SPACEWIRE HOT MODULES

Session: SpaceWire Networks and Protocols

Long Paper

Asaf Baron, Isask'har Walter , Ran Ginosar and Isaac Keslassy

VLSI Systems Research Center, Elec. Eng. Dept., Technion, Haifa 32000, Israel

Ofer Lapid

Israel Ministry of Defense

E-mail: {ab@tx, zigi@tx, ran@ee, isaac@ee}.technion.ac.il, ofer.lapid@gmail.com

ABSTRACT

SpaceWire networks may include units, such as memory or processor, which are bandwidth limited and in high demand by several other units. Such modules are termed Hot Modules (HM). SpaceWire uses wormhole routing to deliver packets comprising multiple flits (characters). Wormhole routing helps minimize the number of buffers and transmission latency. On the other hand, under high load the network can become congested due to long worms that occupy resources at multiple network nodes, and block paths of many other packets. This situation may be exacerbated at the presence of HMs. In this paper we demonstrate that a single HM can dramatically reduce network efficiency and cause an unfair allocation of system resources. The network efficiency is reduced because many worms can wait in different routers waiting for the HM to be available while blocking other packets that are not destined to the Hot Module. The allocation of system resources is unfair because in order to reach the HM, packets from farther nodes need to win more arbitration cases than packets from nodes that are closer to the HM. We explore several solutions for the HM problem in SpaceWire networks. A leading solution is based on an end-to-end credit-based access regulation mechanism. We employ network simulations to investigate how the solutions solve the network efficiency and access fairness problems.