Proc. Annual Symposium on Research & Industrial Training, 03(2016) 361-368
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INVESTIGATE A METHOD FOR PROVIDING THE HIGHEST FIBER PROTECTION PATH FOR DIALOG ENTERPRISE CUSTOMERS

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ABSTRACT

Most of the telecommunication service providers use optical fiber as their transmission medium, because they want to provide their services to their customers with highest signal security, low transmission losses and enormous potential bandwidth. This paper investigates to provide the highest optical fiber path to enterprise customers of Dialog Axiata PLC when the network failures occur due to a damage in the fiber network. Physical and logical topologies are currently used to provide services to the customers through optical fiber network. But these topologies cannot provide 100% service protection for optical fiber paths. Dialog Axiata PLC wants to provide better services with highest protection for their most valuable customers. Path protection index (PPI) was calculated for each of them and most suitable path was identified for increasing 100% PPI. Metro ring networks are used to interconnect "network nodes" of Dialog Axiata PLC as well as "network nodes" of enterprise customers, then 100% protection can be provided for them. High survivability of the optical fiber network, high customer satisfactory and low customer turnover are some advantages of providing the highest protection fiber path to customers.

Keyword: Optical fiber communication, Dual-homing, Ring topology, Protection

1. INTRODUCTION

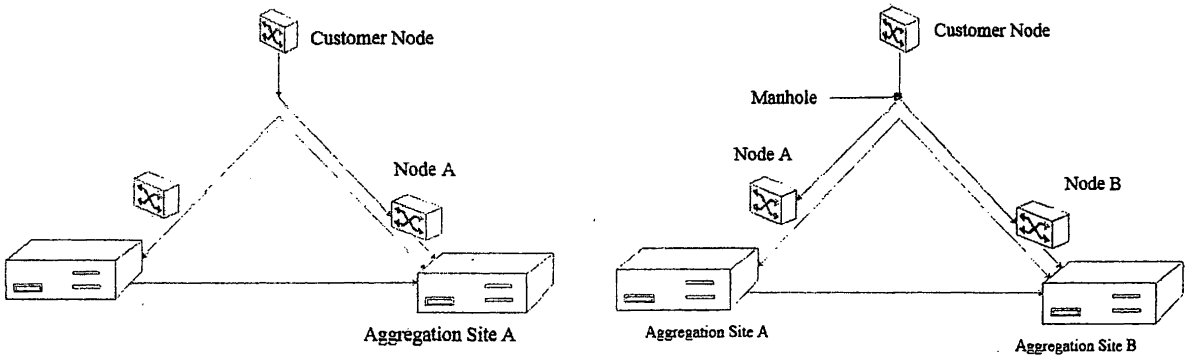
Today's Dialog Axiata PLC transport networks can be considered to consist of three layers. They are, transport-core layer, transport-aggregation layer and transport-access layer. Each of these layer has different functions to perform. Transport-core layer and transport-aggregation layer are based on fiber technologies to provide higher bandwidths and level of flexibilities required in those layers. For providing better services to enterprise customers of Dialog Axiata PLC, they use optical fiber as transmission medium because, network reliability is very

essential for any business[1]. Although they use optical fiber, it is not totally indestructible. Fiber cuts and accidental breaks in an optical fiber can be occurred. Implementation redundancy fiber network architecture is essential to ensure the continued availability of voice and data services to their customers and partners, regardless of what calamities may unfold. At that moment, their fiber network is comprised buried fiber and aerial fiber. Either it is buried or aerial fiber, damage of fiber can be major effect to the network[2]. An important issue in any networks is survivability which means capability of the network to operate in the event of node or link failures[3]. For enhancing the survivability of the network, dual-homing is normally used. In dual-homing, a customer node can be connected to two separate nodes that are connected to the core network. By installing dual fiber paths into customers, then they can typically achieve fiber network redundancy. But dual – homing network cannot be provided 100% for enterprise customers. My project is based on providing the highest optical fiber path to enterprise customers of Dialog Axiata PLC when the network failures occur due to a damage in the fiber network. So that, highest protection fiber path was optimized with connecting metro ring topology then increased protection for customers.

