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Best Congestion Control Routing in Networks

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Abstract: Optical networks move towards being capable to cope with flexible demands the conventional challenge of routing and wavelength assignment turn into replaced by that of routing, modulation and spectrum allocation. In flexible optical networks, digital coherent transceivers modify their symbol rate, modulation layout, and forward error correction to finest serve the network demands. In a nonlinear flexible optical network, these parameters are inherently coupled with the routing algorithm. We propose to use congestion aware routing in a nonlinear flexible optical network and demonstrate its efficiency for the NSFNET reference network (14 nodes, 22 links). The network is sequentially loaded with 100 GB demands until a demand becomes blocked, this procedure being repeated 10 000 times to approximation the network blocking probability (NBP). Three routing algorithms are considered: 1) simple congestion aware algorithm; 2) shortest path routing; and 3) weighted congestion aware routing algorithm with 50, 25, 12.5, and 6.25 GHz resolution flex grids. For NBP = 1% using a 50 GHz grid, congestion aware routing doubles the network capability compared with the shortest path routing.

Keywords: Fiber Networks ,Routing Aware, Congestion Control, Shortest Path, , Optical Networks.

I.INTRODUCTION

The routing protocol in flexible networks has a important effect on congestion, mainly with increasing sizes of the implementations. This congestion becomes poorer quality after a specific area is producing most of the data. It may happen in definite implementations when nodes in one area are requested to collect and transmit data at a greater rate than others [1]. We know that all data produced in an flexible network may probably not be equally important; a few may have a less priority while others have a maximum priority. Therefore categorized service must be provided to these data. As optical networks carry on being able to deal with flexible demands the conventional challenge of routing and wavelength assignment becomes replaced by that of routing, modulation and spectrum allocation (RMSA)[1][2]. We have given the great significance of the routing algorithm for the nonlinear RMSA. In this paper we inspect the effect of congestion aware routing algorithms and measure their performance, effectiveness in delaying the initiation of network blocking. Dynamic environment of the routing can leads to congestion on particular paths. As the congestion is a self compounding problem those paths are frequently nearby to each other which guide to an entire zone in the network facing congestion. We named this zone as the congestion zone. Mostly the congestion can affect the network in two traditions.

1) It can lead to unselective dropping of data,[3] i.e. high significant data might be dropped whereas less significant data are delivered.

2) Due to congestion energy utilization may increase as edges become flooded. In this paper, we learn data sending issues in the occurrence of congestion in flexible networks[5]. We offer the use of data ranking and a priority aware routing protocol, called Congestion Aware Routing. Firstly it has to dynamically determine the congestion zone, secondly to execute differentiated routing; most significant packets are routed in the congestion zone. Less priority packets generated outside the congestion zone wait outside while those produced within the congestion zone are routed out [6]. The congestion zone nodes are dedicated to serving high important data which will enable them to offer enhanced service and extend their lifetime. Our general simulations show that CAR leads to a major increase in the successful packet delivery ratio of high significant data to the sink, and a clear decrease in the usual delay

To provide an analysis of congestion aware routing we generate the following statements in our study:

- The client side data rate is assumed to be fixed.
- Transceivers can contrast layout of modulation and FEC.
- Channels are Nyquist shaped, with a rectangular spectrum of width similar to the figure rate.

- The guard bands between the channels are too less
- The network consist single mode fiber and is time to time enlarged by a lumped erbium doped fiber amplifier (EDFA) with 5 THz bandwidth.
- The distance between amplifiers is fixed all over the network (in this we consider the span length of 100 km). Over the entire network the fiber plant is same and there is no optical spreading compensation is engaged.
- Most of the noise is created from the EDFA within the relations and hence losses at the nodes may be unobserved[7].
- The spectral consumption is sufficiently high that the nonlinear impairments correspond to 100% spectral consumption in the link where blocking happens.
- We consider the network to become blocking at the point when the first blocked demand occurs

