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Router and routing designs for 3D torus optical network on chip

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With the rapid development of electronic products, the high-speed computing applications pose greater demands of the on-chip performance, which cannot be coped with the Network on Chip (NoC) because of its inherent limited bandwidth and low communication efficiency. Recently, the Optical NoC (ONoC) has emerged as a promising solution. Furthermore, 3-Dimensional (3D) ONoC was proposed to reduce the communication conflict among the significantly increasing number of Intellectual Property (IP) cores on the ONoC. However, current optical routers with 3D ONoC topology have redundant crossbars, and the routing algorithm lacks agility and relies on the deterministic strategies without the awareness of the network status. More importantly, the previous routing algorithms were designed with the objective to either minimize the power consumption or transmission delay. Different from large-scale optical networks, the OnoC pays more attention to its transmission reliability, since the wavelength drift will occur if the heat dispersion varies, which deteriorates Signal-to-Noise Ratio (SNR). In this paper, we propose new bidirectional and vertical optical routers for 3D Torus topology, in order to save chip resources. Then, we model the structure of these routers and propose corresponding routing algorithms. The microcosmic packet forwarding algorithm is utilized for each kind of router, meanwhile, the power loss and crosstalk on the optical signal along the light path are analyzed in our adaptive macroscopic routing, with the consideration of thermal-sensitive wavelength drift. Our mathematical analysis and simulation results demonstrate the effectiveness of our methods. Especially, the effectiveness of our routing algorithm is demonstrated via bound analysis.

Biography

Weigang Hou has completed his PhD from Northeastern University (China) School of Computer Science and Engineering. He was the Research Associate from City University of Hong Kong Department of Computer Science. He is currently the Associate Professor of Northeastern University (China). His research topics including elastic optical network, optical data center network, optical network on chip, space information network and software-defined optical network. He has published more than 50 papers in conferences and journals including IEEE/OSA JLT, IEEE/OSA JOCN, IEEE Network, IEEE Globecom, IEEE ICC, etc.

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