CHAPTER 1
INTRODUCTION

1.1 Background

Indonesia is a maritime country with diverse landforms. Amidst the rapid advancement of technology, especially internet connectivity, many areas in Indonesia still lack reliable access to internet services because their areas are rural and difficult to reach. Several existent fixed broadband service providers in Indonesia have difficulty offering high-quality and affordable services to all segments of the population, especially in rural and remote areas. To reach those areas requires high cost, which became a constraint why providers have difficulty reaching these areas. Indonesian internet penetration survey released by APJII [1], 79.5% from total population of Indonesia have connected to the internet in 2024, with 36.41% users report that more than twice of internet disruption occurred in a month. West Java is one of the provinces in Indonesia that has various types of landforms and different characteristics of each area and has regions with various economic conditions for each city. From the study of internet penetration rate in 38 provinces of Indonesia in 2024 by Databoks Katadata [2], West Java with the population more than 50 million people, around 10.75 million people still do not have regular or reliable access to the internet.

On the other hand, competition for internet connectivity services based on NGSO (Non-Geostationary Orbit) satellites in Low Earth Orbit (LEO) is starting to occur rapidly, as it can be one of the solutions to bridge the digital divide and provides global coverage for internet service. Analysts predicted a massive expansion in satellite internet service users and revenue through the latter 2020s with the explosive growth this market is currently happening. Global satellite-based internet service sector in 2024 was estimated to have $5 billion revenue and is projected to reach around $18 billion to $25 billion by 2023. Several major companies that were included in calculation are Starlink by SpaceX, Eutelsat by OneWeb, Kuiper by Amazon. In addition, China is also currently developing satellites to rival Starlink, namely Guowang and Qianfan projects by state-owned SatNet with total 13,000 satellites each, and ~64 craft already launched by end of 2024 [3].

The SpaceX company, as by far has the largest constellation with Starlink technology, offers technology with fast and wide internet access that can reach rural areas. Starlink can be an alternative solution for remote areas in Indonesia which implementation is difficult to reach by Fiber to the x (FTTx) infrastructure which used the most by local Internet Service Providers (ISP) in Indonesia. At the same time, Direktorat Jenderal Penyelenggaraan Pos dan Informatika Kementerian Komunikasi dan Informatika Republik Indonesia (DJPP KOMINFO) through article on their official website [4], released a program called "Penyediaan Akses Internet Fixed Broadband (FBB) as priority to support the digital transformation in which currently being accelerated by the government. Even though the length of fiber optic cables being laid in Indonesia has reached 800.000 km from Aceh to Papua, the network penetration is currently just reached 30%, from 514 city/regions, there are only around 150 that has connected to the fiber optic network [5]. The head of Association of Telecommunication Network Providers (APJATEL) stated that there are areas in Indonesia that is still unserved and experiencing blank spots of internet.

The Minister of Communication and Informatics, in Press Release No. 255/HM/KOMINFO/04/2024, stated that Starlink has obtained an operating permit in Indonesia and will conduct trials in the IKN. The permits fulfilled by SpaceX are applications for a Very Small Aperture Terminal (VSAT) service provider and ISP. On May 19, 2024, SpaceX Company owner, Elon Musk, came to the inauguration of the Starlink launch in Bali, Indonesia. At its inauguration, Starlink also applied for an investment permit and formed a legal entity PT Starlink Services Indonesia (SSI). Starlink offers direct services to customers or business to customers (B2C), and business to business services (B2B).

Local internet providers in the Indonesian Internet Service Providers Association (APJII) stated that there is a lack of transparency in the Starlink operating licensing process. Furthermore, the rapid growth of Starlink which has been successfully implemented in several countries is considered a threat that can disrupt the local internet provider market in Indonesia.

APJII issued recommendations regarding Starlink's regulations in Indonesia:

1. Suspend direct sales permits of Starlink until clearer regulations are implemented.
2. APJII hopes that the government will reopen discussions and reconsider decisions regarding Starlink's license, division of operational coverage areas, and licensing authority by considering input from all stakeholders.
3. Invites the government to take fair and wise steps to maintain the balance and health of the telecommunications industry in Indonesia, so that its benefits can be felt by the entire community.
4. If the government is unable to regulate competition and maintain the health of the industry, APJII demands that the Universal Service Obligation (USO) Biaya Hak Penggunaan (BHP) be stopped.