II. RELATED WORKS

The difficulty of Existing answers in these scenario nodes in the network sends all high priority information to a single sink, tree-based routing is majority appropriate. In this routing scheme, a spanning tree is constructed with the high precedence sink as its root. The setup of such a tree uses restricted flooding from the sink to every node in the network. Low priority data, on the further hand, do not need to follow the same routing scheme. This is right because there may be many low priority sinks and a node might send data to at all of them. For instance, temperature readings might be frontward to one sink while the motion recognition measurements go to an additional sink, and tree based routing schemes endure from congestion, especially if the amount of messages created in the leaves is high. This problem becomes of poorer quality when we have a mixture of high precedence and low precedence traffic traveling from end to end the network[7]. This is because low precedence messages will cross the tree that is formed to route high precedence data in order to reach their destinations. Therefore even when the rate of high precedence data is relatively low, the background sound created by low precedence traffic will create a congestion zone that span the deployment from the dangerous area to the high precedence sink. Nodes in this zone become snowed under and arbitrarily drop high and low precedence messages. These nodes also consume extra energy compared to additional nodes in the network and hence die earlier.

This will direct to only sub-optimal paths being existing to route high precedence data, or a total loss of connectivity from dangerous area to the sink even though additional nodes outside a single routing scheme is used to route both types of traffic[8]. In such a situation, routing dynamics can direct to congestion on specific paths. Since congestion is a self-compounding problem, these paths are frequently close to *each* other which direct to an entire zone in the network facing congestion. Congestion can unfavorably affect the network in two ways. First, it can lead to arbitrary dropping of data, i.e. some packets of high precedence might be dropped while others of less precedence are delivered. This happens because sensor nodes are very easy devices and do not have the ability to differentiate packets (i.e. they do not have multiple queues for different precedence levels). Second, congestion can reason an increase in energy consumption as links become flooded. This can lead to reduction of the limited energy available in the sensor nodes in the crowded area.

III. PROPOSED SYSTEM

This paper planned Congestion Aware Routing (CAR) which is a easy routing protocol that uses data prioritization and care for packets according to their precedence. We defined a congestion zone as the set of sensors that will be required to route high precedence packets from the data sources to the sink. This paper offered algorithms to build a high precedence routing mesh, dynamically determine and configure congestion zones, and perform differentiated routing. Our solutions do not need active queue management, maintenance of many queues or scheduling algorithms, or the use of particular MAC protocols. The planned algorithm for RMSA in a nonlinear flexible network utilizing Nyquist pulse shaping is as follows:

- Resolve the optimum signal power spectral density given the fiber and amplifier arguments.

- For a couple of nodes, select the shortest path that prevents the link with the highest spectral usage (determined by measuring the total optical power which is proportional to spectral usage).

- For this path conclude the total number of amplifier spans (100 km herein) in order to resolve the received signal to noise ratio (SNR).

- For this SNR, resolve the maximum net spectral efficiency (NSE) based on known connection between SNR and NSE for a range of polarization division multiplexed layouts with Nyquist spectra were variable rate FEC is also integrated.

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- Finally conclude the gross symbol rate and assign spectrum to serve the demand between the two nodes. We demonstrated that with the inclusion of small play out buffers at the sink, the CAR based routing is suitable for delivering real-time traffic, such as video, over a wide range of situations.

A. Modeling of Nonlinearities

While frequent models exist for fiber nonlinearities, we try to find a model that captures the salient features of the nonlinear impairments, but is easy enough to permit complicated network studies. Using the Gaussian noise model [4] that if the total accessible spectrum B is modulated over a single span having an attenuation coefficient of α and effective length 1/α, the optimum power spectral density.

