CHAPTER I
INTRODUCTION

1.1 Background

The Internet has been a remarkable success over the past few decades. As one of the most important transmission mediums on the internet, Wide Area Network (WAN), such as inter-data center networks, enterprise networks, and carrier networks, has become the critical infrastructures [1]. Traffic internet in the future will be change because data of large enterprise traffic is shifting to the cloud, changing traffic flows and making traditional WAN suboptimal [5], worldwide technology spending on the Internet of Things (IoT) to reach $1.2T in 2022 [6], 248M desktop video conferencing users and 79% of global internet traffic is video in 2020 [7], and 58% website visits came from a mobile device in 2018, surpassing desktop usage for the fourth consecutive year. Mobile devices also accounted for 42% of total time spent online [8]. Internet service providers hope to launch new businesses in their networks within several because they have many challenge for develop WAN the problem such as: High cost (infrastructure, support, personnel, connectivity, delays), increasing support of cloud applications (inconsistent application performance, expensive backhauling), lack of automation (manual configurations and device-by-device changes), infrastructure sprawl (they need routers, firewall, WAN optimizer, multiple operating systems in every branches), complex WAN architectures (active-standby transport, multiple routing protocols like Border Gateway Protocol (BGP)-Open Shortest Path First (OSPF)-others) [9]. Mining segment has many branches, they need communication data from head office to each branch for their business.

Software Defined Wide Area Network (SD-WAN) solution can solved solution for implement in enterprise company, such as mining, multi national company, banking, and Financial Service Industry (FSI). Their benefit SD-WAN solutions like: Ease of use and implementation, security with Internet Protocol Security (IPsec) traffic encryption, manageable device in all branch and head quarter, auto fail link over connection, application performance with optimization and load balancing traffic based on Quality of Services (QoS) connection with important application [5]. Existing research discuss using SD-WAN for backup when primary link has down and using Fourth Generation Long Term Evolution (4G LTE) for backup connection for communicate from Automatic Teller Machine (ATM) to data center [6]. Business to Business also called B2B market for get the data research is mining industry, they has problem with high cost connection from site exploration to their head office, the second

problem has quality internet and need optimized traffic, and last problem link condition has different with every site.

This research discuss more complex with multiple link include private connection and public connection with study case: Mining enterprise customer with recommendation for implementation topology and techno economic analysis. The testing with more scenario to get fail link over, WAN load balance and simplified WAN management and customer in mining area in Kalimantan to get data in head office Jakarta. Goals of research is simplify WAN management and cost reduction using SD-WAN and the cost will compare with existing link.

1.2 Problem Identification

The identification of the problems in this study are as follows:

- Internet requirement for business continuity for communication data from head office to branch (mining company)
- High bandwidth for access internet such as application, business, datacenter is increase
- WAN is best effort didn't have control to access for priority/ QoS
- Private link cost is expensive, need efficient solution secure connection
- Need auto failover when connection failed and need load balance important traffic
- Business grow and has branch and has takes effort to manage, need Solution for manage all branch
- Identification of value using SD-WAN technology without expensive link Very Small Aperture Terminal (VSAT)
- Regulations devices must compliant with regulations

1.3 OBJECTIVE

The objectives to be achieved in this study are as follows:

- Perform technical needs calculations for the implementation of SD-WAN on the B2B customer
- Data testing uses real case in customer testing for SD-WAN implementation
- The simulation for mining industry using multi link private and public connection for design 7 branch and 1 head office
- Test parameters auto fail link over, link load balance, manage branch and headquarter for simulation

- Giving recommendation regarding the implementation of SD-WAN with real proof of concept (POC) performance real test
- Design and topology implementation of SD-WAN solution and testing as simulation in real condition with limit branch
- Business feasibility SD-WAN change links requirement without VSAT
- Techno-economic of the implementation SD-WAN compare not uses, on the enterprise market
- Total cost ownership and business visibility implement SD-WAN include estimated cost of implementation
- Using SD-WAN vendor for learn and capture the data of implementation
- SD-WAN vendor develop with large vendor for infrastructure on SD-WAN and cybersecurity vendor secure SD-WAN for pricing comparation
- SD-WAN devices are compliant with regulations

1.4 SCOPE OF WORKS

The limitation problems in this study are as follows:

- It's only design and topology implementation of SD-WAN solution and testing as simulation in real condition with limit branch
- The simulation for mining industry using multi link private and public connection, the propose are 7 branch and 1 head office in Jakarta
- Using SD-WAN vendor for learn and capture the data of implementation
- Test parameters auto fail link over, link load balance, manage branch and headquarter for simulation
- Data testing uses real case in customer testing for SD-WAN implementation.
- Testing only after implementation of SD-WAN
- Propose recommendation with link WAN minimum for implementation SD-WAN without VSAT

1.5 HYPOTHESIS

The hypothesis in this study are as follows:

- The implementation of SD-WAN makes reduce cost of internet/ WAN, simplify management of branch connection better than didn't use because before using SD-WAN needs private connection such as Multi Prtotocol Layer Switch (MPLS)/

VSAT for communicate from site to head office, when use SD-WAN can combine until replace with cheaper link, such as broadband internet with secure Virtual Private Network (VPN) tunnel over public/ private if still use it. The using public link can safe for purchase SD-WAN devices

- The SD-WAN devices has approved by Indonesia government
- Total cost owner ship of implement SD-WAN will return BEP in several years compare implement existing connection, the result before 1 year can achieved
- The implementation of the SD-WAN has positive result in Net Present Value (NPV), Internal Rate of Return (IRR), and sensitivity analysis

1.6 METHODS OF RESEARCH

In the thesis, the authors for getting result of result will conducted:

- Survey of implementation and techno-economic analysis on the implementation of the SD-WAN implementation for enterprise with the aim of reduce cost of internet connection, simplify WAN Management and branch, which can support the requirement internet for enterprise business sector
- Getting advice from vendor SD-WAN and real simulation of implementation while proof of concept for get data to get recommendation for implementation
- Calculation NPV, IRR, and sensitivity analysis are conducted to find out Capital Expenditure (CAPEX) and Operational Expenditure (OPEX).
- Giving the final assessment report for SD-WAN implementation with techno economic and business sensitivity analysis