Proceeding Series of the Brazilian Society of Applied and Computational Mathematics, v. 6, n. 1, 2018.

Trabalho apresentado no XXXVII CNMAC, S.J. dos Campos - SP, 2017.

Proceeding Series of the Brazilian Society of Computational and Applied Mathematics

Multicast RSA Algorithm with Defragmentation for Elastic Optical Networks (work in progress)

L. Fernando Delvalle[1],
R. Ester Alfonzo[2],
Diego P. Pinto-Roa[3]
Facultad Politecnica,UNA, San Lorenzo, Paraguay

1 Introduction

Elastic Optical Network (EON) is a new paradigm proposed in [2] to improve the use of the spectrum in the current optical fibers. They propose to change the static allocation of the spectrum to the connection requests, by a dynamic and flexible allocation according to the demand, granting to each user the exact amount of spectrum that bandwidth request. The main focus of study in EON is algorithms design that perform the routing of point-to-point (unicast) request, and the assignment of spectrum [2] also known as Routing and Spectrum Assignment (RSA). EON networks impose optical layer constraints: continuity, contiguity and non-overlapping of spectrum allocation. In the context of dynamic traffic, optimum solutions can not be calculated due to short time to answer the requests. Therefore, blocking of requests occurs because to spectrum fragmentation, being one of the main problems of EON [1]. In a very fragmented network the available spectrum is not entirely contiguous, so the optical layer constraints make it impossible to complete the requests. A summary of the algorithms that reorganize or defragment the EON networks can be founded in [1].

The implementation of point-to-multipoint (multicast) services in EON, such as teleconferences, mass data transport, server migrations, and others, are performed through the Multicast RSA (MC-RSA) algorithms [4]. Multicast traffic increases network fragmentation much faster than the unicast traffic. In our study of the-state-of-the-art, in [3], a solution has been presented for this problem, where network fragmentation is measured each time a traffic request arrives, and this is assigned to less-fragmented spectrum block. However, when a blocking happen this approach does not performance any action. The above-mentioned proposal does not solve completely the fragmentation problem, as each new arrived request will still increasing network fragmentation. Specifically, the literature

[1]luisfernandod126@gmail.com
[2]rasalde@gmail.com
[3]dpinto@pol.una.py

only proposes defragmentation strategies for unicast traffic, leaving open the design of defragmentation strategies for a multicast context.

2 Proposal

In this paper we propose a network defragmentation strategy to maximize the number of multicast connection requests accepted. The Defragmentation Multicast Algorithm (DMTA) receives as input a graph $G(V, E)$ whith V nodes and E links, and $MR(s, D)$ request where $s \in V$, and $D \subset V$. The output is a multicast tree MT. The algoritm works as follows: firstly, the MT tree is initialized; for each destination $d_i \in D$, a unicast path p_{sd_i} is calculated with the Shortest Path Tree (SPT) algorithm [4] and First-Fit (FF) based spectrum allocation [2]. If the p_{sd_i} was not blocked, p_{sd_i} is added to the MT tree; otherwise, a standard defragmentation algorithm is applied to attempt to unblock it [1] and a pb_{sd_i} path from s to d_i is recalculated using the SPT-FF. If pb_{sd_i} is blocked again, MR is finally rejected, otherwise, pb_{sd_i} is added to the MT tree.

3 Conclusions

Finding a solution to the fragmentation problem in multicast requests environment is critical to success point-multipoint services, hence the importance of the proposed algorithm. There is important to mention that if a defragmentation task is performed for each blocked path, the run time of the algorithm will be very high. But, the resources availability will be maximized. Testing of the proposed algorithm will be carried out in a future work and compared with others of the-state-of-the-art approaches.

References

[1] D. Amar, J. L. Auge,N. Brochier, C. Lepers, N. Perrort and E. Le Rouzic. Spectrum fragmentation issue in flexible optical networks: analysis and good practices. *Photonic Network Communications*, volume 29, 2015. DOI: 10.1007/s11107-015-0487-1.

[2] B. C. Chatterjee, N. Sharma and E. Oki. Routing and spectrum allocation in elastic optical networks: a tutorial. *IEEE Communications Surveys and Tutorials*, 2015. DOI: 10.1109/COMST.2015.2431731.

[3] M. Markowski. Algorithms for deadline-driven dynamic multicast scheduling problem in elastic optical networks. *Network Intelligence Conference (ENIC)*, 2016. DOI: 10.1109/ENIC.2016.046.

[4] Q. Wang and L. K. Chen. Performance analysis of multicast traffic over spectrum elastic optical networks. *Optical Fiber Communication Conference (OFC/NFOEC)*, 2012.