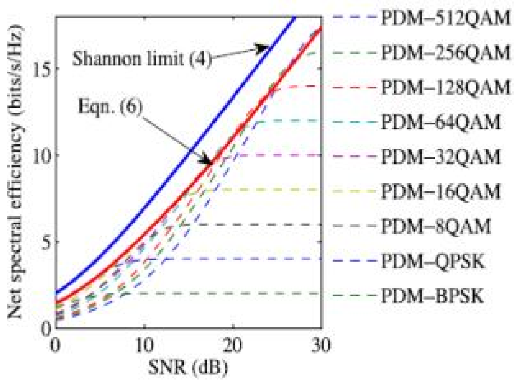

Figure1: Fig.1. Net spectral efficiency (NSE) versus SNR for various PDM_QAM layouts.

B. Optical Modulation Format

Since the Shannon limit does not indicate the modulation layout or the FEC coding transparency that should be employed, we seek an alternative fairly accurate bound as to what might be realizable in practice. In order to consider this for polarization division multiplexed quadrature amplitude modulation (PDM-QAM) constellations we decide using analytical terminology combined with direct simulation of the performance in the occurrence of additive white Gaussian noise the bit error rate (BER) as a function of SNR[3]. Rather than assume soft decoding we conventionally use the hard decision decoding bound for the binary symmetric channel.

From this the NSE as a function of SNR can be obtained for a given cardinality of QAM to give **Fig.1**. We note that for a terrestrial core optical transmission network the SNR will characteristically be in the region of 5 to 25 dB for the fiber and amplifier parameters previously discussed corresponding distances ranging from approximately 100 to 10000 km [9]. Over the region of interest shown in **Fig.2** the NSE that can be understand with PDM-QAM and optimal hard FEC can be approximately bounded. If the optimum launch power spectral density is used then the SNR is exclusively defined by the route through the network. Hence knowing the SNR then using the estimated realizable bound this then defines the appropriate amount of spectrum that must be assigned in an flexible network.

C. Routing Algorithm

We believe our benchmark as shortest path (SP) routing with first fit allocation of the optical spectrum, and two congestion aware (CA) variants of shortest path routing that are:

CA1: chooses the shortest path that prevents the fiber link that is most congested, prepared with Dijkstra's algorithm on the graph where the edge weight for the most congested path has been replaced by time without end.

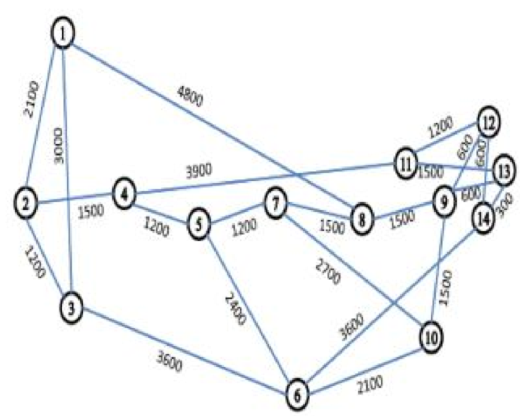

Fig.2. NSFNET topology with the lengths in km marked on links.

CA2: The shortest path through a weighted network, where the weight of an edge joining nodes i and j is given by $W_{ij} = L_{ij} / \eta_{ij}$ where L_{ij} is the physical length and η_{ij} is the proportion of the total spectrum which is still available on that edge [10].

Since the system operates with a constant power spectral density the spectral usage is comparative to the total optical power in any link creation congestion a parameter that is straightforward to measure for an installed network.

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IV. CONCLUSION

Congestion aware routing has been investigated in nonlinear flexible optical networks and shown to be effective for the reference NSFNET topology. We observe that the network blocking probability (NBP) follows a generalized extreme value distribution, allowing robust estimates of the load for a given NBP to be obtained. When NSFNET is sequentially loaded with 100 GB demands the proposed algorithm with a 6.25 GHz flex grid, allows the network to support 1744 demands compared to 328 demands using a fixed 50 GHz grid with shortest path routing for NBP = 1%.

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