Performance Analysis of Distributed Optical Routing Network Based on Tunable Lasers and Cyclic AWG Router

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INTRODUCTION

With the development of communication technology, 5G's application scenarios have become more and more extensive, and the demand has become stronger and stronger. In today's optical communication networks, bandwidth resource utilization and latency have become important performance indicators.

OBJECTIVES

We plan to introduce a scalable and reconfigurable distributed optical switching/routing network structure based on tunable lasers, which is applied to the metropolitan and data center networks. Compared with the structure of fixed-wavelength lasers, the performance of the network based on tunable lasers is improved in resource utilization and queuing delay.

METHODS

Five fully connected nodes are considered, with each node connected with the other four nodes through a fiber link. Each node consists of 16 tunable transceivers, two arrayed waveguide gratings and a node controller as shown in Fig.1. The switching instructions are distributed using the pilot tone modulation technology. Global resource optimization strategy is dynamically adjusted according to the network load.

The transmitter sends a signal through a low speed management channel using the pilot tone modulation technology, so that each node can get the information of other connected nodes, and a selected master node can obtain the global network information and send switching/routing instructions.

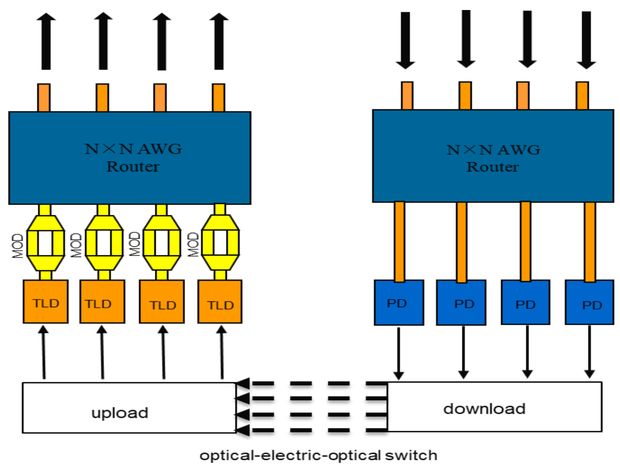

Fig. 1 Composition of node

RESULTS

Different traffic loads related to uneven distribution of the routing network are analyzed.

When the network is in 0.5 to 0.7 load traffic, adopted strategy can improve the overall network resource utilization by 5% - 10% and shorten the queue length by more than half whatever the uneven degree of traffic is.

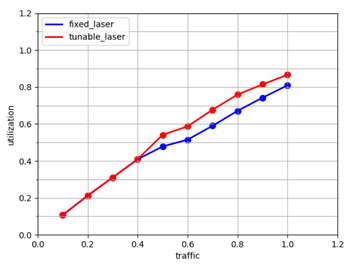

Fig. 2 utilization of low uneven traffic

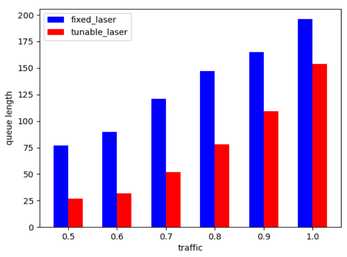

Fig. 3 queue length of low uneven traffic

When the network is in 0.8 to 1 traffic load, if uneven degree of the traffic is low, the adopted strategy can improve the overall network resource utilization by 5% - 10% and shorten the queue length by 20% - 45%. If uneven degree of the traffic is medium, the adopted strategy can improve the overall network resource utilization by 10% and shorten the queue length by 30% - 45%. If uneven degree of the traffic is high, the adopted strategy can improve the overall network resource utilization by 20% and shorten the queue length by 40% - 55%

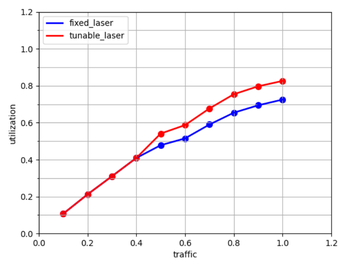

Fig. 4 utilization of medium uneven traffic

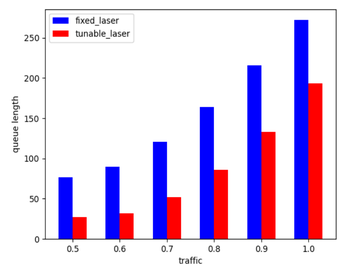

Fig. 5 utilization of medium uneven traffic

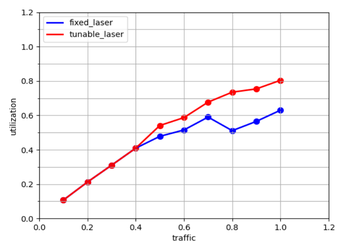

Fig. 6 utilization of high uneven traffic

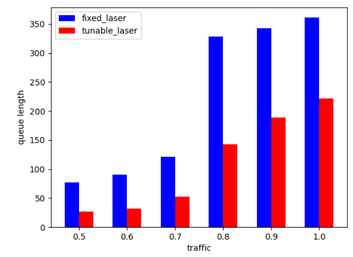

Fig.7 utilization of high uneven traffic

CONCLUSIONS

By dynamically allocating the link bandwidths, the resource utilizations of single node and the whole network increase, and the queuing lengths decrease. Especially when the network is in high traffic load of more uneven distribution, proposed strategy can get better performance.