CHAPTER 1
INTRODUCTION

1.1. Background

The high level of competition in the fulfillment of broadband services in the telecommunications industry requires the speed of service delivery with a high ñQuality of Service (QoS)ò. The most appropriate technology to provide QoS in broadband service is Fiber Optics, however, the fulfillment of ñFiber to The Homeò is an expensive job which requires an excellent planning in the network deployment to meet current and future needs.

Fulfillment speed of ñFiber to The Homeò network influenced by the design speed and the speed of the FTTH network construction. Designs process needed to match the customerôs/userôs demand, which talk about the number of customer, bandwidth, and estimated future need in order to obtain the feasibility of the investment costs.

In the design guide of FTTH network [1], the first stage is doing the initialization and survey demand, then making the fiber optic network scheme called High Level Design (HLD), then conducting the survey to determine the location of optical distribution point. The results of the survey and ODP plotting become a reference in making the network design of ñFiber to the homeò as the ñLow Level Design (LLD)ò and become the ñAs Plan Drawing (APD)ò for the development process.

In the design process of FTTH network, there are two design called HLD and LLD, HLD is on desk survey and LLD is on site survey, so that the difference is on the survey process. There are differences between on-desk survey and on-site survey, it is the reason why the initial design (HLD) requires adjustment to the actual condition. By leveraging the advances in the field of Geographic Information System, the difference in distance and coordinate points on the on-desk and on-site survey will be getting smaller. With particular approach, these differences can be eliminated and on-site survey process can be eliminated.

Preliminary statistics show the differences in the results of measuring the distance of 2 point with Google Earth and GPS [2], that An average ratio of the distance between two observation points that are plotted on Google Earth compared to GPS measurement is = 1: 1.115, in other words, the GPS measurements generate distance 11.5% longer than the measurement by Google Earth.

Another research [3] shows the differences in the results of measuring coordinate point using Google Earth at different times. An improvement in the accuracy of measurement to measurement on

the Google Earth site of the month September 2012 with RSME 3.36 m to 1.80 m in October 2012 it may be caused by updating a Google Earth image with a new better resolution.

Both these studies conclude that there is a difference between the measurement results between Google Earth (measurement on desk) and GPS (measurement on site). The first difference is the difference in the coordinates and the second is the difference in distance between the two points. Furthermore, there is a difference measuring results [3] at the same measuring point that performed at different times. The results obtained in more recent time shows smaller result of ñRoot Mean Square Error (RMSE)ò which means the results of the latest measurement is better than before, it is possible because there is some data improvement from Google Earth.

The development that can be done is by increasing the number of measurement points, because in previous studies using only 8 points [2] and 16 points [3]. Increasing the number of measurement points can provide an overview of accuracy and consistency of better measurement.

1.2. The Gap of The Real Condition and The future

The current FTTH design use the survey data of location [1], where the design based on the demand and location. Resulted in on-site visit needs to be done after the data obtained, then create the FTTH design called ñAs Drawing Plan (ADP)ò which became the basis of FTTH Deployment. Furthermore there is another method, FTTH design that uses GIS known as the ñHigh Level Design (HLD)ò, then performed the survey to create the ñLow Level Design (LLD)ò which used as ñAs Plan Drawing (APD)ò. The results of the survey demand uploaded into GIS so that the map of demand will be obtained. Then create the design (using GIS) based on the map of demand that known as the ñHigh Level Design (HLD)ò. To make the FTTH design, location survey is needed and the survey results will be made as ñLow Level Design (LLD)ò, and this design process known as ñAs Drawing Planò.

ñModeling the coordinate difference between on-site survey and on-desk process on fiber to the home (FTTH) design using GIS (Geographic information system) Approachò is a FTTH design that can be done in a short time with an acceptable QoS and lower cost. Because with GIS applications (e.g. with Google Earth, G-Map, etc.), on-site visits are not necessary. With modeling based on the difference in the point coordinates and distance between two points, measurement with the calculation compared with the survey results will produce a GIS approach with actual conditions.

1.3. The Problem Identification

Fulfillment network of ñFiber to The Homeò is an expensive job that needs an excellent planning in the deployment process. The differences between on-desk process and on-site survey, make the on-site survey must be conducted before making the FTTH design to avoid losses during the FTTH network deployment.

By leveraging the advances in the field of Geographic Information System (GIS), the difference between on-desk processes with GIS applications [1] [2], direct measurement via survey locations, and accuracy improvement of difference distance from time to time [2], can be modeled. Therefore with the GIS approach, on-desk process result can be equal to measurement results.

FTTH design, beside requiring the distance data or the length of the network that has to be built, also requires the coordinate points of the Network Elements such as the coordinates of the placement of ODC and ODP. With similar approach, estimation of the coordinate point of the survey, with the coordinate point of on-desk process that helped by GIS, and translation model of one coordinate point [4] can be obtained.

1.4. The Research Objective

FTTH network design has a very important role in the deployment of FTTH networks because it affects the investment feasibility and marketing time, therefore it must be done well. Survey locations are still required due to the differences in point coordinates and the distance between two points on the design with on desk process and survey locations.

Modeling the different point coordinates and the distance between two points coordinates on on-desk process and location survey. So as to determine the coordinates of the point and the distance of two points, can be determined by coordinate point and the distance of two point coordinates with particular approach.

Measurement of coordinates point and the distance of two points on on-desk process with Google Earth View with 3D view would be more accurate. Measurement of the coordinates of the location survey using GPS and two-point distance measurement with roll meter.

1.5. Hypotheses

The development of the accuracy level of point coordinates measurement and distance point coordinates in Geographic Information System can help the process of making the FTTH network design, however there are still differences on on-desk processes and measuring results in the location.

From the difference in measurement results on on-desk and on-site process, the model can be made. Modeling the different point coordinates and the distance between two points coordinates on on-desk process and location survey. So as to find out the point coordinate and the distance of two points, can be determined by the point coordinates and the distance between two points by on-desk process.

With this model, site survey process can be eliminated so as to reduce the time of design and other resources.

1.6. Scope of Work

This research was conducted in Jember city and **valid for Jember City only**, East Java with the samples that taken from 3 cluster locations with minimum sample of at least 100 points per cluster, so that the optimal results can be achieved with latitude coordinates boundaries from -8,23036 to -8,15188 and longitude coordinates boundaries from 113,57793 to 113,80821, for at least 100 points with the measurement of 5 digits behind the comma.

This study does not consider the condition of the road (such as dirt road, rocky, asphalt road) that passed by the FTTH networks. The consideration is the route, distance, and placement of the Optical Distribution Cabinet (ODC) and the Optical Distribution (ODP), therefore this design is suitable for the FTTH network design that use the aerial cables (aerial) with 1 meter as the smallest unit.

Distance measurement use the straight distance method with a maximum distance of less than 100 km, therefore the Earth's curvature factor can be ignored because of the difference is less than 1 meter.

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