

ABSTRAK

Kebutuhan layanan internet berkecepatan tinggi mendorong institusi pendidikan untuk memilih arsitektur jaringan serat optik yang tepat, namun pemilihan antara *Point-to-Point* (P2P) dan *Point-to-Multipoint* (P2MP) sering dilakukan tanpa dasar pengukuran multikriteria yang terstruktur. Penelitian ini bertujuan menganalisis dan membandingkan kinerja kedua arsitektur tersebut berdasarkan parameter *Quality of Service* (QoS) dengan metode *Analytical Hierarchy Process* (AHP). Penelitian menggunakan pendekatan kuantitatif eksperimental pada jaringan serat optik Universitas Almuslim, Kabupaten Bireuen, dengan lokasi pengujian di Bidang Pusat Komputer dan beberapa fasilitas jaringan fakultas. Pengukuran dilakukan menggunakan iPerf3 dan Wireshark pada kondisi trafik normal dan jam sibuk, menghasilkan 202 data mentah yang mencakup lima parameter QoS, yaitu *throughput*, *delay*, *jitter*, *packet loss*, dan *bandwidth*. Pembobotan kriteria dilakukan melalui matriks perbandingan berpasangan skala Saaty 1–9. Hasil pengujian menunjukkan arsitektur P2P mempertahankan *Throughput* stabil 95 Mbps dengan *delay* rata-rata 2,68 ms, *jitter* 0,85 ms, *packet loss* 0,054%, dan *bandwidth* tetap 100 Mbps, sedangkan P2MP mengalami penurunan kinerja seiring bertambahnya pengguna dengan *delay* rata-rata 19,56 ms, *jitter* 2,70 ms, *packet loss* 0,604%, serta *bandwidth* menurun hingga 6,25 Mbps pada 16 pengguna. Perhitungan AHP menghasilkan bobot *Throughput* 0,61, *delay* 0,18, *bandwidth* 0,17, *jitter* 0,09, dan *packet loss* 0,05 dengan *Consistency Ratio* 0,027 ($< 0,1$) sehingga penilaian dinyatakan konsisten. Skor akhir menempatkan P2P pada peringkat pertama dengan nilai 9,90 dibandingkan P2MP sebesar 5,26. Dengan demikian, arsitektur P2P direkomendasikan untuk layanan yang menuntut kualitas dan kestabilan tinggi, sedangkan P2MP tetap relevan untuk perluasan cakupan pengguna dengan keterbatasan biaya infrastruktur.

Kata Kunci: *Analytical Hierarchy Process, fiber optic, point-to-multipoint, Point-to-Point, Quality of Service.*

ABSTRACT

The growing demand for high-speed internet services requires educational institutions to select an appropriate optical fiber network architecture, yet the choice between Point-to-Point (P2P) and Point-to-Multipoint (P2MP) is often made without a structured multi-criteria basis. This study aims to analyze and compare the performance of both architectures based on Quality of Service (QoS) parameters using the Analytical Hierarchy Process (AHP) method. A quantitative experimental approach was applied to the optical fiber network of Universitas Almuslim, Bireuen Regency, with testing conducted at the Computer Center Division and several faculty network facilities. Measurements were carried out using iPerf3 and Wireshark under normal and busy-hour traffic conditions, producing 202 raw data records covering five QoS parameters: throughput, delay, jitter, packet loss, and bandwidth. Criteria weighting was performed through a pairwise comparison matrix using the Saaty 1–9 scale. The results show that P2P maintained a stable Throughput of 95 Mbps with an average delay of 2.68 ms, jitter of 0.85 ms, packet loss of 0.054%, and a constant bandwidth of 100 Mbps, whereas P2MP experienced performance degradation as the number of users increased, with an average delay of 19.56 ms, jitter of 2.70 ms, packet loss of 0.604%, and bandwidth declining to 6.25 Mbps for 16 users. The AHP computation produced weights of 0.61 for throughput, 0.18 for delay, 0.17 for bandwidth, 0.09 for jitter, and 0.05 for packet loss, with a Consistency Ratio of 0.027 (< 0.1), confirming the consistency of the judgments. The final scores ranked P2P first at 9.90 compared to 5.26 for P2MP. Accordingly, P2P is recommended for services demanding high quality and stability, while P2MP remains relevant for expanding user coverage under infrastructure cost constraints.

Keywords: Analytical Hierarchy Process, fiber optic, point-to-multipoint, Point-to-Point, Quality of Service.