

RINGKASAN

ANALISIS KUALITAS DATA INTERNET OF THINGS DENGAN PROTOKOL MQTT PADA ALAT SMART POWER METER : STUDI KASUS TELKOM JAKARTA BARAT

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Pemantauan konsumsi energi secara real-time melalui perangkat *smart power meter* berbasis Internet of Things (IoT) membutuhkan komunikasi data yang andal, khususnya ketika menggunakan protokol *Message Queuing Telemetry Transport* (MQTT) sebagai mekanisme utama pengiriman data. Pada kondisi implementasi nyata, masih ditemukan adanya kehilangan data yang mengakibatkan ketidaksesuaian antara nilai total daya hasil pemantauan dengan tagihan resmi dari penyedia listrik, sehingga diperlukan analisis terhadap kualitas data yang dikirim agar tidak terjadi grafik pemantauan yang tidak kontinu maupun kesalahan akumulasi konsumsi daya. Penelitian ini menganalisis kualitas layanan (*Quality of Service/QoS*) protokol MQTT pada perangkat smart power meter di Gedung Telkom Jakarta Barat dengan mengukur tiga parameter utama, yaitu *throughput*, *delay*, dan *packet loss*. Pengujian dilakukan pada tiga skema lingkungan jaringan yang berbeda, meliputi variasi jarak perangkat terhadap akses *Wi-Fi*, kekuatan sinyal (RSSI) dan jumlah perangkat terhubung. Data diperoleh melalui *sniffing* paket menggunakan Wireshark selama periode pengujian lima hari dan dianalisis secara kuantitatif berdasarkan standar TIPHON.

Hasil penelitian menunjukkan bahwa kualitas komunikasi MQTT sangat dipengaruhi oleh kondisi jaringan, di mana peningkatan jarak, lemahnya RSSI yang menyebabkan kenaikan *delay* dan *packet loss*, serta penurunan *throughput*. Skema 1 memberikan performa terbaik dengan transmisi stabil, sedangkan Skema 3 mengalami degradasi signifikan akibat sinyal rendah (-86 hingga -90 dBm) dan *idle time* panjang. Temuan ini menegaskan bahwa kualitas data menggunakan protokol MQTT bergantung pada kestabilan sinyal nirkabel, konfigurasi jaringan yang tepat, serta minimnya gangguan di lapisan MAC, sehingga dapat mendukung sistem monitoring energi yang lebih efisien, andal, dan berkelanjutan.

Kata kunci : Efisiensi energi, Teknologi, *Power Meter*, *Internet of Things*, MQTT, *Packet loss*, *Throughput*, *Delay*, TIPHON.

SUMMARY

AN ANALYSIS OF DATA QUALITY IN INTERNET OF THINGS-BASED SMART POWER METERS UTILIZING THE MQTT PROTOCOL: A CASE STUDY OF TELKOM WEST JAKARTA

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Real-time energy consumption monitoring using Internet of Things (IoT)-based smart power meters requires reliable data communication, particularly when employing the Message Queuing Telemetry Transport (MQTT) protocol as the primary data transmission mechanism. In practical implementation, data loss is still frequently observed, leading to discrepancies between recorded cumulative power consumption and the official billing issued by the electricity provider. Therefore, an evaluation of the transmitted data quality is required to prevent discontinuities in monitoring graphs and inaccuracies in total energy measurements. This study analyzes the Quality of Service (QoS) performance of the MQTT protocol on smart power meter devices installed in the Telkom Jakarta Barat Building by measuring three key parameters: throughput, delay, and packet loss. The experiments were conducted under three different network scenarios, involving variations in distance from the Wi-Fi access point, signal strength (RSSI), and the number of connected devices. Data were acquired through packet sniffing using Wireshark over a five-day observation period and quantitatively evaluated based on the TIPHON standard.

The results indicate that MQTT communication performance is highly dependent on network conditions, where increased distance and poor RSSI lead to higher delay and packet loss, as well as reduced throughput. Skema 1 demonstrated the most optimal performance with stable transmission, while Skema 3 experienced significant degradation due to weak signal strength (−86 to −90 dBm) and prolonged idle time. These findings confirm that MQTT data reliability is strongly influenced by wireless signal stability, proper network configuration, and minimal interference at the MAC layer, thereby supporting the development of an efficient, dependable, and sustainable IoT-based energy monitoring system.

Keywords: *energy efficiency, technology, smart power meter, Internet of Things, MQTT, packet loss, throughput, delay, TIPHON.*