

ABSTRAK

Analisis Kinerja Manajemen Router dan Monitoring QoS Berbasis MQTT pada Jaringan *Fixed Wireless Access* (FWA) Pribadi Menggunakan SDR USRP B210

(2026 XI + 56 Halaman + 15 Gambar + 14 Tabel + 33 Daftar Pustaka)

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Pemanfaatan Jaringan Seluler Pribadi (*Private 4G*) berbasis *open-source* merupakan solusi efisien bagi institusi untuk mendapatkan infrastruktur komunikasi lokal secara terjangkau. Namun, implementasi jaringan ini di area bersinyal lemah seringkali terkendala oleh ketiadaan jalur serat optik, sehingga menuntut pemanfaatan koneksi nirkabel komersial sebagai *wireless backhaul*. Ketergantungan pada *wireless backhaul* memicu tantangan krusial, yaitu fluktuasi *bandwidth* dan kongesti lalu lintas data yang rentan memutus sinkronisasi antara perangkat transmisi srsRAN. Penelitian ini bertujuan untuk memitigasi anomali transmisi tersebut melalui perancangan arsitektur relai menggunakan perangkat *router* MikroTik berspesifikasi *SOHO* dengan tipe RB951Ui-2nD. Metodologi penelitian ini difokuskan pada dua aspek utama: manajemen *routing* dan sistem pengawasan (*monitoring*). Pada aspek pertama, konfigurasi perutean statis dan *Network Address Translation* (NAT) tipe *Masquerade* diimplementasikan untuk mendistribusikan akses internet secara stabil. Untuk mengatasi fluktuasi sinyal, metode *Quality of Service* (QoS) menggunakan *Simple Queue* diterapkan guna menjamin ketersediaan *bandwidth* prioritas bagi lalu lintas data *Evolved Packet Core* (EPC). Pada aspek kedua, keberhasilan manajemen QoS divalidasi secara waktu nyata (*real-time*) melalui pembangunan *Network Management System* (NMS) berbasis platform pemrograman visual Node-RED. Sistem ini mengekstraksi metrik kualitas jaringan—seperti *throughput*, *delay*, dan *packet loss*—secara *event-driven* melalui protokol lightweight Message Queuing Telemetry Transport (MQTT).

Kata Kunci: *Private 4G, Wireless Backhaul, MikroTik, Quality of Service, MQTT, Node-RED.*

ABSTRACT

Performance Analysis of MQTT-Based Router Management and QoS Monitoring on a Private Fixed Wireless Access (FWA) Network Using SDR USRP B210

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Utilizing open-source-based private cellular networks (Private 4G) offers institutions an efficient, cost-effective solution for establishing local communication infrastructure. However, deploying these networks in areas with weak signals is often hindered by the lack of fiber-optic connectivity, necessitating the use of commercial wireless connections as wireless backhaul. This reliance on wireless backhaul introduces critical challenges—specifically bandwidth fluctuations and data traffic congestion—that risk disrupting synchronization between srsRAN transmission devices. This research aims to mitigate such transmission anomalies by designing a relay architecture using a MikroTik router (SOHO-class model RB951Ui-2nD). The methodology focuses on two primary aspects: routing management and monitoring systems. Regarding the first aspect, static routing and Masquerade-type Network Address Translation (NAT) are implemented to ensure stable internet access distribution. To address signal fluctuations, a Quality of Service (QoS) method utilizing "Simple Queue" is applied to guarantee prioritized bandwidth availability for Evolved Packet Core (EPC) data traffic. In the second aspect, the effectiveness of the QoS management is validated in real-time through the development of a Network Management System (NMS) based on the Node-RED visual programming platform. This system extracts network quality metrics—such as throughput, delay, and packet loss—in an event-driven manner using the lightweight Message Queuing Telemetry Transport (MQTT) protocol.

Keywords: Private 4G, Wireless Backhaul, MikroTik, Quality of Service, MQTT, Node-RED.