Spectrum Partitioning based Conflict Aware BSR-MPP (Backup Spectrum Reservation with Multipath Protection) Technique for EON Networks -A Review

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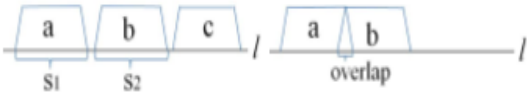
ABSTRACT
This paper represents a strategy that makes an optimal use of available spectrum for primary and backup paths for serving the connection requests. Various strategies have been used by different researchers such as SBPP (Shared Backup Path Protection), MPP (Multipath protection) and DPP (Dedicated Path Protection). The strategy we are going to use for optimization of primary and backup spectrum allocation is BSR-MPP (Backup Spectrum Reservation with Multipath Protection) in which available spectrum is divided into two parts namely primary spectrum and backup spectrum and we can use the path with better availability and less congestion no matter the path is secondary or primary.

Keywords
Multipath routing, Protection and Restoration, BSR-MPP, SLICE, Frequency Slots(FS)

1. INTRODUCTION
Proficient Elastic optical networks are flexible optical networks as it is assumed that one optical path is provided for each connection request but it is not guaranteed that it makes best use of available spectrum due to some spectrum used by guard bands therefore we make use of BV-WXC (Bandwidth Variable cross Connect) which multiplex different connections in one light path so as to make optimum use of spectrum. However in WDM (wavelength division multiplexing) networks have fixed bandwidth allocation and have fixed and rigid bandwidth grids and they cannot overlap each other which results in the wastage of spectrum when the traffic demand is less than the allocated spectrum, on the other hand in EONs bandwidth grids can be overlapped or in other words spectrum can be shared. EONs also have resilience property which is a physical property of a material that comes to its original state after contortion. The two main elements in EONs are SBVT (Sliceable Bandwidth Variable Transponder) and BV-WXCs (Bandwidth Variable cross Connect).The function of SBVT is to provide signals of variable spectrum

based on transmission distance. Laser sources in SBVT generates signals. BV-WXC switch elastic light paths and multiplex different connections in one light paths so as to make optimum use of spectrum. Two main approaches in EONs are protection and restoration. Protection is a pre planned mechanism in which routes are reserved in advance before starting communication. In Restoration routes are reserved in advance and is the process of recovering connection after its failure. Therefore later is more cost efficient than protection. We need backup paths because connection requests which are rejected due to unavailability of spectrum can be survived using backup paths. It is good to have more than one backup path because multiple backup paths increases connection acceptance rate. In fig 1, (a) shows the adjacent light paths and (b) shows that the lightpaths a and b are sharing the spectrum and in (c) and (d) lightpaths b and a are using overlapped spectrum respectively. Due to overlapping wastage of spectrum is minimized and spectrum is used optimally.



(a) Example of light paths (b) a and b are sharing spectrum

(c) b is using the overlap (d) a is using the overlap Fig.1 Illustration of EONs using spectrum

There are two important constraints for elastic optical networks i.e. spectrum contiguity and spectrum continuity. In EONs available spectrum is divided into slices or slots called Frequency Slots. According to spectrum contiguity the Frequency Slots FS must be consecutive in lightpath and according to spectrum continuity all links travelled by lightpath of an optical route must use same set of FS. Each slot should be of same size. Different number of FS are allocated to primary and secondary paths. Backup path is longer than the primary path therefore more number of slots are allocated to backup path. Moreover both the lightpaths use different modulation formats. Spectrum Sliced elastic optical path network (SLICE) is spectrum efficient network that allocates spectrum flexibly to paths according to traffic and path length. In other networks fixed bandwidth is allocated to paths without considering the amount of traffic and the length of a path. But in SLICE networks bandwidth is allocated according to traffic demand and length of a path which minimizes the wastage of spectrum and helps in saving it. Spectrum saving is also attained by squeezing out the strand of spectrum that has not been used which could be used further for another path. It is also cost efficient. In fig.2 Path B is carrying more traffic therefore more spectrum is allocated to it rather than path A and B. Path C is carrying least traffic therefore less spectrum is allocated to it.