2. METHODOLOGY

2.1 Limitation of the current situation

Figure 1 shows the currently available structure



(a) (b)

Figure 1: a) linear connection b) dual-homing connection

Figure 1 a) shows that some enterprise customers of Dialog Axiata PLC are directly connected to the one node without redundancy path. This node is also connected to aggregation site. But, this connection is not protected, because there is only one linear path between node and customer. Path between customer node and node A is unprotected. Path protection index (PPI) for such customers is 0%.

Figure 1 b) shows that customers are connected by using dual-homing connection. Distance between customer node and manhole is unprotected linear path. These two configuration cannot be provided 100 % protection. So, enhancing the security of fiber optic network and increasing the satisfactory of the enterprise customers must be considered. By considering these facts, the most suitable fiber optic path is optimized with low cost.

2.2 Calculating Path Protection Index (PPI)

Figure 2 shows dual-homing connectivity for customers.

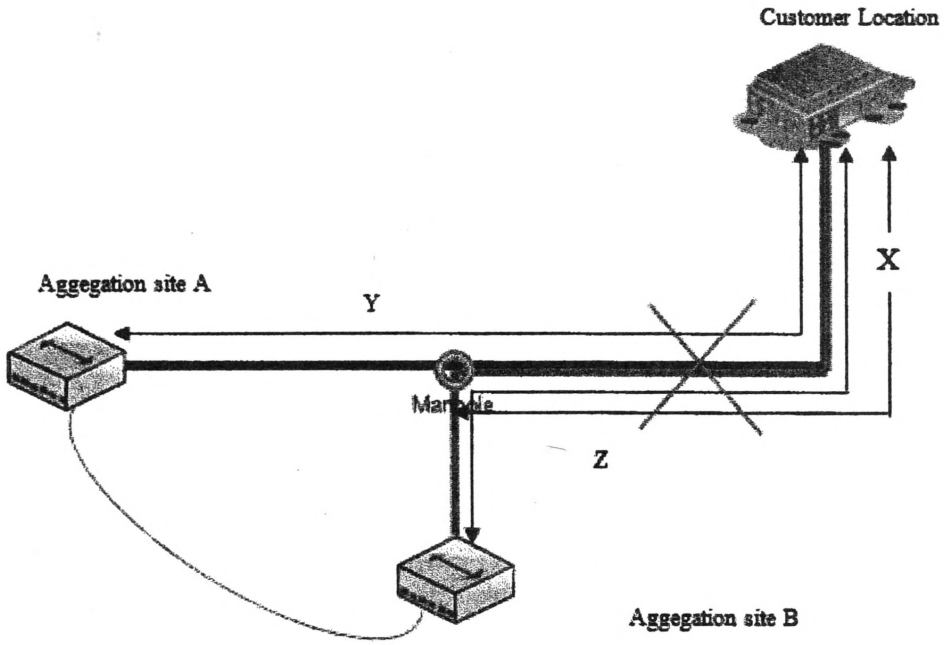


Figure 2: Dual-homing connectivity with distances

Parameters that are used to calculated path protection index;

X = Distance from customer location to manhole i.e. linear portion (common path)

Y = Distance from customer location to site A

Z = Distance from customer location to site B

PPI equation can be expressed as below.

Unprotected Portion (UP) = (X/(Y+Z))

Path Protection index (PPI) =1- (UP) (1)

As a percentage, PPI can be mentioned. That is, [(1- (UP))] %.

2.3 Providing highest protection fiber path

There are several steps to plan highest protection fiber path. Such as;

- Select the customers that want to provide highest protection.

- Categorize them who are already have dual – homing connection or not.
- Identify existing fiber path setup and calculate the path protection index (PPI).
- Investigate optical fiber network in the Dialog Axiata PLC and select the metro-ring that are available in the network.
- Give the dual-homing fiber connection for customers that are not currently connected through optical fiber and calculate PPI for these customers.
- Provide new access ring for customers to increase path protection index into 100% with cost effectively.

Point-to-point connections are replaced by ring structure. Ring topology is used for providing highest protection to customers. Figure 3 shows ring network topology that are available and provided highest fiber protection path through access ring for customer.