The recommendation arose from concerns about the potential for discriminatory treatment by the government and its lack of firmness in Starlink operations, including concerns about Starlink's ability to shut local ISP businesses down in some areas [6].

Basically, each technology has advantages and disadvantages in its implementation. Further research on the comparison between the technical performance and economic aspects, regarding service performance, usage costs, and economic impacts of Starlink services with FTTx services in Indonesia need to be answered to understand the involvement and potential of each solution. However, both service providers use two different technologies, so it is very possible that in the future they will need to coexist. The difference between both technologies delivers different performance results. By observing the network parameters and comparative methods, this research will analyze which technology suits best for dense urban, urban, suburban, and rural areas. In addition, analyzing Starlink’s and FTTx’s actual performance by doing field testing in each area which results will also be used to calculate the technologies’ affordability for the end-users, cost-effectiveness, and regulation recommendations to fulfill each region’s broadband internet needs and recommendations to reduce the digital divide in Indonesia, especially West Java.

1.2 Problem Identification

1. Indonesia local providers have difficulty in providing reliable and affordable internet across every region's characteristic.
2. Starlink enters Indonesia, offering reliable internet which may compete with local fixed broadband access providers.
3. Concerns in Indonesia's affordability and cost-effectiveness in dense urban, urban, suburban, and rural area to access reliable and affordable broadband internet access. In this research, West Java, which has significantly different economic conditions between each region, is being studied.

1.3 Objectives

1. Identifies the actual performance of Starlink in different area characteristics, representatively in dense urban, urban, suburban, and rural areas in West Java.
2. Identifies the actual performance of the existing ISP, FTTx.
3. Technical aspect analysis of Starlink capacity, QoS estimation.
4. Conduct performance tests of Starlink and FTTx in each area to estimate reliability, including analyzing throughput, latency, packet loss, and availability from both ISPs.
5. Comparing Starlink's and FTTx's economic aspect to analyze cost-effectiveness for end-users, based on the performance test results to determine affordability.
6. Analyzes the comparison of Starlink and FTTx to fulfill internet needs of West Java.
7. Policy recommendations for the existence of Starlink in Indonesia

1.4 Scope of Work

1. The satellite technology to be studied is SpaceX Starlink, in comparison with FTTx service in four representative areas in West Java.
2. Technical analysis of the technologies is done by doing performance tests. Satellite technical analysis is carried out by doing capacity analysis to estimate QoS.
3. Starlink's antenna is placed on the ground for mobility. The inconsistent weather conditions in rainy season caused both technologies can't perform maximum.
4. FTTx providers performed are varied, depending on the availability in each area.
5. The economic analysis conducted Cost-to-Income Ratio and Cost per Mbps. Limited to the end-users' point of view, in which to determine the customers' affordability.
6. Average income is conducted using data collected by Badan Pusat Statistik (BPS)

1.5 Hypotheses

1. Starlink has the potential to provide better service and internet network performance in suburban and rural areas, or areas that are difficult to cover by FTTx infrastructure.
2. FTTx service will remain more reliable and affordable in dense urban and urban areas, considering the population and demands.
3. Both technologies can coexist fairly without severely disrupting each other in terms of economics due to their significant differences, advantages, and disadvantages.

1.6 Research Methodology

1. Literature Study

   Learn more about FTTx in Indonesia and about satellites, which specifically Starlink. From the technical aspect, the services offered by the technologies, as well as the economic and regulatory aspects through theories from books, journals, and papers.
2. Data Collection

   Taking data of the user segment per region. For more, field testing for analyzing throughput and latency data from both technologies. In addition, collecting data that is related to satellite technology, especially SpaceX's Starlink that can be used to calculate capacity and as study materials need to be done.
3. Technical Analysis

   Identifying Starlink satellite networks capacity and performance, and FTTx services in each representative area to compare service performance, reliability.
4. Economic Analysis

   The economic aspect of technology is crucial in implementing technology in a country. Conducting observations on the suitability of the needs of the customers and technologies, that can lead to the affordability of the technology for the end-users in each area to determine which technology suits each area more.
5. Conclusion

   The expected conclusion that can be drawn from this study is to be able to answer the questions of Starlink’s ability to fulfill the internet needs for everyone across different geographical areas. Comparing the reliability of Starlink and existing technology, in which is FTTx, in West Java region, and how the two technologies can coexist. To estimate cost-effectiveness as end-user, as well as cost analysis calculations that can conclude the technologies affordability to each different region in West Java.