

Elastic Flow Control and Parallel Switch Design for SpaceWire Router

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Long Paper

Chunjing MAO, Yong GUAN

College of Information Engineering, Capital Normal University, Beijing, 100048, China/ Department of Computing, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China

Zili SHAO

Department of Computing, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China

Jie Zhang

College of Information Science & Technology, Beijing University of Chemical Technology, Beijing, 100029, China

E-mail: mcjing@tom.com, gxy169@sina.com, cszlishao@comp.polyu.edu.hk, jzhang@mail.buct.edu.cn

ABSTRACT

In a SpaceWire network, to connect equipments together, a SpaceWire router uses the wormhole routing to deliver packets. However, in the wormhole routing, there inherently exists the braking-problem that increases the average non-blocking latency. In this paper, we propose an elastic flow control mechanism to solve this problem. In addition, we propose a novel parallel switch architecture with pipelining to improve the transmission speed and switching efficiency, and optimize its FPGAs implementation. We implement our technique and test it in Xilinx FPGAs. The results show that on average the non-blocking latency can be reduced to 245ns at 200MHz. By using our elastic flow control, a long physical connection between two nodes can be established without reducing the bandwidth utilization. With our pipelined parallel switch architecture, the transmission speed can be enhanced to over 300Mbps and the circuit scale can be reduced 50% compared with the original design in FPGAs implementation.