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Optical Cable Backbone Network Design In The Province Kalimantan Middle Use Technology DWDM OTN

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ABSTRACT

In designing the backbone network for the province of East Kalimantan using *Dense Wavelength Division Multiplexing* (DWDM) and *Optical Transport Network* (OTN) devices which cover 10 districts and cities consisting of 34 segments, of which 34 segments consist of 10 OTN DWDM sites and 16 *Optical Land Amplifier sites* (OLA). From the results of the design and simulation of the backbone network, it was found that the value of the *Optical Link Power Budget* (OLPB) < 50 dBm where this value is the ideal value in deploying a DWDM OTN backbone network, and the range of the *Optical Signal Noise Ratio* (OSNR) is between 20 dBm < OSNR < 40 dBm, which is the ideal value for OSNR, and has an *Optical Rise Time Budget* (ORTB) < 60 ps, and also has a segment margin system of > 7 dB.

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1. INTRODUCTION

Palapa Ring alone is wrong onethe government's main priority program for build system network backbone cable optics which have capacity big and high speed by integratingexisting network with existing network will made. Palapa Ring alone divided into 3 main segments, namely, Palapa Ring West (PRB), Central Palapa Ring (PRT), and East Palapa Ring (PTT). Palapa Ring Project already start held with destination for connect island island which there is in Indonesia good through track land and track sea.
Project Palapa Ring already make some big rings in Indonesia, but 11 rings which connect Sulawesi and NTT still not finished. Related to the problem the, network backbone optics from Makassar– Maumere as part from 11 parts ring the designed use technology device *Dense Wavelength Division multiplexing* (DWDM) [1].

Optical cable backbone network development also planned in a few area like planning network backbone *long term Evolution* (LTE) 4G in the area districts Sleman in the province of Yogyakarta [2]. Besides that for planning network backbone for region Sumatra North alone also currently planned [3].

In writing this scientific journal, for the selected area is the province of Kalimantan East, where province Borneo East future will projected experience progress and development fast. So in order to anticipate this, it is necessary quick made and held network backbone cable optics land and cable optics sea which could connect all districts andcity which there is in province Borneo East which amount total as much 7 CityRegency and 3 City intermediate. Picture 1 under this show project Palapa Ring.

Picture 1. Project Palapa Ring

In general, wired communication systems marine optics consists of two main parts namely the land part (Dry Part) and also the sea part (Wet Parts). On the land part (Dry Part) consists of from the main Site Shelter that serves as the place establishment device terminal whichconnect Among Site shelter (station) between districts, city which located in the areaprovince Island. Whereas part sea (Wet Part) consists of marine optical cable along with element supporter which covers device Optical Repeater (RPT), Cable Jointing (CJ), and, Cable Branching Unit (BU) whichworking for connect station (shelter) between island. by whole device terminal which there is in the shelter consist from Cable Terminal Box (CTB), Power FeedingEquipment (PFE), Submarine Line Monitoring (SLM), Submarine Line Terminal Equipment(SLTE), Network Monitoring System (NMS),and Network Protection Equipment (NPE), whereas device which there is outside shelterconsist from Ocean ground Bed (OGB) and Beach Manhole (BMH). Device components in the shelter serves as a pointterminal end of the physical optical cable while those outside the shelter such as BMH and OGB serves as a Landing Station (LS) from the marine optical cable before going to the device which there is in the site (shelters). Fordevices outside the shelter consist of: Ocean ground Bed (OGB) and Beach manhole (BMH). Whereas device which there is inside the shelter includes a *Cable Terminal Box* (CTB), *Power Feeding Equipment* (PFE), *Submarine Line Monitoring* (SLM), *Submarine Line Terminal Equipment* (SLTE), *Network Monitoring System* (NMS), and *Network Protection Equipment* (NPE). Picture 2under this show diagram system communication marine optical cable.

2. RESEARCH METHOD

The research methodology used in writing this journal is bycollect preliminary data on geographic maps Province Borneo East. Thing this important in the determine stages next. To collect geographic information dataand characteristics of the province of Kalimantan East especially amount city and districts which there is in province the, writer use *Software Google Folder* and help data from *Google Wikipedia* .

After the initial data collection stagerelated province Borneo East, So stages next is To do division of segments between districts and cities in the province of East Kalimantan for knowing is districts or cityit enters the optical cable segment land or marine optical cable. It can also obtained with the help of *Google Map software* nor *Google Earth* . After stages identification of the segment is done, then stages next is share all city districts which there is in in province East Kalimantan into two segments, namely: segment land (*Inland*) and segment sea (*Submarine*).

If stages identification and division of segments in all districts and city in province Borneo East done conducted, so stages next is To do measurement distance between city and district as the basis for determining quantity score from long cable optics which will held in all districts city in East Kalimantan province. For measurement districts and city which enter into the segment land (*Inland*) used *Software Google maps* , whereas for To domeasurement in the city of the incoming district into the submarine cable segment (*Submarine*), thenused *Software Google EarthPro* .

For Stages next after get data results measurement long cable which pass all districts and City middle in province Borneo East with use *Software Google Folder* and *Google Earth* , then a design drawing is made network topology *backbone* on each each province with use map the province to make it easier in

the making design picture at a time identify and ensure that each counties and cities in the picture topology the can connected Among one same other. For design picture topology network backbone this can use *Software Microsoft Word* .

