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Analyzing Delay and Capacity in Passive Optical Network

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Abstract: ***During transmission of data in a network it is desirable that packet transmission will complete without packet loss and take less time. There are many Major cause of packet loss such as congestion. Because of this there is requirement of some methodology that can reduce the packet loss and return reliable data transmission over the network. In this paper, the proposed work is representing the solution of the same problem as the major Hypothesis. The Proposed system is the advancement of existing PON technology with the inclusion of bandwidth utilization as well improving the network throughput by utilizing the bandwidth in an effective way. The proposed system will benefit the higher reliability of data communication in a Private Network. The reliability is presented here in terms of lower packet loss than the existing system. The proposed approach will work dynamically. In this approach, the system will first detect the packet loss and then provide the solution of the problem by reducing the packet loss.***

Keywords: Packet Delay, PON, End to End delay, SHA

1. Introduction

Today, with the increasing development and usage of electronic media, the demand for number of nodes in a network have significantly increased. In addition, there are number of networks in which different kind of data is usually transferred, using multicasting and/or broadcasting The access methods based on the optical fibre are getting more and more attention as they offer the ultimate solution in delivering different services to the customer premises. Due to the lack of active units in the light path the architecture of PON is simple, cost effective and offered bandwidth that is not possible to achieve by other access methods [1].Due to less number of active units in the light propagation path, the architecture of passive optical networks is usually simple, cost effective and offer wide bandwidth [4]-[6]. In this paper we evaluate the packet delay of sub network that form PON through analysis and simulation. We use the 2 lane system that is based on ring topology to reduce the packet loss than existing system. With the aim to provide a better solution to this problem of packet delay we evaluate delay and also aggregation based bottleneck network where a secure system is implemented using SHA algorithm. Thus increase capacity over the network and reduced packet delay. By using fibre optic network access bandwidth gap can overcome [2].A global perspective of multicast capacity and delay analysis in Mobile Ad-hoc Networks (MANETs) gives that node mobility is at the same time-scale as data transmissions [3].In this paper we evaluate capacity and delay of sub network that form PON and then compare the results with IEEE802.15.4a standard [5].

2. Proposed Methodology

To represent the complete PON system, ring based architecture with N number of nodes is taken. All Nodes are identical and placed at equal distance in a ring from. To monitor the nodes and to track the network faults placed save points over the path of Ring. We have placed N number of Checkpoints placed at equal distance from each Node. Now, as the communication begins, source and the receiver node are selected dynamically. If no fault occurs the data will be transferred uninterruptedly. As the fault occurs the fault is detected by the previous save-point and it will find the alternative path to transmit the data over the network. The complete bandwidth is divided in two parts, one for the normal communication and other for the recovery option. As the fault occurs the data will be transferred from this recovery path. The system has given the better results as compared to existing approach. We proposed an algorithm named as rerouting to alternative path (RAR).Various algorithm were proposed for capacity improvement, delay and better bandwidth utilization. Typical characteristics of DBA at different traffic loads, within the two major standards for PONs, Ethernet PON and gigabit PON was studied [8]. An algorithm for minimizing the efficiency problems that arise when online scheduling and wavelength assignment is employed in WDM-EPON networks, leading to improved capacity utilization and consequently reduced frame delay [7].

Here to represent the bottleneck problem we have taken a hierarchal architecture. In this 4 sub-networks is taken that connect in a hierarchal way. In this work we have shown the concept of Data Aggregation travelling over the network, it means a large amount of data is being travelled over the network. Now to travel the data efficiently and to resolve some load from the channel we are presenting a filtration approach. Network architecture based on tree topology is presented which will increase the capacity of network by using SHA algorithm. In SHA algorithm, the nodes filter the bad packet and only packet that have required information is transmitted.

3. Network Model

3.1 Ring type topology

In this paper we define two types of network for the analysis delay over network, based on the ring topology for reducing the packet loss when data is transmitted over it. MATLAB is used for simulation purposes. The proposed work is about to find the optimal solution of any broken link or data loss in a high speed WIRELESS PON-network. The proposed work is about the generation of such an approach that will dynamically compensate the problem of link failure and provide the optimize solution without any data loss. In this proposed work, a scenario is defined that is based on ring topology with 10 numbers of nodes with same number of save points. The dimension of topography is about 750m * 750m.