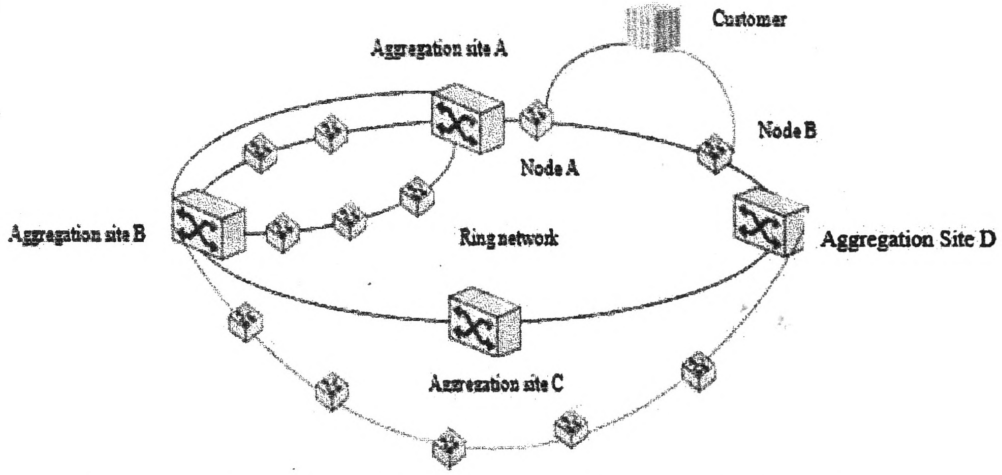


Figure 3: Ring network topology for increasing protection

According to ring network topology is shown in Figure 3, 100% path protection index can be provided. Although any fiber path was damaged, service is provided to customers from either node A or node B. So, service down time can be minimized.

3. RESULTS AND DISCUSSION

3.1 PPI for all customers

The final outcome of this project is providing the 100 % protection for dialog enterprise customers to their optical fiber path.

Figure 4 shows PPI of exisiting fiber connection setup for customers.

where, C1 – C6 are customers that are already connected through dual – homing connection.

Providing 100% protection is the target for this study.

Figure 5 shows PPI of new fiber setup.This 100% line is shown by straight line in the Figure 4 and 5.

where, C7 – C18 are customers who are not currently available fiber path

New dual – homing connection is proposed for these customers and calculated PPI for them.

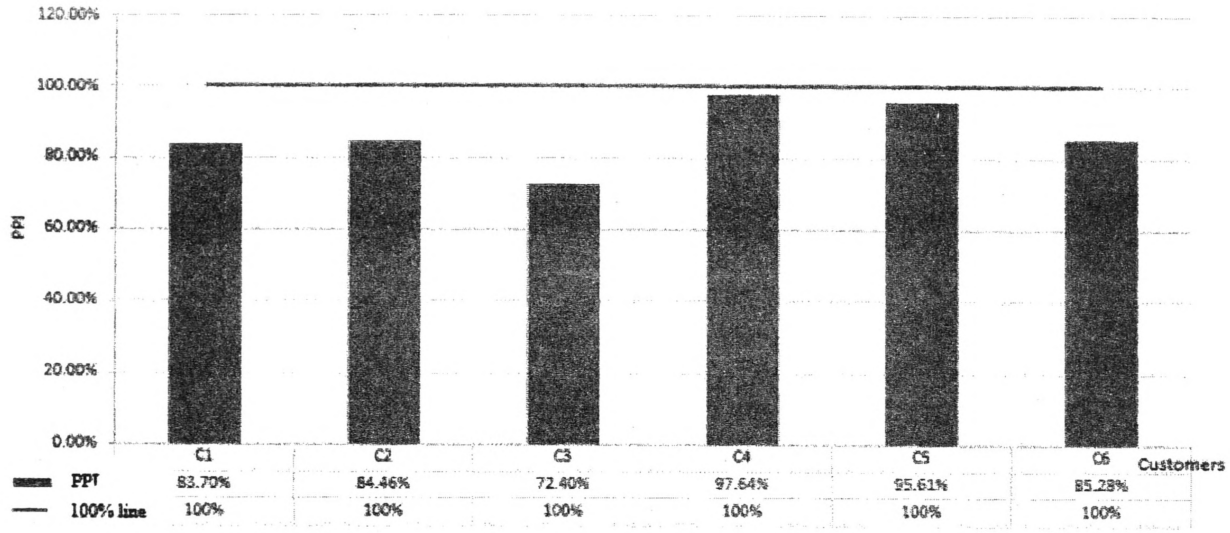


Figure 4: PPI of customers already connected through dual – homing fiber connectivity