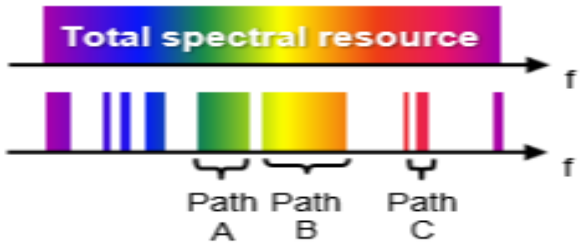


Fig.2 Spectrum allocation according to traffic demand

Shared Backup Path Protection (SBPP): We use backup paths in order to control traffic flow, by diverting traffic from active path to backup path. Elastic optical networks are protected by shared backup path protection approach; for surviving the connections, backup resources are reserved in advance for each connection. SBPP is an approach in which one backup path is shared among multiple active routes. Backup paths are used only when there are failures or traffic exceeds in primary paths. This approach can protect only one failure at a time. The backup path can be shared among the primary paths those who are not likely to be failed at a same time. Due to sharing of single backup path resource requirement is less in SBPP. SBPP has high sharing efficiency as it make use of the network more expeditiously by sharing one backup route for many connections and large amount of bandwidth is reserved due to only single backup path. If number of paths fail at a time it becomes difficult for a single backup path to recover the failure.

Dedicated Path Protection (DPP): Dedicated as the name indicates that one backup path is dedicated to a single primary path and it is not shared by other paths. In 1+1 dedicated protection approach there are two paths between source and destination, both the paths carry traffic and destination is installed with decision circuitry that picks out better of the two paths. In 1:1 dedicated protection approach backup route does not come into use until primary route fails or traffic flow increases and after the repair of primary route either the connection is returned back to primary route or persist on backup route. This approach is faster than SBPP as no time is wasted due to sharing as single backup route is dedicated to single active route but spectrum usage is more because every primary path uses their own backup paths and there is no sharing.

Multipath Protection (MPP): In multipath protection the packets or message is split into multiple paths, these multiple paths contain the same content that reaches the destination, if one path fails it does not effect the message because another path also contains the same content . This approach distribute the message efficiently in network. The length of paths must be small because less failures occur on shorter paths. This protection scheme is expensive due to multiple paths.

Backup Spectrum Reservation with Multipath Protection (BSR-MPP): Connection requests that are failed due to unavailability of single backup path can be sustained by using multiple backup paths. This increases connection acceptance rate. In backup spectrum reservation with multipath protection, spectrum is divided into primary and backup paths. When connection request arrives it looks for primary path and after the completion of search for primary path it seeks for secondary path. If the connection request is not survived by single backup path, another backup path is then allocated to that request. The second back up path is searched only when first backup path's spectrum is unavailable. Reservation of spectrum must make certain about the continuity and contiguity of Frequency Slots. Slots are shared in this approach. Spectrum required for primary and backup paths depend upon the length and modulation format. Backup path is longer than the primary path therefore more slots are required by backup path than primary path. Due to more backup paths, the more resources are consumed. Different modulation formats used are Binary Phase Shift Keying (BPSK), Quadrature Phase shift keying (QPSK), 8-Quadrature Amplitude Modulation (8-QAM), 16-Quadrature Amplitude Modulation (16-QAM). Lower modulation format endorse longer distance.

