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REVIEW ARTICLE

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OPTIMIZED PROTECTION SCHEME FOR SURVIVABLE FIWI NETWORK

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ABSTRACT
Survivability is associated to "provide service to users even after any failure occurs in network. Survivability can be defined as "capability of any system to carry forward its functioning during and after any failure occurs in the system". Survivability is one of the important issue in Fiber-Wireless (FiWi) access network because network component failures may cause a large amount of data loss, especially when the failure occurs in optical back-end. In this paper our main consideration is on survivability in FiWI network. For this our work divided in two phase. In first phase we discussed the optimization of backup ONU and in other phase we discussed the deployment of back up fiber in network.

Keywords— Fiber-Wireless Network (FiWi), Backup fiber,Backup Optical-Network-Units (ONU), Survivability

I. INTRODUCTION

Fiber-Wireless (FiWi) broadband access network is a favorable access technology, because it consolidate the technical merits of PON and WMN networks together. It combine the advantage of both network such as higher bandwidth of PON at back end and low cost of WMN at front end. Hence we can say that FiWi provides services to user with high capacity and reduced cost. In FiWi network passive optical network considered as backend network whereas wireless mesh network considered as front end network. FiWi technology has numerous advantages, such as higher bandwidth, stable communication, flexibility and easy deployment of front end wireless mesh network.

In FiWi OLT is called an optical line terminal, this is a device which serves as the service provider endpoint of a PON. It furnish two main functions first one is to make conversion between the electrical signals used by the service provider's equipment and the fiber optic signals used by the passive optical network and to coordinate the multiplexing between the conversion devices on the other end of that network. An optical network unit (ONU) unit transforms incoming optical signals into electronics at a customer's premises in order to serve telecommunication services over an optical fiber network.

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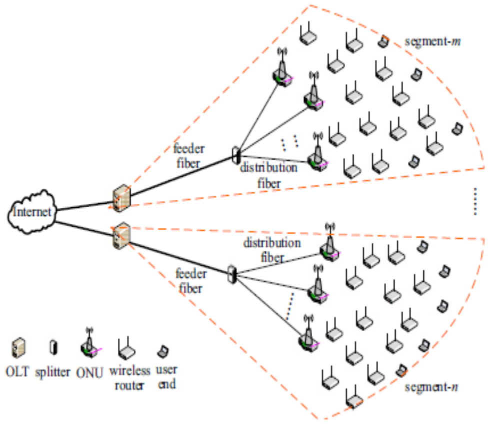

Fig.1. Fiber Wireless Network [11]

Diverse concerns are related to FiWi Network such as Placement of ONU, Survivability at back end and front end and Energy saving. ONU placement is associated with, "how efficiently ONUs can be place in the network to reduce the network deployment cost". Survivability is related to "provide services to users even after any failure occurs in network". Energy saving is related "How to save energy in FiWi network". Here our main focus on survivable FiWi network.

II. LITERATURE

Since FiWi supports a huge data rate (typically of the order of Gbps), any kind of failure may results in huge data loss. Hence, the survivability is one of key issues in the FiWi network. Feng and Ruan propose a protection scheme in [2] to enhance survivability of the FiWi against single OLT failure by first designating backup ONUs and then deploying backup fibers between them. Once an OLT in a segment fails, the interrupted traffic can be transferred to other available neighbor-segments through the backup ONUs and backup fibers. With the objective of Maximum-Protection-Minimum-Cost (MPMC), an Integer Linear Programming (ILP) model is proposed to Feng and Ruan propose a protection scheme in [15] to enhance survivability of the FiWi against single OLT failure by first designating backup ONUs and then deploying backup fibres between them. Once an OLT in a segment fails, the interrupted traffic can be transferred to other available neighbour-segments through the backup ONUs and backup fibres. With the objective of Maximum-Protection-Minimum-Cost (MPMC), an Integer Linear Programming (ILP) model is proposed to optimize deployment of the backup fibres. Considering the computational complexity of ILP model, a heuristic algorithm is proposed in Ref. [3] to solve the MPMC problem .

A protection scheme is proposed in Ref. [4] to improve the works in Refs. [2,3] in terms of full protection and fast restoration. This protection scheme attempts to cluster the segments by deploying backup fibers, such that traffic in failed segment can be transferred to any further available segments in similar cluster. An ILP model is proposed to optimize deployment of the backup fibers aiming to minimize the restoration delay with the constraint of full protection.

As an extension of DARA [5, 6] in terms of survivability, the Risk-and-Delay Aware Routing (RADAR) algorithm is proposed in Ref. [7] to protect FiWi against various failures such as wireless gateway failure, ONU failure or OLT failure. In RADAR, each wireless router advertises the wireless link state periodically. Based on the link state information, RADAR computes the wireless path with the minimum end-to-end delay from a wireless router to any wireless gateway. A fault-tolerant approach is proposed for joint wireless and optical survivability in multi-radio FiWi [8]. This approach includes two steps. In first step, with the shortest path criteria, a backup wireless path is computed for each primary wireless link to tolerate the possible wireless link failure. In the second step, with the purpose of improving network scalability, an ILP model is proposed to optimize the assignment of channels for each link in the primary and backup paths.

It is demonstrated in Ref. [9] that FiWi access network is a promising alternative for the survivable NG-PON. By selectively equipping some of the ONUs with wireless functionality, the interrupted traffic due to distribution fiber failure can be wirelessly transferred into other available distribution fibers. Also, a probabilistic analysis model is proposed to evaluate the survivability of FiWi in terms of average number of failure-free connections among ONUs. However, the work in Ref. [9] focuses on only ONU failure without considering OLT failure. Furthermore, the issue about routing decision for restoring the interrupted traffic remains untouched.

