

5G Key Technologies Adopted in South Asian Countries

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Abstract - Due to rapid changes in the wireless communication world, we discussed the adaptation of 5th Generation (5G) key technologies in South Asian countries. There are eight South Asian countries and only four countries have taken the steps to deploy 5G technology while only two countries could be deployed commercially at present. These four countries deployed Non-Standalone (NSA) 5G network while Sri Lanka deployed a Standalone (SA) 5G network as a pilot project. This work is extended to describe the challenges faced in south Asian countries when deploying the 5G network and finally discussed future trends.

Keywords: *Non-Standalone (NSA), Standalone (SA), massive Multiple Input Multiple Output (mMIMO), 5th Generation (5G), Ultra-Reliable Low Latency Communication (ULLRC).*

I. INTRODUCTION

In 1980, the launch of analog cellular systems in the world created a revolution in wireless communication systems. The continuous evolution of wireless communication is experienced day to day in the telecommunication world. The 5G of mobile broadband technology is the latest which gives greater speed data and connectivity with low latency [1]. This 5G is a major milestone in wireless technology and will be replaced the existing 4th Generation Long Term Evolution (4G LTE) technology [2]. 5G could be implemented in non-standalone (NSA) which uses existing 4G network infrastructure or standalone (SA) modes when deploying according to the requirement of the mobile network operators (MNOs). There are key technologies introduced in 5G technology such as new spectrum bandwidth, mMIMO and beamforming, lean design, network slicing, CUPS and multi-access edge computing. Further, 5G Network Radio (NR) will make better with technologies of flexible slot base framework, scalable Orthogonal Frequency Division Multiple Access (OFDM) numerology, advanced Low-Density Parity Check codes (LDPC), mMIMO and mobile mm-wave [3].

There are eight countries in South Asia namely Sri Lanka, India, Pakistan, Nepal, Afghanistan, Bhutan, Bangladesh and Maldives. The Indian Institute of Technology launched the 5G testbeds at 5 locations in May 2022. Also, Reliance Jio and Airtel plan to launch the 5G in 13 cities namely Ahmedabad, Bengaluru, Chandigarh, Chennai, Delhi, Gandhinagar, Gurugram, Hyderabad, Jamnagar, Kolkata, Lucknow, Mumbai, Pune on 29th of September 2022 [4].

Before Afgan was fallen to Thalaibhan, the 5G foundation was laid in March 2021 through a parallel wireless project while the Open Radio Access Network (ORAN) with Etisalat. Bangladesh is planning to have a 5G network in the country in 2024. It will be covered selected cities as well as government facilities [5]. In the Maldives, 5G is presently commercially available the greater Male' area. The Ooredoo service provider implemented the 5G network and it has above 1Gbps peak speed and average speed is 400 Mbps- 600 Mbps. Nepal is expected to launch 5G by the end of 2022. However, Nepal is not a country that demands 5G since the 4G network was introduced with a delay. It is a plan to launch 5G services in

Pakistan in 2023. They have decided to allocate a 700 MHz band. However, it is maybe delayed to launch due to political instability in the country [6]. Dialog Axiata, Mobitel, Airtel and Hutch service providers successfully tested 5G in Sri Lanka in 2019. Hence, Sri Lanka became the first ever country which tested a 5G facility in South Asia. There are 3 service providers namely Dialog Axiata, Mobitel and Sri Lanka Telecom which operate pre-commercially 5G networks in selected areas. However, Dialog Axiata operates it separately Stand Alone network of 5G. Airtel Lanka tested its 5G trials with the Non-Stand Alone network technology with the highest ever speed record of 1.9 Gbps. Hutch also has done its 5G trials recording a speed of 1.8 Gbps. The 5G facility was launched in Bhutan on 27th December 2021 for commercial use in its 3 major cities [7].

A. Contribution

The main contributions of this work are listed as follows:

- Identified the countries which deployed 5G technology in South Asia.
- Briefly explained the reasons that the remaining South Asian countries could not deploy the 5G.
- Explored the technologies used for deployment.
- Identified the challenges and explored future trends.

B. Paper Organization

The remainder of the paper is organized as follows: Section II presents the 5G key technologies adopted in South Asian countries and challenges faced in South Asian countries during the transition from 4G to 5G in Section III. Section IV, future trends and Section V conclude the whole paperwork.

II. THE 5G KEY TECHNOLOGIES ADOPTED IN SOUTH ASIAN COUNTRIES

The four countries in South Asia introduced 5G technology. Further than Bhutan and Maldives 5G is commercially available for selected cities while India and Sri Lanka already conducted trials and awaiting launch.