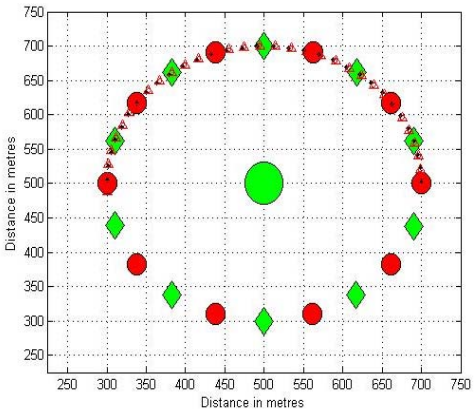

Figure 1: Network Communication

CBR is used for traffic generation with packet size of 512 bytes at the rate of 25 Mbps. Red circles defines the nodes and green colour diamond shapes represents the save points over the ring network. In this proposed work any random node can start communication by taking any random node as the destination node. The figure 1 shows the network communication in the ring form. Where the sender is fixed at node 1 and the receiver is selected at random. Time taken for successful packet delivery is 2.07 seconds.

In figure 2, the fault is generated at some random position and finds the destination node from the opposite side. And perform the packet delivery successfully.

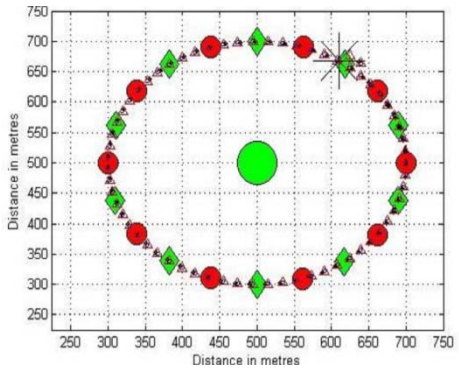

Figure 2: Fault Recovery in Existing Method

The time taken by existing method for packet delivery is 7.923 seconds as fault occur over the network. Here figure 3, shows the successful packet delivery in case of proposed approach where the recovery path will be selected to transfer data over the network for successful packet delivery. The time taken by the proposed approach is 3.074 seconds.

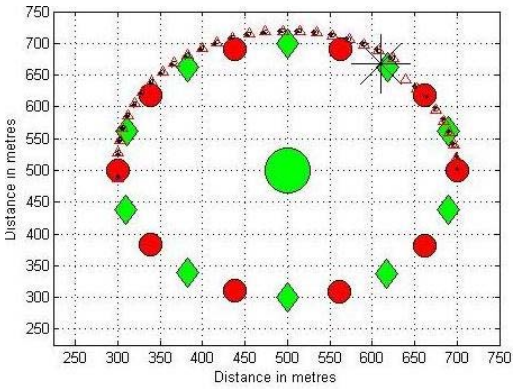

Figure 3: Successful Packet Delivery (Proposed Approach)

3.2 Tree type topology

In this particular scenario, we deal with Bottleneck problem in PON architecture. Here to represent the bottleneck problem we have taken a hierarchal architecture. We have taken 4 sub-networks that connection in a hierarchal way. In this work we have shown the concept of Data Aggregation travelling over the network, it means a large amount of data is being travelled over the network. Now to travel the data efficiently and to resolve some load from the channel we are presenting a filtration approach. The authentication is being done using SHA algorithm. The distance between each node is constant and it is 42.4264m and coverage region of each node is about 8 m.

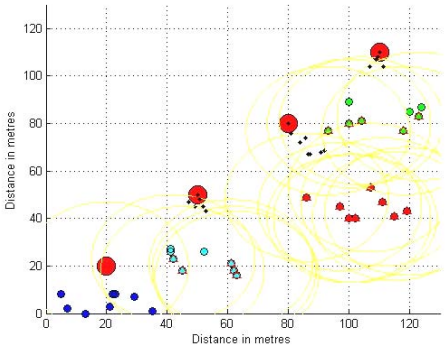

Figure 4: Hierarchical Network

4. Performance Metrics

End-to-End Delay

End-to-End delay is the time taken for a packet to reach the destination from the source node.

$$\text{End to End delay (ms)} = \frac{\sum (\text{Delay of each entities data packet})}{\text{Total number of delivered data packets}}$$

5. Results

The analysis is showing the comparison of existing and proposed approach in terms of time taken.