In FiWi, the front-end WMN is self-healing because its mesh topology can provide alternative routes, while the back-end PON cannot survive network component failure due to its tree topology. Thus, we focus on the protection of the back-end PON in works [10,1]. Both works consider optimizing the deployment of backup resource to carry the traffic interrupted by network components failures, aiming at the continuously available service.

In Ref. [1], author aim to develop a survivable architecture with protection rings by deploying backup fibers, so as to protect the back-end PON against single feeder fiber or OLT failure. Because the failed segment can transfer its traffic along two branches of the protection ring simultaneously, the delay for restoring the interrupted traffic (i.e., restoration delay) is significantly reduced. Author propose a novel Ring-Based Protection Algorithm (RBPA) to optimize the deployment of backup fibers with the objective of full protection and minimum backup fiber cost. In the simulation, we evaluate our RBPA in terms of backup fiber cost (measured in the total length of backup fibers) by comparing with the Min-Cost-Max-Protection (MCMP) scheme.

III. PRIOR APPROACH

3.1 Ring Based Protection scheme for survivable FiWi network considering multiple failures :

We consider Ring Based Protection scheme for survivable FiWi network as base paper. To enhance the survivability of FiWi against multiple failures following steps need to be follow:

- First randomly select one of the ONUs in each segment as the backup ONU.
- Then, cluster all the segments in the whole network.
- In last, to build a protection ring in each cluster the deployment of the backup fibers take place among the backup ONUs in different segments
- In this way, any pair of segments in the same cluster
  can backup for each other along the protection ring.

3.2 Problem Statement in Ring Based Protection scheme for survivable FiWi network:

1. Selection of backup ONU in each segment enhances the number of backup ONUS in the whole cluster.
2. Because of more number of Backup ONUS, more backup fibre is needed to be deployed amongst the backup ONUS.
3. Thus the overall cost and complexity of network increases.

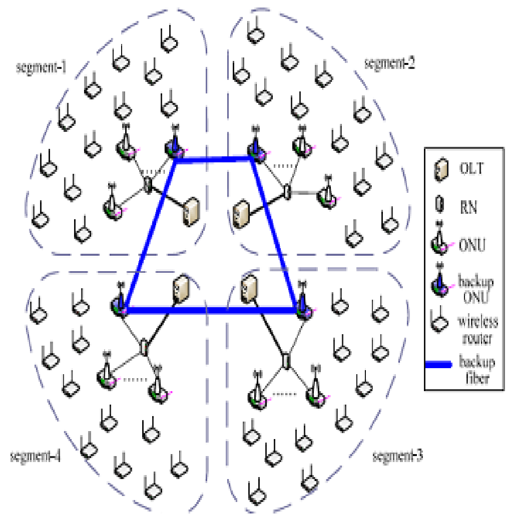

Fig.2 Ring Based Protection scheme for survivable FiWi network [1]

. IV. OUR APPROACH

4.1 Objective of proposed solution to overcome survivability problems in FiWi Network:

- To optimize the selection of backup ONUS.
- Optimization in deployment of back up fibre in network.
- By optimization in selection of backup ONUS and
  deployment of back up fibre we achieve optimality.

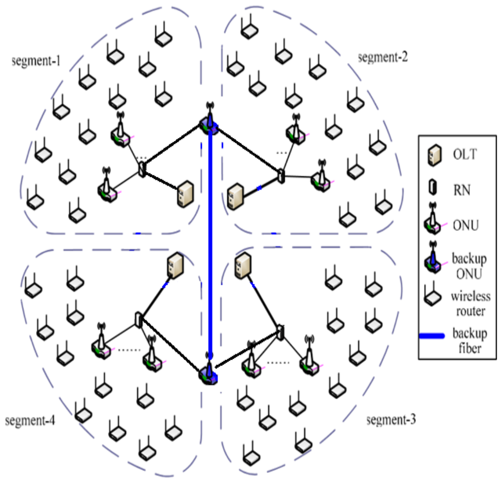

Fig.3 Proposed architecture survivable FiWi network

4.2 Steps to be follow

- ✓ In this architecture we select a common ONU as a backup ONU between two segments in network.
- ✓ In similar manner we select another backup ONU for two remaining segments.
- ✓ By doing this we reduce the number of backup ONUS in the network.
- ✓ Then we deployed a back up fibre between these two backup ONUS.

4.3.1 Summary

Since the number of backup ONU decreases, the length of backup fiber which is deployed between them is also reduced.

In this manner we can optimized the selection of backup ONUS and optimized the deployment of back up fibre in the network and make our network more survivable and reliable.

4.3.2 Expected Outcome

Simulation will be carry out in MATLAB R2009a (Version 7.8.0.347). In the simulation, we will investigate the performance of our proposed method by comparing with the scheme proposed in base paper by considering following validation parameters:

Survivability ,delay, error rate, data delivery rate, computational time etc.

V. CONCLUSION

In this paper, we have proposed a new and efficient protection scheme to enhance the survivability of FiWi network. In proposed work, we consider the optimization problem of selecting backup ONUs, and deploying backup fibbers. It is expected that the proposed approach can provide a near-optimal solution with much less solution time than the previous approaches. Therefore, we can conclude that the proposed scheme will be promising for the survivable FiWi network, with a lower deployment cost, stronger network survivability.

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