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Bridging the digital divide in the Republic of South Africa: The emergence of low earth orbit networks

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Abstract

Overcoming the digital divide in rural and remote areas of the Republic of South Africa (RSA) has been a challenging and daunting. This is because of the country's vast geographically landscape. As of 2023, only 70% of South Africans had reliable internet access. The COVID-19 pandemic has further worsened this gap, as education, business, government services were conducted online. The need for internet has risen significantly as the country is embracing the potential of Information and Communication Technology (ICT) as a stepping stone to economic and social development. However, the traditional way of deploying broadband is limited by the prohibitively expensive nature of extending high-capacity fibre and microwave backhaul to remote districts, making many business cases unviable for terrestrial operators. As a result, this paper examines the role of Non-Terrestrial Networks (NTNs) specifically Low Earth Orbit (LEO) satellites in bridging this digital divide. Furthermore, this paper examines two promising LEO satellite-based solutions. The first solution leverages LEO constellations as a backhaul for current 5G terrestrial networks. The other solution leverages direct-to-direct (D2D) LEO services to provide low-latency Internet access in remote and underserved areas. This paper further presents the challenges that are slowing down the adoption of LEO, including the regulatory barriers and high deployment costs. The recommendations to expedite LEO adoption and integration into 5G networks are also highlighted. Integrating 5G infrastructure sharing with LEO satellite networks reduces deployment costs, improves rural broadband coverage, and guides policy reforms that promote equitable access and efficient spectrum use in South Africa. This study enhances technical understanding of LEO deployment and provides a strategic reference for policymakers, researchers, and industry leaders working to bridge the rural digital divide.