

ABSTRACT

Patengan Village, located in the Ciwidey District, is one of the areas directly affected by limited internet access and low utilization of information technology. The village is nearly classified as a 3T area (Underdeveloped, Frontier, and Outermost), facing serious challenges in telecommunications infrastructure development and improving digital literacy. Residents often have to walk up to 3 kilometers just to access an internet connection, significantly limiting their access to information, education, and economic opportunities. This situation has a considerable impact on the community's quality of life and poses a major barrier to fully developing the village's local potential.

As a solution to these problems, this study proposes the development of a Broadband Village network based on Fiber to the Home (FTTH) technology supported by Gigabit Passive Optical Network (GPON) network architecture. The infrastructure is designed using a fiber optic cable backbone from the central point in the village office to the Optical Distribution Point (ODP), which is then distributed to Optical Network Terminal (ONT) devices in strategic locations such as schools, mosques, and village halls. Network modeling is carried out using tools such as Google Earth for route planning, as well as link budget and Quality of Service (QoS) testing to ensure network reliability. This technology was chosen because of its advantages in terms of high bandwidth capacity, low latency, and long-term efficiency.

The design results aim to evaluate the performance of the PON network on the Broadband Village project at three ONT locations through manual calculations and OptiSystem simulations. The speed test results show that the Mosque (3.83/4.82 Mbps), School (8.75/9.45 Mbps), and Village Hall (13.45/11.30 Mbps) mostly meet or exceed the target. The PRx difference is ± 2.8 – 3.1 dB, Q-Factor 42–115 (simulation up to 246), BER ≈ 0 , and SNR > 50 dB. Based on ETSI EG 202 057-2, QoS meets the standards with a throughput of 1.05–1.70 Mbps, packet loss $< 1\%$, delay < 7 ms, and very low jitter. This network is declared feasible and of good quality for rural areas.

Keywords: 3T areas, digital literacy, GPON, RT/RW Net, telecommunications infrastructure