After stages making picture *backbone* network topology design in the province East Kalimantan has been completed, then the stages next is make tabulation data the technical aspects of all segments of the city district are good traversed by land and optical cable lines track cable optics sea into the form table *Spreadsheets Excel* . Thing this need conducted To use make it easy in the transfer data from *Microsoft Excel* to *Microsoft Word* . Besides that destination from make tabulation data in form *Spreadsheets Excel* is To use easy to do calculations score *Optical Link Power Budget* (OSNR), *Optical Signal Noise Ratio* (OSNR) and *Optical Rise Time Budget* (ORTB).

After stages making tabulation

data in form *Microsoft Excel* done made. So stages next is To do design infrastructure backbone East Kalimantan province into *Software OTN planners* . *OTN Planner* alone is *Software* which issued by company *Vendor* device cable optics *Fiberhome* . Where *Software* this of course devoted for make design project infrastructure device network *backbone* cable optics using DWDM device base and OTN.

After design infrastructure network backbone optics province Borneo East done conducted with use *Software OTN planners* , so stages The next step is to calculate the value of *Optical Link Power Budget* (OLPB), *Optical Signal Noise Ratio* (OSNR) and *Optical Rise Time Budget* (ORTB). For the calculation of OLPB and ORTB alone could conducted manually using *Microsoft Excel* , whereas for calculation OSNR must conducted use *Software OTN Planner* because method calculation OSNR enough complicated and only could generated with simulation topology network *backbone* which already designed in *Software OTN planners* . Figure 34 below shows a diagram flow (*Flowcharts*)

3. RESULTS AND DISCUSSIONS

On province Borneo East, the most dominant segment is segment land-based optical cable that all district cities and city intermediate which there is in province Borneo East traversed by cable optics land, while in East Kalimantan province do not use Marine optical cables. Picture 42 below shows the network topology *backbone* East Kalimantan province. Which interesting from topology network *backbone* Borneo East is amount OLA sites as many as 16 sites more than amount site DWDM OTN which only amount 10 site. Thing this because large expanse of territory and distance between districts and cities in East Kalimantan province are very far apart so that need more many site OLA compared with province other in island Borneo alone. Amount site OLA which there is in network East Kalimantan *'s backbone alone amounts to* 16 OLA sites, more than any site DWDM OTN which amount 10 site.

Site OLA on network *backbone* East Kalimantan is located in the sub-district of Yang each other relate and border with districts which traversed by segment cable the. For segment Cape Redeb – Sendawar left lane consists of 3 DWDM sites OTN that is site (Cape Redeb – Ujoh say Sendawar) and 3 site OLA that is site (Karaa Longdjanew - Tabang). For OA module and module PA which is attached to the segment This amounts to 20 modules that are installed on the side Tx and Rx, where the OA modules are 10 module and module PA amount 10 module. Figure 43 below shows the simulation Tanjung Redeb – Sendawar segment (Segment Left Side Path)

4. CONCLUSION

From results design network infrastructure backbone existing DWDM OTN optical cable in province Borneo East could taken conclusion and suggestion as follows:

From the simulation results of *Optical Link Power Budget* (OLBP) and *Optical Signal Noise Ratio* (OSNR) show that result calculation still in limit which ideal for implementation infrastructure DWDM OTN where limitation score from OLPB < 50 dBm whereas range limitation ideal from OSNR alone ranges from 15 dBm < OSNR< 40 dBm. Whereas limitation average score from OSNR is range 27 dBm < OSNR < 40 dBm. From the example of the comparison between calculation manual OSNR with use *Software OTN Planner* got difference difference score which very small that is 0.15 dBm for OSNR *forward* and 0.01 dBm for OSNR *Backward* or average < 1dBm. This can be caused by factors others like factors from *Bit Error Rate* (BER) and *forward Error Correction* (FEC) which have linkages direct with determine quality from

output output signal system transmission from *module* OA and PA. From results. calculation good by manual and *Software OTN Planner* taken conclusion that calculation by manual nor by software have levels and results that are almost same accuracy and the precision. On moment To do process *design engineering* for device DWDM OTN, there is should avoid amplifier module installation (OA and PA) by Suite (*cascade*) because it will make the value of OSNRthat is on the side of the receiver will be more low which means good signal qualitysent from *Transmitter* Tx side to side *Receiver* Rx Becomes reduce. As instead recommended for put 1 module OA on the side *Transmitter* Tx and 1 PA module on the side *Receiver* Rx with compensationdid addition score from*gain* and *Output Power* from module *amplifier* the. On site segment which have long cable optics which enough far >157 km, there is good add site *Optical Land Amplifier* (OLA) between the segments so that the value of from OLPB permanent is at < 50 dBm. In the DWDM network topology design OTN in province Borneo East, writer on purpose design condition network in condition ideal, will but in implementation it can be occur Thing on the contrary where resultsmeasurement damping show enhancement loss which enough tall, but it can be anticipatedwith add *margin loss* Becomes 7 dB for segment land and 5 dB for segment sea To use anticipate that matter. In the process planning and DWDM infrastructure designOTN is good when installing OA and PA modules when simulating the value of from *gain* and *Output Power* always greater than the attenuation loss and distance cable. Thing the very required in order to get the Margin System that good. From results simulation and analysis as well as calculation score OLPB and OSNR show project development OTN DWDM infrastructure in the province East Kalimantan is very suitable for held as project pilot (*Pilot projects*) in the going to *Indonesia Digital Nation* (IDN).

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