# CHAPTER I
# INTRODUCTION

## 1.1 Background

Software-Defined Network (SDN) architecture offers many advantages related to flexibility, higher network programmability and simplicity of application service development. On the other hand, this architecture leaves a number of issues related to scalability, reliability and performance (such as delay and control communication overhead) to be applied to large-scale networks such as the Service Provider / Wide Area Networks (WAN).

Controller placement design depends upon the resilience and performance aspects of placement, usually no single solution will be found but the best placement is a placement Controller among multiple selected parameters [2]. Some algorithms design and studies have been done to optimize the design of SDN controller placement this, Heller [1] discusses the optimization of the propagation latency by using k-median (average case latency) and k-center (worst case latency) using an algorithm facility location optimization problem. Hock et. al [2] create a resilient framework-based Pareto Optimal placement Controller (POCO) for parameter optimization analysis that takes into account failure Controller, Controller placement Disruption, Load imbalance and Inter-controller Latency. Gung Yao [3] defines Capacitated Controller Placement Problem that takes into account the load of the controller in algorithm design.

Most formulas, applications and algorithms that have been made previously used to determine the optimal placement (number and location of the controller) to be placed on a given topology viewed as a whole network or to plan the optimal placement SDN network as a new network deployment.

This thesis propose design solutions of controller placement on well-established traditional existing legacy network with a large number of nodes, million of users and various services. SDN design topology created by taking into consideration the configuration of traditional existing network to ensure reliability, the design begins by setting a 'candidate' where to place the controller selected based

router/switch with high processing bandwidth on a legacy network and taking into account the maximum propagation delay and other parameters of POCO framework [2] and load of the controller to ensure that every controller load on the network can not exceed the capacity of the controller itself [3].

### 1.2. Problem Definition

Controller design placement depends with the resilience and performance aspects required, there is usually no single best placement solution but the trade-off between some selected parameters [2]. POCO framework provides a Pareto-optimal placement of data on the resilience aspect of the design is based Controller failure parameter, controller placement disruption, Load imbalance and Inter-controller latency. Another important parameter when determining the controller placement is the load controller (load of the controller), where the load of each controller on the network can not exceed the capacity of the controller itself [3].

This thesis was made to solve the problem of controller placement if the location of the controller determined in advance (legacy network -given, as a 'candidate', based on the location of the main router on the existing network): whether they will be optimum placement? And if not, how many and where were the additional controller should be installed? to obtain the optimum design.

### 1.3 Limitations and Requirements

Controller design placement modeling made with the assumption using the parameters that have been made previously [2], taking into account the capacity of controller in processing network task on the design placement will be obtained design results in a more accurate and optimized to obtain a topology that is more reliable.

This new algorithm must meet :

a. Controller placement design in the same accuracy with previous studies.
b. Design algorithm provides a more simple and efficient Controller placement design for large-scale network service provider, divided into several areas and geographically dispersed.

## 1.4 Research Objectives

The main objective of this thesis is to determine the Optimal placement Controller Schematic Design which meets the requirements of resilience network parameters, controller imbalance and maximum controller load. Taking into consideration the network configuration and flow of traditional existing network to maintain reliability of operational and maintenance the network elements, service reliability and resiliency.

## 1.5 Hypotheses

By using the parameters in the POCO framework, controller load and controller placement based on traditional network topology strategy will obtain a better placement in ensuring the reliability and performance of SDN network.

- Placement Candidates based on nodes with high processing bandwidth ensure the placement of controllers were on high reliability.
- Controller load capacity to ensure the controller can serve tasks of the network, reducing overhead and failure probability.

## 1.6 Scope of Work

This research aims to find controller placement design which takes into account latency, resiliency and controller capacity for large-scale network topology in a simpler and efficient way.

The activities will be implemented in the research design of Controller Placement for SDN Network are :

- Provide an overview of the controller placement design.
- Testing the effect of configuration choosen with Controller placement design parameters.
- Shows the relationship between parameters on POCO Framework towards design.
- Provide more efficient scenario when designing the placement of SDN controller into the network.