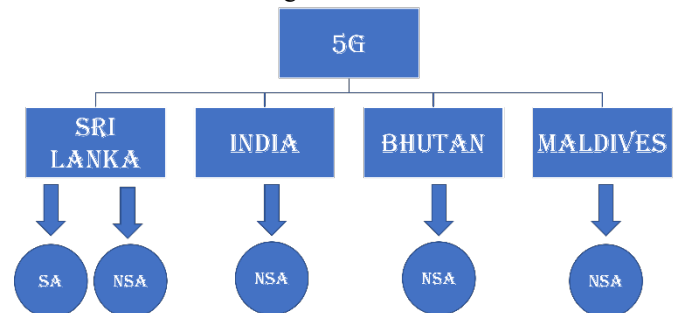


Fig. 1 5G deployment modes in South Asian countries.

Fig. 1 shows the 5G deployment modes in south Asian countries. There are two basic deployment modes such as Non-Standalone (NSA) and Standalone (SA) [9]. NSA mode is 5G technology implemented with 4G LTE existing architecture and

SA mode is the separate architecture used with 5G Radio Access Network (RAN). In Sri Lanka, Dialog Axiata service providers used SA deployment mode and the other three service providers used NSA deployment modes. We identified several benefits use NSA 5G over SA 5G. These are low-cost, easy and fast deployments and they will give a pathway to develop the SA 5G network [8]. However, NSA 5G have major drawbacks it uses more energy as both 5G and 4G infrastructure are powered.

Table 1. Adoption of key technologies to 5G deployments in South Asia.

Technologies	NSA	SA
New spectrum and bandwidth	✓	✓
mMIMO and beamforming	✓	✓
Lean design	✓	✓
Network slicing	✗	✓
CUPS	✓ (Limited)	✓
Multi-access edge computing	✓ (Limited)	✓

Table 1 shows the details of the adoption of co-technologies for 5G deployments in South Asia. NSA 5G could use CUPS and multi-access edge computing only up to a limited level. Also, network slicing is unable to use in NSA deployment mode. Therefore, NSA does not have the capability of low latency and high speed which improve the 5G network performance.

Table 2. Adoption of 5G NR to 5G deployments in South Asia.

5G NR Technologies	NSA	SA
Flexible slot base framework	✓	✓
Scalable OFDM numerology	✓	✓
Advanced LDPC	✓	✓
mMIMO	✓	✓
Mobile mm-wave	✓	✓
eMBB	✓	✓
ULLRC	✗	✓
mMTC	✗	✓

Table 2 shows the details of the adoption of 5G NR to 5G deployments in South Asia. The SA 5G network was deployed to complete the new architecture with 5G RAN and NR. The NSA 5G network is developed over an existing 4G network architecture. NSA only supports enhanced Mobile Broadband (eMBB) and Ultra-Reliable Low Latency Communication (ULLRC) and massive Machine Type Communication (mMTC) services cannot be deployed on NSA.

III. CHALLENGES FACED IN SOUTH ASIAN COUNTRIES DURING THE TRANSITION FROM 4G TO 5G

All eight South Asian countries are considered developing countries. Further, the Covid-19 situation and world economic crisis badly affected their economy during the past few years. Hence, Afghanistan, Bangladesh, Nepal and Pakistan had compelled to delay 4G implementation due to high-cost involvement. However, Bhutan, India, Maldives and Sri Lanka managed to launch 5G as they had their 5G road map in place before the crisis. However, Dialog Axiata could not implement SA 5G transition by investing approx. USD 250 million as they expected due to the dollar crisis in Sri Lanka. For 5G implementation, it is required to deploy more 5G stations investing very huge cost which will provide industries and users facilitating with very high network speed connectivity and up to 1 million devices connect seamlessly among them while ensuring a highly reliable network with low latency. In current trends industries are not ready to face this evolution as they have very less knowledge about 5G capabilities [8]-[10]. Hence, service providers have a big challenge in getting their Return of Investment (ROI) as expected.

IV. FUTURE TRENDS

There will be an industry evolution due to the 5G deployment based on the data and connectivity. The South Asian countries' economies are based on agricultural backgrounds. Therefore, 5G implementation could be used in most areas in the agriculture field to obtain details and track and monitor in real-time. Sri Lanka and Bangladesh are more in the apparel industries and both countries can utilise 5G for the concept of smart factories with automation. Further, tourism in South Asian countries is very popular in the world. Hence, Augmented Reality (AR) or Virtual Reality (VR) helps to promote tourism. There are hundreds of applications that could be developed to use 5G technology [6]-[8].

V. CONCLUSIONS

In this paper, we have discussed the adaptation of 5G key technologies with 5G deployments in South Asian countries. We observed that NSA 5G technology is vastly used during the 4G to 5G transformation mainly due to cost-effectiveness, easy deployment and the least roll-out time. However, no any South Asian country is still ready to use all benefits.

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