Optical Interconnection Network Based on Distributed Switching for Data Center Application

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1.Introduction

In this work, we propose a data center optical interconnection network architecture based on distributed optical switches and the corresponding message scheduling algorithm. The network performance of the optical interconnection network is analyzed with simulation in terms of service throughput and message delay.

2.Network Architecture

The architecture uses a two-dimensional torus topology with 5×5 optical switches for each node. The network nodes are designed as a dynamically configurable internal structure, enabling flexible deployment of the number of wavelengths and transceiver modules.

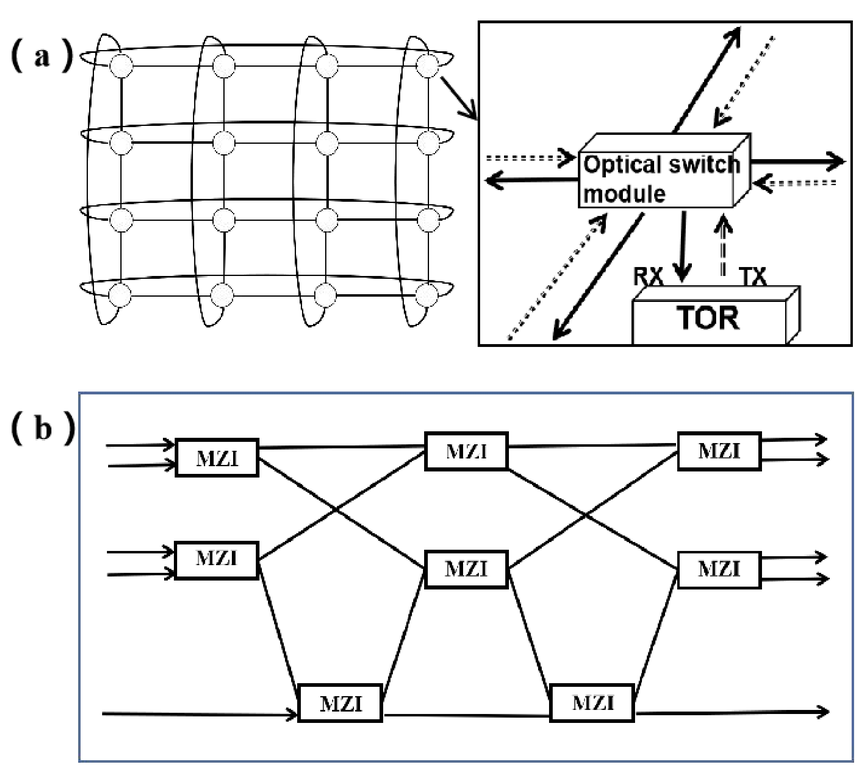

Fig. 1.
(a) Network topology and node block diagram.

(b)5×5 Optical switching structure.

(c) Configurable internal structure of nodes

3.Simulation results and discussion

The number of wavelengths in each optical link is assumed to be m and the number of transceiver modules available in each network node is assumed to be n. We study the scalability and robustness of the structure through analyzing throughput and message delay under different configurations.

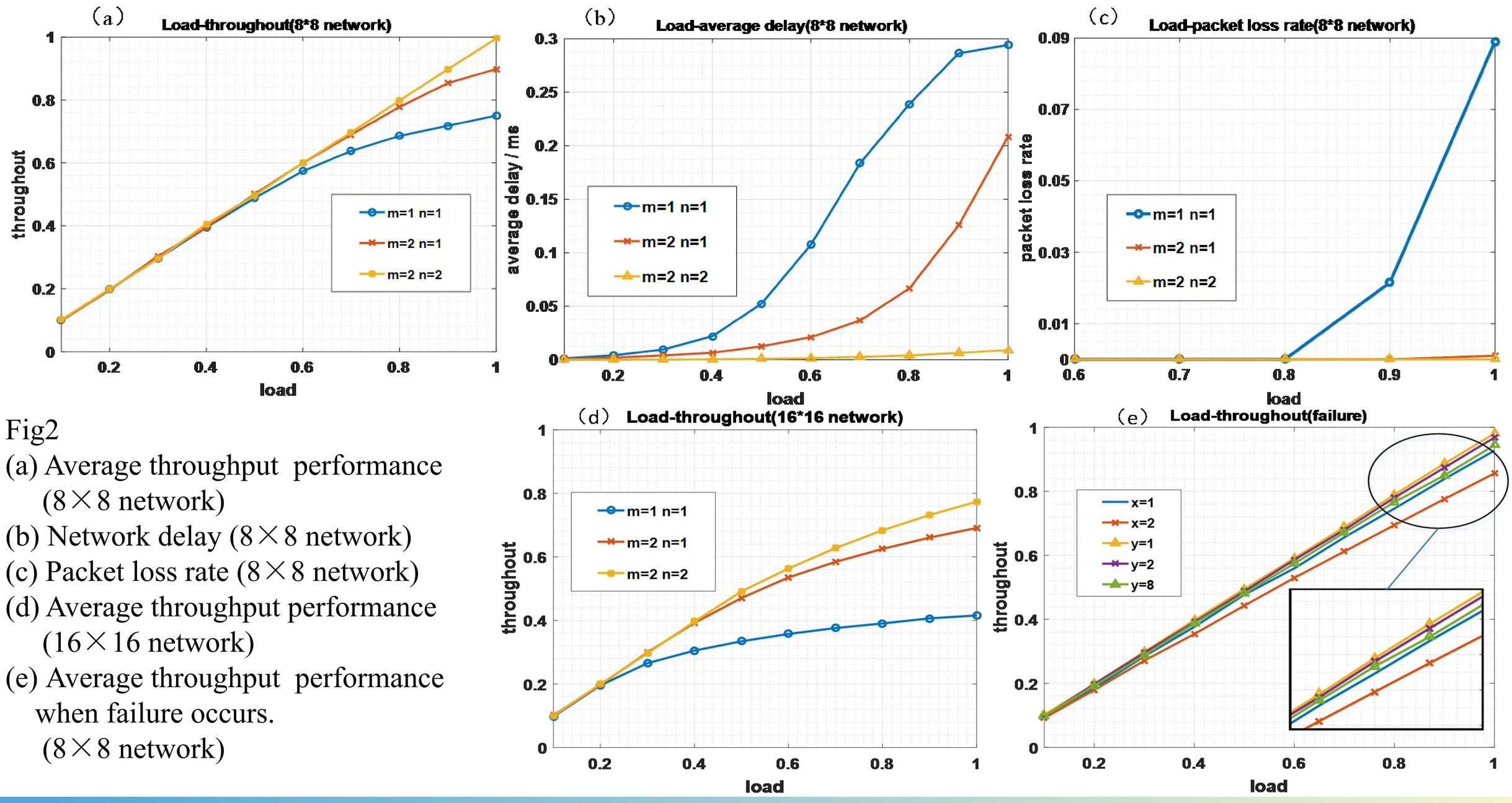

Fig2
(a) Average throughput performance (8×8 network)
(b) Network delay (8×8 network)
(c) Packet loss rate (8×8 network)
(d) Average throughput performance (16×16 network)
(e) Average throughput performance when failure occurs. (8×8 network)

4. Conclusion

Simulation results show that the node configuration of two wavelengths and two transceiver modules can achieve a high network throughput up to approximately 100% of the network capacity. When multiple link failures occur randomly, the throughput close to 90% can still be obtained through different route assignments, verifying the great robustness and high scalability of the proposed scheme