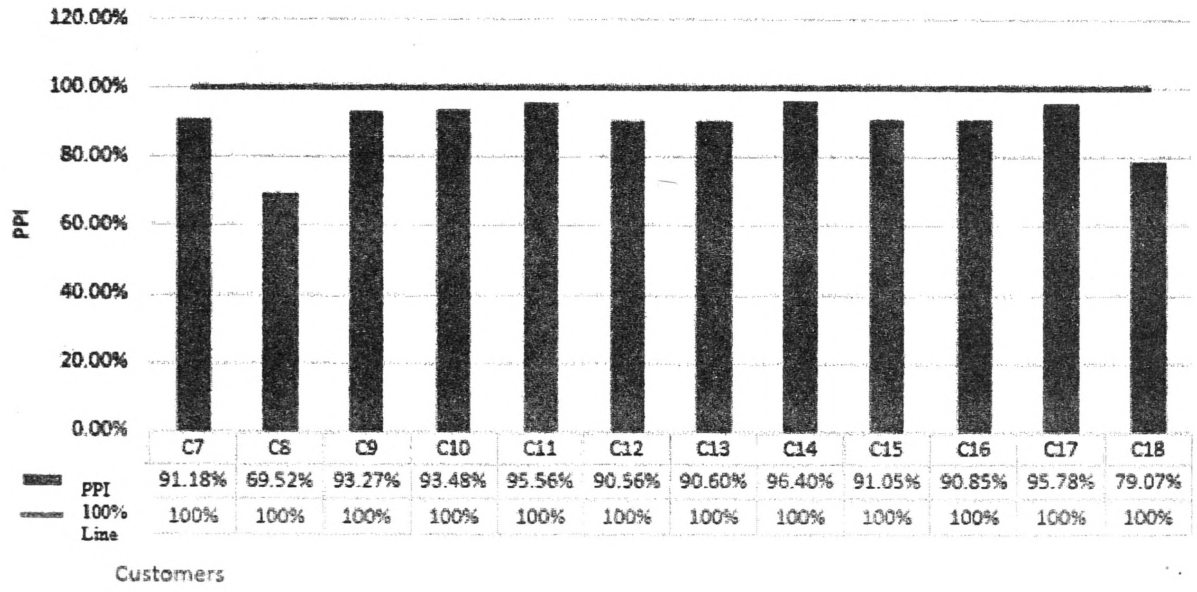


Figure 5: PPI of customers who are connected through new dual-homing connectivity

Table 1 shows the linear distance for customers i.e. unprotected portion, and the details about new path distance that have proposed for providing 100%

Table 1: Details about customer and the additional path

Customer	C 1	C 2	C 3	C 7	C 8	C 4	C 5	C 6	C 9	C 10	C 11	C 12	C 13	C 14	C 15	C 16	C 17	C 18
Linear portion / m	212.65	224.67	558.99	108.16	656.61	39.64	129.54	127.86	87.94	85.54	39.64	147.19	189.95	49.04	158.64	163.5	67.72	258.09

Additional Path / m	321.35	760.00	903.33	80.00	56.94	321.35	144.24	164.72	76.82	294.38	379.90	98.08	317.28	280.94	70.93	207.30

According to Table1, There is only one additional path for all C3, C7 and C8 customers. This is because, these customer locations can be connected one metro ring. So, PPI can be increased into 100% for these three customers by providing only one additional path. Table 1 also shows additional distances are want to provide 100% protection for other customers.

4. CONCLUSION

Providing high security optical fiber network is most important to all telecommunication service providers. So, this study is based on to investigate to provide the highest optical fiber path to enterprise customers of Dialog Axiata PLC when the network failures occur due to a damage of fiber network. Customers who are most valuable in the Dialog Axiata PLC, were selected for providing 100% protection. Among these customers, some of them are already connected through dual – homing connection through optical fiber. Optical fiber transmission is not provided some customers at that moment. Then new two nodes are proposed for these customers for dual – homing connection. Path protection index (PPI) is increased into 100% by using metro ring connectivity for all these two types of customers. There are some advantages by increasing service protection of customers. They are high signal security, high customer satisfactory, low transmission losses, low customer turnover and high survivability of optical fiber network. It is very important to Dialog Axiata PLC, as a largest telecommunication service provider in Sri Lanka.

ACKNOWLEDGEMENTS

The first author would like to acknowledge and extend increment gratitude to all the staff at Dialog Axiata PLC and Department of Electronics, Wayamba University of Sri Lanka who have supported to do this research project successfully.

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