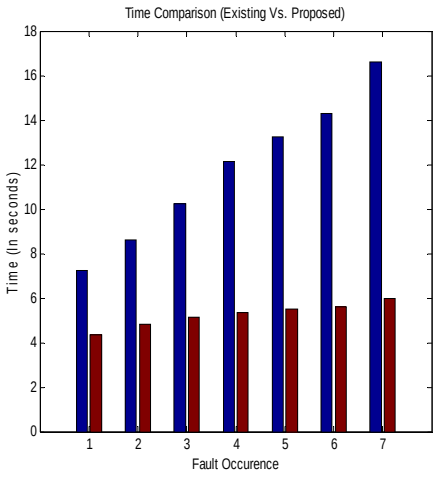

Figure 5: Time Comparison (Existing Vs. Proposed)

Here figure 5 is showing the comparison of existing and proposed approach. As we can see the proposed work has improved the overall time taken by the network in case of fault recovery.

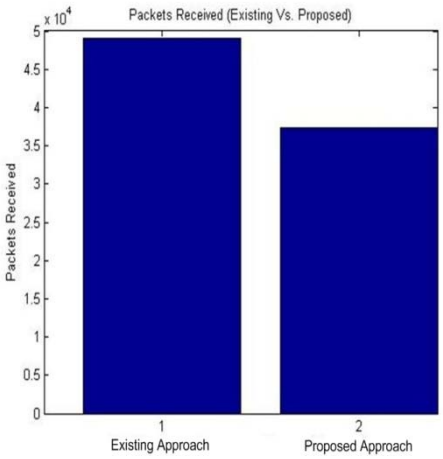

Figure 6: Capacity enhancement (Existing Vs. Proposed)

As in above figure the proposed approach has reduced the data communication over the network, because of this the network reliability and efficiency both will be achieved. In the proposed approach total packet received 37292 and in existing approach total packet received 49100.

6. Conclusion

For reducing packet delay a RAR algorithm is applied, which has proven to significantly reduce the packet delay in ring network. We have developed a comprehensive probabilistic analysis for evaluating the packet delay performance of next-generation PONs (NG-PONs Delay. This algorithm will help in reliable communication over a network in terms of lower packet loss. It is found that RAR approach provides better results than existing approach. Our analysis also improves the network reliability and efficiency. We also demonstrate the identification of network bottlenecks using our analysis.

References

[1] F. Aurzada and M. Scheutzow, "Capacity and Delay Analysis of Next-Generation Passive Optical Network (NG.PON)", IEEE Transaction on Communications, vol. 59, pp. 1378-1388, May 2011
[2] G. Kramer, "Ethernet PON (EPON): Design and Analysis of an Optical Access Network", Photonic Network Communications, vol. 3, no.3, pp. 307-319, July 2011
[3] Y. Wang, X. Chu and X. Wang, "Optimal Multicast Capacity and Delay Tradeoffs in Manets: A Global Perspective", IEEE Infocom, pp. 640-648, April 2011
[4] Flexlight Networks, "G-PON – The Next Big Thing in Optical Access Networks, Comparison between E-PON, APON and the emerging G-PON Technology", www.flexlight-networks.com, Sept. 2002
[5] IEEE Standard 802.3AH, "CSMA/CD access method and physical layer specification Amendment: Media Access Control Parameters, Physical Layers and Management Parameter for Subscriber Access Networks", 2004
[6] J. S. Vardakas and M. D. Logothetis, "Packet Delay Analysis for Priority- based Passive Optical Networks", IEEE Conference on Emerging Network Intelligence, pp. 103-107, Oct. 2009.
[7] K. Kanonakis and I. Tomkos, "Online upstream scheduling and wavelength assignment algorithms for WDM-EPON networks", IEEE Conference on Optical Communication, pp. 1-2, Sep. 2009
[8] B. Skubic, Chen Jiajia and J. Ahmed, "A Comparison of Dynamic Bandwidth Allocation for EPON, GPON, and Next-Generation TDM PON", IEEE Communication Magzine, vol. 47, issue 3, pp. 40-48, March 2009.

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