

Abstract

This study presents a comprehensive analysis of 5G network performance using the Firecell Labkit and various User Equipment (UE) in a controlled laboratory environment. Leveraging advanced tools such as Wireshark and iPerf, the research aims to explore the unique capabilities and challenges of the 5G service-based architecture. Key performance metrics, including data rates, latency, jitter, packet loss, and error rates, were evaluated under diverse network scenarios. Initial results from the laboratory tests reveal significant findings. The measured RTT varied significantly with packet size and test conditions. For instance, smaller packets (8 bytes) exhibited RTTs around 12.1 milliseconds, while larger packets (128 bytes) showed RTTs ranging from 0.154 milliseconds to 15.2 milliseconds under different traffic loads. Packet sizes tested ranged from 8 bytes to 1500 bytes. Under a traffic load of 20M, smaller packets (8 bytes) had an RTT of 12.1 milliseconds, while larger packets (1500 bytes) had an RTT of 0.394 milliseconds. This indicates that larger packets may be more efficiently handled under higher traffic conditions. Higher traffic loads generally resulted in lower RTTs for larger packets, suggesting that the 5G network's architecture can efficiently manage bulk data transfers.

These findings provide valuable insights into optimizing 5G networks and their applications, particularly in the development of smart sensors for IoT. The study highlights the potential of 5G technology to revolutionize IoT by enabling real-time data transmission, efficient communication protocols, and sustainable power management. The experimental setup and detailed analysis offer a foundation for future research, guiding the development of advanced electronic devices and IoT applications that fully leverage the enhanced capabilities of 5G.