5G coverage. Sri Lankan Government is also obliged by reducing Telecommunication Levy

from 11.25% of telecom service revenue and accommodating necessary infrastructures, acts, and bills to get the maximum productivity [12].

On the industrial front, 5G will significantly increase productivity and efficiency through effective automation of tasks and digital connectivity. 5G's power to enable SMART businesses from agriculture to manufacturing through a wealth of data will provide access to identify new insights, enabling industries to do more, deliver more and contribute more to the national economy. Furthermore, 5G will also smooth business operations with strategic decision-making based on Big Data and experiences produced through advanced data analytics and data science - enabling organizations to distinguish new avenues and redefine customer experience while encountering diminished cost on the overall digital operation [13]. 5G trial networks have been extended to more locations in Colombo, Negombo, Wattala, Galle, Kandy and Polonnaruwa cities. Several User-Experience Centers are now opened at Liberty Plaza, Galle Face, University Colombo, One Galle Face, Kandy Arcade, Galle Arcade, and Deepa Uyana for Dialog Axiata PLC, Sri Lanka Telecom Mobitel PLC, and Hutchison Telecom Lanka PLC subscribers to get the 5G experience with their registered 5G devices [14].

5 COMPLICATIONS OF IMPLEMENTING

5.1 TECHNOLOGICAL CHALLENGES

5G uses higher signal bandwidth which refers to millimeter wave spectrum; frequencies higher than 6 GHz. But it is not possible for 5G to run entirely on millimeter wave frequencies: the propagation qualities of these bandwidths make it difficult to achieve widespread coverage, particularly in more sparsely populated areas like Colombo, Dehiwala, Mount Lavinia, Moratuwa, Negombo and, etc. Higher radio frequency propagates less power and less range even with optimized modulation and output power.

Today our telecommunication network rollouts are essentially based on the use of macro base stations. However, this issue faced with 'millimeter wave' requires operators to increase the density of their networks with smaller cells. 5G – which will probably bring about a sizeable increase in data traffic, and which will use millimeter wave frequencies whose propagation capabilities are weak – will require the widespread deployment of low-power base stations (small cells). To fulfill demand and empower 5G, estimates indicate at least 10 small cells per macro base station are required in urban settings, where cells are already today somewhat tightly meshed to handle traffic density [15].

Another challenge that must be faced is the size of the 5 antennas. Due to the massive MIMO processing that will require the utilization of an exceptionally enormous number of transmitting components rather than which used for 2G, 3G and 4G. Also, extra antenna viable with new 5G bandwidths should be deployed [16]. So, the re-utilization of existing poles could problematic, and new transmission locales should be found. To perform at its best, mobile operators install their base station in elevated locations. These new sites will also need to be carried out to install small cells in semi-elevated locations [17].

5.2 COMMON CHALLENGES

With above mentioned technological challenges, building a 5G network is expensive, and carriers will raise the money to do it by increasing customer revenue. Much like LTE plans caused higher introductory cost, 5G will presumably follow a comparative way. As the generation increases, device also must be upgraded. 4G and older devices cannot support 5G by giving a software update or any. Whole device must be replaced which directs for a common challenge faced every time when new technology comes forth [18].

Government will need to tackle 5G services in waves across multiple vertical sectors. These include spectrum availability, EMF radiation regulations, infrastructure sharing, and cybersecurity. 5G raises undeniable public health concerns. The wellbeing of the public impacts of radiofrequency (RF) radiation have been the subject of various researches, with mixed outcomes. Moreover, there is little information on the effect of 5G in the instance of people who might be presented to a higher centralization of RF energy because of the more noteworthy number of antennas that will be used [19].

Security and privacy would be the most important common challenge with any information driven technology, thus the 5G rollout should contend with both standard and sophisticated cybersecurity threats. Although, 5G falls under the Authentication and Key Agreement (AKA), a system intended to set up trust between networks, it would currently be viable to track individuals close by using their mobile devices. This could even be leading to eavesdrop on live calls. The 5G network core is based on software defined networking (SDN) and network function virtualization (NFV). SDN and NFV make use of the HTTP and REST API protocols and these protocols are mostly used in the Internet. Tools for finding and exploiting vulnerabilities of the above-mentioned protocols are available to any adversary. With speed expected to be extents faster than current levels, so too will connectivity increment. It will drive cloud-based and virtualization administrations to be sealed as possible to ensure user privacy and security. [20]

6 CONCLUSION

Sri Lanka could be a fruitful 5G market. In any case, first, essentials should be tended to and 4G's potential should be completely tapped. Better mindfulness and marketing for smartphones will help. Improved availability would as well, particularly in rural areas. Fixed wireless offers could assist with moving the market along. 5G will prompt one of the greatest innovative changes making limitless open doors in Sri Lanka. It will have the option to reasonably fulfill the prerequisite of the 1000-time traffic development and give user fiber-like access data rate with "zero" latency user experience. 5G can connect to 100 billion devices with guaranteed delivery of a consistent experience across a variety of scenarios including the instances ultra-high traffic volume density, ultra-high connection density, and ultra-high mobility. Sri Lankan Telecommunication operators have announced network investment plans and seen those help 5G expansion as we move into a post-pandemic world. As much as network investments are significant, they are meaningless without solid product offerings. Here, as well, we've seen improvement, especially as 4G launches spur competitive offerings.

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