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HYBRID SATELLITE-5G NETWORK DEPLOYMENT IN SUB-SAHARAN AFRICA: CHALLENGES AND PROSPECTS

Abstract

The world is making a gradual transition to 5G, the next generation mobile communication network, motivated by the need to connect more people and devices as well as unifying other mobile communication standards and technologies. This technology is geared towards providing Enhanced mobile Broadband (eMBB), Ultra-reliable Low Latency Communication (URLLC), massive Machine Type Communication (mMTC) and Fixed Wireless Access (FWA), which will usher in new application areas such as remote surgery, driverless and autonomous vehicles, media and content delivery networks by providing ubiquitous access, tactile internet, increased connectivity and capacity, low latency etc. To achieve these lofty goals, 5G would rely on certain key enabling technologies such as Massive MIMO, Millimeter wave communication, Network densification etc. relying on a heterogeneous network deployment. In order to fully achieve the ubiquitous coverage and satisfy various distinct use cases - rural/remote connectivity, disaster/emergency response, moving platforms e.g. trains, vehicles etc and to bridge the coverage gaps especially in developing regions such as sub-Saharan Africa, 5G could be deployed alongside satellite networks to extend its capabilities. The geographical coverage and broadcast nature of satellites could be exploited to support unserved and underserved locations, as well as to relieve terrestrial systems of signaling in a software defined network configuration. With modern satellite constellations being deployed in Low Earth Orbit (LEO), latency has been greatly reduced and can therefore support some delay sensitive applications. However, integrating satellite and terrestrial communication networks to create a hybrid network on its own poses a lot of challenges such as hand-over complexity, Quality of Service (QoS) issues, backhaul constraints, protocol convergence, spectrum sharing and interference management etc. This paper examines the feasibility of such such seamless integration of 5G with satellite networks leveraging the

strengths of both systems, with consideration to challenges as highlighted above, as well as other unique technical and regulatory issues peculiar to the sub-Saharan Africa sub-region such as infrastructural deficit, power instability, low average-revenue per user, right-of-way issues, multiple-taxation, insecurity etc. Some proposed recommendations are therefore provided to serve as regulatory and technical guide for both governments and operators in mitigating the aforementioned challenges. Lastly, the paper investigates how this "hybridization" could help in improving the quality of life of citizens in sub-Saharan Africa through reduced inequality, and better access to communication services.

Keywords: 5G, Satellite, Hybrid, sub-Saharan Africa, Millimeter Wave Communication, Massive MIMO.