2. RELATED WORK

Bowen Chen et al.[1] proposed algorithm, dynamic load balancing shared path protection (DLBSPP) to cure multi link failures in SLICE and traffic self-adaptive restoration (TSAR) technique was adopted to restore traffic affected by failures. To recover single link failure SPP is used and in case of multi link failures SPP cannot recover efficiently, so DLBSPP is used for multi link failures. Krzysztof Walkowiak et al.[2] said that EONs are considered best solution for both huge bandwidth and for providing flexible connections, but in EONs main problem in network design is routing and spectrum allocation so they integrate Shared Backup Path Protection (SBPP) and RSA algorithm. Congyuan Yang et al.[3] studied about the bandwidth variable optical networks like EONs which shows the advantage of resource allocation over WDM networks. SRM (Spectrum reservation matrix) was proposed that resolved the SPP(Shared path protection) problem of BV (Bandwidth variable) networks and tried to use spare allocated capacity. Jorge Lopez et al.[4] demonstrated that the failures could be recovered by pre-reserving resources. For this they used (1+1) dedicated path protection scheme. Aras Tarhan et al.[5] said that spectrum resources could be shared among connections. Routing and spectrum allocation algorithms using strategies like primary first fit modified backup last fit (PF-MBL) were used to decrease fragmentation and increase share-ability. Jie Zhang et al.[6] examined the problem of providing shared spectrum for set of requests in flexible bandwidth optical networks which is done to minimize spectrum utilization. MFSB (minimum free spectrum-block consumption) algorithm is used for providing shared path. MFSB results better performance in terms of blocking probability and spectrum consumption and also ensures that failure probability is lower than all others. Roza Goscien et al.[7] analysed that in EONs besides improving network spectral efficiency, this paper also shows the resilience property of EONs.

3. LITERATURE SURVEY

Table 1

Author	Work done	Benefits	Draw backs
Jie Zhang et al. (2011)	A novel recovery algorithm for multi-link failures in spectrum-elastic optical path networks	DLBSPP algorithm cured multilink failure and restored traffic affected by failure	SPP approach was not able to recover multilink failures.

Mirosla w Klinkow -ski et al. (2011)	Shared backup path protection in Elastic optical networks: Modeling and Optimization	EON were considered best solution for huge bandwidth and for providing flexible connections	Main problem in EONs was is routing and spectrum allocation
Nan Hua et al. (2012)	Shared path protection based on spectrum reserved matrix model in bandwidth-variable optical networks	SRM (Spectrum reservation matrix) was proposed that resolved the SPP(Shared path protection) problem of BV (Bandwidth variable) networks	Survivability became a main problem.
Yabin Ye et al. (2012)	Traffic and power-aware protection scheme in Elastic Optical Networks	Capacity was reserved for both working and protection paths. Failures are recovered by pre reserving resources for protection.	Pre-reserving of resources makes it less cost efficient and resources get wasted if no failure occur later.
Cicek Cavdar et al. (2013)	Shared path protection for distance adaptive elastic optical networks under dynamic traffic	Scalability of elastic optical networks is better and availability is good of connections for large number of bandwidth requests.	Bandwidth blocking probability is reduced.
Bowen Chen et al. (2014)	Spectrum-block consumption for shared-path protection with joint failure probability in flexible bandwidth optical networks	MFSB (minimum free spectrum-block consumptio n) algorithm resulted in better performance in terms of blocking probability and spectrum consumptio n	Occurred a problem of providing shared spectrum for set of requests in flexible bandwidth optical networks
Krzyszt of Walkow iak et al. (2015)	Protection in Elastic Optical Networks	In EONs besides improving spectral efficiency resource requirement is reduced in case of failures.	Scalabitity became a problem

4. GAPS IN LITERATURE

The issue of spectrum partitioning is ignored in existing literature. The conflict between primary and secondary path during path assignment is also ignored. There is issue of continuity and contiguity of Frequency slots in existing literature. The issue of communication overheads is also ignored in the existing literature.

5. CONCLUSION

Backup spectrum reservation with multipath protection for EONs is considered best due to increase in connection acceptance rate, a spectrum is divided into primary and secondary paths instead of using different spectrums for different paths which makes optimum use of spectrum. This paper makes comparison among various protection techniques. Certainty of Continuity and contiguity of frequency slots is also ignored in past which we will try to make sure in future.

6. REFERCENCS

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